ELEMENTAL ANALYSIS OF BILLS OF QUANTITIES FOR THE CONSTRUCTION OF BUNGALOW BUILDINGS IN OWERRI

BY

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**CERTIFICATION**

We certify that this work has been accepted in partial fulfillment of the requirements for the Award of Master of Science (M.sc) degree in Project Management Technology of the University.

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DEDICATION

This work is dedicated to Almighty God and all lovers of research and Human capacity development
ACKNOWLEDGEMENT

I am very grateful to God Almighty for providing me the enablement to carry out this study.
My special thanks and appreciation goes to my project supervisor, Dr. A.C. Ogbonna, for his cooperation, patience and untiring effort to see that this work is finally completed. His advice, constructive criticism and meticulous concern for minute details from start to finish are highly appreciated.

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**TABLE OF CONTENT**

**TITLE PAGE**  
Page i

**CERTIFICATION**  
Page ii

**DEDICATION**  
Page iii

**ACKNOWLEDGEMENT**  
Page iv

**ABSTRACT**  
Page v

**TABLE OF CONTENTS**  
Page vi

**CHAPTER ONE - INTRODUCTION**  
Page 1

1.1 Background study  
1.2 Statement of the problem  
1.3 Aim and Objectives of the study  
1.4 Research questions  
1.5 Hypothesis  
1.6 Significance of study  
1.7 Scope/ limitation of study  

**CHAPTER TWO - LITERATURE REVIEW**  
Page 11

2.1 Historical development of the cost control process  
2.2 The bill of quantities  
2.3 The purpose of bills of quantities  
2.4 The Standard Method of Measurement  
2.5 Interim valuation and Final Accounts
2.6 Examination of consistently unexecuted substructure bill items by Contractors

CHAPTER THREE - RESEARCH AND METHODOLOGY

3.1 Introduction
3.2 Research design
3.3 Study Population and Sample
3.4 Instrumentation
3.5 Data Analysis Method

CHAPTER FOUR - DATA PRESENTATION AND ANALYSIS

4.1 Introduction
4.2 Comparison of Elemental proportional cost allocation from one bill to another
4.3 Respondents opinion on Consistency of unexecuted items in substructure by contractors
4.4 The extent of the Quantity Surveyor’s responsibility for valuing Unexecuted items
4.5 Cost significance of unexecuted items by contractors on substructure cost
4.6 Direct cost of unexecuted Substructure items by contractors
4.7 Discussion of results

CHAPTER FIVE - CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion
5.2 Recommendations
References
Appendix

LIST OF TABLES

1) Table 1. Elemental Summary of ten bills of quantities of bungalow buildings 39

2) Table 2. Elemental Analysis of ten bills of quantities of bungalow buildings 41

3) Table 3. Percentage comparative analysis of elemental proportional cost of Bungalow buildings 42

4) Table 4. Elemental proportional cost allocation between 2010 and 2003 figures 43

5) Table 5. Respondents opinion on consistency of unexecuted items by contractors 44

6) Table 6. Respondents opinion on the extent of the quantity surveyors Responsibility for valuing unexecuted substructure items 45

7) Table 7. Respondents opinion on the cost significance of unexecuted substructure Items on the total cost of substructure/project 46

8) Table 8. Value of unexecuted substructure items in the bill of quantities for (10 no. projects) 50

9) Table 9. Mean cost of unexecuted items to mean cost of substructure 51

10) Tables 10 – 15. Regression analysis derivation 52/53
LIST OF FIGURES

Figure 1  Scatter Diagram of Regression  54
ABSTRACT

Dissatisfaction expressed by clients on the poor performance and level of service received from construction industry operators especially professionals gave birth to the need for this study. This study examined the measurement, valuation and payment for bills of quantities items consistently not executed by contractors in Nigeria. Primary data for this study was obtained from questionnaire randomly administered to Quantity Surveyors at a conference in 2008 and secondary data obtained from the elemental analysis of ten bills of quantities of bungalow buildings in Owerri. The substructure bill of ten projects was also analyzed and the mean item score and regression was calculated to show any relationship between the cost of unexecuted substructure items and the total cost of substructure. Elemental analysis reveal that substructure showed the slightest decrease of 16% in proportional cost allocation in 2010 compared to other elements of similar bungalow buildings using 2003 figures. The study also revealed that bill of quantities contain some measured items consistently not executed in practice by contractors in Nigeria, but which are eventually valued and paid for during interim valuation and final accounts, the items have significant implication on the cost of the project. With a calculated correlation coefficient of 0.99, it means that there is a very strong positive relationship between Total cost of unexecuted items and Total cost of substructure, also a calculated t-value of 19.545 with corresponding p-value as 0.000 shows that at 0.05% level there is a very strong positive correlation between cost of unexecuted items and cost of substructure which means that the cost of unexecuted items has significant effect on the total cost of substructure.
CHAPTER ONE

INTRODUCTION

1.1 Background

Before the 19th century, according to Grafton (1966), the quantity and cost of construction could not be assessed before construction work commenced on site. Builders executed work and on completion would collate the cost of materials, labour, overhead and profit and negotiate with the client and architects. This process was plagued with disputes, loss of time and goodwill between the client and architect on the one hand and the builder and his measurers on the other hand.

The introduction of the main contracting system in the 19th century according to Seeley (1996) implied price competition before construction commenced on site. This led to the development of pre-measuring (taking off quantities) from designs (drawings and specifications) and assembling them into a bill of quantities (BOQ) for the purpose of tendering and contractual arrangements. Eke (2007), notes that the Quantity Surveyor was traditionally charged with the responsibility of measuring and valuing building works in the 19th century, based on the concept of complete design of the building before construction and then paying the various craftsmen for their individual work quantities on completion. The Quantity Surveyor is the expert who advises on the economics and cost of construction work in the building and construction industry. Bills of quantities were prepared based on the rules of the Standard Method of Measurement. According to the Nigerian Institute of Quantity Surveyors (2008), “the Bill of Quantities shall fully describe and accurately represent the quantity and quality of work to be carried out. Work which cannot be measured shall be given
as provisional sum. Work the extent of which is not known shall be provisional and given in a bill of approximate quantities”. The basis for advising on budgets, cost plan, cost analysis, cost control, valuation, tendering and contractual arrangements etcetera are based on the preparation of the bill of quantities.

With the development of the quantity surveying profession in the 19th century construction projects can be quantified and priced prior to implementations to give a forecast of a probable tender figure. This activity of the Quantity Surveyor and information it provides assist developers and contractors in budgeting, financing, cost planning, cost control and finalizing accounts of construction works.

However, according to Best and De Valence (1998), “many clients have become dissatisfied with the performance and level of service they are receiving from the construction industry and as such are increasingly demanding better value from the industry. Clients allege poor performance in terms of time, cost and quality, poor constructability, adversarial attitude resulting in claims and disputes. These concerns are not only directed at contractors but also towards industry professionals acting as consultants and advisers during the construction process”. For example, bills of quantities are alleged to contain items that are measured, valued and paid for even when they are not eventually executed by the contactor.

Nisbet (2002) has described how building costs are now scrutinized more closely and with greater skill and accuracy as buildings have become larger, more complex and more expensive, and building clients have become more exacting in their requirements. These and other factors have compelled the Architect to design with greater care and in more detail and since the ultimate cost of a building is determined at the design stage, the Architect has
increasingly directed his attention to cost control/reduction procedures and invited assistance from the Quantity Surveyor right from the design stage. Some of these items are operations, processes/activities that are good construction practice but are temporary in nature, and they may not form part of the finished product. Field experience indicates that contractors in Nigeria often consistently omit these items during execution, because they are not graphically shown on drawings and also they are measured by the rules of the Standard Method of Measurement. Almost all sections of the bill of quantities contain items which are consistently omitted in practice by contractors for which the contractor would want to be paid. They appear to be more prevalent in the substructure element of the bills of quantities and the cost becomes significant considering that according to Mac-Barrango (2003), substructure accounts for about 20% to 25% of the total cost of buildings. The consequences of billing, valuing and paying for work unexecuted by the contractor include

(a) High estimate that can make a prospective developer to divert investment into other industries, (b) disputes and litigation which scare investors, (c) questioning the integrity of the construction professionals, and the entire process/system bearing in mind that consultants/professionals are primarily engaged by the client at a cost (including professional and administrative fees) for the purpose of giving value for money and this require to be justified. On the other hand, savings in time and cost from these items can be directed to improve the quality and value of vital aspects of the finished product among others

Cost is a very important factor in project delivery. According to Best and De Valence (1998), “construction process is commonly expressed in terms of establishing equilibrium between the three principal concerns of time, cost and quality” and he notes that “clients would like to
construct a facility of the highest quality, at minimum cost and in the shortest possible time”. Therefore cost being a very important factor in project delivery, throws light on bill items and operations which are consistently unexecuted in practice by Nigerian contractors and whose omission will not adversely affect nor significantly diminish the required quality of the building, and whose omission will produce cost savings for the client on the project. While seeking an optimum price, the quality of the project should not be compromised on the excuse of cost savings as it may affect the life cycle/running cost throughout the predicted life of the project.

Talking about building cost, total building cost depends on much more than mere construction cost; it includes related cost such as design fees, interest and holding charges, legal costs, cost of repairs and maintenance, occupancy and operating costs. Ikpo and Olusola (2000), pointed out “that the initial cost of construction represents only a small part of the cost of a building over its lifetime. Even the cost of design is so small when considered against the life cycle cost of a building that it is almost insignificant – somewhere between 0.1 and 1%”. It is in the early stages of the design and documentation process that many of the most important decisions that determine the ultimate value of final product are made. However for many clients, initial/capital cost is a dominant factor.

Hence, according to Dennis (1997), there is no point in designing a project that will cost N5000 /m² when the client can only afford N2000 /m² and can only get N1800/m² in return. Chua et al, (1999) opine that the major goals in a construction project are budget/cost, time, and quality in this descending order. Singh and Singh (2004), posit that cost can be seen in the total amount spent on a project but more importantly on the value of what it is spent.
A client therefore who engages the services of a design team of professionals like Architects, Engineers, Quantity Surveyors, and other specialist/subcontractors would expect that his interest be protected and uppermost in their activities. Therefore valuing and certifying work consistently not executed in practice by contractors in Nigeria constitute a disservice to the client in addition to increasing the cost to the project without increasing the value of the finished work and hence would question the relevance of consultants, professional fees and the bill of quantities in building project delivery.

This study therefore sees the need to examine these complaints, establish their validity, degree of significance and proffer suggestions to enable clients get value for their money by ensuring that the contractor is paid only for work executed while unexecuted items are adjusted to provide savings for the client, while at the same time ensuring that the contractor gets a just pay for all their cost and a reasonable profit.

1.2 Statement of the Problem

The need for cost management in the present economic situation in the country has obviously become very pressing when one considers news from the electronic and print media regarding mismanagement of project funds and increasing cases of project abandonment. Giwa (1988) went further to state that in Nigeria; one major problem is that contracts are completed at sums much higher than the initial estimate.

Since the advent of the main contracting system in the 19th century, most formal and large construction projects have been let or executed using the bill of quantities. According to Atkinson (2000), those who dispense with the bill of quantities do so to their peril since it is
one of the most useful tools for project management especially when drawn up in accordance with the rules of the Standard Method of Measurement. The bill of quantities is a most viable tool for contract administration, valuing work done by the contractor and for general cost control purposes. It provides a firm basis for better financial control, with the aim of the client getting value for his money.

However, both Turner (1999) and Bamdupe (2006) assert that some of the items measured in the bill of quantities that are eventually get valued and paid for but consistently not executed in practice by contractors in Nigeria are occasioned by the application of the rules of the Standard Method of Measurement, a document which originated from Britain- the birth place of Quantity Surveying. According to Olusegun (2005), some can be traceable to supervisory and or unethical practices on the part of contractors and consultants. This view is supported by Mac-Barrango (2006), who identifies bribery and corruption as a major problem militating against the successful implementation of construction projects in Nigeria. With this situation, clients are not likely to get value for their money, and consequently, the purpose of engaging consultants and professionals will be lost. Also the integrity of the professionals will be in question. In addition, any data, analysis or decision based on such a document or project can be inaccurate and misleading.

