THE NEED FOR PRE-TENDER COST CONTROL FOR COSTRUCTION

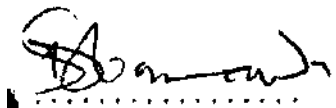
PROJECTS
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A *thesis submitted to the Postgraduate School, Ahmadu Bello University, Zana, in partial fulfillment of the requirements for the award of the decree or Master of Science in Construction Management in the Department of Building, Faculty of environmental Design, Ahmadu Bello University, Zaria, Nigeria*

SEPTEMBER, 1996

DECLARATION

I hereby declare that this thesis has been prepared by me, that it is a record of my own research. It has not been presented in any previous application for a higher degree. All quotations are indicated and the sources of information are specifically acknowledged by means of references.



.....

ADA, Alhaji Suraja

September, 1996

CERTIFICATION

This Thesis/dissertation entitled THE NEED FOR PRE-TENDER COST CONTROL FOR CONSTRUCTION PROJECTS By Dada, Alhaji Suraja meets the regulations governing the award of the degree of Master of Science in Construction Management of Ahmadu Bello University, Zaria and is approved for its contribution to knowledge and literally presentation.

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DEDICATION

To my Late Mother

Maryam Dada

for the good upbringing and encouragement

to work hard which I received at an early age

and

Also to my understanding wife

Aitine Dada

for her support and assistance in seeing to the

completion of this work

ACKNOWLEDGEMENT

My immense gratitude goes to Mr. Z. J. Sikora, Head of Department of Building, for initiating the rudimentary ideas that evetually engendered this study.

I owe a great many intellectual debts to my initial supervisor Mal. Saleh Mohammed Sani for his unalloyed assistance, largesse and zeal toward ensuring the successful completion of this work. Similarly, are my debts to the final Supervisory Committee composed of Messrs. O.W.D Obadofin (Chairman) and Mr. Z. J. Sikora (member).

I also wish to register my appreciation to other academic staff of Building Department especially Dr. O.G. Okoli, Mall. Kabir Bala, Mall. M. M. Garba and Mall. I. K. Zubairu.

I cannot close without mentioning the assistance I received from my colleages and friends Mohammed Baba Adamu, Adamu Shehu Yanda, Bashir Ahmed and Buhari Mukaila, all of Prime and Bell Partnership for providing most of the data for the work.

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ABSTRACT

The process of controlling construction costs starts well before the advertisement for tender and the notice to proceed is issued to the Contractor. There are steps and procedures an owner can follow to ensure that there are no suprises on the tender day that will derail the progress of the project. This study has explored and recommended steps and procedures an owner or his agent can take to control costs from inception and feasibility study phases up through the scheme and Detail Design Phases and finally to the submission of tenders. The study has also focused attention on ensuring that the contract sum is within the owners approved budget or cost limit.

The study was therefore confined to the Pre-tender stage with the total development cost to the client as the main parameter.

The Principal objectives include providing insight into Pre-tender cost control, categorising various stages involved in pre-tender cost control and propose a model which is anticipated to overcome most of the hindrances encountered.

Pre-tender estimating techniques and models were critically reviewed. A carefully designed questionnaire was administered in conjunction with Personal interviews.

The proposed analytic model requires adopting any of the estimating techniques and models in arriving at the Preliminary Cost Estimate and applying the calculated costant to obtain the probable completion cost for budget purpose.

The perceived benefits of the model include inter alia reliability, adaptability to current estimating practice, simplicity, ease and accuracy.

The viability of the model was seen to be contingent upon derivation of the intial unbiased Preliminary Estimate and ensuring that the time lapse between the initial Preliminary estimate and contract award is not wide.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND

Everyone spending money is concerned with obtaining good value. No sensible person would knowingly accept an inferior article if a better one could be obtained for the same price. Similarly, society wishes to obtain maximum benefits from resources available to it. The benefit may arise from physical goods, from services or from leisure. The more complex the value are, the more necessary it is to evaluate the alternatives and plan the best way of using resources" Stone (1967).

The concept of pre-tender cost control has grown in importance ever since the emergence of organised construction business ventures. Construction projects as investment decisions are always executed over a span of time involving the present and the future. This makes it imperative for the participating parties to clarify and if possible quantify the constraints involved. "Building Project designs involve many constraints which relate to costs, time, manpower and materials" Svensson (1982).

