COST IMPLICATIONS OF VARIATIONS IN CONSTRUCTION PROJECTS IN NIGERIA

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A THESIS SUBMITTED TO THE POSTGRADUATE SCHOOL, AHMADU BELLO UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS OF THE DEGREE OF MASTER OF SCIENCE IN CONSTRUCTION MANAGEMENT

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JULY, 1998

DECLARATION

I hereby declare that this thesis has been prepared by me and that it is a record of my own research work. It has not been presented in any previous application for a higher degree.

All quotations are indicated and the sources of information are Specifically acknowledge by means of references.



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CERTIFICATION

This Thesis entitled: Cost implications of variations in Construction projects in Nigeria by NNOROM CLIFFORD OKWU, Meets the regulations governing the award of the degree of Master of Science (Construction Management) of Ahmadu Bello University , and is approved for its contribution to knowledge and Literary Presentation.

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DEDICATION

This Thesis is dedicated to my beloved wife (Philar) and son (Philip) for their love, understanding and sacrifice.

ACKNOWLEDGEMENTS

Thanks be to God Almighty for his love and Mercy and for keeping me alive.

I could not find better words of expressing my sincere thanks and appreciation to my supervisors in the persons of Dr. I. Mbamali and Mallam Kabiru Bala for their contributions. My special thanks goes to Dr. Mbamali the Chairman, Supervisory Committee for his relentless efforts in guiding me all through the preparation of this thesis. The patience and time he took in reading through this manuscripts are invaluable. I also wish to thank Mr. Z. J. Sikora, the Head of Department of Building and all the members of staff for their moral support throughout my study, including all my colleagues in the same professional field whose criticism at one time or the other gave me a rethink of decision.

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ABSTRACT

The study carefully examined the cost implications of variation on total contract cost of building projects. It also investigated the extent to which the variations affect the initial contract sums of such building projects.

The study which is mainly based on project files and interaction with professionals and clients draws samples of twenty-three (23) completed projects from four states (Kaduna, Kano, Anambra and Imo) within the area of interest. The initial contract sums were obtained from the bills of quantities while the final contract sums were obtained from the final accounts. The sums were subsequently broken down into group building elements.

This work shows that the overall increase over initial contract sums is 22.7%. The various final account statements attributed these increases to substructure 3.0%, superstructure 5.7%, finishes and Services has each 3.7%, lulling and furnishings 0.96%, External works 2.1% and preliminaries 1.3%. The gravity of the problem is different for the two types of clients studied, that is, public client 39.1%. and private client 7.2%.

The study concludes that variation in most cases result in cosl and lime overruns. Also, since substructure, superstructure, finishes and services have the highest cost magnitude in relation to the total contract sum, they could be seen to be the most critical elements requiring the greatest attention during construction.

Suggestion for reducing variation in construction projects includes, adequate planning, comprehensive pre-contract planning , adequate design briefs, guided by proper feasibility and viability studies should be embarked upon before commencing any project. Also Architects should ensure that Quantity surveyors are allowed to estimate the variations before issuing variation orders.

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

One of the most serious problems facing the Nigeria construction Industry today is the fact that almost all projects are being completed at sums much higher than their initial contract sums. For example, the Amenity Hospital Kaduna originally awarded at ₦4.3 Million has a projected final account of ₦7 Million an increase of about 63% (Daily times 5 May, 1983). The specialist Hospital in Minna, Niger State, originally awarded at initial contract sum of ₦17 Million was re-awarded to the same contractor at ₦40.5 Million an increase of 138% (new Nigerian 11 April, 1983). The presidential lodge Abuja originally awarded at about ₦20 Million was revised to ₦35 Million an increase of 75% (Concord 29 May, 1983). In Zaria the contract for the new office complex for the Nigeria Institute of Transport and Technology (NITT) was awarded at a cost of ₦14.5 Million in 1983. It was reviewed to a cost of ₦31 Million in 1986 and again to ₦100 Million in 1989 (Builder Magazine, April/May, 1996). The newswatch magazine of 7 December, 1987, and 9 May, 1988 contained several of such cases. It is these types of increase which led Nsan (1984), the then, Minister of Works and Housing to conclude that construction cost in Nigeria is among the highest in the world.

The cost of Construction projects are influenced by a variety of factors, some of which are interrelated. It is essential that the client or his representative (i.e Architect) should be fully aware of the cost consequences resulting from variation of work (e.g. change in design or specification) during construction works.

The term cost, implies the price (to be) paid for a particular item. Cost can be divided into tangible and intangible costs. The tangible costs include prices for materials, labour and plant, while the intangible cost is the overhead expenses (the site -overhead and head office overhead). This is the cost to the contractor, while to the client, it includes the contractor's profit, consultants fees, statutory charges, insurance premium and cost in use etc (it total costs or life cycle cost as is often termed)

Variation however means the alteration or modification of the design, quality or quantity of the works as shown upon the contract drawings and described by or referred to in the contract bills. It also includes, the addition,omission or substitution of any work, the alteration of the kind or standard of any of the materials or goods to be used in the works and 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 works, materials or goods which are not in accordance with the contract.

The work of Giwa (1988) on ninety (90) completed building projects revealed that.

(a) The overall increase over initial contract sums is 26.02% (Pre-second foreign Exchange Market- PRE-SFEM).

(b) The various final account statement attributed these increases to fluctuation 10.20%, variation 8.43%, P.C sums 5.98%, remeasurement 0.5%, provisional sums 1.37% and others 2.28%.

This analysis shows that variation is the second major factor contributing to higher increase over the initial contract sums.

Variation is one of the peculiarities of the building contract. This is due to the fact that hardly could any building be constructed without any variation. Variation is also among the significant factors contributing to the differences between initial and final contract costs (sums) as revealed in another study (37 projects) of Giwa (1988), while efforts had been concentrated on other factors contributing to high costs of construction especially fluctuation, little has been done on variation. This non-challant attitude may not be unconnected with the general belief that there would always be a variation in any construction project. Thus, there is provision for the variation and its valuation in the contract conditions. However the effect of variation as a contributor to the projects cost and time overruns cannot be over emphasized. In some cases it can lead to the total abandonment of the project.

In this regard therefore, some of the questions to be answered include "has the problem of cost implications (effects) of variation in construction project in Nigeria risen to the extent that even professional experts whose duty it is to control cost, surrendered? What is the magnitude of this problem ? What are the root causes and effects of variation and how can they be minimised with some degree of certainty to enable reliable planning and budgeting for construction works to be made. These are some of the questions which this research work set out to seek answers for.

1.2 THE NEED FOR THE STUDY

Variation is an important phenomenon in the process of building construction. Onyeri (1989) remarked that clients see variation as a "leprosy that must be avoided". Marsh (1981) while agreeing with onyeri (1989) described variation as the "Cancer of Contracting".

The study of Giwa L.S (1988) revealed that out of the thirty-seven (37) projects subjected to changes in contract prices, twenty-seven (27) were abondoned because of rising prices of which variation is one of the major causes. Another study of Oladipupo (1988) showed that out of twenty (20) abandoned projects, three (3) of them were due to the variation (i.e positive variation)

The effect of variations on construction projects can not be ignored as it often lead to cost and time overruns and can at times result to abandonment of the projects. Hence, there is a need for study to be done on cost implications of variations on construction projects so as to reduce its menace in project delivery in Nigeria.

1.3 AIMS AND OBJECTIVES

The aim of the study is to expose the impact of variation on contract costs and project administration to serve as a basis for reducing variations in building construction works.

In order to achieve this aim, the study is set out with the following objectives:-

(i) To determine the cost effects of variation on the initial contract sums.

(ii) To determine the cost implications of variation on different elements of building projects (i.e. substructures, superstructure, finishes, fittings and furnishings, services, External works and preliminaries)

(iii) To examine the implication of variation on the contractor's working capital.

(iv) To examine the impact of variation on the client's finances (i.e budget and cash flow).

1.4 METHODOLOGY OF RESEARCH

The research was conducted by the use of project files and with the aid of structured questionnaires to collect data from the participants in the building construction projects such as the Architects, Builders/Contractors,Quantity Surveyors, Engineers and the clients (which include private individuals, Ministry of works etc).

This study is based on the scientific approach to research (i.e the logical and systematic approach to the resolution of a research problem.) The type of sampling adopted for the research was simple random sampling. About twenty-five questionnaires were sent out to the following organizations namely, Consultancy Firms, Construction Companies and client organizations in some states of the federation (i.e Kaduna, Kano,Anambra and Imo).

The analytical tools employed or used are:-

(i) Simple statistical tabulations (i.e tables based on classification, ranking and description), pictorial presentation and charts.

(ii) Statistical measure of Central tendency and dispersion

(iii) Arithmetical computations; totals, averages and percentages etc.

Inference based on the utilization of the tools as well as qualitative assessment of the data collected were made by deductive reasoning, from which conclusions and recommendations were drawn for the study.

1.5 SCOPE AND LIMITATION

This research work is limited to a sample of twenty-three selected construction projects in Nigeria. Also the study will be limited to buildings which are constructed by contractors and shall not be concerned with those executed by direct labour. In addition, the study will only examine building projects and shall not include Civil Engineering projects.

CHAPTER TWO

COSTS, VARIATIONS, FLUCTUATIONS, ADDITIONAL WORKS AND CONTRACT CONDITIONS

2.1 COSTS:

The cost of a commodity, whether it be a simple one like a length of timber or a complex items like a building, is the sum of all the payments (whether money or otherwise) made to the factors of production engaged on the production of that commodity. Factors of production are defined in economics as Land, Labour, Capital, and Entrepreneurship Raftery (1991). Hence, the term cost is that which must be given in order to acquire, produce or affect something. Cost can be divided into tangible and intangible costs, Fasola, (1990). The tangible costs include prices for materials, labour and plant, while the intangible cost is the overhead expenses (i.e. the site overhead and head office overheads).

In the construction industry, almost all budgeting techniques are based on cost. The term cost when used in the Construction industry causes a lot of confusion. The misunderstanding is so much that sometimes a speaker and a listener may each construe it to mean different things depending on the circumstances of their communication. In any sale as reported by Ferry and Brandon (1991), three basic concepts are present, cost, price, and value.

The cost to the purchaser is the seller's prices, with value acting as arbiter between the parties, Bennett and Ormerod (1984), Giwa (1988), Fellows et al. (1991). Value, in common parlance, is taken to mean the intrinsic worth of a good. The value of a good gives an indication both of its scarcity and its utility when compared with

others. Value can be regarded as a complex entity made up of the following components, scarcity, utility, cost of production, value in use , value in exchange and most importantly, marginal utility, Raftery (1991). Hence value is not an intrinsic quality but rather is a relationship between the valuator and the thing being valued, then its primary determinant is marginal utility.

Price is the amount (of money usually) that someone is willing to pay for some particular goods. It can either be determined by the interplay of supply and demand in the market situation or else be fixed by the entrepreneur or the authorities Raftery, (1991)

However, Wilson (1982) noted the confusion in the building industry between cost and price, and this made Giwa (1988) to further assert that the term "cost" and "price" are often used interchangeably as the price given by one party to a project is the cost to another party for that project. Hence, the builder's price is the client's cost, the subcontractors price is the builder's cost. (Ferry and Brandon, 1991). Consequently, final contract sum is at one and the same time both the cost incurred by the client and price offered by the contractor or builder.

Several classification of costs are in common usuage. A basic classification in economics are fixed, variable and semi-variable costs respectively, but in the context of the construction industry, the classification is slightly different, Fellows et al. (1991). El-Rufai.(1982), Abubakar (1985) and Osbourn (1991) identified the basic cost components of construction projects as shown in figure 1. However, these components of construction costs are grouped under two major classifications as direct and indirect costs respectively.

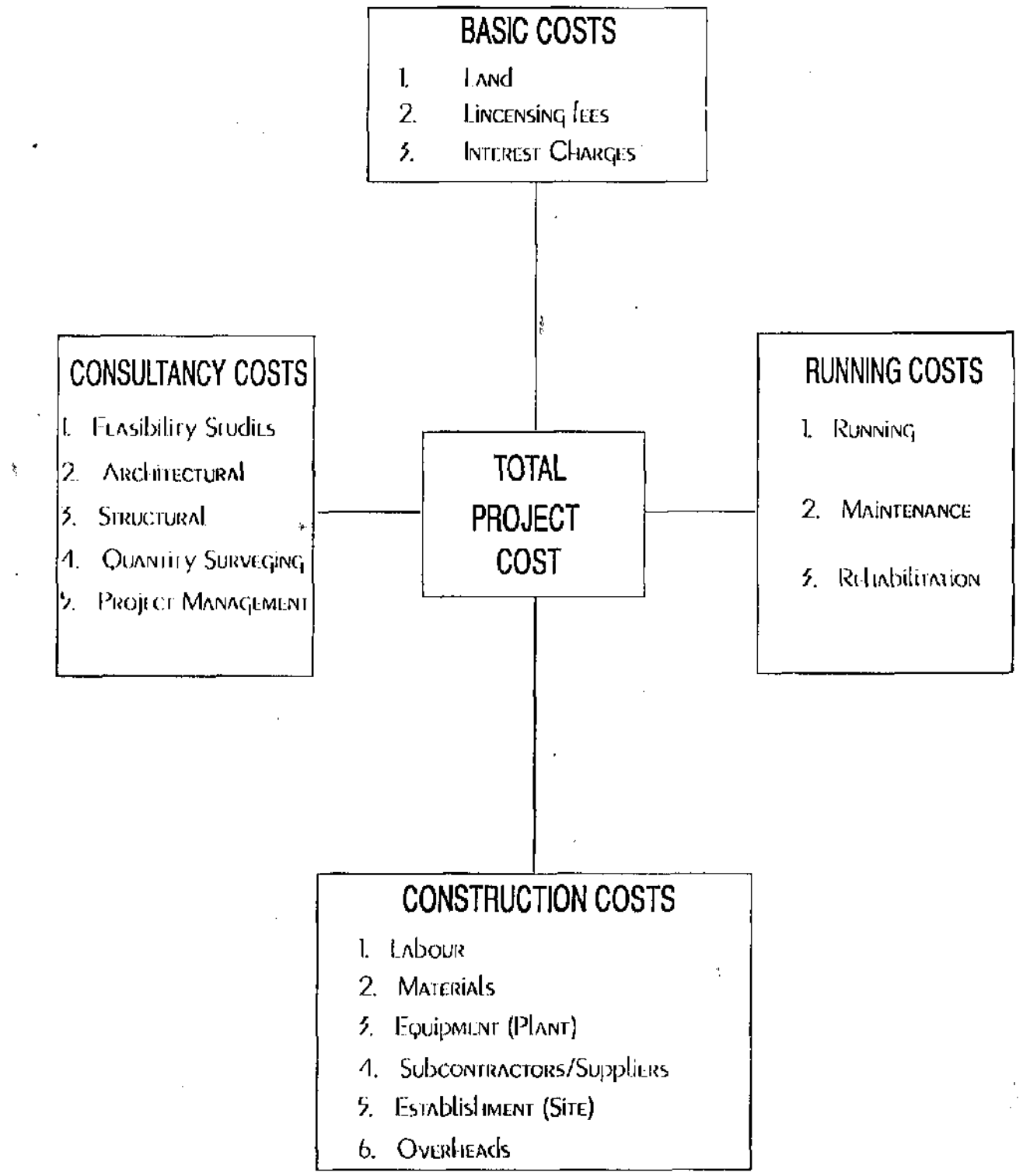


Fig. 2.1 Components of the total cost system of a construction project.

SOURCE: (i) El-Rufai, N.A (1992)

(ii) Abubakar, Abdu (1985)

(iii) Osbourn, D. (1991)

2.2 VARIATIONS

There is a misconception that all the increases in building and civil engineering contracts are due to variations Onyeri,(1989). Furthermore, experience has shown that except in the circle of professional Quantity Surveyors, a lot of people do confuse variations, fluctuations and additional works for each other. Therefore, it is pertinent to differentiate them outrightly.

It is usually the objective of the designers to have a building project without any variation. However, Hughes (1981) was of the view that it is very difficult to design any building or civil Engineering projects so comprehensively in such a way that no variation is required. The consequence is that any change that the client or his representatives make after the contract is signed, no matter how minor, would require a new contract to be drawn up, such a situation will be cumbersome and irritating, and would lay the client open to charges of breach of contract each time a change is called for. Thus, the inclusion of a variation clause in the condition of contract will obviate these inconveniences. Notwithstanding, there must be some kind of limitation to the variations in a contract. In quantity, their cumulative effect can operate to destroy the best of contracts and the habit of ordering them is in itself a disease, Marsh (1981).

Among the critical reasons for the differences between the initial and final contract sums of construction projects in Nigeria, from the analysis of thirty-seven (37) reported cases in the media done by Giwa (1988), variation was ranked third. The detai[1] s shown on table 2.1.

TABLE 2.1: CAUSES OF THE DIFFERENCES BETWEEN INITIAL AND FINAL CONTRACT SUMS OF CONSTRUCTION PROJECTS.

REPORTED CASES	*PERCENTAGES (%)*
1. Fluctuation	26.98%
2. Payment delay (Lack of fund)	20.64%
3. Variation	12.70%
4. Lop sided foreign agreement	11.11%
5. Increase in prime cost (P.C) sums	7.94%
6. Compensation /Political	6.35%
7. Over payment (due to Mobilization	3.17%
8. Disputes.	3.17%

SOURCE: Giwa S.L (1988) "Differences between Initial and final contract sums of Construction projects in Nigeria: Causes and solutions" (Paper presented at N.I.Q.S. Seminar)

2.3 EXTENT OF VARIATIONS

Variation means the alteration or modification of a design, its quality or quantity in a contract and includes the addition, omission or subtraction of (minor) works or the alteration in kind and standard and the removal from the site of works, materials and goods.

The word "minor" is very significant for it was never intended for major revisions either in cost, design or operations. Furthermore, it is equally significant to note that such works (constituting variation) must have been contemplated during the pre-contract stages *(i.e design and documentation stage) such as provisional quantities in substructure* (foundation or underground works) Onyeri, (1989). Also variation envisages minimal cost in a contract. Thus any extra work that compels the original contract sum to rise from Y to 2Y or 3Y falls outside the meaning or definition of variation (where Y is the original contract sum). Also, whilst all variations are claims, not all claims constitute variation.

Claims for opening up for inspection any work covered up which was in accordance with contract or claims arising for loss or expense in dealing with antiquities whilst increasing the project cost is certainly not a variation.

It should be noted that although all variations on building projects are issued or sanctioned by the Architect.but not all Architect's instructions constitute a variation. The condition of contract (J.C.T. 1980) has however classified some Architect's instructions deemed variation. There are:-

(i) Clause 6.1.3 Statutory obligations

(ii) Clause 2.2.2.2 Correction of contract bills

(iii) Clause 22 B Restoration after damage (Perils)

(iv) Clause 28.2.2 Incomplete work at determination

(v) Clause 33.1.4 Work after War damage.

The Joint Contract Tribunal (J.C.T), 1980 Edition, Clause 13.1 under two sub-clauses define what constitute a variation. This includes the addition, alteration or omission of any obligation or restriction imposed by the employer in the contract bills in regard to :

(i) Access to the site or use of any specific parts of the site,

(ii) Limitation of working hours

(iii) Limitation of working space

(iv) The execution or completion of work in any specific order. It needs be emphasized further that the Quantity surveyor does not issue variation orders, and has no right under the contract conditions to issue such an order. He only measures and values variation. The only person that has the authority is the Architect. But, before issuing such an order, the

Architect is supposed to get clearance from the client unless the matter involved is very urgent. Clients also have every right to reject any variation issued and included in the certificate to which clearance was not sought or obtained from them.

2.4 FLUCTUATIONS

Fluctuation refers to increases or decreases in cost due to legislative or market forces over and above the quoted market prices (Onyeri, 1989). In most construction contracts, provision is made for the Contractor or Employer to enjoy the benefit of increases or decreases in the price of basic resources arising from inflation or deflation as the case may be. EL- Rufai (1988) was of the view that fluctuation clauses are designed to obtain for the Contractor (or Employer) the amount of any increases (or decreases) in cost, usually of labour and materials or both, which may take place after the tender is accepted and before the work is completed.

Thus, from the above, it could be inferred that fluctuation claims are explicitly limited to labour and materials. It is a fluctuation in cost where a bag of cement previously biffed at ₦400 rises to ₦450. The extra cost of ₦50 is a fluctuation and not a variation. Fluctuation in some cases are allowed on contract with the completion period over one year while it is not allowed for contract with completion period under a year. The main reason for this is that while it is possible for the contractor to project the cost of building materials over a period under a year, it is difficult to do so for a period over a year due to Government policies etc. For example, the price as at 1995 was over forty times the price in 1973. (see table 2.2 and figure 2.2)

Clause 31 of the Federal Ministry of works lump sum contract conditions is explicit about the manner in which the fluctuations should be calculated. The basis of adjustment for the increases or decrease in the material costs is the list of materials or goods with their basic prices entered by the contractor at the back of the bills of quantities. Also the basis of adjustment is the rates of wages (labour) as contained in the bills or schedule of rates which is in accordance with the rates or wages fixed by the Federation of Building and Civil Engineering contractors current at the date of tender.

TABLE 2.2 : SHOWING TREND IN PRICES OF SOME BUILDING MATERIALS 1973 - 1995

MATERIALS	UNITS	1973	1975	1980	1983	1985	1988	1990	1993	1994	1995
Cement	Per bag	1.50	3.50	5	5.50	12	25	60	95	510	550
Gravel	Lor/ld	14	40	60	80	100	200	500	1,000	3,000	3,000
Sand	Lor/ld	14	16	20	25	30	80	150	250	650	700
Louvre Frame	Each	3.50	7.50	8	10	15	45	70	120	160	170
Louvre Blades	Each	0.65	0.95	2.50	3.20	3.50	12	18	25	48	55
225mm Cement Block	No	0.20	0.35	0.60	1.60	1.80	2.50	7.50	15	25	30
C.I.S Roofing sheet	Per bdl/20	15	25	35	75	150	170	900	2,500	4,500	5,000
Abestors Roof sheets 2x44x1.02	Each	2.50	9	8	12	20	40	50	135	320	370
Nails 3" 4" 5", 6"	Bags	0.25	0.40	23	24.80	24	40	40	720	1,800	1,800
Abestor Ceiling sheets 1.23x1.2m	Each	1.20	4	2.10	4	4	30	30	56	130	140
Water closet	Per set	32	50	300	350	350	400	720	1,280	1,450	2,200
Wash-hand Basin	Each	18	20	50	115	135	185	250	450	450	750
Emulsion paint	Per Gal	4	5.50	6.20	7.10	7	15	20	45	300	450
Gloss Paint	Per Gal	4.50	6.50	7.10	42.50	45	47	65	135	450	450
Bath	Each	400	400	450	600	900	1000	2500	3,000	5,500	6,000
Flush doors	Each	30	35	45	80	100	120	250	300	500	550
Floor tiles	Each	9.00	10.20	12.50	12.50	18	80	160	200	450	500
TOTAL		548.25	633.90	1035.00	1448.20	1916.30	2491.50	5490.50	10251	20243	22695
Percentage increase using 1973 as the Base Year.		100%	116%	189%	1264%	350%	454%	1056%	1866%	3692%	4139%

Source: Builders Magazine (Journal of Building Science and Management) April/May 1996.