1.3 Aim and Objectives of the Study

This work aims to study selected unexecuted substructure items by contractors in Nigeria, determine the level of prevalence of non-execution of some work items in the bill of quantities and to ascertain the level of the cost of the items to the total cost of the project. Consequently, the objectives of this research are as follows:
a) To do an elemental analysis of bill of quantities of ten completed bungalow buildings
b) To analyze the substructure element of bills of quantities to determine the prevalence of unexecuted measured items
c) To verify whether contractors adopt alternative cost, time or method related techniques for unexecuted bill of quantities items.
d) Determine the relationship between the costs of unexecuted bill of quantities items to the total cost of project.

1.4 Research Questions

In order to accomplish the objectives of this study, the following research questions are relevant.

1) How does the elemental proportional cost allocation of elements in ten bills of quantities differ from one to another?
2) How does the elemental allocation of cost of bungalow buildings in 2010 differ proportionately from 2003 figures?
3) To what extent do Quantity Surveyors agree that some bill items are consistently not executed in practice by contractors in Nigeria?
4) Who should take responsibility for the measurement and valuation of unexecuted bill of quantities items?
5) Do contractors adopt alternative cost, time, or method related techniques for unexecuted bill of quantities items?
6) What is the relationship of unexecuted bill of quantities items to the total cost of the project?
1.5 Hypothesis

In line with the research questions raised, the following hypotheses were formulated to facilitate the analysis of data obtained from the questionnaire.

*Ho1* Unexecuted substructure bill items by contractors do not have significant cost impact on the substructure cost of the project.

*Ho2.* There is no significant relationship between the costs of unexecuted substructure items and the total substructure cost of the project.

1.6 Significance of the Study

Olusegun (2005) asserts that building construction activity plays a very important and dynamic role in the process of sustainable economic growth and development of any nation. It helps to provide accommodation, create employment, and acts as a service industry to other sectors/industries etcetera. According to Olusegun (2005), “the construction industry is known to be a major contributor to national development. Its contribution to Gross Development Product is reported between 5-10% in most countries; it employs about 10% of the workforce and contributes well over 50% of Gross Capital Formation”. Jagboro and Kuma-Agbenjo (2002), admit that it is generally claimed that Construction industry has a multiplier effect on the activities of other sectors of the national economy. Investments in the building construction industry therefore have a multiplier effect on other sectors of the economy. Betts (2009), predicts in a report “Global Hotspot from here to 2020” that construction growth in Nigeria will be the fastest of all market by 2020. As a service industry, hardly any sector of the economy functions without the services of the industry. This underscores the magnitude of the sector.
Therefore any uneconomic wastes among other factors, amount to a significant setback to economic development and realization of the prediction/forecast.

There is the need to strengthen the professionalism of design team and cost experts, to seek to identify crucial areas of reducing the cost of building construction work, by identifying items that are consistently not executed in practice by Nigerian contractors, and by adjusting at the final account stage the value of such non-executed items in the bill of quantities to reflect the exact quantity, quality, and value of work executed by the contractor.

Other benefits to be derived include

i) Improving the integrity of the documentation mechanism, so that the information they provide can be reliable and useable e.g. cost analysis, cost planning and, cost control.

ii) To enable clients obtain value for their money while the contractor who executes the job receive his due for actual work done.

iii) Maintain transparency and accountability in project delivery.

iv) Increase confidence of all parties to the contract.

v) Reduce/eliminate disputes and litigation in the construction industry.

It is hoped that these will make investment in the construction industry both qualitative and affordable, also, providing such saving or cost reduction will attract more developers into the industry, enable provide employment, accommodation and economic growth.

Developers, design team professionals, contractors, government and end users are bound to find this study useful and helpful.
1.7 **Scope and Limitation of Study**

To be able to carry out this study successfully, the scope of this research study has been limited to (a) construction of bungalow buildings in Owerri metropolis, (b) Projects/contracts let on a firm bill of quantities, (c) Contracts based on Standard Form of Building Contracts JCT 80 Edition (Private with Quantities) and Formal/public projects. Special attention focused on the substructure element of the bill of quantities because of peculiarities of this work element with its tendency to vary with the physical environment.
CHAPTER TWO
LITERATURE REVIEW

2.1 Historical Development of Cost Control

Seeley (1996) explains that cost planning as presently operated is the logical extension of a process which started since the 18th century. Eke (2007), notes that the Quantity Surveyor traditionally charged with the responsibility of measuring and valuing building works in the 19th century, when the concept of designing complete building before construction and then paying the various craftsmen for their individual quantities after the completion, was introduced. Measurer were employed to measure and value the cost of work after it was both designed and executed and argue with the client and architect on behalf of the various tradesmen. This procedure caused a lot of disputes and loss of goodwill between the client, Architect and the respective tradesmen. With the introduction of the main contracting system in the 19th century came the necessity of price competition before construction. It was in response to this situation that the measurers developed the skill of pre measuring, i.e. the skill of taking off quantities from drawings and assembling them into a bill of quantities to both provide a basis of competition and award of contract before construction commenced. These measurers later turned to become the present day Quantity Surveyors. This was followed by the introduction of approximate estimating techniques which attempted to give a forecast of a probable tender figure.

2.2 The Bill of Quantities

There have been several and different definitions of the bill of quantities.
The Wikipedia defines the bill of quantities as “a document used in tendering in the construction industry in which materials, parts and labour and their costs are itemized. It also details the terms and conditions of the construction or repair contract and itemizes all work to enable a contractor to price the work for which he/she is bidding”. Atkinson (2000) defines the bill of quantities as comprising a list of items of work which are briefly described. To Seeley (2003), the bill of quantities sets down the various items of work in a logical sequence and recognized manner, in order that they may be readily priced by contractors.

Potts (2004), explains that the principal use of the bill of quantities in current practice is to obtain competitive tenders; for this purpose bills should be standardized as possible in standard of measurement, format and layout. Bills of quantities fully describe and accurately represent the works to be carried out, including the obligations required of the contractor, and so provide a uniform basis for the preparation of competitive tenders. According to The Nigerian Institute of Quantity Surveyors (2008),”the bill of quantities shall fully describe and accurately represent/measure work to be executed.

Preparation of the bill of quantities is a core function of the quantity surveyor and it is prepared based the rules/guide of the document called ‘The Standard Method of Measurement’ (SMM). Most other functions of the quantity surveyor derive and are based on the information provided in the bill of quantities.

Seeley (2003), explains that several forms of bills of quantities have been in use but the most common type and that suit most purposes is the Elemental bills, – in which the items are arranged, not in trade order under main headings of the separate trades, but are grouped according to their position in the building (elements). Each element comprises an integral part
of the building. In practice most contractors do not seem to favour the use of elemental bills, mainly on the grounds that possible advantages on the site are outweighed by disadvantages at the tendering stage.

2.3 The Purpose of the Bill of Quantities

The bill of quantities not only serves for the measurement of quantities and quality of work, it also form a basis for tendering, placing contracts, contract arrangements, preparing cost plan, cost analysis, budgets etcetera. According to Pedley (1998), “Bills of quantities are the most comprehensive document describing all the work to be done and containing all the prices and condition between its covers. No other form of document is as comprehensive and serves as many purposes as the Bills of quantities”.

Atkinson (2000), explains that the traditional purpose of the bill of quantities is to act as a uniform, cost and labour saving basis for inviting competitive offers/tenders. From this process follows the use of the bill of quantities through the post tender stages to the final account/settlement. Willis and Willis (2005), describes Bills of quantities “just as one asks before having a suit made what it will cost, so a prospective building owner rationally wants to know before placing order what the cost of his building or project will be. The architect and engineer can prepare designs, drawings and specifications which clearly define what is wanted but the builder obviously cannot quote an accurate price simply by looking at these documents. This is the purpose of the bill of quantities”.

But one problem with the bill of quantities according to Ferry and Brandon (1991) is that “the vast majority of the items are still largely measured “in place”; that is to say they are measured as fixed in the building with no allowance for waste and no identification of the
plant and tools required in installing them. This is to avoid the possible situation arising where the Quantity Surveyor tells the contractor “how to do his job” or makes assumptions as to his efficiency”.

2.4 The Standard Method of Measurement (SMM)

The rules governing the measurement of construction work are laid down in the Standard Method of Measurement of building works, authorized by the agreement between the Royal Institution of Chartered Surveyors and the National Federation of Building Trades Employers. Potts (2004), opine that the Standard Method of Measurement provides a uniform basis for measuring building works and embodies the essentials of good practice; Standard Methods of Measurement have become increasingly more complicated. According to Atkinson (2000), they give rise to claims for additional payment based on interpretation of the method. The application of the clauses of the Standard Method of Measurement provide room for bill items to be measured, and paid in valuations even when they are not executed and the interpretation of the Standard Method of Measurement can sometimes be ambiguous, an example is the definition/interpretation of rock excavation and protection.

2.5 Interim Valuation and Final Accounts

According to Potts (2004), under most forms of contract, the contractor’s work is valued and certified on a monthly basis for the work he has completed and for materials supplied up to the valuation date, unless otherwise stated as in the case of stage payments.

One of the functions of the quantity surveyor (in accordance with the provision of the conditions of contract on which most contracts is placed) is to prepare interim valuations for
the contractor when ordered by the Architect, to be paid for work properly and satisfactorily executed. The burden is then on the quantity surveyor to accept responsibility that before any work is valued or recommended for payment it must have satisfied the required quantity and quality specified and prescribed and measured in the bill of quantities and or shown on the drawings or other design documents.

The quantity surveyor measures and values the work carried out and submits a recommendation for payment on account. The Joint Contract Tribunal (JCT 1980 Edition), clause 30.1.2 provide that “Interim Valuation shall be made by the quantity surveyor whenever the Architect considers them to be necessary for the purpose of ascertaining the amount to be stated as due in an interim certificates”. Valuation as the name implies represents the Quantity surveyors estimation of the value of work done by the contractor (as shown on the tender documents) up to the period which he considers due to be paid. For contracts based on firm bill of quantities, valuation will usually be based on the bill of quantities.

An acceptable common practice in Nigeria is for the Project Architect to score the contractor’s progress of work on percentage basis following section by section or element by element presentation in the bill of quantities. The quantity surveyor prepares interim valuation for the Architects certification based on the scoring. This method is prone to error as the valuation is valued as a percentage of bill section and not item by item.

For the quantity surveyor, Interim Valuation is the first opportunity to provide savings/ cost reduction for the client by omitting the value/amount of items measured in the bill of quantities but not executed in practice by the contractor. This requires following the bill of
quantities item by item, and a close monitoring of the contractors work to discover and identify items not executed during the progress of the works. Although the contractors rates must be accepted as his own and cannot be altered once a contract has been signed but it can reveal duplications which when discovered must be rectified and provide cost reduction/savings.

Final Accounts consist of the final value of work executed by the contractor, and is presented in an add/omit format. According to Ferry and Brandon (1991) it is presented starting with the original contract sum, and adjustment for provisional sums – of money or quality of work which are embodied in the contract bills, in the light of actual work carried out, Payment for variations and for addition to, and omission from the work, Correction of errors in the bill of quantities or other contract documents and Adjustment of contingency sums.

In the view of Potts (2004), the Quantity Surveyor is usually responsible for the preparation and calculation of the final cost of the work. This is achieved by preparing a final account in which the contract sum is adjusted to take account of all variations and other financial adjustments in accordance with the terms of the contract.