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For a typical project, both the client and his design advisers need to evaluate the chances of the project proposal exceeding the best estimated cost or time. "Criteria for evaluating comparing and ranking alternative building designs must be evolved. In most building project designs, minimum financial cost is one of the most important of the criteria for evaluating alternatives.," Asimow (1975).

Clearly, the field of pre-tender cost control is extremely wide. Economic evaluations are required both for individual buildings and for developments, and for their maintenance and adaptation to meet changing needs. "There is also a need to evaluate regulations affecting building designs to ascertain their consequences on costs and values". Stone (1967).

Generally, any consequences of a design which affects the use of resources can be regarded as a cost. "Some estimate of the cost is usually possible. Consequences which affects the satisfaction obtained from such qualities as appearances, comfort and convenience are less easy to evaluate since the values allocated to such factors are personal and subjective". Cartledge (1973).

Frequently users find it difficult to measure the satisfactions they obtained even from buildings in use. Clearly, it is more difficult to evaluate expected satisfactions at the design stage, especially where, as frequently the case, the future users can not be identified Nevertheless the difficulty in determining values is not an adequate reason for refusing to evaluate the costs. The importance of differences in value cannot be assessed until the differences in costs are ascertained. If cost differences are small, differences in value will be given considerable weight in reaching design decisions. Where cost differences are large, value differences of the same order and direction will be necessary to justify the more costly solution.

Generally, it is convenient to arrange costs and values in the form of comparative balance sheets. This arrangement facilitates cross comparison, the evaluation of errors, the the testing of design alternatives.

In essence Pre-tender evaluation of building designs consists of tracing the consequences of alternatives on the use of resources and on the values which are created. A large part of the costs usually consists of the costs of the construction, maintenance and servicing of the building.

Pre-tender cost control is also concerned with the costs in the future as well as with the present costs. It is necessary to predict changes in comparative cost levels.

1.2 STATEMENT OF PROBLEM

In these times of increasing costs the majority of promoters of building work insist on projects being designed and executed to give maximum value for money. Rising prices, restrictions on the use of capital and high interest rates caused employers to demand that their professional advisers should ensure suitably balanced costs throughout all parts of the building, as well as an accurately forecast overall cost, involving close collaboration between the Consultants concerned, it is therefore, vital to operate an effective cost control procedure during the pre-contract stage of a project to keep its total cost within the employer's budget. Where the lowest tender is substantially above the initial estimates, the design may have to be modified considerably or even worse, the project may have to be abandoned.

Seeley (1984) has summed up seven pressures that neccessitates the importance of effective controlling building costs at the pre-contract stage. Amongst them are the following:-

1) There is greater urgency for the completion of projects, and few employers have the time to allow for the design of schemes consequent upon the receipt of high tenders.

2) Employers' needs are becoming more complicated, more consultants are being engaged and the estimation of probable costs become more difficult.

3) Employing organisations, both public and private, have tended to become larger and are themselves adopting more sophisticated techniques for the forecasting and control of expenditure, and they in turn expect a high level of efficiency and expertise from their professional advisers for the building projects.

4) The introduction of new techniques, materials and components creates greater problems in assessing the capital and maintenance costs of buildings.

5) Additionally, the fact that most items of mechanical and electrical installation materials are imported and the attendant frequent changes in foreign exchange rates creates more difficulties in the estimation of the cost construction. The level of mechanical and electrical component of construction can be as much as 50-95% of total cost of construction for Office Block and Petrochemical Plant respectively. Umole, (1990).

Considering the importance of effectively controlling cost from the foregoing, it is vital to improve and refine the existing cost control tools.

1.3 AIM AND OBJECTIVES

The broad aim of the study is to suggest an approach to Pre-Tender cost control which minimises the hindrance encountered in practice and yet presents a reliable result.

The aim of this study are:

i) To provide an insight into the Pre-Tender cost control highlighting the role this play in determining the overall construction costs.

ii) To identify and categorise the various stages involved in Pre-Tender cost control and the techniques to be adopted at each stage in ensuring that target is not exceeded.

iii) To survey and analyse the existing practice in the industry with respect to Pre-Tender cost control.

iv) To identify the problems encountered in practice in adopting cost control techniques especially at the pretender stage.

v) To suggest a method or improving the existing techniques with a view to enhancing their reliability.

vi) To draw conclusion and recommend for further studies in the research area for validation of the method.