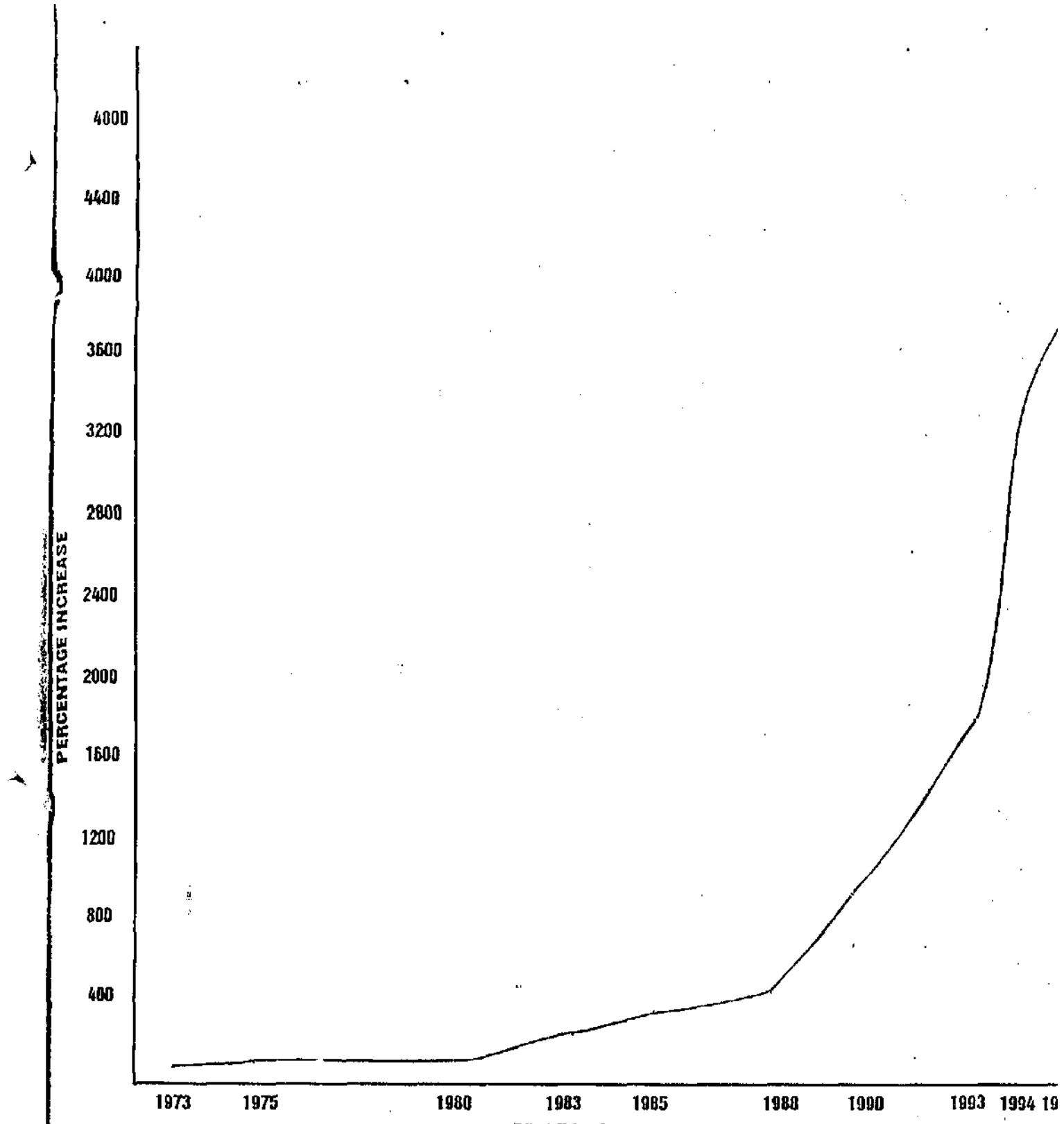


FIG 2.2: PERCENTAGE INCREASE OF BUILDING MATERIALS PRICES FROM 1973-1995

It is important to know that while variation valued during the interim valuations are subject to retention, fluctuations are not. This is due the fact that fluctuation constitute additional money which have been spent by the contractor which should be paid back so as not to affect his working capital.

In addition, it is worthy of note that while the J.C.T, 1980 form of contract conditions contains detailed provision for full recovery of fluctuation claims (clauses 31A, C and E) and partial fluctuation claims (clauses 31B, C, D and E), the Federal Ministry of works (F.M.W) form of contract conditions contains provisions only for partial fluctuation

2.5 ADDITIONAL WORKS:

Additional works refers to extra -work to the contractor during the execution of a project for which a client does not deem fit or necessary to invite a fresh tender. An example is the ordering of work of stabilization and erosion control to a project in which erosion problems were not previously anticipated or envisaged. Also, where a client signed a contract to Build four houses and is later required to increase it to five or six, this is not a variation but an additional works or addition to the works.

2.6 CONTRACT CONDITIONS:-

All contracts are governed by contract conditions which Giwa et al (1989) defined as "the detailed provisions incorporated into or in the contract, laying down the rights and duties of the parties, the functions of the Architects and other persons connected with the contract and the procedures for administering the contract".

Variation in building projects and their valuation is dealt with under clause 13.1 J.C.T (1980) and clause 11 of the F.M.W contract conditions. The J.C.T (1980) clause is more explicit about variations with the inclusion of clause 13.1.2 which says that variations also include addition, alteration or omission of any obligations or restrictions imposed by the employer in the contract bills in regard to :

(i) Access to the site or use of any specific parts of the site

(ii) Limitation of working space

(iii) Limitation of working hours

(iv) The execution or completion of work in any specific order but exclude nomination of a sub-contractor to supply and fix materials or goods or to execute work of which the measured quantities have been set out and priced by the contractor in the contract bills for supply and fixing or execution by the contractor (clause 13.1.3)

These clauses (13.1.2 and 13.1.3) are conspicuously absent in the F.M.W form of contract conditions which is still having same notion as the J.C.T 1963 edition. The treatment of fluctuation on the other hand are dealt with under clause 31 of both the F.M.W and J.C.T 1963 Forms. However, there are shortcomings in the use of these clauses in the contract conditions. An example is the definition of materials under material fluctuation. Some contractors will claim that everything except labour is a material whereas there are some items like petrol, diesel, nails and grease that are considered "consumable" and not materials. Also market price of a given good or service depends on a multiplicity of variable like location of seller and buyer, commission for the buyer etc. There is no provision to enable the contractor to be re imbursed where prices vary due to exchange rate variation,

so is the case of interest rate and financing costs.

In essence as mentioned by Ekwueme (1981), and EL- Rufai (1988), the forms of contract used in Nigeria are inadequate and/or unsuited for Nigeria condition and there is great need for review of the contract conditions so as to ensure the successful execution of construction projects in Nigeria.

Apart from the inadequacy of the contract conditions, most contractors as well as those connected with the operation of the contract conditions do not fully understand their rights and obligations under the form as well as adhere strictly to them.

This may not be unconnected with the fact that majority of them are illiterates and even the literate people among them such as Director general, Ministers, Commissioners etc have a problem of understanding the forms, because they are not professionals in the industry. This may be one of the reasons why Wallace (1970) called for a "Complete redrafting of forms so that laymen, contractors and building owners alike can understand what are their own duties and obligations and what are those of the Architect".

CHAPTER THREE

CAUSES, EFFECTS AD TREATMENT OF VARIATIONS IN CONSTRUCTION PROJECTS

3.0 CAUSES OF VARIATION IN CONSTRUCTION PROJECT

Giwa (1988) Summarized that variations could arise from many sources namely clients, designers, builders, sub-contractors and suppliers etc. Giwa's view was emphasizing on the contributions of the various parties to the construction projects.

Furthermore, in the bid to break the causes of variations further, Crystal Smith (1962), Marsh (1981), Ramus (1981), Willis and George (1981), Ayeni (1986), Onyeri (1989) identified the following reasons as the causes of variations in construction projects:-

(i) Inadequate allowance for project planning

(ii) Architect intention to vary the design or specification

(iii) Site conditions or unforeseen contingencies

(iv) Delay in obtaining materials and economic reasons

(v) Lack of discipline

(vii) Building Services

(xviii) Discrepancy between two or more of contract documents

(ix) Discrepancy between statutory requirements and any contract documents

(x) Client wishes

3.1.0 INADEQUATE ALLOWANCE FOR PROJECT PLANNING

Majority of the building clients in Nigeria are always too much in a hurry to have their dreams realized. This is particularly true of projects that have commercial or significant social undertones. Hence, they give inadequate time to their consultants to work or fashion out the appropriate design and do a thorough analysis of the contractor's capability before the contracts are signed and the commencement of construction work on site. Isiadinso (1988) remarked that a project which is let in a hurry without adequate planning for operational modalities will definitely cost more than another for which adequate time was allowed for planning and execution. From his experience, about eighty percent (80%) of the cost of any project is committed at the planning stage. Orenuga (1986) mentioned also that hasty designs and analysis of the contract often lead to alterations or omissions which may necessitate variations.

A prominent example of inadequate project planning can be taken from the case studies done on the construction of two laboratory blocks for Obafemi Awolowo University by Ogunlana and Olomolaiye (1988). According to them, the project was a N17.6 million contract to build four laboratory blocks and one administrative block. However, due to funding difficulties, the client decided to phase the contract. The first phase was for the construction of two out of the five blocks earlier advertised at N2.44 million and contract duration of forty-four weeks. The contractor agreed to give a discount of 12.5% to the client. The contractor encountered problems on the contract such as delay in honouring payment certificates, inadequate working drawings, changes ordered by the client e.g central air- conditioning instead of single units, P.V.C conduit pipes etc. Thus, the contractor later

waived the 12:5% discount and the contract period was increased by about three years.

3.1.1 ARCHITECT'S INTENTION TO VARY THE DESIGN OR SPECIFICATIONS

The largest number of variation arise from the Architect's intention to vary the design or the specification as mentioned by Wainwright (1979), Yelwa (1984) and Ramus (1981). One of the reasons for this is, the Architect because of their rights under the variation clause tend not always to crystallize their intentions on paper before the contract is signed. Another reason may be due to the Architect's intention to introduce new materials into the building to replace the inavailable ones.

3.1.2 SITE CONDITIONS OR UNFORESEEN CONTINGENCIES:

The nature of the site my necessitate that more work be done than was previously planned. This is sometimes true of the sub-structure works (foundation). While this may be blamed on inadequate site investigation on the part of the designers, it can also be a spill-over of the client's impatience to start the construction work on site. An example of this ascertion is a project for the construction of three office/Lecture blocks and one lecture theater for the department of mathematics at the Obafemi Awolowo University, Ile-Ife. Neither the contractor nor the consultants did any soil investigation before signing the contract, hence, the high underground water level (water table) was not detected until excavation started Ogunlana and Olomolaiye,(1988). As a result, the foundation had to be redesigned and excavation made deeper. Furthermore, some unforeseen contingencies may necessitate a variation on construction contract e.g flood, earthquake, civil war etc.

However, the contribution of these occurrences to variation is negligible as they rarely occur in Nigeria.

3.1.3 DELAY IN OBTAINING MATERIALS AND ECONOMIC REASONS.

Delay in obtaining necessary construction materials may often give rise to variation in a construction work. This is particularly true of some construction materials that are imported to this country which because of the time lag between the period they are ordered and when they are eventually received on site, their prices may have gone up many times thus necessitating changes in order to still meet up the client's budget. At times these materials may not come, thus needing new specification which may constitute a variation.

Many Architects are in the habit of specifying materials without checking their availability. Some even specify materials whose production had been stopped years back because they never bothered to update their knowledge of manufacturers and their products.

3.1.4 LACK OF DISCIPLINE:

Another root cause of variations in construction projects in Nigeria is the lack of discipline among the consultants handling the projects. This is due to their collusion with the contractors to accept and increase the amount of variation partly to share from and partly to increase the contract sum, thus, increasing their fees which is a function of the contract sum. As a result, they don't advise the client properly on the need to ensure adequate design and/or contract documents before commencing the construction work on site. It is not uncommon in Nigeria to commence a project without proper design drawings and/or contract

documents, and in some cases, design drawings are produced without any site visit for Engineering appraisal and in others, bills of quantities bear no relevance to drawings. The result of these action of cause, is that the contractor is confronted with an avalanche of problems during construction which include variations, culminating in delays, increase costs and in some cases abandonment of the project Olowo-Okere (1988). Also, as remarked by Marsh (1981), the consultants are fond of saying "that's a matter of detail we can sort out later on site" especially during the pre-contract stage. Hence, there is the tendency for inadequacy of information in the contract documents for the contractors to price and when the construction eventually commences on site, it may lead to a lot of variation in the project.

3.1.5 ARCHITECT INSTRUCTIONS:

The Architect can issue instruction which in turn have to be empowered under the conditions of contract. However, it need be emphasized that not all instructions become variations which will adjust the contract sum, Clause 13.1 J.C.T,1980 under two sub-Clause defines what constitutes a variation. Some of the Architect's instruction that do not constitute a variation are:-

(1) The removal of sub-standard works and materials and goods

(ii) The substitution of measured quantity duly priced by the contractor in the contract bills by a nominated sub-contractor.

F.M.W condition of contract clause 4 and J.C.T 1980 contract condition explained fully the mode of issuing the instruction. Aqua group (1983) emphasized on the Architect

instruction that if care is not taken in issuing them could lead to delay in the execution of the construction project.

3.1.6 BUILDING SERVICES:-

Building services include sanitary appliances, water installations, gas installations, electrical installations etc. The building services are often represented in the main contract bills of quantities with prime cost sums (P.C. sums) which in most cases are less than the actual cost of services they represent. The reason for this is the lack of detail design of the services during pre-contract stage and when the detailed design is done especially during the period of construction, a lot of variations are brought into the design. According to Oforeh (1988), building services constitutes between 20% and 30% percent of the total building cost. Therefore, one can imagine the effect of the variation on this aspect of the building project. Furthermore, from the analysis of the cost of installation of the blumbing and electrical services of some twenty-one (21) projects done by Ahlulmhen (1989), variations and fluctuations contributed greatly to the differences between initial and final contract sums (cost) to an increase of about 114 percent (see table 3.1)

TABLE 3.1 SHOWING THE PERCENTAGE INCREASE IN THE COST OF BUILDING SERVICES.

S/N	DESCRIPTION OF WORK	LOCATION	COMT. PERIOD	TOTAL DURATION	INITIAL COST	FINAL ANTICIPATED COST ₦	INCREASE ON ORIG. COST ₦	% INCREASE	REMARKS
1	Office Block (Electric)	Kano	1984	11 Months	456,373.21	482,237.80	25,924.55	5.70	Variation
2	Factory (Electric)	Markurdi	1985	21 "	134,031.18	148,831.18	14,800.00	11.00	Var./Fluct.
3	Guest House (Electric)	Abuja	1986	09 "	139,407.02	182,755.80	43,348.78	31.10	" "
4	Factory (Plumbing)	Lagos	1987	21 "	159,967.64	237,670.81	77,903.17	48.80	" "
5	A Block of 4 flats	Lagos	1987	16 "	42,978.64	78,689.50	35,710.86	83.10	" "
6	Office Block (Electric)	Lagos	1987	27 "	245,865.95	503,846.95	257,981.00	104.90	" "
7	Office Block (Plumbing)	Lagos	1987	96 "	406,510.75	1,256,870.96	850,360.21	209.20	" "
8	Classroom Block (Elect.)	Lagos	1987	23 "	32,740.00	48,534.98	15,794.96	48.20	" "
9	Office Block (Electr.)	Kano	1988	52 "	864,926.74	2,154,578.50	1,289,651.76	149.10	" "
10	Office Block (Electr.)	Markurdi	1988	74 "	88,603.31	142,561.84	53,958.53	60.90	" "
11	Students Hostel (Electr.)	Jos	1988	76 "	803,407.33	1,745,695.03	942,287.70	117.30	" "
12	Students Hostel (Electr.)	Jos	1988	76 "	411,209.09	668,724.93	257,515.84	62.60	" "
13	Office Block (Plumbing)	Lagos	1988	11 "	179,854.62	315,696.60	135,840.98	75.50	" "
14	Office Block (Elect. & Plumb.)	Lagos	1989	19 "	52,450.00	71,931.18	19,481.16	37.10	" "
15	Residencial Duplex (Elect.)	Lagos	1989	14 "	30,000.00	55,813.88	25,813.88	86.00	" "
16	Semi Detached Bungalow (Elect. & Plumbing)	Lagos	1989	18 "	29,805.17	54,675.80	24,870.63	83.40	" "
17	Residential Staff Quart. (Elect.)	Lagos	1989	10 "	29,617.18	46,720.78	16,915.40	56.80	" "
18	Ten Story Office Block (Plumb)	Lagos	1989	36 "	3,450,567.04	4,842,075.00	1,591,504.96	40.30	" "
19	Office Complex (Elect. & Plumb)	Lagos							
20	Six Story Off. Block (Plumb)	Abuja	75%	98 "	4,107,256.00	12,074,251.00	7,966,995.00	194.00	" "
21	Five Story Off. Block (Plumb)	Lagos	85%	85 "	1,367,023.00	3,125,964.60	1,758,941.60	128.70	" "
		Lagos	70%	36 "	1,036,481.90	1,856,459.80	819,977.90	79.10	" "
	TOTAL				14,069,003.74	30,094,585.34	16,025,581.54	114.00	

SOURCE: Abhulimhen J. E. (1989) Effective Cost Control of Building Services

3.1.7 DISCREPANCY BETWEEN TWO OR MORE OF THE CONTRACT DOCUMENTS

The J.C.T 1980 and F.M.W lump sum contract conditions Clause 2.2, state that any "error in description or in quantity or omission of items from the contract drawings and/or specifications shall not vitiate the contract but shall be corrected and deemed to be a variation required by the Architect/supervising officer. At times, there may be an error omitting an item in the bills of quantities or the quantity may be low, such an error shall be treated as a variation required by the Architect. Hence, the more the number of such errors, the greater the variations and the longer the completion period. All these affect the contract sum.

3.1.8 DISCREPANCY BETWEEN STATUTORY REQUIREMENTS AND ANY CONTRACT DOCUMENTS

When a discrepancy is discovered between any statutory requirements and the contract documents, such result in a variation. This is more prominent in the building services like plumbing and electrical installation where some changes may be necessary for the services to conform to the statutory requirements. Variation as a result of this factor is often negligible and depends on the location of the building. For example, a building located in a rural area may not rigidly be required to conform to the statutory requirements in contrast to another building situated at a city centre.

3.1.9 CLIENT'S WISHES:-

The contribution of the clients to the incessant variations in the construction project cannot be over looked. This is particularly true of the finishes and external works to a building which the clients are often known to have influenced or changed. Also, clients are often known to have changed or reduced/expanded some areas in the buildings to suit their after - thought.

3.2.0 EFFECTS OF VARIATIONS ON CONSTRUCTION PROJECTS

The cumulative effect of variations can operate to destroy the best of contracts Marsh, (1981). This fact cannot be refuted especially when the numerous effects of variations on contractors, clients, consultants, site managers and society at large etc are considered. Hughes (1981) also is of the view that variation can often lead to a loss of financial control of the project.

3.2.1 EFFECTS OF VARIATION ON CONTRACTORS:-

The ultimate effect of variations in a construction project on the contractor is to increase (or decrease) the completion period and overhead costs with subsequent lost of profit.Marsh (1981) is of the view that a simple change of specification may involve the contractor in some activities which include:-

(I) cancellation of or modification to orders already placed on his own works or on outside suppliers;

(ii) The placing of new orders;

(iii) Delay and/or re-phasing of the construction programme to accommodate the variation.

(iv) Delay in delivery of material to site due to action under (i) above

(v) Re-phasing of site works or concentration of work into a shorter period with consequent additions, overtime cost and lost of productivity

(vi) Extending the period of the contract

It is obvious from the above that variation has the effect of increasing the administrative costs of the contractor. Furthermore, Hughes (1981) believes that even relatively trivial variations can on the average have a devastating effect on the progress of work on site. Also the urge to postpone the issue of variations can inevitably lead to claims, the expenditure of much staff time and effort in resolving the ensuing problems. In addition, where the variation involves reduction in the scope of work, it may reduce the expected profit of the contractor. Ideally, the contractor is supposed to claim for the loss of overhead costs in this circumstances. However, in practice the computation of this overhead cost is very cumbersome and some contractors may not be aware of their rights. So, in most cases, contractors often loose the overhead cost to the client when there is reduction in the scope of works.

3.2.2 *EFFECTS OF VARIATION ON CLIENTS:*

On the part of clients, variation may lead to increase or decrease in the contract sum and completion period or target time. However, experience has shown that the latter is usually difficult to achieve due to a number of factors. One of these factors is the time lag before the re designed drawings are produced. This usually prolong the completion period. Also, this time lag for the reproduction of the drawings may allow for inflation to set in, thereby increasing the cost of the construction (fluctuation). Where the variation is only one item, few contractors may not seriously quarrel with it. They may accept it as one of the hazards of contracting. When it is a series of variations where the programme is affected and when the time spent by the contractors head office staff starts to become totally out of the initial value of the contract, the contractors will seek to recover additional expenses for:-

(i) Abortive time spent by the head office staff not otherwise directly charged to the contract.

(ii) Prolongation of the contract period on site

(iii) Loss of productivity and overtime working due to changes in the programme.

All the above claims from the contractor will have to be settled by the client and this will lead to increase in the contract sum and completion date.

Also, the client may loose the rents that would have accrued to him had the project been completed on time or as scheduled. In case of the owner - occupier property, the client may need to be paying rents where he is still occupying. Again, where the client had obtained a bank loan for the construction of the house, the interest on the capital will be on the increase as long as the project remains uncompleted. All these losses tend to discourage the client in future against such type of investments.

However, it has been established by Kharbanda (1980) that the cost of change (Variations) in design to the client increases with the construction programme as illustrated (by figure 3.1) below.