From the time the actual construction work commence on site, differences are bound to occur between measured bill and actual site work – due to Time/method related techniques of the contractor and the provisions of the Standard Method of Measurement for items that must be measured and paid whether the contractor executes them or not and this will necessitate re measurement/savings.

**2.6 Examination of some substructure measured items in the bill of quantities prevalently unexecuted by contractors in practice in Nigeria.**
The substructure element of the bill of quantities comprises all work below the ordinary ground level up to the ground floor slab. It consist a separate section in the bill of quantities. It is most often measured as ‘Provisional’ because design is most times inconclusive before tendering and this implies that it will be subject to re measurement on completion. Over the years, the design and measurement of the substructure element has remained inconclusive at pre tender stage. According to Benham (2002), “As all practicing quantity surveyors know, no building is fully designed at tender stage (at least not in our combined 60 years of experience). Although a desirable objective, this is, and will remain, unobtainable.” The substructure element constitute a capital and a vary cost significant aspect of the building. According to Mac-Barango (2003), it can account for as much as 20% of the total cost of the building.

Giwa (1988), in a survey found that substructure re measurement accounted for 58% of the overall increases observed in provisional quantities, concrete work (mainly due to reinforcement re measurement) accounted for 22%, External works 15%, whereas the rest aspects accounted for 5%.

As stated earlier the application of the rules of the standard method of measurement provide for measurement and inclusion of some of these items and hence the call for careful consideration of the application of the standard method of measurement clauses to the Nigerian environment. For example, the Nigerian Institute of Quantity Surveyors (2008), clause D20.7 provides that a contractor should be allowed and paid for earthwork support to sides of trench and pit excavations whether or not in fact the contractor executes them. According to the Nigerian Institute of Quantity Surveyors (2008), it is a risk item and the
contractor chooses to take the risk at his own peril or may adopt another method related
technique for time, cost or convenience sake.

Adetola (2001) writing on the Quantity Surveyors dilemma stated that the greatest obstacle
hindering the Quantity Surveyor from fully demonstrating his professional skill to the fullest
advantage is the quality of information given to him by other members of the design team. In
the said article, Adetola (2001), opines that within the design team, the Quantity Surveyor is
the only one who needs to work on the information provided by all other members of the
design team (Architects, Civil and Structural Engineers, Services Engineers, Interior
Designers etc). Therefore the quality of the bill produced will merely represent the quality of
designs details, specifications, and other information made available to the Quantity Surveyor
by other members of the design team. The Royal Institute of British Architects (RIBA) “Plan
of work” defines various stages of project development from feasibility to project completion
stages – it is on few instances that this methodology or process is adhered to.

Adetola (2001) notes that one disturbing aspect of the Quantity Surveyor practice is the
architect having produced sketch drawings without details expects the Quantity Surveyor to
produce a detailed bill of quantities instead of preliminary estimate or bill of approximate
quantities. This insufficient information and lack of details gives rise to provisional quantities
and sums in the bill of quantities. This is one aspect that require to be addressed to enable
eradicate measured bill items not executed in practice by Nigerian contractors and provide
cost savings to both client and project.

In another example, Okoli and Kehinde (2001), in a survey carried out in Kano State and
Federal Capital Territory, Abuja observed that rising damp is a problem encountered in most
buildings and is easily traceable to faulty construction such as non- inclusion of damp proofing materials. The survey of 75 building project drawings and 189 ongoing construction projects revealed poor practice of damp proofing with the resultant rising damp related problems in the areas covered and by extension many areas of the country.

The professionals (architects, Quantity Surveyors, engineers) claim to specify and supervise damp proofing of buildings was found not entirely true. Out of 75 building project drawings and 189 ongoing projects surveyed, it was only in one building that provision was made for damp proofing representing 1.3%, only in 2 out of 189 was damp proofing used representing1.05%. The study/survey revealed that the Quantity Surveyor by the rules of the Standard Method of Measurement and good practice included and measured damp proofing in the bill of quantities but these are rarely executed in practice by contractors sometimes due to lack of availability of the materials specified or for lack of supervision on the part of the professionals and yet the contractor gets paid. In all cases, the client/end user is the looser for paying for work not done, not getting value for his money and also incurring additional cost of maintenance arising from rising damp during the operational life of the building.

(a) Excavation—generally

Excavations generally are the first major activity in the substructure part of a building project following site preparation and setting out operations. Hardly would any substructure work progress without excavation for foundation in trenches or pits for column bases, basements and the like. Foundation is work below ordinary ground and must necessitate excavation.

A survey conducted by Seeley (2003) shows that, depending on the complexity of the design, excavations and related activities constitute as much as 20% of substructure cost.
(b) **Excavating Topsoil**

This item appears as the first excavation bill item and activity in the excavating work. It is usually taken about 150mm thick. It is measured over the total surface area to be occupied by the building. It is described as “excavating topsoil required to be preserved”. Even when this is not the case, it has become an item in every bill of quantities and priced and paid when it is not necessary, required nor specified. According to Baccarini (2004),”In my experience many students automatically measure this item whether or not it has been specifically requested”.

(c) **Excavation of Working Space**

The Nigerian Institution of Quantity Surveyors (2008) clause D20.6 provides that “working space excavation (which shall not be subject to adjustment if more or less space is actually required) shall be measured from the face of finished concrete work”. Working space refers to additional excavation necessary to provide access to enable workmen to provide support where formwork is required to faces of concrete work in foundations, especially where it is required to ensure that concrete covers reinforcement in substructure work. According to Sandra et al (2005), a superficial square metre item of working space allowance to excavation is taken for formwork, rendering, tanking or protective walls where it is necessary for workmen to operate from the outside and the space available is less than 600mm. Boston (2010), points out that although there are many types of foundations, different ground conditions, soil types, all dictate the form our foundation will take. Strip foundation is the most common and widely used. “It must be remembered that if building the foundations in block work and/or brick, space must be found in the trench to stand and build. It is considered normal practice”. The measurement is taken as the girth or the length of the formwork.
multiplied by the height measured from the commencing level of the excavations to the bottom of formwork.

Willis (2005), explains that “from the rules of The Standard Method of Measurement it will be seen that working space excavation (like earthwork support) is a contractors risk item which does not fall to be adjusted whether executed or not”. The rates quoted in the bill of quantities is composite and will normally include for digging, backfilling, compacting, additional earthwork support and removing spoil all in one component rate for the space or volume of excavation required. Since the Standard Method of Measurement allows a contractor to be paid for this work item whether or not it is done, and construction/contracting work being profit driven, just like most other business undertakings, the tendency is for the contractor to omit it and claim for the cost. A common practice in Nigeria is to pour concrete to the faces of excavations and The Standard Method of Measurement requires that where this is done it should be clearly so stated as in the case of concrete strip foundations and concrete beds laid on earth or hardcore. Take for instance; total excavation required for a column base measuring 1.00m long x 1.00m wide will be 1.5m long x 1.5m wide. This will result in an extra 50% of the volume of the excavation, backfill and compact and remove spoil. This shows that as much as 50% of the cost of total excavation can be saved if this item is not executed. From field experience or in practice, and in agreement with Ferry and Brandon (1991), contractors can excavate for column bases the exact size (length and width)/volume required and can therefore omit the working space required for formwork and pour concrete to the faces of excavations in which case, the Standard Method of Measurement rules require that it be so stated.
(d) **Rock Excavation**

The Standard Method of Measurement defines rock as any material met with in excavation which is of such size or position that it can be removed only by means of wedges, special plant or explosives. They are measured as a separate or alternatively may be given as extra over each of the various types of excavation. Rock excavation is measured as a provisional item especially given that due to our level of technology and tendering time, much soil survey report are not ready at the point of design and billing. The definition of the term ‘rock’ has become controversial as contractors claim that any strong or hard soil met in excavation is rock. The quantities and rates for this item are mostly measured provisional and serve as guide should the need arise for valuation. The common practice of Architects in Nigeria is to assess the contractor’s progress of work by percentage and the Quantity Surveyors valuation is based on the Architects assessment. Comparative prices of measured work obtained from Newpro Quants Consultants (2002), indicate that the bill rate for extra over/rock excavation per cubic metre is about 5 times the cost of normal excavation.

(e) **Earthwork Support**

Earthwork support is another name for planking and strutting. It is the practice of upholding the earth and sides of excavations of trenches, pits, basements and the like during excavation and foundation construction activity by whatever means possible, to avoid collapse of the vertical sides of the excavations. Smith (1986), notes that earthwork support is measured in square metres to the actual face of excavations which may require supporting. According to him, should the estimator decide to price the earthwork support item and then subsequently the contractor chooses not to carry out the operation, the amount in the bill of quantities will
still be paid because the amount is for risk undertaken by the contractor in choosing to leave the sides of the excavation unsupported.

According to Ayeni (1997), “The Standard Method of Measurement specifies among others that the vertical faces of excavations shall be supported by materials other than sheet piling for any face over 250mm high and the angle of slope is 45°. Also it must be priced whether it is needed or not.” According to Seeley (1995), Earthwork support largely depends upon two main factors; the depth of excavation and the nature of the soil to be upheld. According to Seeley (2003), Earthwork support to sides of trenches, pits and the likes where exceeding 300mm in depth, is measured and allowed whether the support will actually be required on the job or not.

Willis and Willis (2005), explains that earthwork support must be measured to excavations whether it will be necessary or not, to cover the builder/contractors responsibility to uphold the sides. It is for the builder/contractors estimator to decide from information available to him from tender documents or site visits, nature of ground/soils, the extent and strength of support he will require. Even if he decides that he will not use any, there is still a risk to be priced. If the sides of excavation fall in, he will have to make good at his expense and if any worker is injured or killed in the process the contractor is fully liable.

The Nigerian Institute of Quantity Surveyors (2008) provides the guide for the measurement of earthwork support in section D.15.1 and states that earthwork support shall be deemed to mean providing everything requisite to uphold the sides of excavation by whatever means are necessary and shall be measured to all faces of excavation whether or not any is in fact required.
Generally speaking, most foundation and substructure work is billed “provisional”. By the provisions of the rules of the Nigerian Institution of Quantity Surveyors (2008), Earthwork support have always been measured and valued even though they have always been omitted in practice by contractors in the Nigerian construction industry. It is argued that Nigerian soils are relatively firm, not susceptible to earthquakes, tremors or other movements as in areas where the rules of the parent Royal Institution of Chartered Surveyors (1979) originated or other zones prone to tsunamis.

Earthwork support doctrine in The Standard Method of Measurement also follows the provisions of the Joint Contracts Tribunal (1980), conditions of contract. An alternative is for the contractor to price his bill based on method related charge e.g. batter the sides of excavation to slope. Ferry and Brandon (1991), explains that a contractor is allowed to, subject to the approval of the Architect, adopt a method or cost or time related technique that enhances his work and profitability which is not detrimental to the specified quality of the finished product.

One important question that is often asked is whether the omission of earthwork support in practice affects the quality or performance of the project now or in the future. So far, every discussion on this points to the negative. Hence a continuous retention of this item in the bill of quantities when it is not required remains controversial.

(f) Anti Termite Solution Treatment

Punmai (2006), asserts that termites popularly known as white ants cause considerable damage to wood work, furnishings and lots more in buildings. In some countries the loss caused due to termites is estimated to be as high as 10% of the capital outlay of the building.
Anti termite treatment is therefore necessary so that damages are either reduced or stopped altogether. Bestway (2000) claims that “Termites are serious pests and they cause more than $1 billion worth of damage every year.” He also notes “that anti termite treatment is best done to foundations and hardcore beds during construction before concrete is cast respectively. The process involves spraying chemicals that deter pests”. The origin and necessity of anti termite application is purely those of good building construction practice and economics. It is measured by the square metre. Anti termite solution treatment is applied to all the surfaces of excavations to prevent/protect the building components and materials from termite infestation. Timber exposed to earth is susceptible to termite infestation and this is very common in most parts of Nigeria especially the middle and northern parts of Nigeria.