1.4 SCOPE AND LIMITATIONS

The research topic is particularly useful to clients/owners and professionals but in some cases (where package deal contracts are employed) it could be of help to contractors as well

The clients here cover both the public and private sectors that are particularly involved in construction projects. The professionals that are generally involved at the pre-contract stage whose actions have consequent cost implications are normally the Architects and the Quantity Surveyors. Furthermore the precise period of interest herein is the interval between the project inception to the stage when tenders are invited.
It was not possible to cover the entire Country in the study, owing to numerous obvious constraints. Thus, the study covered only a cross section of the Country.

1.5 METHODOLOGY

The research process adopted for the study can be categorised in three:

i) Review of literature on the subject matter.

ii) Identification and Analysis of current practice

iii) Proposal for an effective Pre-tender cost control.

The first stage was accomplished through the critical study of magazines, journals, seminar papers, proceedings, text and other publications relating to the subject. This enabled the attainment of the first two objectives and provided a basis for formulating the practical review approach.

The second stage was addressed from the results of oral interview and questionnaires administered to Consultancy firms and clients Organisations. This outcome enable the fulfilment of the third and fourth objectives.

The results of the first and second stages provided the milieu for accomplishing the last objective.

Finally, conclusions drawn and recommenations have been made for further studies.

CHAPTER TWO

LITERATURE REVIEW

AN OVERVIEW OF PRE-TENDER COST CONTROL

2.1 DEFINITION OF COST CONTROL

Cost has been defined by Raftery (1991) as "that which must be given in order to acquire, produce or affect something". It has also been referred to as the sum of payments made to factors of Production. Another definition by Umole (1991) refers to cost as the amount of money (or other form of legal exchanges) paid by the developer/client to the Contractor. Umar (1981) defines cost as meaning cost to building owner not the Contractor.

From the foregoing definitions, cost may be defined as the total cost of construction including all general allowances such as overheads and profits, professional fees and expenses, and such other costs that may be necessary for the execution of the Project. It can thus be broken down to include inter alia the following:

1. Cost of Materials & Equipments.
2. Cost of labour for fixing, assembling and installation.
3. Contractors cost of site and head office overheads.
4. Contractors profit.
5. Contractors incidental expenses from retentions.
6. Consultancy fees.

Control has been defined by Haynes, et al (1975) as a process that guides activity towards some predetermined goal. Glueu (1979) in addition has itemised the fundamentals of any control system as;

- Establishing standards for measurement.
- Developing measurement procedures to determine progress toward organisation objectives.
- Acting to reinforce successes and correct shortcoming.

The Concise English dictionary meaning of the word control is to command, order, direct or influence. However as a management tool it can be said to include a number of principles some of which are; forecasting, planning, organising, motivating, co-ordinating etc.

Putting the two concepts together, cost control is generally seen to be an umbrella term governing all contributory stages involving cost analysis, cost planning, cost comparison, cost checking, cost reconciliation at the tendering stage and cost monitoring at the Post Contract stage.

2.2 PURPOSE OF COST CONTROL

In order to comprehend fully the purpose and benefits of pre-tender cost control considered within the scope of this study, it is worthwhile reviewing briefly the activities conducted at the various stages of the design process.

2.2.1 ACTIVITIES AT THE PRE-TENDER STAGE

The stages in the design process are categorised by Seeley (1988) as

a) Inception

b) Feasibility study

c) Outline proposals

d) Scheme Designs

e) Detail Designs

Inception stage is relatively straight forward. the client approaches the architect of his choice and usually with his requirements in the form of floor area required and the target cost Cartledge (1973). Although Seeley (1988) did not consider this to be of much relevance, Cartledge (1973) attaches some importance to it since it enables the client to know thoroughly what his requirements are. Further, it is common knowledge that in Nigeria due consideration is sometime not given to this stage which more often than not leads clients into embarking on projects that are not seen to completion. The importance of this stage therefore as highlighted by Cartledge (1973) is for the client to know thoroughly what are his requirements.