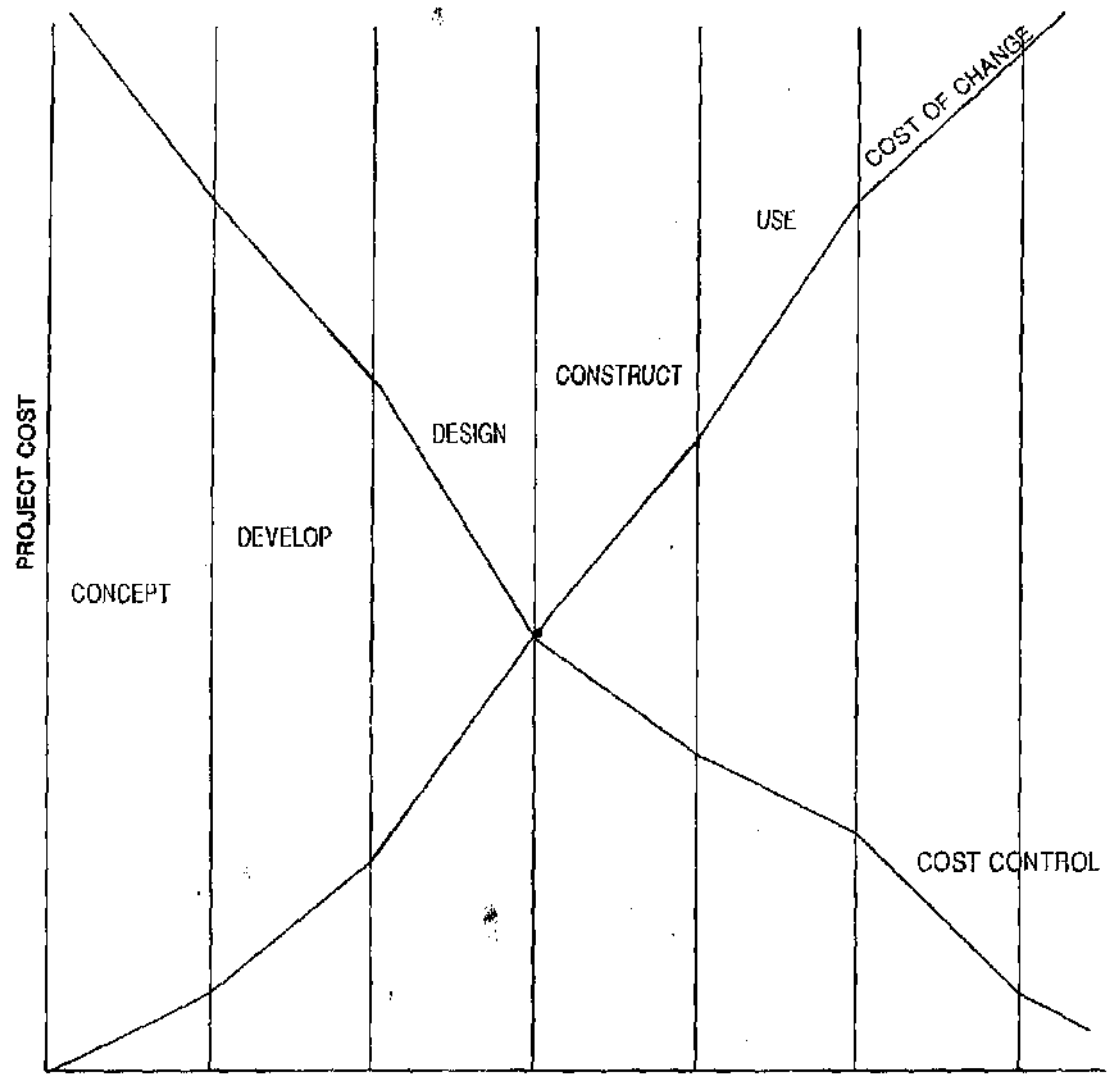


Fig. 3.1 COST OF CHANGE OVER CONSTRUCTION CONTRACT STAGES OF A TYPICAL PROJECT

SOURCE:. Kharbanda, O.P (1980)

The above figure shows that it will be less expensive if changes in the design are

done at early stages of the project than when the construction has already commenced on site or even when the project is being used. Also, it shows the ability to control cost which diminishes rapidly over the life of the project.

3.2.3 EFFECTS OF VARIATIONS ON CONSULTANTS

The effects of variations on the consultants also cannot be overstressed. Firstly, it will make them to be involved in further designs and negotiations with the contractor on the project. In addition, the increase or decrease in the contract sum as a result of the variation will have the effect of increasing or decreasing their professional fees. Furthermore, the disputes, loss of financial control, extension of time and losses to the clients as a result of the variation may have adverse effect on the image of the consultants that are involved in the project.

3.2.4 EFFECTS OF VARIATIONS ON SITE MANAGERS:

According to Johnston (1981), Site management must be able to:

(i) Anticipate the progress and problems of construction.

(ii) Control men and materials with equal efficiency.

(iii) Complete the contract within the programmed period

(iv) Carry out the work to specifications.

However, it has been found out that with variation, much of the site manager's time is taken up investigating the new design matters (variations) to ensure that the changes can be well accommodated. Only little time is therefore left for attending to the responsibilities

of construction, control of workmanship and management of materials on site. These hardly seem satisfactory to the client, contractor or even site manager. Hence, adequate pre-contract planning will go a long way in reducing variations as well as enhance the activities of the site managers.

3.2.5 WASTE OF MATERIALS

Material wastage on site is another probable effect of variations in construction projects. This may be due to cutting and mending of some positions to accommodate newly designed materials to replace the former designs. Materials wasted on site are appauling loss of precious resources and yet we accept it too readily perhaps believing that it is an inevitable consequence of the construction process. The losses as a result of the wastage of the materials can be expressed in many ways:

(i) Reduction in profit to the builder

(ii) Increased cost to the client and community at large

(iii) Problems associated with safety, quality control and performance

3.2.6 PROJECT DELAY/ABANDONMENT

Another vital effect of the variations in construction projects is delay/abandonment. Where the changes are enormous and costly, it may lead to the total abandonment of the project. This fact was established from the study of twenty (20) abandoned projects done by Oladipupo (1988) out of which three of them were due to the variations in the scope of works.

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Osemenam (1987) itemised the followings as the effects of abandoned projects:

(i) Wastage and under-utilization of manpower resources.

(ii) Under utilization of equipment and plant purchased for the project.

(iii) Reduction in employment opportunities.

(iv) Increase in final cost of projects due to payments for idle and unproductive time arising out of contractors claims, additional cost of re-mobilization and inflation.

(v) Lowering of living standard.

(vi) Decrease in national tax base and revenue accruing to Government by way of personal and corporate taxation.

(vii) Decrease in temporaries of economic activities.

(viii) Reduction in the individual and corporate purchasing power leading to a slow down in the activities of the manufacturing service and raw materials sector of the economy.

(ix) Increase in bankruptcy of firms and companies and incidence of bad debts.

(x) Decrease in revenue accruing to government parastatals which lead to their inability to provide essential services or maintain those already provided.

(xi) Difficulties in attracting foreign loans and investments because of lack of faith in the country's ability to manage resources.

3.3 TREATMENT OF VARIATIONS IN CONSTRUCTION PROJECTS

According to Marsh (1981), a vital factor in the successful control of variations is the timing of price negotiations. It is very important because of the pressure for the physical

progress of the work and the complexities in assessing the price change. In some cases, instructions are given to the contractor to make changes with the alteration in price (value of the variation) to be negotiated later. In doing so, not only is any possible negotiating advantage lost, but any curb on the enthusiasm of the client to make variations is removed (as the client would not know the cost implications of his variation). Also, the options available for the variations may not adequately be considered and this makes the financial control of the contract impossible. Marsh (1981) is of the view that the ideal sequence of the ordering for variation should be:

(i) Client decides that a particular variation would be desirable.

(ii) Contractor is instructed to assess the effect of the proposed variation in terms of price, time and performance.

(iii) Contractor submits his proposal under (ii) above (i.e. Price, time and performance).

(iv) Client decides whether he can afford the variation taking all factors into account.

(v) If client decides to proceed with the variation, then he negotiates amendments to price, time for completion and specification.

(vi) Client issues formal variation order in writing using a standard serially numbered form.

(vii) Contractor proceed with the work.

However, this seems a long series of steps and the main point is that client should consider the variation very well before giving approval for it. Hughes (1981) while emphasizing on the need to limit variation in construction projects agreed with Marsh (1981) that clients must seriously consider the net cost of the variation, the effect on time and

disruptive potential of the variation before instruction regarding the variation are issued. The disruptive potential according to Hughes (1981) involves the aggregate effect of variations on other operations both present and future as well as the timing of the issue of the variation.

3.3.1 SOURCES OF VARIATION INFORMATION

The primary source of most variation should be found in the Architect's formal orders Jagboro (1989). There is often a temptation to measure "what the contractor has actually done" but the real criterion is "what has he been required to do? Also where daywork is concerned, the Quantity Surveyor has to work from sheets signed by the Architect's representative (ie. clerk of work). In some cases, site measurement of the variation may be necessary as such adequate record of drawings must be kept.

3.3.1.1 DOCUMENTS

The Quantity Surveyor should keep a special file for variations which should be kept with all the other documents referring to the contract. Copies of the instructions issued by the Architect should be filed here in numerical order as well as all drawings received which relate to variations.

3.3.1.2 SITE VISITS

Wainwrights (1979) emphasized that Quantity Surveyor should visit the site regularly depending on the size of the contract and the measurement of the variations can be done on any of these occasions particularly if the work is to be subsequently covered up.

3.3.2 MEASUREMENT AND RECORDING OF VARIATIONS

According to Willis and Willis (1980), it is not advisable to start too soon on measurement of variations when future development which cannot be foreseen, might affect the surveyor's work. On the other hand, it is costly to postpone the measurement of variations for too long a time. This is because fresh memories are lost and the accumulation of such work may be a serious strain at a time when there is pressure in other directions. When starting to measure, the Quantity Surveyor should either have the Architect's instructions or a list of items of variation compiled for which variation orders will be requested. Each will be taken in turn and relative measurement made. The method is to omit the work contained in the contract bills from details in the original dimensions and to add the measurement for the work as carried out. It is very important to keep omissions and additions distinct and it is suggested that at the top of every page and at every change from omission to addition the word "omit" or "Add" shall always be written. Each item of variation should be headed with a brief description instruction number, date issued and date measured for identification purposes.

TABLE 3.2 RECORDING OF VARIATIONS

DESCRIPTION			QTY	UNIT	RATE	N	K
A 1	No 12	Issued: 12/10/95 Measured: 19/10/95					
	Description						
Omit	150mm sandcrete blocwall partitions and substitute with 100mm sandcrete wall Ditto		100	m^2	450.00		
		Page 2/6 item D					
Add	100mm sandcrete blockwall laid in a stretcherbond jointed with cement and sand mortar (1:4) etc.						
2/10.00 3.00	60.00						
2/4/6.00 3.00	96.00						
	156.00		156	m^2	400.00		

SOURCE: Wainright, W.A (1979)

TABLE 3.3 RECORDING OF VARIATIONS

DESCRIPTION			RATE	N	K
A 1	No 12	Issued: 12/10/95 Measured: 19/10/95			
		100mm sandcrete blocwall partitions and substituted for 150mm sandcrete wall Ditto	450.00		
A Omissions					
		150mm sandcrete blockwall 100m^2 laid in strecher bond etc.			
B Additions					
2/10.00 3.00	60.00	100mm Sandcrete block work ditto	400.00		
2/4/6.00 3.00	96.00				
	156mm^2				

SOURCE: (1) Ramus, J.W (1981)

(2) Wainright, W.A. (1979).

The method of recording the measurements of variations involved the use of A4 size paper ruled with dimension columns on the right. Thus, all the information - measurement, billing and pricing are presented on the same sheet (See Table 3.2).

Another method of ruling is shown on Table 3.3. However, this is not much favoured because it increases ruling sheets for the Quantity Surveyors' firms.

3.3.3 BILLING OF VARIATIONS

Very often a small variation can be billed directly from the dimensions but when the variation is complicated, it may be necessary to draw up a special abstract. The abstract should be arranged in trade order but omissions and additions should be recorded on separate abstract sheets. The total of the omissions and additions should be carried to the final summary, so that more information is given in the document.

There are about two method of billing used in practice, the first method is shown in Table 3.4 where the omissions and additions of each Architect instruction are treated before the next instruction. The advantage of this method is that the net difference between the omissions and additions of each instruction can readily be obtained. However, the sheets used for the billing are another design entirely.

Another method is the use of the normal billing sheets with each item of omissions and additions recorded on separate sheets with a clear heading at the top corner (see table 3.5). The advantage of this method is that it does not require another type of paper. The summary of variation account is done as shown in table 3.6.

3.3.4 PRICING VARIATION AND COMPLETE RE-MEASUREMENTS

It is advisable to price variation at the time measurements are recorded if possible so that variations can be brought into the interim valuations. Also the Quantity Surveyor can render an excellent service to the Client/Architect by preparing the periodic financial statements as the work progresses as this allows him to see at a glance the financial position of the contract. Complete remeasurement of the whole works may be necessary at times where the contract has not been well planned with extensive variation. However, before this is done, the Quantity Surveyor must first obtain the agreement of both parties to the contract. This is because the contract is based upon omission and additions and does not allow for complete measurement.

TABLE 3.4 BILLING OF VARIATION

VARIATION	QTY	RATE	OMISSIONS N K	ADDITION N K
A. I NO 12 Issued : 12/10/95 Measured : 19/10/95 Description Omit 150mm sanderete blockwall partitions and substitute with 100 mm sanderete wall. ditto Omissions 150 mm sanderete as described (page 2/6 item D) Additions 100 sanderete as described including all labour.	100 156	450.00 400.00	45,000.00	62,400.00
TOTAL TO SUMMARY			45,000.00	62,400.00

Source as per table 3.2

TABLE 3.5 BILLING OF VARIATIONS

VARIATION				OMISSION N K
150mm sandcrete as described (page 2/6 item D)	100	m²	4,500.00	45,000.00
.. ..				..
Total to Summary				..
				---------
100 mm sandcrete as described including all labours				=========
	156	m²	400.00	Additions
				62,400.00
				..
				..
TOTAL TO SUMMARY				

Source : Ayeni And Partners, Quantity Surveying Firm in Lagos.

TABLE 3.6 SUMMARY OF VARIATION ACCOUNT

ARCHITECT'S INSTRUCTION	OMIT ₦ K	ADD ₦ K
No. 1	199,000.00	220,000.00
No. 2		
No. 3		
No. 4		
No. 5		
No. 6		
No. 7		
No. 8		
No. 9		
ETC		
TOTAL carried to final Account Summary		

Source: JAGBORO, G (1989)

3.3.5 VALUING VARIATIONS

There are laid down procedures for valuing variation depending on whether the contract is with quantities or without quantities. These procedures are in J.C.T (1980) clause 13 sub-section 5 and 'F.M.W' Condition of contract clause 11, subsection 4. For contract without bills of quantities, a schedule of rates is normally used to value the variations that arise during the contract. While for contract with bills of quantities the methods of valuation are as follows:

1. Work which can be properly valued by measurement,

(i) Work similar to that set out in the contract bills, executed under similar conditions and with no significant changes in the total quantity shall be valued at bill rates.

ii) Work of a similar character to that set in the contract bills but not executed under similar conditions and/or with significant change in quantity shall be valued at rates pro-rata to those in the contract bills, a fair allowance being made for other differences in conditions and/or quantity.

iii) Work not similar to that set-out in the contract bills shall be valued at fair rates.

iv) Omission shall be valued at the rates and prices contained in the bills.

When valuing the foregoing, the following must be taken into account.

i) Measurement must be in accordance with the method of measurement used for the preparation of the bill of quantities.

ii) Allowance must be made for any percentage or lump sum adjustment in the contract.

iii) If appropriate, allowance must be made for any addition or reduction of preliminaries.

2. Work which cannot be properly valued by measurement shall be valued on daywork basis.

If any variation substantially changes the conditions under which other work is executed then that other work shall be re-valued as if it was itself a variation. If the variation does not involve additional or substituted work or straightforward omission or if the valuation cannot reasonably be effected by the application of these valuation rules, then a fair valuation must be made.

CHAPTER FOUR

4.0 DATA COLLECTION AND PRESENTATION

4.1 FIELD SURVEY

The field work was effected by interaction with professionals and clients and by the use of project files (i.e. detailed inspection of contract documents of completed projects) with the aid of structured questionnaires. The interaction or personal interview provided the opportunity for getting other facts that could be difficult to put across by the respondents.

The main documents considered were the approved bill of quantities and the corresponding interim valuations, certificates and final accounts. The initial and final contract sums including amount of variations for each project and the building elements were collected from the bill of quantities and final accounts respectively.

4.1.1 SAMPLING PROCEDURE

The type of sampling adopted for the research was simple random sampling. About twenty-five (25) questionnaires were sent out to the following organizations:

(i) Consultancy Firms

(ii) Construction Companies

(iii) Client Organizations

4.1.2 DATA COLLECTION PROCEDURE

A number of questions which had direct relevance to the research problem were drawn up and compiled into a questionnaire. It was believed that the answers to the questions will help in solving the problem (see Appendix Q).

The method adopted for the administration and collection of the questionnaires was by hand. The questionnaires were administered to respondents picked by simple random sampling from the list of construction companies, client organizations and consultancy firms in the country.

The breakdown of the distribution of the questionnaires are as follows:

	Breakdown
Consultancy firms	9
Construction companies	8
Clients organizations.	8

4.1.3 PROBLEMS ENCOUNTERED DURING THE ADMINISTRATION OF THE QUESTIONNAIRES

Numerous problems were encountered, in the process of collecting the data. One of the major problems encountered in collecting the data required for this research was that most contractors, clients and consultants were unwilling to release the contract documents and other related information on past and completed projects. This is because despite the fact that they were assured of strict confidentiality, they were still wary of accusations and recriminations. Another problem encountered in data collection was the haphazard nature in which the contract documents were kept. The final account in most cases were not prepared properly such that it became difficult to single out the final cost and amount of variation for building elements (e.g. substructure, superstructure, finishes etc.). Again, almost all the respondents complained about the depth of the information required from the questionnaires especially the cost distribution (ie. initial cost, final cost and amount of

variation including source of variation) of all the group elements of the building projects completed. Infact, it took direct personal efforts coupled with the assistance of the respondents to extract these detailed cost data from project files. In some projects, some documents were missing making it difficult to fill the cost distribution of the group elements.

Furthermore, in some of the projects surveyed, extension of time were given to the contractors either as a result of delayed payments by the clients or due to variations. Thus it became difficult to separate the extension of time given to the contractors due to variations.

In addition, out of the twenty-five questionnaires sent out, Thirteen (13) were filled and returned, giving a response rate of 52% . However, nine were properly completed.

4.1.4 BREAKDOWN OF RESPONDENTS

The study revealed that out of nine respondents that completely filled the questionnaires, four were consultancy firms (mainly Quantity Surveyors' firms), three construction companies and two clients organisation (ie. Federal and State ministries of Works)(See Table 4.1)

The greater number of the Quantity Surveying firms is because they have more details concerning the topic than other firms.

TABLE 4.1 BREAKDOWN OF RESPONDENTS INTO ORGANIZATIONS

CATEGORIES OF ORGANIZATION	TOTAL NUMBER OF QUESTIONNAIRES SENT OUT TO *RESPONDENTS*	TOTAL NUMBER OF QUESTIONNAIRES RECEIVED FROM *THE* RESPONDENTS	TOTAL NUMBER OF QUESTIONNAIRES COMPLETELY *FILLED BY THE* RESPONDENTS	PERCENTAGE OF QUESTIONNAIRES COMPLETELY FILLED BY THE *RESPONDENTS*
Consultancy Firms	9	5	4	45%
Construction Companies	8	4	3	33%
Clients Organization	8	4	2	22%
TOTAL	25	13	9	100%

Source: FIELD SURVEY (1997).

4.2 DATA PRESENTATION

The information from the appendices (i.e. A, B, C.....J) which were derived from the questionnaires and presented in the form of tables, pictorial representation (e.g. histograms) etc. for the purpose of easy comprehension. The summary of the causes, effects and suggested solutions of variations in building projects from the respondents were also written out. Also included are the list of implications of variations on contractor's working capital and client's cash flow.

TABLE 4.2 COST INFORMATIONS OF THE PROJECTS WITH VARIATIONS

PROJ. NO	INITIAL CONTRACT SUMS (N)	FINAL CONTRACT SUMS (N)	AMOUNT OF VARIATIONS IN THE PROJECTS (N)
1	11,611,544.87	54,231,430.87	2,534,148.24
2	2,415,451.60	4,072,081.53	400,652.35
3	5,122,345.60	6,608,381.00	1,152,032.40
4	6,500,000.00	14,700,000.00	3,470,000.00
5	13,450,000.00	27,850,000.00	7,701,000.00
6	3,103,660.00	6,260,231.20	1,522,198.90
7	798,235.60	880,305.90	82,070.30
8	821,092.95	1,200,954.70	379,861.75
9	10,000,000.00	14,030,000.00	4,030,000.00
10	141,593.52	147,662.21	6,068.69
11	253,245.19	265,040.56	12,155.37
12	369,477.95	387,710.95	18,233.00
13	175,060.10	202,060.50	17,000.50
14	16,451,638.08	21,478,075.15	5,026,437.07
15	5,070,687.73	8,720,011.15	3,449,324.80
16	12,015,994.91	16,948,334.52	2,110,473.28
17	16,284,943.82	19,747,130.02	2,421,200.14
18	9,450,000.00	7,700,000.00	-1,750,000.00
19	22,811,142.40	18,456,601.50	-4,354,540.90
20	14,348,873.40	23,632,162.20	6,449,881.30
21	4,709,802.84	5,805,800.14	847,698.80
22	561,502.00	621,100.52	48,398.40
23	476,982.30	476,982.30	-
	156,943,275.90	254,422,056.90	35,574,294.39

SOURCE: FIELD SURVEY (1997)

TABLE 4.3: COMPARISON OF THE INITIAL AND FINAL CONTRACT SUMS

Categories Of Projects	Total No of Project	Percentage %
Project with increase in contract sums due to variation.	20	87.0%
Projects Completed without Variation	1	4.3%
Projects with decrease in Contract sum due to variation	2	8.7%
TOTAL	23	100%

SOURCE: FIELD SURVEY (AS SHOWN ABOVE)

The data that were presented and analysed above were on twenty three (23 completed projects from nine (9) respondents. Out of the twenty-three projects, twenty have variations that increase the scope of work with subsequent increase in contract sum, two have reduction in the scope of work with decrease in contract sum, while the remaining one was completed without any variation.