The assumption that traditional type of foundation construction in Nigeria using concrete foundations, block work filled solid with weak concrete, cement mortar damp proof course and damp proof membrane, concrete bed/flooring provides adequate prevention/protection from termite penetration into the superstructure is not sustained. Punmai (2006), states that a careful examination of untreated building will show that damage by termites and evidence of their activity is not difficult to find.

In a recently priced bill of quantities, this item singly constituted about 4.5% of entire cost of substructure.

(g) **Formwork to Column Bases and Attached Columns**

According to Baccarini (2004), Formwork can be described as a temporary support or mould into which in-situ concrete is poured. Punmai (2006) defines formwork as a temporary ancillary construction used as a mould for the structure in which concrete is placed and in
which it hardens and matures. The Encarta Dictionary (2009) defines formwork as a structure generally made of timber in which liquid concrete is placed, compacted and allowed to harden. It is measured to all the surfaces of the finished structure which requires to be temporarily supported during the deposition of the concrete and is to remain until the wet concrete cures to the required strength. Measurement of concrete comprises concrete, reinforcement and formwork. While concrete and reinforcement are part of the permanent finished product, formwork (which is a temporary material and operation that does not form part of the finished product) is stripped and reused several times on the project. Once the concrete is cured the formwork is stripped unless in special circumstances and if for convenience it is required to be left in. According to Punmai (2006) the cost of formwork may be up to 20-25% of the cost of structure in building work. Using comparative bill rates obtained from Newpro Quants consultants (2002), in a priced bill of quantities for concrete work, 1m$^3$ volume of concrete was priced for N22, 500 while formwork to sides of column bases was priced for N1000/m$^2$. From the rates it shows that for every 1m$^3$ of concrete (1.00mx1.00mx1.00m), we require 4m$^2$ of formwork (4x1.00mx1.00m). This represents N4000 for every N22,500 cubic of concrete; equivalent to 18%. This savings is significant when considered in relation to the size of concrete work in any given project.

In response to a question and answer session, the opinion of the Royal Institution of Chartered Surveyors (RICS) is that “if, in a bill of quantities, the foundation quantities include for formwork and working space,(Standard Method of Measurement 6th edition clause D.12), and if those items are not marked “provisional”, then, in the event the contractor chooses, with approval, to execute the excavations neat and so dispense with the
need for formwork, is it correct to adjust the quantities accordingly’?, The answer is No, it would not be correct to omit the formwork(or working space) in accordance with the actual method employed by the contractor, unless the change is confirmed as an instruction of the architect. If a variation order is issued, then the work (excavation and earthwork, and concrete work) should be re-measured and valued in accordance with clauses 13.5.1.2/3 of Standard Form 80(Private with quantities). For example, the common practice/method adopted by contractors in Nigeria is to build up walls and thereby leaving only one or two faces of concrete to be covered and yet get paid for formwork to four face of concrete.

(i) Damp Proofing

Damp proofing in the building can be provided either as damp proof course (on walls) or as damp proof membrane (under floors). Damp proof course and damp proof membrane are described by Seeley (1996), as meaning the same thing and having the same function, which is, to prevent rising damp and moisture penetration especially from the substructure to other parts of the building. The difference exists mainly from their position and location in the building. Damp proof course in locations is to prevent moisture penetration in walls especially in heights above 150mm above ground level while damp proof membrane is best located below floors.

Rising damp is a common problem encountered in most buildings which is traceable to faulty construction such as non-inclusion of damp roofing. Hall (2009) asserts that rising damp is a worldwide phenomenon and a major cause of decay in buildings. Common defects due to rising damp in buildings occur in walls and floors. Finishes and paints are affected, concrete begins to deteriorate, timber being an organic material is susceptible to fungal growth and
bacterial attacks thereby reducing mechanical strength, metals are exposed to corrosion thereby negatively affecting the life and performance of the building. Punmai (2006), lists other effects of moisture penetration to include softening and crumbling of plaster, efflorescence resulting in disintegration of brick work and block work and consequent reduction in strength and dampness which promotes and accelerate growth of termites and mosquitoes.

In some parts of Nigeria, according to Okoli and Kehinde (2001), particularly in the northern parts, it is a common belief that building sites are dry (with low water table), hence most buildings are erected without any form of damp proof course or damp proof membrane even in situations where they are indicated in drawings and measure in the bill of quantities.

To guarantee durability and enhance the life of buildings including reducing the running/maintenance cost during the life of the building, appropriate and effective damp proofing is necessary. The costs of buildings are not necessarily the initial cost of construction but most and more of the cost is during the operational life of the building. Lack of and non-inclusion of damp proofing in buildings therefore is an area for consideration for cost reduction (in the operational life of the project). Depending on the type and size of project, material specified, damp proof course and damp proof membrane can account for as much as 2% of substructure cost. It should be mentioned that most Quantity Surveyors measure and include damp proof course and damp proof membrane in the bill of quantities as good practice (whether shown on drawings or not). The items are eventually valued and paid to the contractor by the client even though they are consistently omitted in practice by contractors; this is possible through unethical practices which are a common place in Nigeria. At other times, the contractor may
substitute a higher specified materials for a less and cheaper one and gets paid the price for a higher quality. For example, in practice, it has been observed that some contractors substitute bitumen felt damp proofing material on walls with cement mortar.

(j) **Block work Filled Solid with Concrete**

Block work in foundations, especially where hollow walls are specified, are required to be filled solid with weak concrete to improve their structural density/stability, and as a damp penetration check. The price of block work filled solid with weak concrete is usually more expensive than the price of normal block work wall per square metre. On some projects it is estimated to cost as much as two and half times the price of normal block work wall or those of block wall in the superstructure. This appears to be one of those items that are consistently not executed in practice by contractors in Nigeria and they are often paid for in valuations. When valuing work, the Architect/Quantity Surveyor is empowered by the provisions of the conditions of the contract to request the contractor to open up covered work for inspection where such work is already covered, and the cost of such will be paid where it is found that the contractor has complied with the quality and specifications. This provision has not often been invoked in Nigeria

(k) **Protection of Measured Work**

According to Seeley (2003), Protecting measured work in the bill of quantities is an important activity that has not been appreciated by parties to the building contracts. More often it can lead to disputes, claims and arbitration in building contracts. To avoid ambiguity and duplications in the bill of quantities, there was need to distinguish between protecting the site
from protecting the works. According to Singh and Singh (2004), Protecting the site refers to preliminary items like fencing, providing watching and security, providing external lighting at nights, and such items of a general nature that are required and not referring to any particular trade, these are facilities more often required from the commencement of the contract to completion/handing over, while protecting measured works refers to care of items or components of measured works (materials, and workmanship already incorporated into the works) where/whose exposure to foreseeable hazards are likely to affect the life/quality of the incorporated materials or workmanship and are only required for the period of care required. For example, wet concrete require protection during the period of curing, block work during the period of setting, and wet painted surfaces from rain and dust before and during drying. The Nigerian Institute of Quantity Surveyors (2008) describes it as “Allow for protecting work in this section of the works.” and given as an item. This item often appears at the concluding part of the bill section or element. The meaning, interpretation and method of protection according to the Nigerian Institute of Quantity Surveyors (2008) is the discretion of the contractor.

From field experience, the pattern of pricing reveals much of arbitrariness in estimators pricing of protection items. There are no details of the type of the protection to be provided nor reasonableness/relationship between the cost of the protection to the cost of making good or replacement of work in any event of failure. Valuation and payment for protection has become one most controversial subject between consultants and contractors. The controversy and difficulty arise as to what and how protection should be valued and paid. Most contractors see protection as a risk item and as such should be paid the amount quoted in the
bill by the contractor whether actually it is eventually done or not just the same way other risk items like earthwork support is valued. Those who favor this school of thought are of the opinion that a tender price is binding on the contractor to protect the work in the section by his quoted price. The contractor will not be allowed to claim more or less whether he does more or less than is required. The test of this school of thought is however challenged when there is a significant variation in scope, contract duration or construction change order. Most quantity surveyors tend to pay the sums allowed in the bill of quantities whether any protection is done or not. Here the client is not getting value for his money because the conditions of contract require the quantity surveyor to prepare interim valuations for the contractor to be paid only for work properly and satisfactorily executed. The burden is then on the quantity surveyor to accept responsibility that before any work is valued or recommended for payment it must have satisfied the required quantity and quality specified and prescribed and shown on the drawings or other design documents.
CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The focus of this chapter is to inform on the research models employed in the presentation, analysis and interpretation of data collected in the course of the study. The primary data for this study was obtained through questionnaires administered to Quantity Surveyors (the building cost experts) at a biennial conference of the Nigerian Institute of Quantity Surveyors at Kaduna in 2008 and the secondary data was obtained from the elemental analysis of ten bills of quantities of bungalow buildings from Owerri metropolis.

The quantity surveyors are:

Probationers – Quantity Surveyors who have obtained a first degree or its equivalent in quantity surveying from a recognized higher Institution of learning and are engaged in a quantity surveying practice

Members – This category is similar to the above but in addition, has passed the Test of Professional Competence examination and is qualified to affix MNIQS after their names

Fellows - This is the highest category who in addition to satisfying the qualifications for the ‘members’ category have been in practice for not less than 10 years, having demonstrated professionalism and experience, are qualified to affix the designation FNIQS after their names.

The survey concentrated on Quantity Surveyors because Quantity Surveyors are the professionals who are responsible for the preparation of bills of quantities, preparation of
interim valuations, recommendation for payments and final account and generally cost matters in building projects.

The classification was informed by the impact which their knowledge, academic qualifications, years of participation and experience, influences and authority their respective categories and opinions weigh on the survey. Elemental analysis of ten bills of quantities of completed bungalow buildings was carried out for proportional allocation and Comparative analysis of elemental cost of bungalow buildings between 2003 and 2010 figures. The substructure bill of ten projects was also analyzed and the mean item score and regression was calculated to show any relationship between the cost of unexecuted substructure items and the total cost of substructure.

3.2 Research Design

In order for this study to be conclusive we require to sample the opinion of all Quantity surveyors, contractors, clients and all professionals engaged in construction work in the building industry. However owing to constraints posed by time and financial limitations it was decided to undertake a sample study of only Financial members who attended the 2008 national conference and the elemental analysis of ten bills of quantities in Qwerri metropolis.

3.3 Study Population and Sample

The population used in this study is the entire number of Quantity Surveyors engaged in the management of construction works in Nigeria, covering the consulting, construction and others in the private/public sectors like banks, companies, corporations, lecturers in higher
institutions. The reasons for this is that the above activity segment represent the bulk of the areas of practice of the profession and where response to the survey is considered relevant, These categories generate the bill of quantities, valuations and final account, Provide availability and accessibility of the targeted respondents.

A total of 130 questionnaires were administered and 104 duly completed questionnaires were returned, representing an 80% response.

Population  679 (obtained from QS connect, an official newsletter of the Nigerian Institute of Quantity Surveyors Vol. 4 No. 2 Sept. 2006)

Sample size         130
Respondents         104
Fellows             12
Members             63
Probationers        29

3.4 Instrumentation

Instrumentation refers to the tools used in the generalization of data for this study. This comprises primary and secondary data. The Primary data which was used for this study was collected using structured and unstructured questionnaires (closed and open ended) including multiple choice questions where respondents are required to choose an opinion. The mix of questions will afford the respondents the opportunity to provide alternative answers. The personally delivered questionnaires was very effective in view of the fact that most people show unwillingness to attend to research questionnaires posted by mail due to suspicion and confidentiality, and also due to delay and security with the postal system. The secondary data
was obtained from bills of quantities of completed bungalow building projects within Qwerri metropolis and information obtained from relevant literature such as textbooks, journals, Internet etcetera.