TABLE 4.4 CATEGORIES OF THE PROJECTS WITH THEIR INITIAL CONTRACT SUMS

CONTRACT SUMS (Thousand of Naira)	TOTAL NO. OF PROJECTS	PERCENTAGES %
Below 100	0	0
100 - 500	5	21.70%
500 - 1000	3	13.05%
1,000 - 5,000	3	13.05%
Above 5,000	12	52.20%
TOTAL	23	100

It could be seen from the above table that projects with their initial contract sum above (N5,000,000) five million Naira, are more prone to variations while projects below one hundred thousand Naira (N100,000) rarely have variations. The reason for this may be due to the extent of the work to be carried out here.

TABLE 4.5: COST INFORMATION OF THE ELEMENTS OF BUILDING WITH VARIATIONS

PROJ. NO	SUBSTRUCTURE			SUPERSTRUCTURE			FINISHES			FITTINGS & FURNISHINGS		
	INITIAL COST	FINAL COST	AMT OF VARIATION	INITIAL COST	FINAL COST	AMT OF VARIATION	INITIAL COST	FINAL COST	AMT OF VARIATION	INITIAL COST	FINAIL COST	AMT OF VARIATION
1.	1.425.673.00	1.450.942.85	20968.85	9885872.00	52083353.00	507481.00	1408105.00	2313538.00	70422.00	450.000.00	575900.00	100700.00
2.	313.458.00	322.722.00	9.264.00	2033689.00	3681505.00	2914/.35	346019.00	546.019.00	150.000.00	76.555.00	20835.00	-55720.00
3.	882.322.00	982.322.00	10.000.00	2307182.00	2821215.00	272831.00	771517.60	10354444.00	263.926.40	115650.00	115650.00	-
4.	750.000.00	1.200.000.00	450.000.00	3500000.00	5100.000.00	750.000.00	1830000.00	2500.000.00	820.000.00	1000.000.00	1500000.00	500.000.00
5.	1.800.000.00	2.300.000.00	500.000.00	5100.000.00	7000.000.00	1100.000.00	2500000.00	4700.000.00	901.000.00	1.500.000.00	4200000.00	300.000.00
6.	231.630.00	450.980.00	160.400.40	995958.50	1698050.20	120.300.30	568.990.40	1580.600.10	659.698.20	100.000.00	120.000.00	10.000.00
7.	200.287.70	230.332.00	30.044.30	320181.00	350.196.00	30014.90	57124.30	57124.30	-	54719.60	54419.60	-
8.	194.671.10	226.734.00	32062.90	302707.75	509578.30	206870.55	277389.10	277389.10	-	30798.00	54719.60	23.921.50
9.	1.500.000.00	1600.000.00	100.000.00	2500000.00	4.000.000.00	1500.000.00	1300.000.00	2000.000.00	700.000.00	100.000.00	100000.00	-
10.	18.233.06	24301.75	6068.69	24310.74	24.310.74	-	52.268.09	52.268.09	-	3646.60	3646.60	-
11.	36.466.05	48261.42	11.795.37	36466.11	36.466.11	-	87.518.66	87518.66	-	31603.96	31603.96	-
12	54.699.07	72932.07	18.233.00	54.699.17	54.699.17	-	120.338.16	120.338.16	-	47405.94	47405.94	-
13	26.250.00	43250.50	17000.50	35.000.00	35000.00	-	57750.00	57750.00	-	22750.00	22750.00	-
14.	1.584.292.56	3058701.75	1474409.19	4460363.03	5277821.40	817458.37	1640456.95	2315063.00	674606.05	2.125.000.00	2526140.00	410040.00
15	1.013.338.85	1742629.00	729290.15	2071693.73	3562671.50	1490978.02	542031.27	932126.00	390094.73	9885.50	17000.00	7115.50
16	2.406.506.00	3809456.20	807956.00	4578408.00	5490300.34	505100.30	1508200.00	2405100.10	670400.12	980,689.32	805,406.20	-175253.12
17	3.504.200.30	4059600.60	401.000.30	6509434.20	7507349.30	650.200.14	2503409.10	3600.090.30	840000.20	1.210.000.00	1.490.000.00	120.000.00
18	1.150.000.00	1000.000.00	-150.000.00	2500000.00	2000.000.00	-500.000.00	1800.000.00	1500.000.00	-300.000.00	1000.000.00	800.000.00	-200.000.00
19.	3500400.20	2405300.00	-1.095.100.10	1500.060.08	1.300.400.40	-199660.40	6500.800.20	5200400.30	-1300399.90	2500100.00	200.000.00	-500100.00
20	2506705.40	4560495.60	1.068.980.60	4430.200.40	6400300.20	-050600.40	2600.500.30	3880400.00	1200300.20	1970667.20	3039866.20	980.000.00
21	800.000.60	860.898.00	50.097.60	1009800.20	1794500.00	587600.20	900.000.10	900.000.10		400.000.44	400.00.44	-
22	120.500.75	140.800.60	15096.90	230500.22	250200.22	18000.60	100.800.30	1201800.40	15300.90	50.000.20	50.000.20	-
23.	80.080.80	80.080.80	-	106780.20	106780.20	-	108.000.40	108000.40	-	50.000.50	50.000.30	-
	24.099.715.47	30.670.741.44	4.567.568.65	54.493.007.05	111.035.497.10	8.936916.73	27.578.219.83	36.133.965.01	5.755.348.70	11.32372.06	17.995.644.04	11511.773.55

SOURCE:: FIELD SURVEY (1997)

TABLE 4.5 (CONT.) COST INFORMATION OF THE ELEMENTS OF BUILDING WITH VARIATIONS

PROJECT NO	SERVICES			EXTERNAL WORKS			PREELIMINARIES		
	INITIAL COST	FINAL COST	AMT OF VARIATION	INITIAL COST	FINAL COST	AMT OF VARIATION	INITIAL COST	FINAL COST	AMT OF VARIATION
1.	2007700.00	5393401.00	1760800.00	2,000,000.00	369.7577.00	63,000.00	300,000.00	722,425.00	10,776.39
2	350223.00	352,905.00	2682.00	-	-	-	68,305.00	104,150.00	35,845.00
3	795675.00	1353750.00	558,075.00	100,000.00	140,000.00	40,000.00	150,000.00	160,000.00	7,200.00
4	1200,000.00	2,000,000.00	200,000.00	809,080.20	1,500,600.90	260,800.00	750,000.00	1,100,000.00	350,000.00
5	2500,000.00	3700,000.00	450,000.00	20,000.00	37011.00	17,011.00	1,200,000.00	1,700,000.00	500,000.00
6	25000.70	750,000.30	305,000.00	39,624.00	61,131.00	21,507.00	148,000.00	160,000.00	6,000.00
7	125923.00	125,923.00	-	21,00,000.00	2,500,000.00	400,000.00	20,000.00	25,000.00	5,000.00
8	136565.10	116888.60	-19676.50	3,000,000.00	4,250,000.00	1,250,000.00	25,000.00	25,000.00	-
9	2300,000.00	4000,000.00	1700,000.00	1,500,000.00	1,530,000.00	30,000.00	800,000.00	800,000.00	-
10	23095.20	23095.20	-	10,939.83	10,939.83	-	9,100.00	9,1000.00	-
11.	24310.74	24310.74	-	21,879.67	21,879.67	-	15000.00	1,5000.00	-
12	33466.11	33466.11	-	32819.50	32,819.00	-	26,000.00	26,000.00	-
13	17560.00	17560.00	-	15750.00	15750.00	-	10,000.00	10,000.00	-
14.	4759458.32	5236253.50	476795.18	470516.79	1139783.50	669266.71	1411,550.38	1924312.00	512,761.62
15	802350.80	1379795.00	57744.20	253411.88	435490.00	182373.12	377,975.20	650,000.00	72,025.00
16.	1020300.00	2598700.40	102300.00	880,495.32	880,495.32	-	641,396.27	958,876.00	200,000.00
17.	980,000.00	1209100.00	200,000.00	880,900.12	980,990.00	60,000.00	700,000.00	900,000.00	150,000.00
18.	15000,000.00	1,200,000.00	-300,000.00	900,000.00	700,000.00	-200,000.00	600,000.00	500,000.00	-100,000.00
19.	5500300.40	4500,200.60	-1000099.80	2500,400.20	2400,300.10	-100100.10	809,080.50	650,000.00	-159,000.00
20	1090800.10	3080600.10	1.250,000.00	950,000.20	1500,500.00	500,000.00	800,000.00	1,200,000.00	400,000.00
21.	850,000.50	950,400.80	90,000.40	500,000.20	600,000.00	70,000.60	250,000.80	300,000.80	50,000.00
22	30,000.10	30,000.10	-	20,000.30	20,000.30	-	10,000.00	10,000.00	-
23	100,060.40	100,060.40	-	20060.20	20,060.20	-	12,000.00	12,000.00	-
	26,399,789.47	38,176,410.85	5,833,620.48	17,025,878.51	22,475,328.32	3,263,86.33	9,133,408.15	11,961,863.80	2,040,527.89

SOURCE: FIELD SURVEY (1997).

TABLE 4.6 COMPARISM OF THE INITIAL AND FINAL COST OF THE ELEMENTS OF THE BUILDING (I.E. SUBSTRUCTURE, SUPERSTRUCTURE, FINISHES, FITTINGS & FURNISHINGS ETC)

CATEGORIES OF PROJECTS ELEMENTS	SUBSTRUCTURES		SUPERSTRUCTURE		FINISHES		FITTINGS & FURNITURES		SERVICES		EXTERNAL WORKS		PRELIMINARIES	
	TOTAL NO OF PROJ.	PERCENTAGE %	TOTAL NO OF PROJ.	PERCENTAGE %	TOTAL NO OF PROJ.	PERCENTAGE %	TOTAL NO OF PROJ.	PERCENTAGE %	TOTAL NO OF PROJ.	PERCENTAGE %	TOTAL NO OF PROJ.	PERCENTAGE %	TOTAL NO OF PROJ.	PERCENTAGE %
Elements with increase in contract sum due to variatio	20	87.0	16	69.6	13	56.5	9	39.1	13	56.5	13	56.5	13	56.5
Elements completed without variation	1	4.3	5	21.7	8	34.8	10	43.5	7	30.4	8	34.8	8	34.8
Elements with decrease in contract sum due to variation	2	8.7	2	8.7	2	8.7	4	17.4	3	13.1	2	8.7	2	8.7
TOTAL	23	100	23	100	23	100	23	100	23	100	23	100	23	100

SOURCE : FIELD SURVEY (1997).

4.2.1 ELEMENTAL COST INFORMATION

It could be seen from table 4.5 and 4.6 that eighty seven percent (87%) of substructural element of building projects were subjected to variation with increase in the contract sum, followed by superstructure by about seventy percent (70%), while finishes, services, external works and preliminaries had each fifty seven (57%) percent. Fittings and furnishing had the least with thirty nine percent (39%).

4.2.2 RATES AT WHICH THE BUILDING ELEMENTS ARE SUBJECTED TO VARIATION

The rating of the elements of the building projects as subjected to variation by the respondents showed that substructure had the highest frequency (19.7%) followed immediately by superstructure (18.2%), finishes (16.1%) and services (15.0%) etc. (see table 4.7 and Appendix N).

TABLE 4.7: RATES AT WHICH BUILDING ELEMENTS ARE SUBJECTED TO VARIATIONS

ELEMENTS	TOTAL POINTS	PERCENTAGES (%)
1. Substructure	75	19.7
2. Superstructure	69	18.2
3. Finishes	61	16.1
4. Fittings and Furnishings	48	12.6
5. Services	57	15.0
6. External Works	48	12.6
7. Preliminaries	22	5.8
TOTAL	380	100%

SOURCE: FIELD SURVEY (1997)

TABLE 4:8 DETAILS OF THE PROJECT GROUPS (PUBLIC BUILDING)

NO OF PROJ.	TYPE OF CLIENTS	INITIAL CONTRACT SUMS ₦	FINAL CONTRACT SUMS ₦	DIFF. BETWEEN INITIAL & FINAL CONTRACT SUMS	AMOUNT OF VARIATION IN THE PROJECTS
1	Public	11,611,544.87	54,231,430.87	42,919,886.00	2,534,148.24
2	"	2,415451.60	4,072,081.53	1,656,629.93	400,652.35
3	"	5,122,346.60	6,608,381.00	1,486,034.40	1,152,032.40
4	"	6,500,000.00	14,700,000.00	8,200,000.00	3,470,000.00
5	"	13,450,000.00	27,850,000.00	14,400,000.00	7,701,000.00
6	"	3,103,660.00	6,260,231.20	3,156,571.20	1,522,198.90
7	"	798,235.60	880,305.90	82,070.30	82,070.30
8	"	821,092.95	1,200,954.70	349,861.75	379,861.75
9	"	10,000,000.00	14,030,000.00	4,030,000.00	4,030,000.00
10	"	141,593.52	147,662.21	6,068.69	6,068.69
11	"	253,245.19	265,040.56	11,795.37	12,155.37
12	"	369,477.95	387,710.95	18,233.00	18,233.00
13	"	175,060.10	202,060.50	27,000.40	17,000.50
14	"	16,451,638.08	21,478,075.15	5,026,437.07	5,026,437.07
15	"	5,070,687.73	8,720,011.15	3,649,323.42	3,449,324.80
TOTAL		76,284,034.19	161,033,945.70	84,749,911.53	29,801,183.37

SOURCE: FIELD SURVEY (SEE APPENDICES A & B)

TABLE 4:9 PRIVATE BUILDING COST INFORMATION

No of PROJ.	TYPE OF CLIENT	INITIAL CONTRACT SUMS N	FINAL CONTRACT SUMS N	DIFF. BETWEEN INITIAL AND FINAL CONTRACT SUMS N	AMOUNT OF VARIATION IN THE PROJECTS
1	PRIVATE	12,015,994.91	16,948,334.52	4,932,339.61	2,110,473.28
2	"	16,284,943.82	19,747,130.02	3,462,186.20	2,421,200.14
3	"	9,450,000.00	7,700,000.00	-1,750,000.00	-1,750,000.00
4	"	22,811,142.40	18,456,601.50	-4,354,540.90	-4,354,540.90
5	"	14,348,843.40	23,632,162.20	9,283,288.80	6,449,881.30
6	"	4,709,802.00	5,805,800.14	1,095,997.30	847,698.80
7	"	561,502.00	621,100.52	59,598.52	48,398.40
8	"	476,982.30	476,982.30	-	-
TOTAL		80,659,241.71	93,388,111.18	12,728,869.47	5,773,111.02

SOURCE : FIELD SURVEY (SEE APPENDICES A & B)

TABLE 4 .10: THE RELATIONSHIP BETWEEN THE TYPE OF CLIENTS AND THEIR TOTAL AMOUNT OF VARIATIONS

TYPE OF CLIENT A	NO OF PROJ B	TOTAL INITIAL CONTRACT SUMS ₦ C	TOTAL INCREASE IN CONTRACT SUMS ₦ D	TOTAL AMOUNT OF VARIATIONS ₦ E	% INCREASE IN CONTRACT SUMS F = D/C x 100/1	% OF TOTAL VAR IN TOTAL INCREASE G = E/D x 100/1	% OF TOTAL VAR TO TOTAL INITIAL CONTRACT SUMS H = E/C x 100/1
PUBLIC	15	76,284,034.19	84,749,911.53	29,801,183.34	111.1%	35.2%	39.1%
PRIVATE	8	80,659,241.71	12,728,869.47	5,773,111.02	15.8%	45.4%	7.2%

SOURCE : AS PER TABLE 4.8 & 4.9

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4.2.3: COST INFORMATION ON BOTH PUBLIC AND PRIVATE BUILDINGS

This information is presented in Table 4.10

TABLE 4.11: GENERATORS OF VARIATIONS IN CONSTRUCTION PROJECTS NIGERIA (RANKED IN ORDER OF MEAN RATING)

	Generators	Mean	Standard Deviation
1.	Inadequate allowance for project planning	8.2	2.6
2.	Site conditions or unforeseen contingencies	7.4	1.5
3.	Architects intention to vary the design or specification	6.8	2.1
4.	Client wishes	6.5	2.6
5.	Delay in obtaining material and Economic Reasons	6.0	2.1
6	Lack of discipline	5.4	2.4
7.	Building services	5.2	3.4
8.	Architect Instructions	5.1	2.8
9.	Discrepancy between two or more of the contract documents	3.5	1.7
10.	Discrepancy between statutory requirements and any of the contract documents.	2.3	1.8

Source: FIELD SURVEY (1997)

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The information above (table 4.11) shows the ranking of the generators of variations in construction projects in Nigeria as given by the respondents. The rating shows that inadequate allowance for project planning has the highest value with mean rating of 8.2, followed closely with site conditions and unforeseen contingencies (7.4) Architect intention to vary the designs or specification (6.8) and client wishes (6.5) etc.

Table 4.12 FREQUENCY WITH WHICH QUANTITY SURVEYORS ARE ALLOWED TO ESTIMATE VARIATION BEFORE THE ARCHITECT ISSUES THE VARIATION ORDERS IN A PROJECT

OPTIONS	TOTAL NO.OF PROJECTS	PERCENTAGES (%)
ALWAYS	1	4.3%
OCCASIONALLY	19	82.6%
NEVER	3	13.1%
TOTAL	23	100%

SOURCE: FIELD SURVEY (1997)

Table 4.12, shows that Quantity surveyors are occasionally called to estimate the value of variations before the Architect issues his orders. This represents 82.6% followed by never 13.1% and always by 4.3%

TABLE 4.13 COMPARISON OF THE INITIAL AND FINAL COMPLETION PERIODS OF THE CONSTRUCTION PROJECTS

CATEGORIES OF PROJECTS	TOTAL NO. IN EACH CASE	PERCENTAGES %
Project with increase in the completion period	20	87.0%
project completed on schedule (i.e on the stipulated date)	0	0%
Project with reduction in the completion period	3	13.0%
TOTAL	23	100%

SOURCE: FIELD SURVEY (1997) - See Appendix J.

Information in table 4.13 reveal that twenty (20) out of the twenty-three (23) projects completed representing about 87% have their completion period pushed up, while three projected have reduction in completion period (13.0%). There was no project completed on schedule (i.e 0%)

4.2.4 SUMMARY OF THE CAUSES OF VARIATION FROM THE RESPONDENTS

(a) Site conditions and unforeseen contingencies

(b) Inadequate pre-contract planning

(c) Non availability or scarcity of specified building materials

(d) Architect intention to improve on the building aesthetics or due to his indecision during pre-contract stages.

(e) The Engineers desire to enhance the structural stability of the buildings

(f) Prime cost items (i.e P.C sums and provisional sums).

4.2.5 SUMMARY OF EFFECTS OF VARIATION IN THE CONSTRUCTION PROJECTS AS GIVEN BY THE RESPONDENTS

Effects on Clients:-

(a) Additional costs (or savings) depending on whether variation increases or decreases the cost of the projects.

(b) It can delay the completion period. At times it makes the clients happier as a result of having the project closer to what they want particularly when they influence the design.

(c) Loss of Revenue for delay in putting the property into use on time especially for development oriented projects.

(d) Prolonging the payback period of invested money.

Effects on Consultants.

(a) Additional work in paper work documentations and may lead to an extension of supervision period or decrease in work if there is reduction in the scope of work.

(b) Professional fees may increase or decrease depending on whether variation increases or decreases the contract sum.

(c) The Architect may achieve an aesthetically or functionally better edifice

(d) The clients may doubt the competence of the consultants.

Effects on Constructors

(a) May increase expenditure and lead to claims for loss and expense if the variation result in increase in the scope of work.

(b) But if the contract sum is reduced as a result of negative variations, he may loose some profit.

(c) It can affect the programme of works and completion period.

(d) It could lead to frustration particularly if variations become excessive and claims not paid on time.

Effect on Site Manager:-

He will spend more time on the work because of additional work if the variation increase the scope of work (i.e Re- Scheduling and programming and re-phasing of works to accommodate new works).

Others:

It may lead to the abandonment of the project where a colossal amount is involved.

4.2.6 SUMMARY OF THE IMPLICATIONS OF VARIATION ON CONTRACTOR'S WORKING CAPITAL AS RECEIVED FROM THE RESPONDENTS

(a) It increases the contractor's working capital, if they are paid before executing the varied work. It can also earn the contractor more profit.

(b) The working capital will be overstretched as a result of increases in the scope of work. The contractor may have to source more fund which will attract additional interest.

(c) Variation with consequent increases in cost will affect the working capital of the contractor adversely because he will require more capital for execution of the project.

(d) Variation with decrease in the contract sum and scope of work on the other hand will leave the contractor with excess capital that may be used for other projects.

(e) It makes a nonsense of any working capital budgeting. It could also disrupt the entire programme of the contractor and make control difficult.

4.2.7 SUMMARY OF THE IMPLICATIONS OF VARIATION ON THE CLIENT'S CASH FLOW AS GIVEN BY THE RESPONDENTS

(a) If the project is a profit oriented development, it would mean delay in realization of profit due to longer payback period.

(b) It can increase the contract sum which means additional spending by the client. Therefore, the sum set aside by the client to spend on other projects would be used for the project at hand.

(c) Due to increase in expenditure on the project, Client's cash flow capability will reduce and this may lead to not honouring certificates on time.

(d) Variation with increases in cost of the project will squeeze the client's cash flow.

4.2.8 EFFECT OF THE IMPLICATIONS OF VARIATION ON CONTRACTOR'S WORKING CAPITAL AND /OR CLIENT'S CASH FLOW ON THE SMOOTH RUNNING AND REALIZATION OF THE PROJECT.

(a) It can lead to frustration of the project where client does not have additional fund.

(b) Failure on the part of the Architect to resolve the issue of variation with the client can cause delay.

(c) If the contractor executes the varied work without being paid on time, dispute can occur

(d) If the client could not source additional fund for the variation, it can cause delay of the project.

(e) It can slow down activities on site due to cash flow problems.

(f) It can also lead to delay in honouring interim certificates.

(g) If it continues unchecked, may lead to abandonment of the project.

4.2.9 SUGGESTIONS OF THE RESPONDENTS ON HOW TO MINIMISE VARIATION IN THE CONSTRUCTION PROJECTS.

(a) Architects and other designers should crystallized their ideas and intention on paper before work commences on site.

(b) Adequate time must be given for project planning and detailing at the pre-contract stages (i.e adequate pre-contract planning)

(c) Site investigation must be done before design work is commenced.

(d) The building services should be properly drawn and fully measured.

(e) The use of prime cost sums and provisional sums must be minimized

(f) They must be detailed cost planning and stable economic condition.

(g) The Quantity surveyor must have to estimate the value of the work before the Architect issues variation order.

(h) Qualified consultants and contractors should only be allowed in project delivery.

CHAPTER FIVE

5.0 ANALYSIS OF THE RESULTS

5.1 RELATIONSHIP BETWEEN THE AMOUNT OF VARIATIONS IN THE PROJECTS AND INITIAL CONTRACT SUMS.

TABLE 5.1 THE RELATIONSHIP BETWEEN THE AMOUNT OF VARIATION IN THE PROJECTS AND THEIR INITIAL CONTRACT SUMS

PERCENTAGE OF VARIATION TO THEIR INITIAL CONTRACT SUMS	CLASS CENTRE (x)	NO. OF PROJECTS
0 - 10%	5	8
11 - 20%	15.5	5
21 - 30%	25.5	2
31 - 40%	35.5	2
41 - 50%	45.5	3
51 - 60%	55.5	2
61 - 70%	65.5	1
TOTAL		23

SOURCE: (Table 4.2 and Appendix B)

The information in table 5.1 is showing the percentage amount of variations in all the projects surveyed (23 completed projects) to their initial contract sums. It shows that eight (8) projects had percentage amount of variations between 0-10-% to their initial contract sums, then followed by five (5) projects between 11-20% etc

It could also be seen from table 4.4 that projects more susceptible to variations are those having their contract sums above five million (₦5,000,000.00) Furthermore, it was found that project with less than one hundred thousand (₦100,000.00) are rarely subject to variations. The reason for this may be due to the extent of the work to be carried out here and completion period which can be between two weeks and four weeks.

When the initial and final contract sums of the twenty-three completed projects were compared and the summary of their final account checked, it was found that twenty projects (87%) had variations that increased the scope of work as well as the contract sums (positive variation). Also two of the projects (8.7%) had variation that decreased the scope of work as well as the contract sums. Only one project was completed on schedule (i.e without variation) (see table 4.3 and Appendix B)

5.2 ANALYSIS OF ELEMENTS OF BUILDING (i.e SUBSTRUCTURE SUPERSTRUCTURE, FINISHES ETC

(a) The information in tables 4.5 and 4.6 show costs distributions of all the elements (i.e initial cost, final cost and amount of variation) of the twenty-three projects completed. It shows that about (87%) eighty-seven percent of the substructure of the building projects were subjected to variation with increases in the contract sum, followed by superstructure by about seventy percent (70%) while finishes, services, external works and preliminaries had each fifty-seven (57%). Fittings and finishingshad the least with thirty-nine percent (39%). Also fittings and furnishings elements of building had ten (10) projects that were executed without variations, followed by preliminaries, external works, finishes with each

eight (8) projects, while services and superstructure had seven (7) and five (5) respectively. The least is substructure with only one (1) project.

Elements with decrease in their scope of work with subsequent decrease in contract sums due to variations are as follows: substructure, superstructure, external works, preliminaries and finishes had only two (2) projects, while fittings and furnishings, and services had four (4) and three (3) respectively.

(b) Table 4.7 and figure 4.1 showed the rates at which the building elements are subjected to variations. The respondents were given four alternatives which are always, usually, sometimes, and never and were required to rate the building elements as they were subjected to variations. For the analysis of their ratings, always was given 4 points, usually 3 points, sometimes 2 points and never 1 point. The summary of their rating from this table shows that variation are mostly issued on substructure (19.7%), followed closely by superstructure (18.2%) and thirdly finishes (16.1%). Others are services (15.0%), fitting and furnishings and external works had each (12.6%) while the least is preliminaries (5.8%).

The reasons given for higher percentage in the substructure is the site conditions and unforeseen contingencies as a result of lack of proper feasibility studies before the design of the projects.

(c) Table 5.2 and Appendix K show the relationship between the amount of variation in the elements of building projects (substructure, superstructure etc) to the initial contract sums while table 5.3 and Appendix L show the relationship between the amount of variation in the elements (substructure, superstructure, finishes etc) to the amount of variation in the projects.

(d) From the cost information in Appendix C, twenty out of twenty- three projects completed, had variation in their substructure that increased contract sums, while two had a negative variation. Even four projects had variation only on the substructure (ie 100% amount of variation in the element to the amount of variation in the projects). This further prove that variation always occur in the substructure more than other elements of the building.

(e) The cost information on superstructure of the building projects executed reveal that sixteen out of twenty-three projects undertaken had variation that increase the contract sums while five had no variation on the superstructure. Two of the projects had a variation that decreased the contract sums.

Variation in the superstructure of the building projects undertaken was attributed to structural changes later ordered by the engineers (i.e addition of more columns and beams with attendant addition in reinforcement and formwork). Other changes could result as a result of addition or omission of some items in the bill of Quantities (e.g doors, windows etc). It is to be noted that while substructure recorded 3.0% total increase in the total contract sums due to variation, superstructure recorded 5.7% The reason for higher increase in the superstructure was due to structural changes (i.e variation) in the completed projects (e.g see Appendices C & D)

TABLE 5.2: THE RELATIONSHIP BETWEEN THE AMOUNT OF VARIATION IN THE ELEMENTS (SUBSTRUCTURE, SUPERSTRUTURE, FINISHES, FITTINGS & FURNISHINGS, SERVICES, EXTERNAL WORKS AND PRELIMINARIES) TO THE INITIAL CONTRACT SUMS.

SUBSTRUCTURE			SUPERSTRUCTURE			FINISHES			FITTING & FURNISHING		
% AMOUNT OF VARIA IN THE ELEMENT TO THE INITIAL CONTRACT SUMS	CLASS CENTRE (X)	NO OF PROJECTS (F)	% AMOUNT OF VAR. IN THE ELEMENT TO THE INITIAL CONTRACT SUMS	CLASS CENTRE (X)	NO OF -PROJECTS (F)	% AMOUNT OF VARIATION IN THE ELEMENT TO THE INITIAL CONTRACT SUMS	CLASS CENTRE (X)	NO OF PROJECTS (F)	% AMOUNT OF VARIATION IN THE ELEMENT TOTHE INITIAL CONTRACT SUMS	CLASS CENTRE (X)	NO OF PROJECTS (F)
0 - 5%	2.5	17	0 -5%	2.5	16	0 - 5%	2.5	16	0 - 5%	2.5	21
6 - 10%	8.0	5	6 - 10%	8.0	2	6 - 10%	8.0	5	6 - 10%	8.0	2
11 - 15%	13.0	1	11 - 15%	13.0	3	11 - 25%	18.0	2	-	-	
-	-	-	16 - 30%	23.0	2	-	-	-	-	-	
TOTAL		23	TOTAL		23	TOTAL		23	TOTAL		23

TABLE 5.2 (CONT.)

SERVICES			EXTERNAL WORKS			PRELIMINARIES		
% AMOUNT OF VARITAION IN THE ELEMENT TO THE INITIAL CONTRACT SUMS	CLASS CENTRE (X)	NO OF PROJECTS (F)	% AMOUNT OF VARIATION IN THE ELEMENT TO THE INITIAL CONTRACT SUMS	CLASS CENTRE (X)	NO OF PROJECTS (F)	% AMOUNT OF VARIATION IN THE ELEMENT TO THE INITIAL CONTRACT SUMS	CLASS CENTRE (X)	NO OF PROJECTS (F)
0 - 5%	2.5	18	0 -5%	2.5	20	0 - 5%	2.5	22
6 - 10%	8.0	2	6 - 10%	8.0	3	6 - 10%	8.0	1
11 - 15%	13.0	2	-	-	-	-		-
16 - 20%	18.0	1	-	-	-	-	-	-
TOTAL		23	TOTAL		23	TOTAL		23

SOURCE: See Appendies C to I

The information in the table above is also represented in the figure shown in Appendix K

TABLE 5.3 THE RELATIONSHIP BETWEEN THE AMOUNT OF VARIATION IN THE ELEMENTS (SUBSTRUCTURE, SUPERSTRUTURE, FINISHES, FITTINGS & FURNISHINGS, SERVICES, EXTERNAL WORKS AND PRELIMINARIES) TO THE AMOUNT OF VARIATION IN THE PROJECTS.

SUBSTRUCTURE			SUPERSTRUCTURE			FINISHES			FITTING & FURNISHING		
% AMOUNT OF VAR. IN THE ELEMENT TO THE AMOUNT OF VAR. IN THE PROJECTS	CLASS CENTRE (X)	NO OF PROJECTS	% AMOUNT OF VAR. IN THE ELEMENT TO THE AMOUNT OF VAR. IN THE PROJECTS	CLASS CENTRE (X)	NO OF PROJECTS	% AMOUNT OF VARIATION IN THE ELEMENT TO THE AMOUNT OF VAR. IN THE PROJECTS	CLASS CENTRE (X)	NO OF PROJECTS	% AMOUNT OF VARIATION IN THE ELEMENT TO THE AMOUNT OF VAR. IN THE PROJECTS	CLASS CENTRE (X)	NO OF PROJECTS
0 - 10%	5.0	9	0 -10%	5.0	8	0 - 10%	5.0	9	0 - 10%	5.0	19
11 - 20%	15.5	4	11 - 20%	15.5	4	11 - 20%	15.5	6	11 - 20%	15.5	3
21 - 30%	25.5	3	21 - 30%	25.5	5	21 - 30%	25.5	3	21 - 50%	35.5	1
31 - 40	35.5	3	31 - 40%	35.5	3	31 - 40%	35.5	4	-	-	-
41 - 100%	70.5	4	41 - 50	45.5	1	41 - 50%	45.5	1	-	-	-
-	-	-	51 - 60	55.5	1	-	-	-	-	-	-
-	-	-	61 - 70	65.5	1	-	-	-	-	-	-
TOTAL		23	TOTAL		23	TOTAL		23	TOTAL		23

TABLE 5.3 (CONT.)

SERVICES			EXTERNAL WORKS			PRELIMINARIES		
% AMOUNT OFVARIA. IN THE ELEMENT TO THE AMOUNT IN THE PROJECTS	CLASS CENTRE (X)	NO OF PROJECTS (F)	% AMOUNT OF VARIATION IN THE ELEMENT TO THE AMOUNT IN THE PROJECTS	CLASS CENTRE (X)	NO OF PROJECTS (F)	% AMOUNT OF VARIATION IN THE ELEMENT TO THE AMOUNT IN THE PROJECTS	CLASS CENTRE (X)	NO OF PROJECTS (F)
0 - 10%	5.0	17	0 -10%	5.0	17	0 - 10%	5.0	22
11 - 20%	15.5	3	11 - 20%	15.5	5	11 - 20%	15.5	1
21 - 70%	65.5	3	21 - 30%	25.5	1	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
TOTAL		23	TOTAL		23	TOTAL		23

SOURCE: See Appendies C to I

The above table is also presented in the figure shown in Appendix L

TABLE 5.4 PERCENTAGE COST OVERRUN OF BUILDING PROJECTS AND THEIR ELEMENTS (i.e SUBSTRUCTURE, SUPERSTRUCTURE ETC) DUE TO VARIATIONS.

	PROJECTS (23)	SUBSTRUCTURE	SUPERSTRUC-TURE	FINISHES	FITTINGS & FURNISHINGS	SERVICES	EXTERNAL WORKS	PRELIMINARIS
TOTAL INITIAL COST (N)	156,943,275.94	24,099,715.47	54,493,007.05	27,578,219.83	11,329,372.06	26,399,789.47	17,025,878.51	9,133,408.15
TOTAL AMOUNT OF VARIATIONS	35,574,294.39	4,667,568.65	8,936,916.73	5,755,348.70	1,511,773.88	5,833,620.48	3,263,863.33	2,040,527.51
TOTAL % INCREASE	22.7%	3.0%	5.7%	3.7%	0.96%	3.7%	2.1%	1.3%

SOURCE : FIELD WORK (1997)

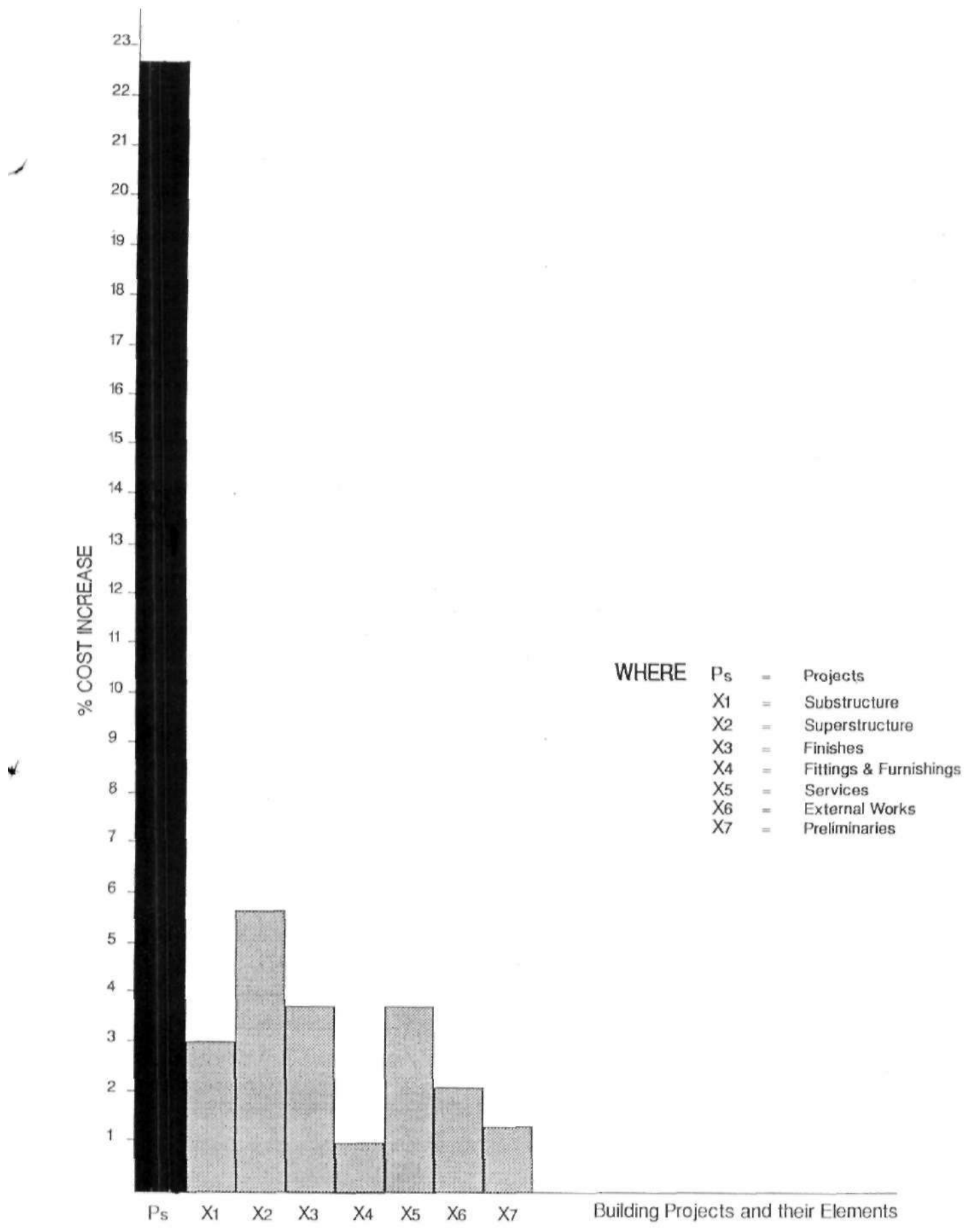


Fig 5.2 Distribution of % increase of the Building projects and their Elements over thier initial contract sums

(f) Finishes accounted for 3.7% total increase in contract sums due to variation in the twenty-three projects completed (see Appendix E). Out of these projects, thirteen of them had an increase in the contract sums,- two had a decrease in contract sums due to negative variations and eight of then were executed without variation. The reason given for variation in the finishing is the client wishes or desire to enhance the standard of finishes of the building close to his/her dream.

(g) Fittings and furnishings had 0.96% total increase in the contract sums due to variation in the twenty three projects studied. Out of these projects, nine were executed with increase in contract sums, four were executed with decrease in contract sums while ten were completed without variation (see Appendix F)

(h) Also, cost information in Appendix G reveals that services had total increase of 3.7% (i.e the same with finishes)in the contract sums for the twenty-three projects surveyed due to variation. Out of these projects, thirteen were executed with increase in contract sums, three were executed with decrease in contract sums, whereas seven were completed without variations.

(i) Appendix H shows that External works had 2.1% total increase in the total contract sums due to variations for the projects completed. Thirteen had positive variation while eight had no variation. However, two had a negative variation. Variation here, is due to clients interference during the execution of the projects to enhance or improve the aesthetics of their buildings.

(j) Preliminaries had the least with 1.3% total increase in the contract sums due to variation for the twenty-three projects. The reason for this is that most of the variations here are due to extension of time given by the client/Architect for the

varied works, and not all variations in the works or projects result in extension of time or completion period.

(k) The table 5.4 and figure 5.2 show the overall percentage cost overrun of building projects and their elements (i.e. substructure, superstructures, finishes etc) due to variations.

5.3 ANALYSIS OF THE TYPES OF CLIENTS (PUBLIC AND PRIVATE)

When it was asked from the respondents which of the projects between the public and private has higher amount of variation, the consensus was public (government projects). Moreover, table 4.10 has proved that government (public) projects, usually have higher projects overruns. From the fifteen government projects, the total increase in their contract sums was ₦ 84,749,911.53 over their total initial contract sums of ₦76,284,034.19 representing about 111.1% of the percentage increase in contract sums. whereas the private clients projects had increase in their contract sums of ₦12,728,869.47 in eight projects, representing 15.8% of the percentage increase in contract sums.

Furthermore, when the percentage of variation to their total initial contract sums were calculated, Government projects had 39.1% while the private clients projects had 7.2% Again the two projects that had decrease in their contract sums due to variation and the one project that was executed without variation were from private clients (see tables 4.8 and 4.9)

All these corroborate the fact that Government projects are more prone to variations than the private clients projects .

The reasons given for the higher variations in Government projects are:-

(i) Inadequate planning at the design stage before the take-off of the project. (ie Inadequate precontract planning)

ii) Bureaucratic inefficiencies, often accompanied by corrupt tendencies

(iii) Frequent changes in chief Executives of Government agencies and parastatals with resultant changes in client's wishes.

5.4 TESTING THE RANKING OF GENERATORS OF VARIATION IN THE CONSTRUCTION PROJECTS USING SPEARMAN'S RANK CORRELATION COEFFICIENT.

The ranking in table 4.11 when based on the standard deviation would produce the order 2,9,10,3,5,6 1,4,8,7.

It is therefore, necessary to investigate or test, if the ranking agrees or disagrees with that based on the arithmetic mean. The spearman's Rank correlation coefficient is calculated for this purpose:

$$R = 1 - \frac{6\sum d^2}{n(n^2 - 1)}$$

Where R = Spearman's Rank correlation coefficient defined in such a way that R can take any value between - 1 and 1

R = + 1 when the rankings are in perfect or complete agreement and R = -1 when they are in perfect or complete disagreement

Where there is no relationship, R = 0

d = difference in each pair of ranks

n = number of objects being ranked

TABLE 5.5 CALCULATION OF THE SPEARMAN'S RANK CORRELATION COEFFICIENT FOR THE TWO POSSIBLE RANKINGS

RANKING BASED ON		A-B = d	d^2
ARITHEMATIC MEAN (A)	STANDARD DEVIATION (B)		
1	2	-1	1
2	9	-7	49
3	10	-7	49
4	3	1	1
5	5	0	0
6	6	0	O
7	1	6	36
8	4	4	16
9	8	1	1
10	7	3	9
TOTAL			162

$$R = 1 - \frac{6\sum d^2}{n(n^2 - 1)}$$

$$\therefore R = 1 - \frac{6(162)}{13(169 - 1)}$$

$$= 1 - \frac{972}{13(168)} = 0.60$$

Since R = + 0.60, Which is close to I, we conclude there is strong agreement between the

ranking based on either of the parameters. Items 1 to 5 of the rankings (inadequate allowance for project planning, site conditions and unforeseen contingencies, Architects intention to vary design and specification, Client wishes and delay in obtaining materials and economic reasons) have the highest weight of influence among the generators (factors responsible) of variation in construction projects. Also items 6, 7 and 8 (lack of discipline, building services and Architect instructions) each having a mean rating of a little more than 5 on a scale of 10, could also be seen to be of appreciable influence on the matter while 9 and 10 with mean rating much below 5, can be considered to be of low importance to the problem.

5.5 CONTRACTOR'S RIGHT TO CLAIM FOR LOSS OF PROFIT AND/OR OVERHEAD WHEN THE SCOPE OF WORK & THE CONTRACT SUMS HAD BEEN REDUCED DUE TO VARIATION

When it was asked whether the contractors claim for any loss of profit and/or overheads costs when the scope of work and the contract sums had been reduced as a result of negative variation. The reasons given are:-

(i) They lacked knowledge

(ii) Clients can hardly approve such claims

(iii) They are ignorant of their right as regards this as well as the fact that they wanted to maintain good relations with the clients and consultants because of future projects. Besides, most of the indigenous contractors do not have qualified professionals (especially quantity surveyors) in their firms.

(iv) One of the respondents argued that since profit is built into the price rate, the contractor cannot or are not expected to claim for work not done or carried out but can claim or are

entitled to claim for loss of overheads.

5.6 FREQUENCY WITH WHICH QUANTITY SURVEYORS ARE ALLOWED TO ESTIMATE VARIATIONS.

Table 4.12 shows that Quantity surveyors are occasionally allowed to price the variation before issuing the instruction to effect the changes. As mentioned during the survey, Quantity Surveyors were brought in to measure the variation after the changes had been carried out. This attitude would not allow the Architect or the client to know the cost implication of the variation before embarking on them. In addition, it does not allow for a thorough analysis of the options available for the variation to reduce cost or quality of the building projects.

5.7 TIME ELEMENT OF THE PROJECTS

TABLE 5.5: RATES AT WHICH THE COMPLETION PERIODS ARE INCREASED.

PERCENTAGE OF THE DIFFERENCE BETWEEN THE INITIAL AND FINAL COMPLETION PERIOD	TOTAL NUMBER OF PROJECTS	PERCENTAGE OF THE NUMBER OF PROJECTS
Less than 0%	2	8.6%
0 - 20%	7	30.4%
21 - 40%	2	8.6%
41 - 50%	1	4.3%
51 - 60%	1	4.3%
61 - 80	1	4.3%
81 - 100%	5	21.7%
Above 100%	4	16.7%
TOTAL	23	100%
SOURCE: Appendix J.		

Information in appendix J and table 5.7 show the time elements of the projects with variations. The table above shows the rates at which the completion periods are increased, while table 4.13 shows the comparison between the initial and final completion periods of the construction projects. It could be seen that twenty of the projects representing about 87% have their completion period pushed up. Although the increase in the completion period cannot be ascribed to variation alone but it has its contribution in it.