3.5 Data Analysis Method

The data collected from the questionnaires were summarized in tabular form. The tabular summary is considered necessary and desirable to enable the researcher generate comparative tabular values for more analysis. The simple percentage was used to determine the strength of information provided in terms of the extent of agreement of respondents to the various items. Further analyses were carried out using the Chi-square and Z – Score tool to test hypothesis. Proportional allocation of Elements analysis of Bills of quantities of ten completed bungalow buildings was analyzed, the substructure bill of ten projects was also analyzed and the mean item score and correlation was calculated to show any relationship between the cost of unexecuted substructure items by contractors and the total cost of substructure.

The formula for chi-square is stated as:

\[ \chi^2 = \sum \frac{(Fo - Fe)^2}{Fe} \]

*Where*

\( \chi^2 \) = Chi-square test statistic

\( \sum \) = Summation sign

Fo = Observed frequencies

Fe = Expected frequencies

Degree of freedom = (c -1) (r -1)
The level of significance $\alpha = 5\%$, while the confidence level is 95\%.

The decision rule for accepting and rejecting the hypothesis is as follows:

Reject $H_0$ if $\chi^2$ cal value $> \chi^2$ tabulated.

Accept $H_0$ if $\chi^2$ cal value $< \chi^2$ tabulated.

The Z-Score test (two tailed normal distribution) has been used in testing the proportion of respondents who hold a certain view as opposed to those of a contrary view.

The formula for Z-score is stated as:

$$Z_{cal} = \frac{x - np}{\sqrt{npq}}$$

Where

$H_0$: $P = 0.5$ probability of 50% respondents in the affirmative (proportion of success in a sample)

$H_1$: $P \neq 0.5$ probability of respondents in the affirmative not 50% (Alternative hypothesis)

$n = $ Total number of respondents (Sample size)

$x = $ number of respondents in the affirmative

$p = $ population proportion of successes

$q = 1 - p$

The level of significance $= 5\%$, while the confidence level is 95\%.

The decision rule for accepting and rejecting the hypothesis is as follows:

Reject $H_0$ if $Z$-cal value $> Z$-tabulated.

Accept $H_0$ if $Z$-cal value $< Z$-tabulated.
Formula for correlation

\[ r = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sqrt{\sum(x - \bar{x})^2 \sum(y - \bar{y})^2}} \]

**Where**

\( r \) = coefficient of correlation

\( x \) = Total cost of unexecuted items in the substructure

\( y \) = Total Substructure cost for the project

\( \bar{x} \) = Mean cost of unexecuted substructure items

\( \bar{y} \) = Mean cost of total substructure cost

Degree of freedom \((10 - 1) \times (2 - 1) = 8\)

\( T \) = test for coefficient of correlation
CHAPTER FOUR
DATA PRESENTATION AND ANALYSIS

4.1 Introduction

This chapter examines the presentation, analysis and interpretation of data assembled during the course of the study.

Data collected from questionnaire was presented in tabular form. As earlier stated, the tabular summary is considered necessary and desirable to enable the researcher generate comparative tabular values for more analysis. Response was grouped into five opinions as follows: (Strongly Agree, Agree, Undecided, Disagree and Strongly Disagree) according to the response and opinion of respondents to questions raised in the questionnaire. The group percentages of respondents opinion was analyzed, results and findings were examined and possible reasons made as to the likely reasons for the occurrence. For ease of analysis, the opinions of respondents who “strongly agree” and “agree” are grouped as Affirmative while respondents who “disagree” and “strongly disagree” are considered as negative, and the opinions of respondents who are undecided were ignored. A comparative analysis of elemental cost of ten bills of quantities of completed bungalow buildings between 2001 and 2010 figures was calculated, also substructure bill for ten projects were analyzed and the relationship between the total costs of unexecuted items to the total cost of substructure was examined.

Table 1 is a summary of the elemental cost allocation of Ten Bills of quantities obtained from priced bill of quantities of Bungalow Buildings constructed within Owerri Town and metropolis which was used for the study.
4.2 Comparison of Elemental proportional cost allocation from one bill to another.

Research question no. 1 was designed to know how bill elements proportional cost allocation differ from one building to another.

Table 1 is a tabulated summary of the elemental summary of ten completed bungalow building projects within Owerri metropolis between 2001 and 2010. From the table, there are ten major elements in an average bungalow building construction. These are principally – Substructure, Frame and Wall, Roof, Door, Window, Services, Fittings, Finishes, Painting and External works. The total cost of substructure element for the ten bills analyzed is N23, 580,929. The individual substructure percentage cost allocation range from a minimum 9.1% to maximum 29.63%. Bill no.1 had the smallest percentage of 9.1% of substructure cost while Bill no.10 had the highest percentage cost allocation of 29.63%. The percentage average is 17.45%. This shows that 50% of the ten bills (bill nos. 1,4,7,8 and 9) fall below average total substructure cost while the rest 50% (bill nos. 2,3,5,6 and 10) are above average. The cost per square metre for the bills of quantities range from a minimum N25, 863/m$^2$ in bill no.1, to a maximum N71, 051/m$^2$ in bill no. 5. Average cost per square metre for ten bills is N39, 808/m$^2$. It shows that bill nos. 2, 5, 8 and 10) cost more than the average cost per square metre while the rest cost below average cost per square metre.

Research question 2 was designed to know how elemental allocation of costs of ten bungalow buildings in 2010 differ proportionately from2003 figures.
TABLE 2: ELEMENTAL ANALYSIS OF TEN BILLS OF QUANTITIES OF BUNGALOW

<table>
<thead>
<tr>
<th>Element</th>
<th>Total Elemental Cost of 10 Bills</th>
<th>Element Mean Cost</th>
<th>% Cost of Element</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure</td>
<td>23,580,927</td>
<td>2,358,093</td>
<td>18.24</td>
</tr>
<tr>
<td>Frame and Wall</td>
<td>11,714,946</td>
<td>1,171,495</td>
<td>9.06</td>
</tr>
<tr>
<td>Roof</td>
<td>18,328,511</td>
<td>1,832,851</td>
<td>14.18</td>
</tr>
<tr>
<td>Door</td>
<td>6,195,314</td>
<td>619,531</td>
<td>4.79</td>
</tr>
<tr>
<td>Window</td>
<td>10,892,626</td>
<td>1,089,263</td>
<td>8.43</td>
</tr>
<tr>
<td>Services</td>
<td>16,022,375</td>
<td>1,602,238</td>
<td>12.39</td>
</tr>
<tr>
<td>Fittings</td>
<td>4,769,290</td>
<td>476,929</td>
<td>3.69</td>
</tr>
<tr>
<td>Finishing</td>
<td>22,949,449</td>
<td>2,294,945</td>
<td>17.75</td>
</tr>
<tr>
<td>Painting</td>
<td>9,139,460</td>
<td>913,946</td>
<td>7.07</td>
</tr>
<tr>
<td>Ex. Work</td>
<td>5,685,330</td>
<td>568,533</td>
<td>4.40</td>
</tr>
<tr>
<td>Total</td>
<td>129,278,217</td>
<td>12,927,824</td>
<td></td>
</tr>
</tbody>
</table>

(Excluding Prelims and Contingencies)

From table 2, total element cost for ten bills obtained from table 1 was tabulated, the mean cost for each element was established and the percentage element cost for each element was computed. The total cost for the ten bills is N129, 278,217. Substructure with N2, 358,093 represented 18.24%, Frame and Wall 9.06%, Roof 14.18%, Door 4.79%, Window 8.43%, Services 12.39%, Fittings 3.69%, Finishing 17.75%, Painting 7.07% and External works 4.40%. From the above, Substructure element had the highest percentage allocation of 18.24% while Fittings had the smallest percentage allocation of 3.69%. Others elements in ascending order are: External works 4.40%, Door 4.79%, Painting 7.07%, Window 8.43%, Frame and Wall 9.06%, Services 12.39% and Roof 14.16%.
### TABLE 3: % COMPARATIVE ANALYSIS OF ELEMENT COST OF BUNGALOW

<table>
<thead>
<tr>
<th>Element</th>
<th>X</th>
<th>Y</th>
<th>(Prop. Analysis) Ration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2003 (%)</td>
<td>2010 (%)</td>
<td>((\frac{Y}{X}) \times 100)</td>
</tr>
<tr>
<td>Substructure</td>
<td>21.40</td>
<td>18.24</td>
<td>0.852</td>
</tr>
<tr>
<td>Frame Wall</td>
<td>7.49</td>
<td>9.06</td>
<td>1.210</td>
</tr>
<tr>
<td>Roofing</td>
<td>21.38</td>
<td>14.18</td>
<td>0.663</td>
</tr>
<tr>
<td>Finishes (Including Painting)</td>
<td>11.05</td>
<td>24.82</td>
<td>2.246</td>
</tr>
<tr>
<td>Services (Elect./Plumbing)</td>
<td>15.84</td>
<td>12.39</td>
<td>0.782</td>
</tr>
<tr>
<td>Door</td>
<td>3.29</td>
<td>4.79</td>
<td>1.456</td>
</tr>
<tr>
<td>Window</td>
<td>4.78</td>
<td>8.43</td>
<td>1.764</td>
</tr>
<tr>
<td>Fittings</td>
<td>8.63</td>
<td>3.69</td>
<td>0.428</td>
</tr>
<tr>
<td>Ext. Work</td>
<td>6.14</td>
<td>4.40</td>
<td>0.717</td>
</tr>
</tbody>
</table>

Where X is the % elemental cost Allocation in Year 2003 and
Y is the Elemental Cost allocation in Year 2010

Table 3 shows the comparative analysis of element proportional analysis (ratio) of cost for ten bungalow buildings between 2003 figures and those of 2010 figures using elemental analysis of bungalow buildings carried out by Mac Barango in Minna in 2003 (see Appendix II, Table 2.1) as basis for the comparison. Elemental cost allocation in 2003 was the dependent variable while element cost allocation in 2010 was independent variable.
Table 4 shows the outcome of the comparison as follows: Substructure is -16%, Frame and Wall 0.19%, Roof - 40%, Finishes 77%, Services - 24%, Door 37%, Window 55%, Fittings 80%, External works - 33%. From the results, Substructure element with - 16% showed the slightest decrease in proportional allocation in 2010 figures compared with similar element proportional cost allocation in 2003 while finishing element showed the highest and most significant increase.
of 77% compared with 2003 figures. Two elements – Substructure 16% and Services 24% showed slight decrease in proportional allocation, two other elements - Roof 40% and External works 33% showed moderate decrease, Frame and Wall with 19% showed slight increase, Door with 37% showed moderate increase, while window 55% and finishing 77% elements showed very significant increases in proportional cost allocation. Fitting exceptionally showed an 80% and very significant decrease in proportional cost allocation from 2003 figures. Since Substructure element showed the slightest decrease, it was selected for further analysis to show the relationship of unexecuted bill of quantities items o the total cost of projects.

4.3 Respondents opinion on Consistency of unexecuted items in substructure by contractors

Question 3 was designed to know the opinion of respondents on the consistency of unexecuted bill items by contractors in Nigeria. The table below presents response on consistency of unexecuted bill of quantities items by contractors.

Table 5: Consistency of unexecuted items by contractors (item 2 on the questionnaire)

<table>
<thead>
<tr>
<th>Respondents</th>
<th>Affirmative</th>
<th>Negative</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strongly Agree</td>
<td>Agree</td>
<td>Undecided</td>
</tr>
<tr>
<td>Fellows</td>
<td>9</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Members</td>
<td>25</td>
<td>25</td>
<td>4</td>
</tr>
<tr>
<td>Probationers</td>
<td>8</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>42 (40.4%)</td>
<td>39 (37.5%)</td>
<td>11 (10.6%)</td>
</tr>
</tbody>
</table>

Source: Field Data 2008

Following from table 5 above, 42 (40.4%) respondents comprising 9 Fellows, 25 Members and 8 Probationers Strongly agree that contractors in Nigeria in practice consistently omit items
measured in the bill of quantities. While 39 (37.5%) respondents comprising 2 Fellows, 25 Members and 12 Probationers Agree. On the other hand, 9 (8.7%) respondents comprising 6 Members and 3 Probationers disagree. Only 3 (2.8%) Members strongly disagree. 11 (10.6%) respondents comprising 1 Fellow, 4 Members and 6 Probationers are undecided. A total of 81 respondents representing 77.9% are in the affirmative while 12 persons representing 11.5% of the respondents are in the negative. 11 persons representing 10.6% did not volunteer any opinion.