It is to be noted from appendix J, that 15 projects had increase in their initial completion date due to extension of time given by the Architect due to variation representing about 65% of the twenty-three (23) projects completed, while 6 projects had no extension of time due to variation representing about 26%. Whereas only two had a decrease in completion period due to decrease in the scope of work (i.e 8.7%) as a result of negative variation.

CHAPTER SIX

6.1 SUMMARY OF RESULTS

1. Inadequate pre-contract planning, site conditions and unforeseen contingencies, Architect intention to vary the design or specification and client wishes were found to be the root causes of variations in construction projects.
2. The quantity surveyors are occasionally called to value (price) variation (82.6%) before effecting the changes in the construction projects.
3. The rating of building elements as they were subjected to variations shows that substructure was the highest (19.7%), followed closely by superstructure (18.2%) and thirdly finishes (16.1%). etc.
4. The overall increase of the twenty-three (23) projects surveyed over their initial contract sums is 22.7%. The various final account statements attributed these increase to substructure 3.0%, superstructure 5.7%, finishes and services each 3.7%, fittings & furnishings 0.96%, External works 2.1% and preliminaries 1.3%.
5. Government (Public) client projects are prone to higher variations (39.1%) than private client projects (7.2%).
6. Contractors do not claim for loss of overheads when the variation has reduced the scope of work and contract sum (i.e negative variation).
7. Positive variation affect the working capital of the contractor adversely as well as client's cash flow and vice versa.
8. Excessive variations can lead to frustration and finally lead to the abandonment of the projects.

6.2 CONCLUSION

Variation in most cases increases the initial contract sums. The total (amount) percentage of variations of all the twenty-three project executed to their initial contract sums was 22.7%. On the average also variation increases the initial completion period by about 60%. So effort should be made to eliminate or reduce this problem in construction projects.

The analysis of this work show that the substructure had 3.0% total increases in the total contract sums due to variation while superstructure had 5.7% whereas there were more number of projects with variations in the substructure than superstructure. In other words, the amount of variation in a project determine the differences between the initial and final cost of the projects.

Others are as follows, finishes and services had each 3.7% total increase in contract sums due to variation in the twenty-three projects completed. Fittings and furnishings had 0.96%, External works and preliminaries had 2.1% and 1.3% respectively. Also the rating of building elements as they were subjected to variation showed that substructure was the highest (19.7%) followed closely by superstructure (18.2%) and thirdly finishes (16.1%) etc. Hence, since substructure, superstructure, finishes and services have the highest cost magnitude in relation to the total contract sum, they could be seen to be the most critical elements requiring the greatest attention during construction.

The ranking of factors responsible for variation in construction projects in order of mean rating in table 4.11 and its testing (spearman's rank correction coefficient) in table 5.5 showed that inadequate pre-contract planning site conditions and unforeseen contingencies, Architect intention to vary the design & specification and clients wishes were rated higher than other factors, while inadequate pre-contract planning was rated highest. Therefore there

is a need for adequate pre-contract planning so as to bring down the incidence of unnecessary variations during construction.

Furthermore, it has been established that the Quantity surveyors are occasionally called to value (price) variations (82.6%) before effecting the changes in the construction projects. This means that the client/Architect will not know the cost implication of variations before work is carried out.

The following also can be established from the study,

(a) Government project are prone to higher variation than private clients projects.

(b) Contractors don't claim for loss of overheads when the scope of work has decrease due to negative variations. The reason being lack of knowledge and ignorance of their rights.

(c) Positive variation will affect the working capital of the contractor adversely as well as the client's cash flow.

(d) Also excessive variation can lead to frustration and finally lead to the abandonment of the project. The various effects of variations on the contractors, clients, consultants, site managers and on the nation call for an urgent and lasting solution to ameliorate this problem in construction projects.

6.2 RECOMMENDATIONS.

In order to reduce substantially or remove completely the variations in construction projects, the following are recommended

(i) Adequate pre-contract planning of construction projects should be done before commencing the construction on site. This involves a thorough site investigation and

allowing the consultants sufficient time for a thorough design and preparation of necessary tender documents for the project.

(ii) consultants should ensure that they do a thorough job during the design stage to ensure that the necessary designs and bills are adequately prepared before commencement of the construction work on site. This will minimize errors in the contract documents and the incessant alteration in the designs.

(iii) Clients should always endeavour to give adequate brief to the Architect during the design stage concerning the functions, quality and cost targets of their building projects. Once the construction work has commenced on site, client should have the least interference with construction projects.

(iv) Quantity surveyors should always be allowed to estimate the value (price) of variations before the inssuance of variation orders. This will greatly help the client and the Architect to know the cost implication of their decisions to alter the original designs.

(v) Adequate market survey for local and available building materials must be done before the design of the building projects are concluded so as to prevent the situation in which there would be scarcity of materials leading to changes in the former designs.

(vi) Again, the pre-dominant rate of variation in the government (public) project sincerely calls for an urgent attention so as to preserve and utilize the resources of our nation to the best advantage of the society. Therefore, the supervising public (government) officials should discharge their duties satisfactorily during the construction of the building projects.

(vii) Professional Institutes like the Nigeria Institute of quantity surveyors (N.I.Q.S), Nigerian Institute of Architects (N.I.A), Nigerian Institute of Builders (N.I.O.B) should guard against the infiltration of quacks into their respective professions as well as ensure that the qualified members discharge their duties with the highest professional conduct.

Areas For Further Research

There is the need for further research into:

(i) Cost implications of variation on contractor's working capital and client's cash flow.

(ii) Cost escalation due to variation with respect to Civil Engineering projects.

(iii) The impact of variation on completion target date of construction projects.

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APPENDIX A

THE CLIENTS AND THE NATURE OF THE BUILDINGS

PROJ. NO	TYPE OF CLIENT	NATURE OF THE BUILDINGS INVESTIGATED
1	Public	NSITF Zonal Head Office, Kano
2	"	Library Training Hall & Production Room, Kad.
3	"	New Science Block complex Fed. College of Educ., Zaria
4	"	C.B.N. Junior Staff Housing Abuja 1No. Block.
5	"	NACB Branch Office Complex Jos.
6	"	Hospital Block for Family Support Programme, Anambra
7	"	Judge's Quarter at Onitsha
8	"	Political Party Building at Ogbalu, Anambra.
9	"	Residential development Kano.
10	"	1 Bedroom units low cost, Abia State Govt, (ASG).
11	"	4 Bedroom units low cost, Abia State Govt, (ASG).
12	"	3 Bedroom units low cost, Abia State Govt, (ASG).
13	"	Senior Staff Quarters detached House, (ASG)
14	"	State House of Assembly, Umuahia, Abia State
15	"	Federal High Court, Abia State
16	Private	Residential Building of Chief Leonard Chukky, Ihiala, Anambra
17	"	Catholic Church Building at Ihiala, Anambra.
18	"	Residential Building of Chief Innocent Okafor, Nnewi.
19	"	Three Storey Office Building for Churum (Nig) Ltd, Onitsha
20	"	Community Hospital at Ubahu Okija, Anambra.
21	"	Consruction of Shops at Nkwogbe Market, Ihiala, Anambra.
22	"	Construction of Commercial College at Nnewi, Anambra.
23	"	Two bedroom flat for MR Emeka, Uli, Anambra.

APPENDIX B

THE COST INFORMATION OF THE PROJECTS WITH VARIATIONS

PROJ NO A	INITIAL CONT. SUMS N B	FINAL CONTRACT SUMS N C	DIFF. BETWEEN INITIAL & FINAL CONT. SUMS N C - B	AMOUNT OF VAR. IN THE PROJECTS N D	% DIFF. IN CONT. SUM TO THE INITIAL CONT. SUMS $\frac{C-B}{B} \times \frac{100}{1}$	% AMOUNT OF VARIATION IN THE DIFFERENCE $\frac{D}{C-B} \times \frac{100}{1}$	% AMOUNT OF VAR. TO THE INITIAL CONT. SUMS $\frac{D}{B} \times \frac{100}{1}$ %
1	11,611,544.87	54,231,430.87	42,619,886.00	2,534,148.24	367%	5.9%	21.8%
2	2,415,451.60	4,072,081.53	1,656,629.93	400,652.35	68.6%	24.2%	16.6%
3	5,122,346.60	6,608,381.00	1,486,034.40	1,152,032.40	29%	77.5%	22.5%
4	6,500,000.00	14,700,000.00	8,200,000.00	3,470,000.00	126%	42.3%	53.4%
5	13,450,000.00	27,850,000.00	14,400,000.00	7,701,000.00	107%	53.5%	57.3%
6	3,103,660.00	6,260,231.20	3,156,571.20	5,522,198.90	101.7%	48.2%	49.0%
7	798,235.60	880,305.90	82,070.30	82,070.30	10.3%	100%	10.3%
8	821,092.95	1,200,954.70	379,861.75	379,861.75	46.3%	100%	46.3%
9	10,000,000.00	14,030,000.00	4,030,000.00	4,030,000.00	40.3%	100%	40.3%
10	141,593.52	147,662.21	6,068.69	6,068.69	4.3%	100%	4.3%
11	253,245.19	265,040.56	11,795.37	12,155.37	4.7%	103.1%	4.8%
12	369,477.95	387,710.95	18,233.00	18,233.00	4.9%	100%	4.9%
13	175,060.10	202,060.50	27,000.40	17,000.50	15.4%	63%	9.7%
14	16,451,638.08	21,478,075.15	5,026,437.07	5,026,437.07	30.6%	100%	30.6%
15	5,070,687.33	8,720,011.15	3,649,323.42	3,449,324.00	71.9%	94.5%	68 %
16	12,015,994.91	16,948,334.52	4,932,339.61	2,110,473.28	41%	42.8%	17.6%
17	16,284,943.82	19,747,130.02	3,462,186.20	2,421,200.14	21.3%	69.9%	14.9%
18	9,450,000.00	7,700,000.00	-1,750,000.00	-1,750,000.00	-18.5%	100%	-18.5%
19	22,811,142.40	18,456,601.50	-4,354,540.90	-4,354,540.90	-19.1%	100%	-19.1%
20	14,384,873.40	23,632,162.20	9,283,288.80	6,449,881.30	64.7%	69.5%	44.9%
21	4,709,802.84	5,805,800.14	1,095,997.30	847,698.80	23.3%	77.3%	17.9%
22	561,502.00	621,100.52	59,598.52	48,398.40	10.6%	81.2%	8.6%
23	476,982.30	476,982.30	-	-	-	-	-
	156,943,275.90	254,422,056.90	97,478,781.00	35,574,294.39	62.1%	36.5%	22.7%

APPENDIX C

COST INFORMATION OF THE ELEMENTS OF BUILDING PROJECTS WITH VARIATIONS (SUBSTRUCTURE)

PROJ NO	INITIAL CONTRACT SUM ₦	INITIAL COST OF THE ELEMENT ₦	FINAL COST OF THE ELEMENT ₦	DIFF BETWEEN INITIAL AND FINAL COST OF THE ELEMENT ₦	AMOUNT OF VARIATION IN THE PROJECTS ₦	AMOUNT OF VARIATION IN THE ELEMENT ₦	% DIFF OF THE DIFF IN THE INITIAL COST OF THE ELEMENT $\frac{D-C}{C} \times \frac{100}{1}$	% AMOUNT OF VAR IN THE ELEMENT TO THE DIFF $\frac{F}{D-C} \times \frac{100}{1}$	% AMOUNT OF VAR IN THE ELEMENT TO THE INITIAL COST OF THE ELEMENT $\frac{F}{C} \times \frac{100}{1}$	% AMOUNT OF VAR IN THE ELEMENT TO THE AMOUNT OF VAR IN THE PROJECTS $\frac{F}{E} \times \frac{100}{1}$	% AMOUNT OF VAR IN THE ELEMENT TO THE INITIAL CONT SUMS $\frac{F}{B} \times \frac{100}{1}$
A	B	C	D	D - C	E	F					
1	11,611,544.84	1,425,673.00	1,450,942.85	25,269.85	2534,148.24	20,968.85	1.8%	82.9%	1.5%	0.8%	0.18%
2	2,415,451.60	313,458.00	322,722.00	9,264.00	400,652.35	9,264.00	2.9%	100%	2.9%	2.3%	0.38%
3	5,122,346.60	882,322.00	982,322.00	10,000.00	1152,032.40	10,000.00	11.3%	100%	11.3%	0.87%	0.20%
4	6,500,000.00	750,000.00	1,200,000.00	450,000.00	3,470,000.00	450,000.00	60%	100%	60%	12.9%	6.9%
5	13,450,000.00	1.800,000.00	2,300,000.00	500,000.00	7,701,000.00	500,000.00	27.8%	100%	27.8%	6.5%	3.7%
6	3,103,660.00	231,630.00	450,980.00	219,350.00	1,522,198.90	160,400.40	94.7%	73.1%	69.2%	10.5%	5.2%
7	798,235.60	200,287.70	230,332.00	30,044.30	82,070.30	30,044.30	15%	100%	15%	36.6%	3.8%
8	821,092.95	194,671.10	226,734.00	32,062.90	379,861.75	32,062.90	16.5%	100%	16.5%	8.4%	3.9%
9	10,000,000.00	1500,000.00	1,600,000.00	100,000.00	4,030,000.00	100,000.00	6.7%	100%	6.7%	2.5%	1.0%
10	141,593.52	18,233.06	24,301.75	6,068.69	6,068.69	6.068.69	33.3%	100%	33.3%	100%	4.3%
11	253,245.19	36,466,05	48,261.42	11,795.37	11,795.37	11,759.37	32.3%	100%	32.3%	100%	4.7%
12	369,477.95	54,699.07	72,932.07	18,233.00	18,233.00	18,233.00	33.3%	100%	33.3%	100%	4.9%
13	185,060.00	26,250.00	43,250.50	17,000.50	17,000.50	17,000.50	64.8%	100%	64.8%	100%	9.2%
14	16,451,638.08	1,584,292.56	3,058,701.75	1,474,409.19	5,026,437.07	1,474,409 19	93.1%	100%	93.1%	29.3%	8.9%
15	5,070,686.73	1,013,338.85	1742,629.00	729,290.15	3,449,324.80	729,290.15	71.9%	100%	71.9%	21.1%	14.4%
16	12,015,994.91	2,406,506.00	3,809,456.20	1,482,950.20	2,110,473.28	807,956.00	58.3%	54.5%	33.6%	38.3%	6.7%
17	16,284,943.82	3504,200.30	4059,600.60	555,400.30	2,421,200.14	401,000.00	15.8%	72.2%	11.4%	16.7%	2.5%
18	9,450,000.00	1.150,000.00	1,000,000.00	-150,000.00	-1,750,000.00	-150,000.00	-13%	100%	-13.0%	8.6%	-1.6%
19	22,811,142.40	3,500,400.20	2,405,300.00	-1,095,100.10	-4,354,540.90	-1,095,100.10	-31.3%	100%	-31.3%	25.1%	-4.8%
20	14,348,873.40	2,506,705.40	4,560,495.60	2,053,790.20	6,449,881.30	1,068,980,60	81.9%	52%	42.6%	16.6%	7.4%
21	4,709,802.84	800,000.60	860,898.20	60,897.60	847,698.80	50.097.60	7.6%	82.3%	6.3%	5.9%	1.1%
22	561,502.00	120.500.78	140,800.60	20,299.82	48,398.40	15,096.90	16.8%	74.4%	12.5%	31.2%	2.7%
23	476,982.30	80,080.80	80,080.80	-	-	-	-	-	-	-	-
	156,943,275.90	24,099,715.47	30,670,741.44	6,571,025.97	35,574,294.39	4.667,568.65	27.3%	71.0%	19.4%	13.1%	3.0%

APPENDIX D

THE COST INFORMATION OF THE ELEMENTS OF BUILDING PROJECTS WITH VARIATIONS (SUPERSTRUCTURE)

P/NO	INITIAL CONTRACT SUMS ₦	INITIAL COST OF THE ELEMENT ₦	FINAL COST OF THE ELEMENT ₦	DIFF BETWEEN INITIAL AND FINAL COST OF THE ELEMENT ₦	AMOUNT OF VARIATION IN THE PROJECTS ₦	AMOUNT OF VARIATION IN THE ELEMENT ₦	% DIFF OF THE DIFF IN THE INITIAL COST OF THE ELEMENT $\frac{D-C}{C} \times \frac{100}{1}$	% AMOUNT OF VARIATION IN THE ELEMENT TO THE DIFF $\frac{F}{D-C} \times \frac{100}{1}$	% AMOUNT OF VAR. IN THE ELEMENT TO THE INITIAL COST OF THE ELEMENT $\frac{F}{C} \times \frac{100}{1}$	% AMOUNT OF VAR. IN THE ELEMENT TO THE AMOUNT OF VAR. IN THE PROJECTS $\frac{F}{E} \times \frac{100}{1}$	% AMOUNT OF VAR. IN THE ELEMENT TO THE INITIAL CONT. SUMS $\frac{F}{B} \times \frac{100}{1}$
	B	C	D	D - C	E						
1	11,611,544.87	9,885,872.00	52,083,353.00	42,197,481.00	2,534,148.24	507,481.00	81.0%	1.20%	5.2%	20.0%	4.4%
2	2,415,451.60	2,033,689.00	3,681,505.00	1,647,816.00	400,652.35	29,141.35	81.0%	18.0%	14.6%	7.4%	1.2%
3	5,122,346.60	2,307,182.00	2,821,215.00	514,033.00	1,152,032.40	272,831.00	22.3%	53.1%	11.8%	23.7%	5.3%
4	6,500,000.00	3,500,000.00	5,100,000.00	1,600,000.00	3,470,000.00	750,000.00	45.7%	46.9%	21.4%	21.6%	11.5%
5	13,450,000.00	5,100,000.00	7,000,000.00	1,900,000.00	7,701,000.00	1,100,000.00	37.3%	57.9%	21.6%	14.3%	8.2%
6	3,103,660.00	995,958.50	1,698,050.20	702,091.70	1,522,198.90	120,300.30	70.5%	17.1%	12.1%	7.9%	3.9%
7	798,235.60	320,181.00	350,196.00	30,014.90	82,070.30	30,014.90	9.4%	100%	9.3%	36.6%	3.8%
8	821,092.95	302,707.75	509,578.30	206,870.55	379,861.75	206,870.55	68.3%	100%	68.3%	54.5%	25.2%
9	10,000,000.00	2,500,000.00	4,000,000.00	1,500,000.00	4,030,000.00	1,500,000.00	60.0%	100%	60.0%	37.2%	15.0%
10	141,593.52	24,310.74	24,310.74	-	6,068.69	-	-	-	-	-	-
11	253,245.19	36,466.11	36,466.11	-	11,795.37	-	-	-	-	-	-
12	369,477.95	54,699.17	54,699.17	-	18,233.00	-	-	-	-	-	-
13	185,060.00	35,000.00	35,000.00	-	17,000.50	-	-	-	-	-	-
14	16,451,638.08	4,460,363.03	5,277,821.40	817,458.37	5,026,437.07	817,458.37	18.3%	100%	18.3%	16.3%	4.9%
15	5,070,686.73	2,071,693.73	3,562,671.50	1,490,978.02	3,449,324.00	1,490,978.02	71.9%	100%	71.9%	43.2%	29.4%
16	12,015,994.91	4,576,408.00	5,490,300.34	911,892.34	2,110,473.28	505,100.30	19.9%	55.3%	11.0%	23.9%	4.2%
17	16,284,943.82	6,509,434.20	7,507,349.30	997,915.10	2,421,200.14	650,200.14	15.3%	65.2%	9.9%	26.9%	3.9%
18	9,450,000.00	2,500,000.00	2,000,000.00	-500,000.00	-1,750,000.00	-500,000.00	-20.0%	100%	-20.0%	28.6%	-5.3%
19	22,811,142.40	1,500,060.80	1,300,400.40	-199,660.40	-4,354,540.90	-199,660.40	-13.3%	100%	-13.3%	4.6%	-0.9%
20	14,348,873.40	4,430,200.40	6,400,300.20	1,970,099.80	6,449,881.30	1050,600.40	44.5%	53.3%	23.7%	16.3%	7.3%
21	4,709,802.84	1,009,800.20	1,794,500.00	784,699.80	847,698.80	587,600.20	77.8%	74.9%	58.2%	69.3%	12.5%
22	561,502.00	230,200.22	250,200.22	20,000.00	48,398.40	18,000.60	8.7%	90.0%	7.8%	37.2%	3.2%
23	476,982.30	106,780.20	106,780.20	-	0	-	-	-	-	-	-
	156,943,275.90	54,493,007.05	111,035,497.10	56,542,490.05	35,574,294.39	8,936,916.73	104%	15.8%	16.4%	25.1%	5.7%

APPENDIX E

THE COST INFORMATION OF THE ELEMENTS OF BUILDING PROJECTS WITH VARIATIONS (FINISHES)

PROJ NO A	INITIAL CONTRACT SUMS ₦ B	INITIAL COST OF THE ELEMENT ₦ C	FINAL COST OF THE ELEMENT ₦ D	DIFF BETWEEN INITIAL AND FINAL COST OF THE ELEMENT ₦ D - C	AMOUNT OF VARIATION IN THE PROJECTS ₦ E	AMOUNT OF VARIATION IN THE ELEMENT ₦ F	% DIFF OF THE DIFF IN THE INITIAL COST OF THE ELEMENT $\frac{D-C}{C} \times \frac{100}{1}$	% AMOUNT OF VARIATION IN THE ELEMENT TO THE DIFF $\frac{F}{D-C} \times \frac{100}{1}$	% AMOUNT OF VAR. IN THE ELEMENT TO THE INITIAL COST OF THE ELEMENT $\frac{F}{C} \times \frac{100}{1}$	% AMOUNT OF VAR. IN THE ELEMENT TO THE AMOUNT OF VAR. IN THE PROJECTS $\frac{F}{E} \times \frac{100}{1}$	% AMOUNT OF VAR. IN THE ELEMENT TO THE INITIAL CONT SUMS $\frac{F}{B} \times \frac{100}{1}$
1	11,611,544.87	1,408,105.00	2,313,538.00	905,433.00	2,534,148.24	70,422.00	64.3%	7.8%	5.0%	2.8%	0.61%
2	2,415,451.60	346,019.00	546,019.00	200,000.00	400,652.35	150,000.00	57.8%	75.0%	43.4%	37.4%	6.2%
3	5,122346.60	771,517.60	1,035,444.00	263,926.40	1,152,032.40	263,926.40	34.2%	100%	34.2%	22.9%	5.1%
4	6,500,000.00	1,830,000.00	2,500,000.00	670,000.00	3,470,000.00	820,000.00	36.6%	122.4%	44.8%	23.6%	12.6%
5	13,450,000.00	2500,000.00	4,700,000.00	2,200,000.00	7,701,000.00	901,000.00	88.0%	40.9%	36.0%	11.7%	6.7%
6	3,103,660.00	568,990.40	1580,600.10	1,011,609.70	1,522,198.90	659,698.20	177.8%	65.2%	116%	43.3%	21.3%
7	798235.60	57,124.30	57,124.30	-	82,070.30	-	-	-	-	-	-
8	821,092.95	277,389.10	277,389.10	-	379,861.75	-	-	-	-	-	-
9	10,000,000.00	1,300,000.00	2,000,000.00	700,000.00	4,030,000.00	700,000.00	53.8%	100%	53.8%	17.4%	7.0%
10	141,593.52	52,268.09	52,268.09	-	6,068.69	-	-	-	-	-	-
11	253,245.19	87,518.66	87,518.66	-	11,795.37	-	-	-	-	-	-
12	369,477.95	120,338.16	12,033.16	-	18,233.00	-	-	-	-	-	-
13	185,060.00	57,750.00	57,750.00	-	17,000.50	-	-	-	-	-	-
14	16,451,638.08	1,640,456.95	2,315,063.00	674606.05	5,026,437.07	674,606.05	41.1%	100%	41.1%	13.4%	4.1%
15	5,070,686.73	542,031.27	932,126.00	390,094.74	3,449,324.80	390,094.73	71.9%	100%	71.9%	11.3%	7.7%
16	12,015,994.91	1,508,200.00	2,405,100.10	896,900.10	2,110,473.28	670,400.12	59.5%	74.7%	44.5%	31.8%	5.6%
17	16,284,943.82	2,500,409.10	3,600,090.30	1,099,681.20	2,421,200.14	840,000.20	43.9%	76.4%	33.6%	34.7%	5.2%
18	9,450,000.00	1,800,000.00	1,500,000.00	-300,000.00	-1,750,000.00	-300,000.00	-16.7%	100%	-16.7%	17.1%	-3.2%
19	22,811,142.40	6,5000,800.20	5,200,400.30	-1,300,399.90	-4,354,540.90	1,300,399.90	-20.0%	100%	-20.0%	29.9%	-5.7%
20	14,348,873.40	2,600,500.30	3,880,400.00	1,279,899.70	6,449,881.20	1,200,300.20	49.2%	93.7%	46.2%	18.6%	8.4%
21	4,709,802.84	900,000.10	900,000.10	-	847,698.80	-	-	-	-	-	-
22	561,502.00	100,800.30	120,100.40	19,300.10	48,398.40	15,300.90	19.2%	79.2%	15.2%	31.6%	2.7%
23	476,982.30	108,000.40	108,000.40	-	0		-	-	-	-	-
	156,943,275.90	27,578,219.83	36,133,965.01	8,555,745.18	35,574,294.39	5,755,348.70	31.0%	67.2%	20.9%	16.2%	3.7%

APPENDIX F

THE COST INFORMATION OF THE ELEMENTS OF BUILDING PROJECTS WITH VARIATIONS (FITTINGS AND FURNISHINGS)

PROJ NO	INITIAL CONTRACT SUMS ₦	INITIAL COST OF THE ELEMENT ₦	FINAL COST OF THE ELEMENT ₦	DIFF. BETWEEN INITIAL AND FINAL COST OF THE ELEMENT ₦	AMOUNT OF VARIATION IN THE PROJECT ₦	AMOUNT OF VARIATION IN THE ELEMENT ₦	% DIFF OF THE DIFF IN THE INITIAL COST OF THE ELEMENT $\frac{D-C}{C} \times \frac{100}{1}$	% AMOUNT OF VARIATION IN THE ELEMENT TO THE DIFF $\frac{F}{D-C} \times \frac{100}{1}$	% AMOUNT OF VAR. IN THE ELEMENT TO THE INITIAL COST OF THE ELEMENT $\frac{F}{C} \times \frac{100}{1}$	% AMOUNT OF VAR. IN THE ELEMENT TO THE AMOUNT OF VAR. IN THE PROJECTS $\frac{F}{E} \times \frac{100}{1}$	% AMOUNT OF VAR. IN THE ELEMENT TO THE INITIAL CONT. SUMS $\frac{F}{B} \times \frac{100}{1}$
A	B	C	D	D - C	E	F					
1	11,611,544.87	450,000.00	575,900.00	125,900.00	2,534,148.24	100,700.00	27.9%	79.9%	22.4%	3.9%	0.9%
2	2,415,451.60	76,555.00	20,835.00	-55,720.00	400,652.35	-55,720.00	-72.8%	100%	-72.8%	-13.9%	-2.3%
3	5,122,346.60	115,650.00	115,650.00	-	1,152,032.40	-	-	-	-	-	-
4	6,500,000.00	1,000,000.00	1,500,000.00	500,000.00	3,470,000.00	500,000.00	50.8%	100%	50.0%	50.0%	7.7%
5	13,450,000.00	1500,000.00	4,200,000.00	2,700,000.00	7,701,000.00	300,000.00	180%	11.1%	20.0%	3.9%	2.2%
6	3,103,660.00	100,000.00	120,000.00	20,000.00	1,522,198.90	10,000.00	20%	50.0%	10.0%	0.7%	0.7%
7	798,235.60	54,719.60	54,719.60	-	82,070.30	-	-	-	-	-	-
8	821,092.95	30,798.00	54,719.60	23,921.60	379,861.75	23,921.50	77.7%	100%	77.7%	6.3%	2.9%
9	1,000,000.00	100,000.00	100,000.00	-	4,030,000.00	-	-	-	-	-	-
10	141,593.52	3,646.60	3,646.60	-	6,068.69	-	-	-	-	-	-
11	253,245.19	31,603.96	31,603.96	-	11,795.37	-	-	-	-	-	-
12	369,477.95	47,405.94	47,405.94	-	18,233.00	-	-	-	-	-	-
13	185,060.00	22,750.00	22,750.00	-	17,000.50	-	-	-	-	-	-
14	16,451,638.08	2,125,000.00	2,526,140.00	401,140.00	5,026,437.07	401,140.00	18.9%	100%	18.9%	7.9%	2.4%
15	5,070,686.73	9,885.50	17,000.00	7,115.50	3,449,324.00	7,115.50	71.9%	100%	71.9%	0.2%	0.1%
16	12,015,994.91	980,689.32	805,406.20	-175,283.12	2,110,473.28	-175,283.12	-17.9%	100%	-17.9%	-8.3%	-1.5%
17	16,284,943.82	1,210,000.00	1,490,000.00	280,000.00	2,421,200.14	120,000.00	23.1%	42.9%	9.9%	4.9%	0.7%
18	9,450,000.00	1,000,000.00	800,000.00	-200,000.00	-1,750,000.00	-200,000.00	-20.0%	100%	-20.0%	11.4%	-2.1%
19	22,811,142.40	2,500,100.00	2,000,000.00	-500,100.00	-4,354,540.90	-500,100.00	-20.0%	100%	-20.0%	11.4%	-2.2%
20	14,348,873.40	1,970,667.20	3,009,866.20	1,039,199.00	6449,881.30	980,000.00	52.7%	94.3%	49.7%	15.2%	6.8%
21	4,709,802.84	400,000.44	400,000.44	-	847,698.80	-	-	-	-	-	-
22	561,502.00	50,000.20	50,000.20	-	48,398.40	-	-	-	-	-	-
23	476,982.30	50,000.30	50,000.30	-	0	-	-	-	-	-	-
	156,943,275.90	11,329,372.06	17,995,644.04	6,666,271.98	35,574,294.39	1,511,773.88	58.8%	22.7%	13.3%	4.2%	0.96%

APPENDIX G

THE COST INFORMATION OF THE ELEMENTS OF BUILDING PROJECTS WITH VARIATIONS (SERVICES)

PROJ. NO A	INITIAL CONTRACT SUMS ₦ B	INITIAL COST OF THE ELEMENT ₦ C	FINAL COST OF THE ELEMENT ₦ D	DIFF BETWEEN INITIAL AND FINAL COST OF THE ELEMENT ₦ D - C	AMOUNT OF VARIATION IN THE PROJECTS ₦ E	AMOUNT OF VARIATION IN THE ELEMENT ₦ F	% DIFF OF THE DIFF IN THE INITIAL COST OF THE ELEMENT $\frac{D-C}{C} \times \frac{100}{1}$	% AMOUNT OF VAR. IN THE ELEMENT TO THE DIFF $\frac{F}{D-C} \times \frac{100}{1}$	% AMOUNT OF VAR. IN THE ELEMENT TO THE INITIAL COST OF THE ELEMENT $\frac{F}{C} \times \frac{100}{1}$	% AMOUNT OF VAR. IN THE ELEMENT TO THE AMOUNT OF VAR. IN THE PROJECTS $\frac{F}{E} \times \frac{100}{1}$	% AMOUNT OF VAR. IN THE ELEMENT TO THE INITIAL CONT. SUMS $\frac{F}{B} \times \frac{100}{1}$
1	11,611,544.87	2,009,700.00	5,393,401.00	3,383,701.00	2,534,148.24	1,760,800.00	168.3%	52.0%	87.6%	69.5%	15.2%
2	2,415,451.60	350,223.00	352,905.00	2682.00	400,652.35	2,682.00	0.8%	100%	0.8%	0.7%	0.11%
3	5,122,346.60	795,675.00	1,353,750.00	558,075.00	1,152,032.40	558,075.00	70.0%	100%	70.0%	48.4%	10.9%
4	6,500,000.00	1,200,000.00	2,000,000.00	800,000.00	3,470,000.00	200,000.00	66.7%	25.0%	16.7%	5.8%	3.1%
5	13,450,000.00	2,500,000.00	3,700,000.00	1,200,000.00	7,701,000.00	450,000.00	48.0%	37.5%	18.0%	5.8%	3.3%
6	3,103,660.00	250,000.70	750,000.30	499,999.60	1,522,198.90	305,000.00	199.0%	61.0%	121.9%	20.0%	9.8%
7	798,235.60	125,923.00	125,923.00	-	82,070.30	-	-	-	-	-	-
8	821,092.95	136,565.10	116,888.60	-19,676.50	379,861.75	-19,676.50	-14.4%	100%	-14.4%	-5.2%	-2.4%
9	10,000,000.00	2,300,000.00	4000,000.00	1700,000.00	4,030,000.00	1,700,000.00	73.9%	100%	73.9%	42.2%	17.0%
10	141,593.52	23,095.20	23,095.20	-	6,068.69	-	-	-	-	-	-
11	253,245.19	24,310.74	24,310.74	-	11,795.37	-	-	-	-	-	-
12	369,477.95	33,466.11	33,466.11	-	18,233.00	-	-	-	-	-	-
13	185,060	17,560.00	17,560.00	-	17,000.50	-	-	-	-	-	-
14	16,451,638.08	4,759,458.32	5,236,253.50	476,795.18	5,026,437.07	476,795.18	10.0%	100%	10.0%	9.5%	2.9%
15	5,070,686.73	802,350.80	1,379,795.00	577,744.20	3,449,324.80	57,744.20	71.9%	9.9%	7.2%	1.7%	1.1%
16	12,015,994.91	1,020,300.00	2,598,700.00	1,578,400.40	2,110,473.28	1,02,300.00	155%	6.5%	10.0%	4.8%	0.9%
17	16,284,943.82	980,000.00	1209,100.00	229,100.00	2,421,200.14	200,000.00	24.4%	87.3%	20.4%	8.3%	1.2%
18	9,450,000.00	1,500,000.00	1,200,000.00	-300,000.00	-1,750,000.00	-300,000.00	-20.0%	100%	-20.0%	17.1%	-3.2%
19	22,811,142.40	5,500,300.40	4,500,200.60	-1,000,099.80	-4,354,540.90	-1,000,099.80	-18.2%	100%	-18.2%	-22.9%	-4.4%
20	14,348,873.40	1,090,800.10	3,080,600.10	1,989,800.00	6,449,881.30	1,250,000.00	182%	62.8%	115%	19.4%	8.7%
21	4,709,802.84	850,000.50	950,400.80	100,400.30	847,698.80	90,000.40	11.8%	89.6%	10.6%	10.6%	1.9%
22	561,502.00	30,000.10	30,000.10	-	48,398.40	-	-	-	-	-	-
23	476,982.30	100,060.40	100,060.40	-	0	-	-	-	-	-	-
	156,943,275.90	26,399,789.47	38,176,410.85	11,776,621.38	35,574,294.39	5,833,620.48	44.6%	49.5%	22.1%	16.4%	3.7%

APPENDIX H

THE COST INFORMATION OF THE ELEMENTS OF BUILDING PROJECTS WITH VARIATIONS (EXTERNAL WORKS)

PROJ. NO A	INITIAL CONTRACT SUMS ₦ B	INITIAL COST OF THE ELEMENT ₦ C	FINAL COST OF THE ELEMENT ₦ D	DIFF BETWEEN INITIAL AND FINAL COST OF THE ELEMENT ₦ D - C	AMOUNT OF VARIATION IN THE PROJECTS ₦ E	AMOUNT OF VARIATION IN THE ELEMENT ₦ F	% DIFF OF THE DIFF IN THE INITIAL COST OF THE ELEMENT $\frac{D-C}{C} \times \frac{100}{1}$	% AMOUNT OF VAR. IN THE ELEMENT TO THE DIFF $\frac{F}{D-C} \times \frac{100}{1}$	% AMOUNT OF VAR. IN THE ELEMENT TO THE INITIAL COST OF THE ELEMENT $\frac{F}{C} \times \frac{100}{1}$	% AMOUNT OF VAR. IN THE ELEMENT TO THE AMOUNT OF VAR. IN THE PROJECTS $\frac{F}{E} \times \frac{100}{1}$	% AMOUNT OF VAR. IN THE ELEMENT TO THE INITIAL CONT. SUMS $\frac{F}{B} \times \frac{100}{1}$
1	11,611,544.87	2000,000.00	3,697,577.00	1,697,577.00	2,534,148.24	63,000.00	84.8%	3.7%	3.2%	2.5%	0.54%
2	2,415,451.60	-	-	-	400,652.35	-	-	-	-	-	-
3	5,122,346.60	100,000.00	140,000.00	40,000.00	1,152,032.40	40,000.00	40.0%	100%	40.0%	3.5%	0.78%
4	6,500,000.00	809,080.20	1500,600.90	691,520.70	3,470,000.00	260,800.00	85.5%	37.7%	32.2%	17.1%	8.4%
5	13,450,000.00	20,000.00	37,011.00	17,011.00	7,701,000.00	17,011.00	85%	100%	85%	20%	2.1%
6	3,103,660.00	39,624.00	61,131.00	21,507.00	1,522,198.90	21,507.00	54.3%	100%	54.3%	5.7%	2.6%
7	798,235.60	2,100,000.00	2,500,000.00	400,000.00	82,070.30	400,000.00	19.0%	100%	19.0%	11.5%	6.2%
8	821,092.95	3,000,000.00	4,250,000.00	1,250,000.00	379,861.75	1,250,000.00	41.7%	100%	41.7%	16.2%	9.3%
9	10,000,000.00	1,500,000.00	1,530,000.00	30,000.00	4,030,000.00	30,000.00	2.0%	100%	2.0%	0.74%	0.3%
10	141,593.52	10,939.83	10,939.83	-	6,068.69	-	-	-	-	-	-
11	253,245.19	21,879.67	21,879.67	-	11,795.37	-	-	-	-	-	-
12	369,477.95	32,819.50	32,819.50	-	18,233.00	-	-	-	-	-	-
13	185,060.00	15,750.00	15,750.00	-	17,000.50	-	-	-	-	-	-
14	16,451,638.08	470,516.79	1,139,783.50	669,266.72	5,026,437.07	669,266.71	142%	100%	142%	13.3%	4.1%
15	5,070,686.73	253,411.88	435,490.00	182,378.12	3,449,324.00	182,378.12	71.9%	100%	71.9%	5.3%	3.6%
16	12,015,994.91	880,495.32	880,495.32	-	2,110,473.28	-	-	-	-	-	-
17	16,284,943.82	880,900.12	980,990.00	100,089.88	2,421,200.14	60,000.00	11.4%	59.9%	6.8%	2.5%	0.37%
18	9,450,000.00	900,000.00	700,000.00	-200,000.00	-1,750,000.00	-200,000.00	-22%	100%	-22%	11.4%	-2.1%
19	22,811,142.40	2,500,400.20	2,400,300.00	-100,100.10	-4,354,540.90	-100,100.10	-4%	100%	-4%	2.3%	-0.43%
20	14,348,873.40	950,000.20	1,500,500.00	550,499.80	6,449,881.30	500,000.00	57.9%	90.8%	52.6%	7.8%	3.4%
21	4,709,802.84	500,000.20	600,000.00	99,999.80	847,698.80	70,000.60	19.9%	70%	14%	8.3%	1.5%
22	561,502.00	20,000.30	20,000.30	-	48,398.40	-	-	-	-	-	-
23	476,982.30	20,060.20	20,060.20	-	0	-	-	-	-	-	-
	156,943,275.90	17,025,878.51	22,475,328.32	5,449,449.81	35,574,294.39	3,263,863.33	32%	59.9%	19%	9.2%	2.1%

APPENDIX I

THE COST INFORMATION OF THE ELEMENTS OF BUILDING PROJECTS WITH VARIATIONS (PRELIMINARIES)

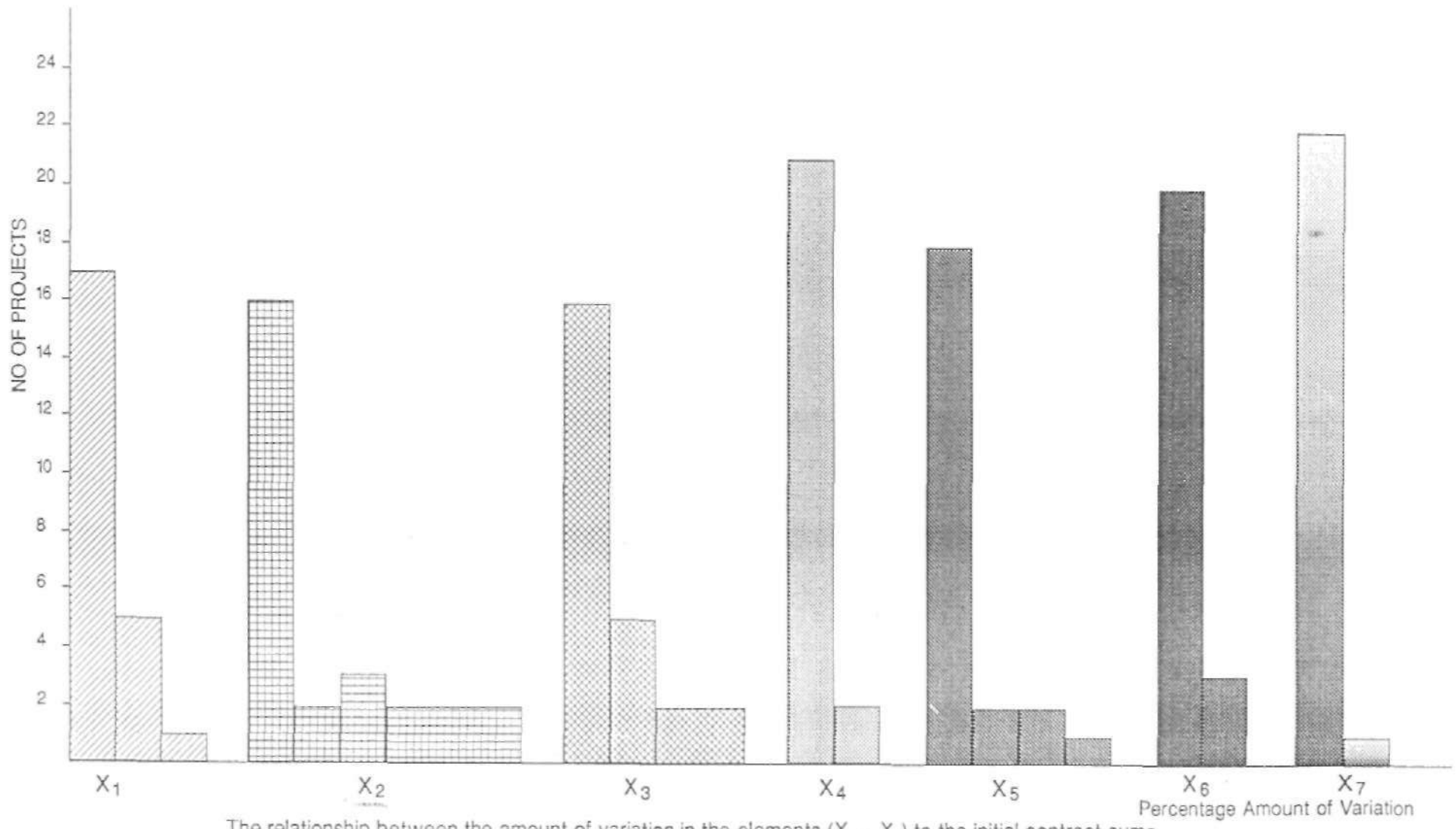
PROJ NO A	INITIAL CONTRACT SUMS ₦ B	INITIAL COST OF THE ELEMENT ₦ C	FINAL COST OF THE ELEMENT ₦ D	DIFF BETWEEN INITIAL AND FINAL COST OF THE ELEMENT ₦ D - C	AMOUNT OF VARIATION IN THE PROJECTS ₦ E	AMOUNT OF VARIATION IN THE ELEMENT ₦ F	% DIFF OF THE DIFF IN THE INITIAL COST OF THE ELEMENT $\frac{D-C}{C} \times \frac{100}{1}$	% AMOUNT OF VAR IN THE ELEMENT TO THE DIFF $\frac{F}{D-C} \times \frac{100}{1}$	% AMOUNT OF VAR IN THE ELEMENT TO THE INITIAL COST OF THE ELEMENT $\frac{F}{C} \times \frac{100}{1}$	% AMOUNT OF VAR IN THE ELEMENT TO THE AMOUNT OF VAR IN THE PROJECTS $\frac{F}{E} \times \frac{100}{1}$	% AMOUNT OF VAR IN THE ELEMENT TO THE INITIAL CONT SUMS $\frac{F}{B} \times \frac{100}{1}$
1	11,611,544.87	300,000.00	722,425.00	422,425.00	2,534,148.24	10,776.39	141%	2.6%	3.6%	0.42%	0.09%
2	2,415,451.60	68,305.00	104,150.00	35,845.00	400,652.35	35,845.00	52.5%	100%	52.5%	8.9%	1.5%
3	5,122,346.60	150,000.00	160,000.00	10,000.00	1,152,032.40	7,200.00	6.7%	72%	4.8%	0.62%	0.14%
4	6,500,000.00	750,000.00	1,100,000.00	350,000.00	3,470,000.00	350,000.00	46.7%	100%	46.7%	10.0%	5.4%
5	13,450,000.00	1,200,000.00	1,700,000.00	500,000.00	7,701,000.00	500,000.00	41.7%	100%	41.7%	6.5%	3.7%
6	3,103,660.00	148,000.00	160,000.00	12,000.00	1,522,198.90	6,000.00	8.1%	50%	4.1%	0.4%	0.2%
7	798,235.60	20,000.00	25,000.00	5,000.00	82,070.30	5,000.00	25%	100%	25%	6.1%	0.6%
8	821,092.95	25,000.00	25,000.00	-	379,861.75	-	-	-	-	-	-
9	10,000,000.00	800,000.00	800,000.00	-	4,030,000.00	-	-	-	-	-	-
10	141,593.52	9,100.00	9,100.00	-	6,068.69	-	-	-	-	-	-
11	253,245.19	15,000.00	15,000.00	-	11,795.37	-	-	-	-	-	-
12	369,477.95	26,000.00	26,000.00	-	18,233.00	-	-	-	-	-	-
13	185,060.00	10,000.00	10,000.00	-	17,000.50	-	-	-	-	-	-
14	16,451,638.08	1,411,550.38	1,924,312.00	512,761.82	5,026,437.07	512,761.62	36.3%	100%	36.3%	10.2%	3.1%
15	5,070,686.73	377,975.20	650,000.00	272,024.80	3,449,324.00	72,025.00	71.9%	26.5%	19.1%	2.1%	1.4%
16	12,015,994.91	641,396.27	958,876.00	317,479.73	2,110,473.28	200,000.00	49.5%	62.9%	31.2%	9.5%	1.7%
17	16,284,943.82	700,000.00	900,000.00	200,000.00	2,421,200.14	150,000.00	28.6%	75%	21.4%	6.2%	0.92%
18	9,450,000.00	600,000.00	500,000.00	-100,000.00	-1,750,000.00	-100,000.00	-16.7%	100%	-16.7%	5.7%	1.10%
19	22,811,142.40	809,080.50	650,000.00	-159,080.50	-4,354,540.90	-159,080.30	-19.7%	100%	-19.7%	3.7%	0.7%
20	14,348,873.40	800,000.00	1,200,000.00	400,000.00	6449,881.30	400,000.00	50%	100%	50%	6.2%	2.8%
21	4,709,802.84	250,000.80	300,000.00	50,000.00	847,698.80	50,000.00	19.9%	100%	19.9%	5.9%	1.10%
22	561,502.00	10,000.00	10,000.00	-	48,398.40	-	-	-	-	-	-
23	476,982.30	12,000.00	12,000.00	-	0	-	-	-	-	-	-
	156,943,275.90	9,133,408.15	11,961,863.80	2,828,455.65	35,574,294.39	2,040,527.51	30.9%	72.1%	22.3%	5.7%	1.3%