Judging from the results of the analysis, the popular opinion of respondents is that contractors in Nigeria consistently omit to execute bill of quantities items in practice. This is the view upheld in the literature review. Possible reasons for this could be by the application of the rules of the Standard Method of Measurement, or situations where the contractor has adopted cost saving, time or method related techniques. At other times, there could be supervision lapses especially where the quantity surveyor was only used to prepare tender documents and later not involved during the post contract stages of the project.

4.4 The extent of the quantity surveyors responsibility for valuing unexecuted items for contractor’s payment.

Respondents’ opinions on the extent of the quantity surveyors responsibility for valuing unexecuted substructure bill items is presented in table 6.

Table 6. Respondents Opinion on the extent of the Quantity the Surveyor’s responsibility for valuing unexecuted substructure items.

<table>
<thead>
<tr>
<th></th>
<th>Not significant</th>
<th>Significant</th>
<th>Very significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respondents</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fellows</td>
<td>0 – 39%</td>
<td>40 – 59%</td>
<td>60 – 100%</td>
</tr>
<tr>
<td>Members</td>
<td>5</td>
<td>30</td>
<td>28</td>
</tr>
<tr>
<td>Probationers</td>
<td>11</td>
<td>7</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>16(15.4%)</td>
<td>37(35.6%)</td>
<td>51(49.0%)</td>
</tr>
</tbody>
</table>

Source: Field Data 2008
Based on table 6 above, 16 (15.4%) respondents believe that the quantity surveyor is not significantly responsible for the measurement, valuation and eventual payment for unexecuted substructure items while 88 (84.6%) made up of 37(35.6%) and 51 (49%) respondents respectively opine that the quantity surveyor is significantly and very significantly responsible if unexecuted bill items are eventually measured, valued and paid for by the client. This opinion is upheld in the literature review as observed in Potts (2004). This is so because the quantity surveyor is the cost expert prepares the bill of quantities and values the contractors work periodically and recommend work or value for payment. However, the quantity surveyor is not the only professional involved in the valuation of projects. The architect sometimes prepares progress report on which the quantity surveyor bases his valuation. Also, there are situation where factors other than sound professional ethics may prevail during the preparation of valuations and certificates.

4.5 Cost significance of unexecuted bill items by contractors on the substructure cost.

Our respondent’s opinion on the cost significance of unexecuted substructure items on the total cost of substructure is presented in table 7 below.

Table 7: Respondents Opinions on the Cost Significance of unexecuted Items on the Cost of the Substructure/Project

<table>
<thead>
<tr>
<th>Respondents</th>
<th>Affirmative</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>Negative</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strongly Agree</td>
<td>Agree</td>
<td>Undecided</td>
<td>Disagree</td>
<td>Strongly Disagree</td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fellows</td>
<td>6</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Members</td>
<td>24</td>
<td>25</td>
<td>6</td>
<td>5</td>
<td>1</td>
<td>61</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Probationers</td>
<td>8</td>
<td>14</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>28</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>38(37.6%)</td>
<td>44(43.6%)</td>
<td>11(10.9%)</td>
<td>7(6.9%)</td>
<td>1(1.0%)</td>
<td>101</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>82(81.2%)</td>
<td></td>
<td></td>
<td></td>
<td>8(7.9%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Field Data 2008
The above table shows that 6 out of 12 Fellows, 24 out of 61 Members and 8 out of 28 Probationers strongly agree, while 5 out of 12 Fellows, 25 out of 61 Members and 14 out of 28 Probationers agree that unexecuted substructure items have significant cost implications on the substructure/project cost. Respondents who strongly agree represent 38% while 44% agree. The total number of respondents in the affirmative is \( (38 + 44 = 82) \) (81.2%) whereas \( (7 + 1 = 8) \) (8%) respondents representing. 8% disagree. 8% is considered insignificant compared with 81.2% percentage of respondents in the affirmative). About 11% are undecided. This result was further subjected to hypothesis test below.

**HYPOTESIS 1**

**H\(_0\). Unexecuted substructure bill items by contractors do not have significant cost impact on the substructure cost of the project.**

To test Hypothesis 1, Z-score test is used to test the proportion of those in the affirmative compared to those in the negative.

\[ H_0: P = 0.5 \]

\[ H_1: P \neq 0.5 \]

\[ n = (38 + 44 + 11 + 7 + 1) = 101 \]

\[ x = (38 + 44) = 82 \]

\[ q = 1 - p \]

\[ Z_{cal} = \frac{x - np}{\sqrt{npq}} \]

\[ Z_{cal} = \frac{82 - 101 \times 0.5}{\sqrt{101 \times 0.5 \times 0.5}} = \frac{31.50}{5.02} = 6.27 \]

\[ Z_{\alpha/2} = 1.96 \]

i.e. \( Z_{0.025} = 1.96 \)
Decision:
Since Z calculated (6.27) is greater than Z critical (1.96) we reject H₀ (the null hypothesis) and accept/conclude that omitted bill of quantities items have cost significant impact on the project cost.

4.6 Direct cost of unexecuted substructure items.
To further confirm the result above, the substructure bill for ten (10 no.) projects was tabulated, analyzed and tested to establish whether there is any significant correlation between the costs of unexecuted substructure measured bill items and the total cost of substructure on a project. The findings are as shown on page 65 below:

H₀₂ There is no significant correlation between the total cost of unexecuted substructure bill items by contractor and the total cost of substructure
Table 8: Value of Unexecuted substructure items in the bill of quantities (10 no. Projects)

<table>
<thead>
<tr>
<th>BILL ITEM(7nos.)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topsoil excavation</td>
<td>1,375</td>
<td>24,250</td>
<td>3,398,672</td>
<td>15,000</td>
<td>46,200</td>
<td>N/A</td>
<td>39,080</td>
<td>85,950</td>
<td>39,500</td>
<td>71,850</td>
</tr>
<tr>
<td>Working space</td>
<td>216</td>
<td>310,600</td>
<td>2,344,251</td>
<td>26,620</td>
<td>51,040</td>
<td>12,200</td>
<td>98,620</td>
<td>11,500</td>
<td>38,250</td>
<td>18,500</td>
</tr>
<tr>
<td>Earthwork support</td>
<td>568</td>
<td>104,400</td>
<td>N/A</td>
<td>50,610</td>
<td>N/A</td>
<td>N/A</td>
<td>75,600</td>
<td>201,960</td>
<td>164,500</td>
<td>43,300</td>
</tr>
<tr>
<td>Anti termite treatment</td>
<td>549</td>
<td>N/A</td>
<td>1,325,192</td>
<td>21,680</td>
<td>84,900</td>
<td>12,300</td>
<td>9,150</td>
<td>184,080</td>
<td>56,400</td>
<td>N/A</td>
</tr>
<tr>
<td>Formwork</td>
<td>12,868</td>
<td>325,200</td>
<td>704,628</td>
<td>40,140</td>
<td>54,000</td>
<td>8,190</td>
<td>7,800</td>
<td>38,180</td>
<td>13,600</td>
<td>9,000</td>
</tr>
<tr>
<td>Block filled solid</td>
<td>3,080</td>
<td>112,500</td>
<td>1,881,198</td>
<td>117,360</td>
<td>333,200</td>
<td>182,040</td>
<td>19,500</td>
<td>403,425</td>
<td>117,500</td>
<td>186,120</td>
</tr>
<tr>
<td>Damp proofing</td>
<td>1,560</td>
<td>72,750</td>
<td>975,460</td>
<td>16,260</td>
<td>N/A</td>
<td>15,615</td>
<td>N/A</td>
<td>174,650</td>
<td>50,550</td>
<td>N/A</td>
</tr>
<tr>
<td>Total Cost of non executed items</td>
<td>20,216</td>
<td>949,700</td>
<td>10,630,401</td>
<td>287,670</td>
<td>569,340</td>
<td>230,345</td>
<td>249,750</td>
<td>1,099,745</td>
<td>480,300</td>
<td>328,770</td>
</tr>
<tr>
<td>Total Cost of substructure</td>
<td>324,792</td>
<td>14,407,180</td>
<td>62,664,505</td>
<td>1,774,205</td>
<td>4,620,750</td>
<td>2,250,515</td>
<td>875,270</td>
<td>6,385,640</td>
<td>4,538,800</td>
<td>3,839,270</td>
</tr>
<tr>
<td>Mean cost of non executed items</td>
<td>2,888</td>
<td>158,283</td>
<td>1,771,733</td>
<td>41,096</td>
<td>113,868</td>
<td>46,069</td>
<td>41,625</td>
<td>157,106</td>
<td>68,614</td>
<td>65,754</td>
</tr>
<tr>
<td>% of unexecuted items to total cost of substructure</td>
<td>6.2%</td>
<td>6.6%</td>
<td>17%</td>
<td>16.2%</td>
<td>12.3%</td>
<td>10.2%</td>
<td>28.5%</td>
<td>17.2%</td>
<td>10.6%</td>
<td>8.6%</td>
</tr>
</tbody>
</table>

Source: Priced bills of quantities 2001-2010
Table 4.9: Analysis of unexecuted substructure items in ten bills of quantities.

Table 9: Mean cost of unexecuted items to mean cost of substructure

<table>
<thead>
<tr>
<th>Bill no.</th>
<th>Substructure cost (N)</th>
<th>Total cost of non-executed items (N)</th>
<th>% age Non-executed items to substructure (x/y) x100</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>324,792</td>
<td>20,216</td>
<td>6.2</td>
</tr>
<tr>
<td>2</td>
<td>14,407,180</td>
<td>949,700</td>
<td>6.6</td>
</tr>
<tr>
<td>3</td>
<td>62,664,505</td>
<td>10,630,401</td>
<td>17</td>
</tr>
<tr>
<td>4</td>
<td>1,774,205</td>
<td>287,670</td>
<td>16.2</td>
</tr>
<tr>
<td>5</td>
<td>4,620,750</td>
<td>569,340</td>
<td>12.3</td>
</tr>
<tr>
<td>6</td>
<td>2,250,515</td>
<td>230,345</td>
<td>10.2</td>
</tr>
<tr>
<td>7</td>
<td>875,270</td>
<td>249,750</td>
<td>28.5</td>
</tr>
<tr>
<td>8</td>
<td>6,385,640</td>
<td>1,099,745</td>
<td>17.2</td>
</tr>
<tr>
<td>9</td>
<td>4,538,800</td>
<td>480,300</td>
<td>10.6</td>
</tr>
<tr>
<td>10</td>
<td>3,839,270</td>
<td>328,770</td>
<td>8.6</td>
</tr>
<tr>
<td>Gross cost of substructure</td>
<td>101,680,927</td>
<td>14,846,237</td>
<td></td>
</tr>
<tr>
<td>Mean cost of items</td>
<td>10,168,092.7</td>
<td>1,484,623.7</td>
<td></td>
</tr>
</tbody>
</table>

REGRESSION

/DESCRIPTIVES MEAN STDDEV CORR SIG N

/MISSING LISTWISE

/STATISTICS COEFF OUTS R ANOVA
/CRITERIA=PIN (.05) POUT (.10)
/NOORIGIN
/DEPENDENT Y
/METHOD=ENTER X1
/PARTIALPLOT ALL
/RESIDUALS DURBIN NORM (ZRESID).

Regression

[DataSet0]

<table>
<thead>
<tr>
<th>Descriptive Statistics</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Substructure Cost</td>
<td>10148093</td>
<td>18883601.07</td>
<td>10</td>
</tr>
<tr>
<td>Total cost of non-executed items</td>
<td>1484623.7</td>
<td>3230707.554</td>
<td>10</td>
</tr>
</tbody>
</table>

Variables Entered/Removed

<table>
<thead>
<tr>
<th>Model</th>
<th>Variables Entered</th>
<th>Variables Removed</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Total cost of non-executed items</td>
<td>.</td>
<td>Enter</td>
</tr>
</tbody>
</table>

a. All requested variables entered.

b. Dependent Variable: Total Substructure Cost
Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
<th>Durbin-Watson</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.979</td>
<td>.977</td>
<td>2868605.68</td>
<td>2.181</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), Total cost of non-executed items
b. Dependent Variable: Total Substructure Cost

ANOVA

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Regression</td>
<td>3.1E+015</td>
<td>1</td>
<td>3.143E+015</td>
<td>382.005</td>
</tr>
<tr>
<td></td>
<td>Residual</td>
<td>6.6E+013</td>
<td>8</td>
<td>8.229E+012</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>3.2E+015</td>
<td>9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), Total cost of non-executed items
b. Dependent Variable: Total Substructure Cost

Coefficients

<table>
<thead>
<tr>
<th>Model</th>
<th>(Constant)</th>
<th>Total cost of non-executed items</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
</tr>
<tr>
<td>1</td>
<td>1559876</td>
<td>1007953</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Total Substructure Cost

Relationship Model: \( Y = 1559876 + 5.785X_1 \)

Residuals Statistics

<table>
<thead>
<tr>
<th></th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predicted Value</td>
<td>1676821</td>
<td>6E+007</td>
<td>1E+007</td>
<td>18688922.20</td>
<td>10</td>
</tr>
<tr>
<td>Residual</td>
<td>-2129354</td>
<td>7353502</td>
<td>.000000</td>
<td>2704547.368</td>
<td>10</td>
</tr>
<tr>
<td>Std. Predicted Value</td>
<td>-.453</td>
<td>2.831</td>
<td>.000</td>
<td>1.000</td>
<td>10</td>
</tr>
<tr>
<td>Std. Residual</td>
<td>-.742</td>
<td>2.563</td>
<td>.000</td>
<td>.943</td>
<td>10</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Total Substructure Cost
Scatter Diagram of Regression

T calculated = 19.545

T 0.05 tabulated at (8) degree of freedom = 1.860

Decision: Since T calculated (19.545) is greater than T 0.05 (1.860), we conclude that the test is highly significant. That is, the cost of unexecuted items has significant effect on the total cost of substructure.

From table 12, the calculated correlation coefficient is 0.99 which means that there is a very strong positive relationship between Total cost of unexecuted items and Total cost of substructure.
substructure. Also from table 14, the calculated t-value is 19.545 with corresponding p-value as 0.000. This shows that at 0.05% level that the cost of unexecuted items has significant effect on the total cost of substructure.

4.7. DISCUSSION OF RESULTS

The bill of quantities of ten completed bungalow buildings constructed within Qwerri metropolis was tabulated and analyzed to show elemental cost and percentage allocation of each element to the total cost of building. There are principally nine major elements in an average bungalow building. These are grouped into (1) Substructure, (2) Frame and wall, (3) Roof, (4) Door, (5) Window, (6) Services (Electrical and plumbing), (7) Finishes (including painting), (8) Fittings and (9) External works. (Preliminaries and contingencies have been excluded because they are not subject to design).

From table 1, the analysis show that substructure element was allocated 18.24% in 2010 when compared to 21.40% in 2003, Frame and wall had 9.06% in 2010 compared to 7.49% in 2003, Roof had 14.18% as against 21.38 in 2003; Finishes (including painting) was 24.82% in 2010 compared to 11.05% in 2003, Services (Electrical and Plumbing) was 12.39% in 2010 as against 15.64% in 2003. It was observed that no two elements maintained the same or exact figures in 2010 and 2003 figures. This is not unusual. There were some changes in the grouping of elements between 2003 and 2010. For example, Electrical and Plumbing elements were kept separate in 2003 but are grouped together under Services in 2010, Painting was measured as a separate element in 2003 bill but grouped together under finishing in 2010, Frame and Wall was grouped together in 2010 but only Wall was mentioned in 2003 bill, (Frame was not mentioned). This however did not negatively affect the outcome of the analysis. It was observed that no two bungalow buildings had an exactly similar percentage distribution of pattern of percentage cost.
allocation. Design criteria, the type of client, size of project, function and use of project and contractors pricing pattern are all factors that influence such behaviors. The implications are that the general summary of the ten bills of quantities could not be used to accurately forecast or project the cost of a future bungalow building project. Forecast and prediction of cost of future bungalow buildings can be limited to similar conditions on which the source of data is based. For example, residential buildings can best be used to forecast the cost of a similar residential building while an office elemental analysis can best be accurately used to forecast the cost of a similar office building all things being equal.

Table 2 shows that two elements - substructure with 16%, and Services with 24% showed slight decrease in proportional allocation from 2003 figures. Substructure showed the slightest proportional allocation decrease of 16%. This is an indication the both design and construction and cost by percentage analysis has not drastically changed but rather have remained consistent with 2010 figures compared to 2003 figures. The simple strip foundation and column pad for bungalow buildings has not changed, Wall element have continued to be built using standard modulated 150mm and 225m thick sandcrete block work while simple plumbing to toilets and kitchens and basic electrical installation have persisted both in design and materials.

Arising from the above, substructure element was selected for further study to determine the cost relationship of unexecuted items to total cost of substructure element which are measured but consistently unexecuted but which eventually get paid by the client through interim valuations and final accounts.

Two other elements - Roof with 40%, and External work with 33% showed moderate proportional decreases, Finishing which include painting, showed 77% and windows with 55% showed very significant proportional increase. This can be due to increase in taste for floor and
wall tiling as against cement and sand screed while ceilings are changing to Plaster of Paris, conice and PVC materials as against asbestos sheets. Fittings element with 80% showed very significant decrease in proportional allocation.

Although prices have been the dominant factor used in the comparison, it must be noted that pricing is a function of type of client, size of job, type and size of contractor, tendering climate and so on. For example, Government projects are likely to cost more due to payment constraints, bureaucracy, VAT and Tax and COT deductions, the size of contractor and tendering climate are bound to affect pricing. It may therefore be necessary to examine jobs done by one contractor to be able to have consistent pricing pattern.

Table 8 shows that unexecuted substructure item include topsoil, working space, damp proofing, earthwork support anti termite among others. The percentage of unexecuted items compared to the total cost of substructure range from a minimum of 6.2% in bill no. 1 to maximum of 28.5 %, in bill no.7, with a mean of 17.4%. The wide margin can be due to the nature of substructure element which cannot be fully designed at tender stage. It is always measured as “Provisional” and is subject to re measurement. Also most of the items permitted to be measured and paid for by the rules of the Standard method of measurement whether they are executed or not are found in the substructure element e.g. working space allowance, earthwork support and others. Close supervision, amount of items covered by SMM rules, the contractors ability to adopt cost, time, or method related techniques could be other factors that contribute to the wide range from 6.2% minimum to 28.5% maximum. Since substructure involves work below ground floor level, JCT 80 (Private with Quantities), provides that an architect can order a contractor to open up covered work for inspection and if the work is satisfactory, the client will pay the cost of opening up but
if the work is defective, the contractor will bear the cost of opening up and making good defects. This provision is seldom invoked.

In tables 10 – 15, Regression was carried out using total cost of substructure as dependent variable and cost of unexecuted items as independent variable. Result show that at 5% level of significance, T calculated is 19.545 which is greater than T tabulated 1.860. This is an indication that the cost of unexecuted items is very significant. And relationship is correlated. It must be stated that most of the items unexecuted are operations and items or activities which do not form part of the finished product hence their cost impact is a subject for further study.

With regard to the consistency of unexecuted substructure items, a total of 81 respondents representing 77.9% are in the affirmative while 12 persons representing 11.5% of the respondents are in the negative. 11 persons representing 10.6% did not volunteer any opinion.

Judging from the results of the analysis, the popular opinion of respondents is that contractors in Nigeria consistently omit to execute some substructure bill of quantities items in practice. The overwhelming opinion of respondents is a confirmation of field experience and the magnitude of the occurrence. This is the view upheld in the literature review. Items consistently unexecuted include topsoil excavation, working space allowance, earthwork support, anti termite treatment, damp proofing, formwork to all sides of attached columns, protection and others.

It was observed that some of the bill items consistently not executed in practice by contractors in Nigeria is occasioned by the application of the rules and provisions of the Standard Method of Measurement and that at other times, the contractor has exercised freedom or discretion to use time or method or cost saving techniques that can save cost and enhance his profitability Pilcher (1992) opines that this is in line with the goal of contracting which is profit driven. On the case of the SMM rules, the implication of this is that clients are paying more for the application of the
SMM rules and not necessarily for additional work done. This can only be remedied if the relevant clauses and conditions are amended. Contractors can be encouraged at tender stage to indicate any cost, time, or method related techniques which they plan to adopt and obtain architects and relevant approvals.

Most respondents in the study agree that non-executed items in the bill of quantities are more prevalent in the substructure. The finding may not be unconnected with the nature of substructure element as a provisional bill occasioned by inconclusive design of the substructure element at pre contract stage which in most cases would result to re measurement, variation and or construction change order. However it was earlier observed that some of the identifiable omitted items consist of preparatory works, operations and activities of a temporary nature which may not form part of the finished product. Detailed site surveys and conclusive designs of substructure will be necessary to achieve firm billing and reduce provisional quantities but the implication would amount to prolonged pre contract documentation process with its attendant longer tendering time and inflation related consequences. Industry operators proffer other possible reasons for the non-execution of bill of quantities measured items by contractors in Nigeria to include that most of the items not executed are not usually graphically shown on the Architects drawings which the contractor uses during contract execution. For example, it is neither conventional nor possible to graphically show earthwork support, anti termite solution treatment, damp proofing course and membrane or mechanical plants and others in drawings. It has also been observed in practice that most contractors do not use the bill of quantities except for valuation and final account purposes. Contractors are therefore to be educated to read all contract documents in conjunction, including preambles and specifications. The view held in the literature review is that conclusive or complete design at tendering stage is not yet achievable to
date. This agrees with the view of Benham (2002), that complete design at tendering stage is not yet achievable to date, hence the practical application of the decision becomes the study of another work.

While 31% of respondents believe that the quantity surveyor is very significantly responsible and 37% significantly responsible, only 15% believe that he is not significantly responsible. Since it is the quantity surveyor who measures the bill of quantities and prepares interim valuation for the contractor the basis on which the Architect recommends to the client for payment, the quantity surveyor seems to share a considerable part of the blame for valuing non-executed items. This view is upheld in the literature review. Field experience shows that although the quantity surveyor prepares the bill of quantities for tendering, some clients do not engage them for post contract services, hence the contractor may claim for all items measured in the bill of quantities even when they are not executed, also the architects method of assessment of work progress by percentage is another factor. However in the Nigerian environment, there are some other factors other than sound professional ethics prevailing in the preparation of valuations and certificates, for example the powers of the Architect, political Godfathers’, bribery and corruption among others.

It must be common knowledge that substructure bill items omitted by contractors in Nigeria will significantly affect the state and performance of the building. For example, non-application of anti termite treatment solution to sides and surfaces of excavations expose the building to termite infestation and reduces the strength and life of timber drastically. Punmia (2006), listed effects of dampness to include:

a) Moisture travel causing softening and crumbling of plaster,
b) Continuous presence of moisture in walls causing efflorescence, resulting in disintegration of bricks and blocks and consequent reduction in strength,

c) Dampness promotes and accelerates the growth of termites etc.