APPENDIX J

TIME ELEMENTS OF THE PROJECTS WITH VARIATIONS

PROJ. NO A	INITIAL COMPLETION PERIOD B	FINAL COMPLETION PERIOD (WEEKS) C	DIFF. BETWEEN THE INITIAL AND FINAL COMPLETION PERIOD C - B	EXTENTION OF TIME GIVEN TO VARIATION D	% DIFF. BETWEEN INITIAL AND FINAL COMPLETION PERIOD $\frac{C-B}{B} \times \frac{100}{1}$	% OF VARIATION IN THE DIFF. $\frac{D}{C-B} \times \frac{100}{1}$
1	50 Weeks	156 Weeks	106 Weeks	106 Weeks	212%	100%
2	24 "	30 "	6 "	6 "	25%	100%
3	28 "	84 "	60 "	36 "	214.2%	60%
4	60 "	110 "	50 "	40 "	83.3%	80%
5	62 "	97 "	35 "	27 "	56.5%	77.1%
6	58 "	102 "	44 "	30 "	75.9%	68.2%
7	40 "	75 "	35 "	21 "	87.5%	60%
8	20 "	40 "	20 "	10 "	100%	50%
9	16 "	18 "	2 "	2 "	12.5%	100%
10	14 "	24 "	10 "	-	-	-
11	14 "	20 "	6 "	-	-	-
12	24 "	40 "	16 "	-	-	-
13	14 "	30 "	16 "	-	-	-
14	24 "	48 "	24 "	20 "	100%	83.3%
15	36 "	52 "	16 "	15 "	44.4%	93.7%
16	50 "	130 "	80 "	20 "	160%	25%
17	70 "	200 "	130 "	40 "	186%	30.8%
18	52 "	48 "	-4 "	-4 "	-7.7%	-100%
19	105 "	96 "	-9 "	-9 "	-8.8%	-100%
20	72 "	140 "	68 "	10 "	94.4%	14.7%
21	24 "	30 "	6 "	2 "	25%	33.3%
22	28 "	35 "	7 "	-	-	-
23	20 "	19 "	-1 "	-	-	-

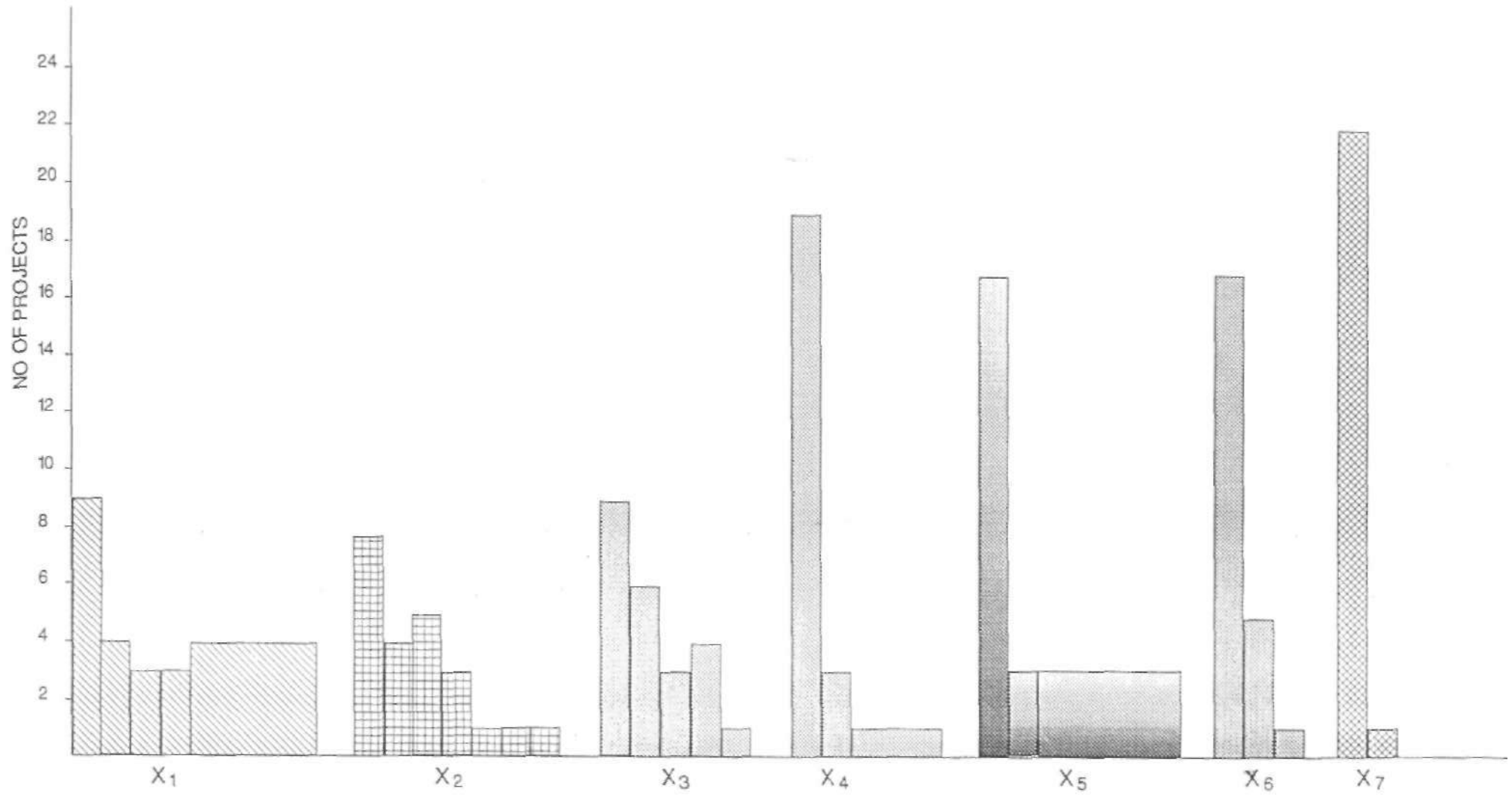
APPENDIX K



The relationship between the amount of variation in the elements (X_1 - X_7) to the initial contract sums.

WHERE: X_1 = Substructure, X_2 = Superstructure, X_3 = Finishes, X_4 = Fittings & Furnishings, X_5 = Services, X_6 = External Work and Preliminaires = X_7

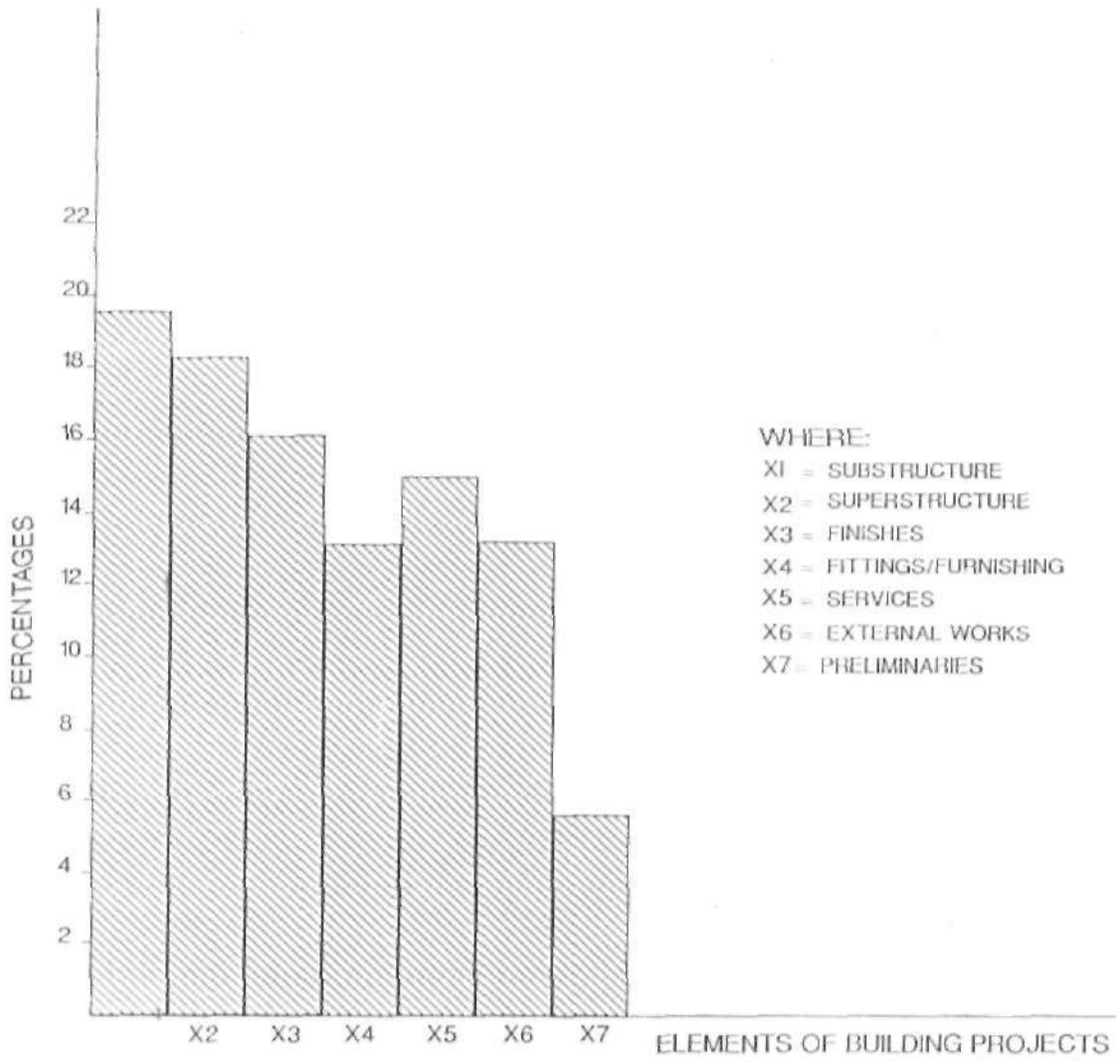
APPENDIX L



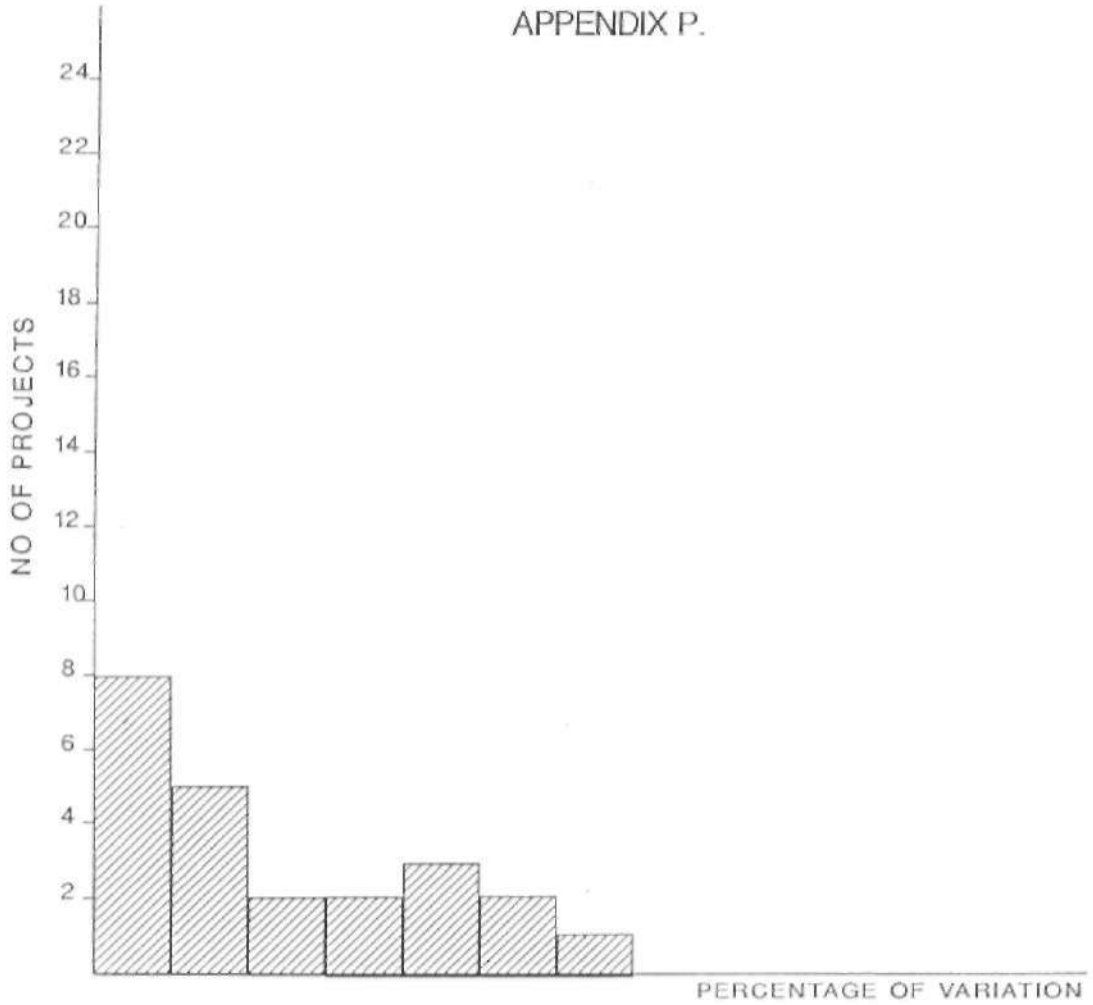
The relationship between the amount of variation in the elements (X_1 - X_7) to the amount of variation in the projects.

WHERE: X_1 = Substructure, X_2 = Superstructure, X_3 = Finishes, X_4 = Fittings & Furnishing, X_5 = Services, X_6 = External Work and Preliminaires = X_7

APPENDIX N



RATES AT WHICH THE BUILDING ELEMENTS ARE SUBJECTED TO VARIATIONS



Histogram Showing the Relationship between the amount of Variation in the Projects to their Initial contract sums.

APPENDIX Q

THIS RESEARCH QUESTIONNAIRE IS TO EVALUTEE THE COST IMPLICATIONS OF VARIATIONS IN CONSTRUCTION PROJECTS (BUILDING) IN NIGERIA

INTRODUCTION:

This questionnaire is for the purpose of collecting data on your firm's/company's building projects. The exercise is purely an academic one and the reseacher - **MR. CLIFFORD NNOROM OKWU** (an M.Sc Student of Ahmadu Bello University, zaria) is quite aware that information received through this medium is absolutely confidential. As you complete this questionnaire the researcher wishes to stress the need for sincerity and accuracy of information as this will enhance the success of the reseach.

Thank you for your anticipated cooperation.

1. (a) Name of firm/company _____

   (b) Address: _____

   (c) Position of the respondent (post held) _____

   (d) Age of respondent: _____

   (e) Sex of respondent: _____

   (f) Qualification of respondent: _____

   (g) Years of experience of the respondent: _____

2. (a) (i) Have you handled any project(s) with vaariation?

   (please tick whichever is appropriate)

   Yes ( ) No ( )

NTH 465725
TH
435-N6

Yes ( ) No ( )

(ii) If yes, how many of them?

(b) What is/are the totaal amount of the projects?

(i) Below N100,000. Yes( ) No( )

(ii) Between N100,000. - N500,000. Yes( ) No( )

(iii) between N500,000.- N1,000,000. Yes( ) No( )

(iv) Between N1,000,000.- N5,000,000. Yes( ) No( )

(v) Above N5,000,000. Yes( ) No( )

3. Please give details below on some of the projects you have handled with variations.

Projects	Initial Contract sum	Final Contract sum	Amount of Variation In The project (s)	Initial Completion Period	Final Completion Period
(i)					
(ii)					
(iii)					
(iv)					

REMARKS/COMMENTS:

4. Please give details on the elements of the building projects you have handled.

PROJECTS / ELEMENTS	SUBSTRUCTURE				SUPERSTRUCTURE				FINIHES				FITTINGS & FURNISHING				SERVICES				EXTERNAL WORK				PRELIMINARIES			
	INITIAL COST	FINAL COST	AMT. OF VARIATN.	SOUR. OF VIRIATN	INITIAL COST	FINAL COST	AMT. OF VARIATN.	SOUR. OF VIRIATN	INITIAL COST	FINAL COST	AMT. OF VARIATN.	SOUR. OF VIRIATN	INITIAL COST	FINAL COST	AMT. OF VARIATN.	SOUR. OF VIRIATN	INITIAL COST	FINAL COST	AMT. OF VARIATN.	SOUR. OF VIRIATN	INITIAL COST	FINAL COST	AMT. OF VARIATN.	SOUR. OF VIRIATN	INITIAL COST	FINAL COST	AMT. OF VARIATN.	SOUR. OF VIRIATN
(i)																												
(ii)																												
(iii)																												
(iv)																												
(v)																												
(vi)																												

5. (a) *Which part(s) oof the building is/are variation(s) issued*

(please tick whichever is ppropriate)

ELEMENTS	ALWAYS	USUALLY	SOMETIMES	NEVER
(i) SUBSTRUCTURE				
(ii) SUPERSTRUCTURE				
(ii) FINISHES				
(iv) FITTINGS & FURNISHINGS				
(v) SERVICES				
(vi) EXTERNAL WORKS				
(vii) PRELIMINARIES				

(b) *Explain why variation(s) Always/Usually occur on above element(s)*

(i) _____

(ii) _____

(iii) _____

6. Please rate the following elements of building in order in which variation occur. (Award the highest with 7 points and others in the descending order of 6, 5, 4,....1)

ELEMENTS	POINTS
(i) SUBSTRUCTURE	
(ii) SUPERSTRUCTURE	
(iii) FINISHES	
(iv) FITTINGS &FURNISHINGS	
(v) SERVICES	
(vi) EXTERNAL WORKS	
(vii) PRELIMINARIES	

7. In the project(s) handled with variation(s) did the Architect allow or consult the project Quantity surveyor to estimate thee value of the variation(s) before instruction is issued? (Please tick one)

   (i) Always ( )

   (ii) Usually ( )

   (iii) Occasionally ( )

   (iv) Never ( )

8. Please write out the title of the project(s0 handled under questions 3

   (i) _____

   (ii) _____

   (iii) _____

9. (a) In your opinion, which type of project between private and government project(s) usually have highest variation? (please tick)

   (i) Private projects ( )

   (ii) Government Projects ( )

   (b) Reason(s) _____

   _____

   _____

10. Please rate the following reasons reasons for variations in order they frequently occur (Award the highest with 10points and others in the discending order of 9, 8, 7, 6,.....1)

NO	FACTORS	POINTS
(i)	Inadequate allawance for project planning	
(ii)	Architect's intention to vary the design or specification	
iii)	Site conditions or unforeseen contingencies	
iv)	Delay in obtaining materials and economic reasons	
v)	Lack of discipline	
vi)	*Architect instructions*	
vii)	Building Services	
viii)	Discrepancy between two or more of the contract documents	
ix)	Discrepancy between statutory requirements and any contract documents	
(x)	Client wishes	

11. Which method of tendering was/were adopteed for the project(s) that has/have the variation(s)

(please tick)

(i) Open Tendering ( )

(ii) Selective Tendering ( )

(iii) Negotiated Contract ( )

(iv) Others ( )

12. (a) When there was/were variation(s) that reduce(s) the scope of the work and the contract sums, did the contractor claim for any loss of profit and/or overhead costs? (please tick)

Yes ( ) No ( )

(b) Resason(s) _____

_____

_____

13. Could you please write out the extension of time given to the contractor by the consultants/clients due to variation in the scope of works in the projects written under question 3.

(i) _____ weeks

(ii) _____ "

(iii) _____ "

14. What are the effects of variations on the following people?

(i) The Clients_____

_____

_____

(ii) The Consultants_____

_____

(iii) Contractors _____

_____

_____

(iv) Site Manager _____

_____

_____

(v) Others _____

_____

_____

15. What are the implication of variations on the contractors working capital

_____

_____

_____

16. What are the implication to the clients cash flow

_____

17. How does either or both on the above affect the smooth running and realization of the projects._____

_____

_____

18. In your opinion what do you think could be done to reduce variations in construction projects._____

_____