Non-execution of damp proof course and damp proof membrane in projects allows ingress of water and cause deterioration observes Okoli and Kehinde (1991) and Hall (2009). Bestway (2000) asserts that termites cause over $1 billion worth of damage every year. Lack of protection for measured work like concrete during curing, wet paint during drying etcetera; result in less performance of buildings including reduction in its expected life. However the truth remains that there are many other factors apart from omitted items in the substructure that can affect the state and wellbeing of a structure. Hall (2009) add other causes of building defects to include bad building practice, builder mismanagement, and deterioration due to age and lack of maintenance. Items measured in the bill of quantities, which eventually get paid for during valuations and final account but are unexecuted in practice by contractors in Nigeria have significant cost impact on the project. a calculated correlation coefficient of 0.99 means that there is a very strong positive relationship between Total cost of unexecuted items and Total cost of substructure, and a calculated t-value of 19.545 with corresponding p-value as 0.000 shows that at 0.05% level there is a very strong positive correlation between cost of unexecuted items and cost of substructure which means that the cost of unexecuted items has significant effect on the total cost of substructure.
CHAPTER FIVE
CONCLUSION AND RECOMMENDATIONS

5.1 CONCLUSION
The construction industry plays a very important and significant dynamic role in the sustainable development of any nation, Nigeria inclusive. The high cost of project delivery and payment for work not executed all contribute to make construction both uneconomical and have a tendency to scare investors and developers from building and construction to other sectors of the economy. Dissatisfaction expressed by building clients on the poor performance and level of service received from construction industry operators especially professionals have been on the increase in recent times. This study was therefore necessitated due to the complaints of dissatisfaction continuously expressed by clients and industry operators (particularly in this case) on the relevance of the quantity surveyor and bills of quantities for projects and the need for clients and building owners to get value for their money. This study examined the measurement, valuation and payment for bills of quantities items consistently not executed by contractors in Nigeria. The objective of the study was to analyze bills of quantities of completed bungalow buildings and examine the prevalence of non-execution of Bill of Quantities items by construction contractors in Nigeria and the resultant direct cost effect on the cost of substructure element. The study used data from the analysis of ten bills of quantities of bungalow buildings constructed in Owerri, and opinions of quantity surveyors as the professionals directly responsible for producing “bill of quantities” upon which contracts are awarded and who also value the contractor’s work for payment.

The substructure bill for ten projects was also analyzed and tested to see if there was a significant correlation between the cost of unexecuted substructure items by contractors and the total cost of
substructure. Based on the analysis of the relevant data, the following were the findings of the research:

i) the substructure element (with 16% decrease in 2010) has the least proportional cost allocation when compared with 2003 analysis of similar element. Attention was therefore directed at the substructure element of bungalow building projects to see the relationship of unexecuted bill items to the total cost of substructure since according to Mac Barango (2003), this element accounts for between 20% - 25% of total cost of bungalow building projects (the highest or the most costly singular element). In this study however, substructure element (although still the highest or most expensive singular element) accounted for 18.24%. Elemental analysis of the ten bills of quantities of bungalow buildings showed that two elements – Substructure 16% and Services 24% showed slight decrease in proportional allocation, two other elements - Roof 40% and External works 33% showed moderate decrease, Frame and Wall with 19% showed slight increase, Door with 37% showed moderate increase, while window 55% and finishing 77% elements showed very significant increases in proportional cost allocation. Fitting exceptionally showed an 80% and very significant decrease in proportional cost allocation from 2003 figures.

ii) 77.9% of respondents mainly quantity surveyors significantly agree that some items measured in the bill of quantities are not executed in practice by contractors. Examples of some of these items include: topsoil excavation, working space allowance, damp proofing, earthwork support and anti termite treatments among others.

iii) Some of the unexecuted items which eventually get paid for by the client via interim valuations follow the application of the rules of the standard method of measurement, RICS(1979) and NIQS (2008)
iv) Unexecuted items are more prevalent in the substructure element of the bill of quantities (occasioned by the fact that (according to Benham 2002) substructure design cannot be accurately conclusive at tender stage) and the vulnerability of this element to construction work changes (hence it is mostly measured as provisional and subject to re-measurement on completion).

v) Contractors have adopted alternative cost/time and method related techniques in cases of unexecuted items. This is to save cost/time and enhance their profitability which are the goals of contractor. Examples where the contractors have adopted cost/time and method related techniques include earthwork support, working space allowance damp proofing etc.

vi) The bill items not executed by contractors do have significant cost impact on the cost of the project. At 5% level of significance t - calculated is 19.545 compared to t - tabulated of 12.592. This implies that there is a very significant correlation between the cost of unexecuted substructure items and the total cost of substructure.

vii) In the opinion of 84.6% of respondents, the quantity surveyor is believed to be very significantly responsible for the valuation and payment by the client for substructure bill items not executed by contractors in Nigeria. This is because it is the quantity surveyor professionally responsible for the preparation of the bill of quantities and who also measures and value the contractors work and recommend sums for payment.

The optimization of resources including getting value for money is the ultimate goal of operators in the construction/building industry. Efforts have been made by clients and developers to engage professionals to help achieve this objective. Consequently, studies have been carried out to ascertain factors which hinder this noble goal especially the use of the bill of quantities and
the incidence of valuing bill of quantities items which are consistently not executed in practice by contractors in Nigeria. The bill of quantities remains a veritable tool in the tendering process and contract arrangement and hence the basis of preparation and valuation technique should be environment compatible/friendly. It must be stressed that items measured in the bill of quantities by the quantity surveyor, in the first instance, was included for a purpose but at final account the quantity surveyor should ensure that items not executed in practice by the contractor are not paid for to achieve savings.

5.2 RECOMMENDATIONS

Leaning on the results of the analysis and findings that some substructure bill of quantities items are consistently unexecuted in practice by contractors in Nigeria, (whether due to lapse, unethical/unprofessional activities of the professional, or due to the applications of the rules of measurements), a number of recommendations become necessary and include among others:

1) Design should be thorough and significantly concluded before billing. As stated earlier, the bill of quantities is to fully describe and accurately measure work to be executed and this cannot be so unless design, the fundamental basis of measurement is significantly achieved. This means that clients are to plan well in advance and allow adequate time for documentation prior to project implementation.

2) The instruments for measurement and contract arrangement, that is the standard Method of Measurement and Standard Form of Contract (Conditions of Contract), should be adaptable to the local environment such as exist in Nigeria. It is strongly recommended that subsequent editions/revisions of the SMM may have to consider the application of these clauses to the Nigerian situation. Clients are not to lose or compromise quality for cost. This will help overcome exclusion and strengthen inclusion in the documentation.
3) On site (residency) and close supervision of the contractors work by the Quantity Surveyor is required. Some clients are likely to avoid this extra cost but the benefits to be derived from it far outweigh the fear. Some clients, (whether for convenience, patronage or for other reasons), separate pre contract and post contract engagement services of the quantity surveyor. This creates gap in documentation and post contract administration of bill of quantities.

4) Contractors are free to adopt any cost or time saving or method related techniques that can enhance their profitability but should not be at the expense of the quality of the finished product. The contractor should obtain relevant approval of the architect to adopt his techniques, while the quantity surveyor should be notified.

Areas for further studies/research is necessary to determine

i) The effect of other factors other than price that determine the Elemental analysis of bungalow buildings should be investigated to know the effect of their respective impacts Price should not be the only or dominant factor in analyzing the Elemental analysis of bungalow buildings.

ii) the degree of cost significance on the entire project,

iii) application of computers for monitoring and on-site valuation and

iv) Further study of the significance of unexecuted items in other sections/elements of the bill of quantities.
REFERENCES


Newpro Quants Consultants (2002), New Comprehensive Construction Cost book 2nd edition,

Nigerian Institute of Quantity Surveyors (2008), Building and Engineering Standard Method of Measurement, 3rd Edition


Wikipedia (2009), Bills of Quantities, en.wikipedia.org/wiki/BQ

APPENDIX 1

QUESTIONNAIRE

Dear Respondent,

We are studying the significance of the omission of some bill of quantity items in practice by contractors in building construction projects in Nigeria.

1) State (a) Name/address of organization/office -------------------------------
   (b) Position/status of officer responding -------------------------------
   (c) (i) Highest qualification ---------------------- e.g. B.Sc. (Q.S)
        (ii) Professional Status ------------------------ e.g. FNIQS
   (d) Number of years of experience (i) Post graduation----------years
       (ii) Post professional qualification ------years

Year professionally qualified (state year) -------------------------------

2) As a quantity surveyor, to what extent do you agree that some BOQ work items are consistently omitted in practice by building contractors in Nigeria? (Tick only one)
   (a) Strongly Agree (b) Agree (c) Undecided (d) Disagree (e) Strongly Disagree

3) Do you agree that unexecuted items are more prevalent in the substructure element of the bill of quantities?
   (a) Agree (b) Disagree (c) I don’t Know

4) Most of the following items (Topsoil excavation, Rock excavation, working space allowance, Earthwork support, Anti termite treatment, Damp proofing, Formwork to attached columns, Hollow blocks filled solid, Sand blinding, Protecting measured work) are believed to be prevalently unexecuted in the substructure section of the bill of quantities, do you agree?
   (a) Agree (b) Disagree (c) I don’t Know
5) Using 10 as the highest and 1 as lowest respectively, rank the following unexecuted items in order of prevalence.

i) Topsoil excavation ( )
ii) Rock excavation ( )
iii) Excavating working space ( )
iv) Earthwork support ( )
v) Anti termite treatment ( )
vi) Damp proofing ( )
vii) Formwork to attached columns ( )
viii) Hollow blocks filled solid ( )
ix) Sand blinding ( )
x) Protecting measured work ( )

5) In which of the above items do you think the contractor have adopted alternative cost saving, time or method related techniques?

---------------------------------------------------------------------------------------------------------------------

6) Based on a total of 100% percent, state the extent to which you think the quantity surveyor should be held responsible if unexecuted items are eventually valued for payment?

7) Do you agree that the BOQ items usually unexecuted in practice by contractors have cost significance on the total cost of the project? (Tick only one)

(a) Strongly Agree (b) Agree (c) Undecided (d) Disagree (e) Strongly Disagree

8) Do you agree that adhering strictly to the construction work programme will help to checkmate the non execution of BQ items listed above?

(a) Strongly Agree (b) Agree (c) Undecided (d) Disagree (e) Strongly Disagree
9) To what extent should the quantity surveyor be willing to be paid consultancy fee based on a sliding scale determined by the extent to which the final construction cost differs/varies from the initial estimated cost of construction?

a (a) Very willing (b) Willing (c) Undecided (d) Unwilling (e) Very unwilling

General comments (briefly) --------------------------------------------------------------

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APPENDIX 11

Table 2.1: Cost analysis of a typical bungalow. (By percentage)

<table>
<thead>
<tr>
<th>Substructure</th>
<th>21.40 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wall</td>
<td>7.49 %</td>
</tr>
<tr>
<td>Roofing</td>
<td>21.38 %</td>
</tr>
<tr>
<td>Finishing</td>
<td>11.05 %</td>
</tr>
<tr>
<td>Electrical</td>
<td>11.34 %</td>
</tr>
<tr>
<td>Plumbing</td>
<td>4.50 %</td>
</tr>
<tr>
<td>Doors</td>
<td>3.29 %</td>
</tr>
<tr>
<td>Windows</td>
<td>4.78 %</td>
</tr>
<tr>
<td>Fittings and Fixtures</td>
<td>8.63 %</td>
</tr>
</tbody>
</table>

*without Preliminaries and Contingencies

(Source: Mac-Barrango 2003.)

Table 3.1: Table of Study Population and Sample

A total of 130 questionnaires were administered and 104 duly completed questionnaires were returned, representing an 80% response.

Population       679 (obtained from QS connect, an official newsletter of the Nigerian Institute of Quantity Surveyors Vol. 4 No. 2 Sept. 2006)

Sample size      130

Response /respondents 104

Fellows          12

Members          63

Probationers    29
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