The feasibility stage establishes the clients requirements. Seeley (1988) argues that it is at this stage that the client often establishes his cost target contrary to Cartledge (1973) who opined that the cost target is established at the previous stage (inception). However, both the two authors agreed that it is at this stage that the process of designing a building that will exactly conform to the clients wishes becomes a team effort of all the consultants involved. It is also at this stage that the Quantity Surveyor can render valuable service by supplying cost information based on the actual cost of previous buildings of similar design taking into consideration factors such as differences of location, site conditions, etc. It is unanimously agreed that, it is at this stage where cost control task is first started with confirmation of cost limit. Cartledge (1973) observed that the feasibility stage is the most crucial for the design team to take decision on whether or not to continue with the project. The estimate prepared at this stage is mainly provisional on a comparative or interpolation basis.

Outline Proposal, Scheme Design and often times the detail design are concurrent activities. Ideally the detail design stage should come after the first two stages must have been finalised (to forestal frequent variations). At the outline stage, the Architect considers alternative ways in which the building can be designed and constructed at the same time liaising with the Quantity Surveyor for

probable cost estimate of each alternative design by providing an outline cost plan. Cartledge (1973) highlighted that the lump sum cost target established at the feasibility stage will now be split into the amount intended for each element. It is pertinent for the architect in close collaboration with the Quantity Surveyor to provide design answers to the following questions within the set cost limit, Ferry et al (1980).

-" What are the physical, technological, financial, public and other constraints within which I have to work?
- What are the priorities of the scheme and what is the best ranking of these priorities.
- What is the total space requirement and how should this space be apportioned to various uses.
- What possible forms can the building take within the identified constraints and clients requirements.
- What possible level of specifications can be incorporated in each of these possible forms to stay within the cost limit and meet prescribed quality and aesthetic requirements".

To answer these questions, the architect produces sketches of various designs solutions of the projects, each of which will be costed by the quantity surveyor using various approximate methods depending on the information accompanying each design solution.

Thus the architect selects specifications and parameters for various parts and components of his solutions while the quantity surveyor prepares cost studies of these components as well as advises on the cost implications of design variables and decisions. Finally, the most optimal design solution is selected for further development.

SCHEME DESIGN STAGE

There is apparent confusion among Architects and Quantity Surveyors as to where outline proposals stage should end while many architects still wonder at its desirability as a whole. While Ferry et al (1980) accepts the above outline of the stage, Cartledge believes that a "broad but accurate" cost allocation should be made over the design elements before the commencement of the scheme design. Cartledge, (1973), however seems to be alone on this contention since the famous RIBA plan work, which serves like a code of practice for architects, is for the view that cost planning continues up to the scheme design stage.

The selected proposal is now developed into a scheme with a preliminary design comprising sketch plans and elevations and such outline specifications that is adequate to enable a firm and reliable cost plan to be prepared. Cost plans are prepared

by means of approximate quantities taken from the scheme and priced using cost analysis data of past projects suitably adjusted for ommissions, price level, quantity, additions, standards and finishes in that order. The design is broken down into functional elements, work sections, trades or operation and cost targets assigned to each division. The elemental format is the most popular for cost analysis purpose since it is more readily understood by clients, Architects and also the Contractors. At the end of this stage both the Project cost plan and key design decisions and concepts have been FINALISED.

DETAIL DESIGN STAGE

This is when the architect and engineers produce the detailed design of every part and component of the project in its final form, and the quantity surveyor commences cost control of the design by costing each element or component of the design as it is produced and checking the estimate against the target set for it in the cost plan - a process often referred to as cost checking. Where there is material deviation between the target cost and the estimate, the quantity surveyor advises the architect to either re-design or modify some aspects of the details. This is often the initial source of conflict with the architect who, according to MOSAKU (1987) develops some emotional attachment to his ideas and strongly resent their being tampered with. This strongly challenges the initiatives and drive of the

quantity surveyor as pointed out by Abdu (1984) because while the architect is grumbling that the aesthetic appeal of his design is being tampered with, the quantity surveyor must still press to ensure that balance is maintained between cost and value and that the budget is not exceeded.

Having analysed the stages involved in pre-tender, we can now appreciate the necessity of pre-tender cost control.

2.3 PURPOSE OF PRE-TENDER COST CONTROL

Costing is generally accepted to mean applying prices to a schedule of items of labour and materials in order to obtain an approximation of the cost of a construction project. It is therefore generally expected to commence from the inception of a project to time when tenders are invited. Traditional techniques had been applied, unfortunately the reputation of the accuracy of the traditional methods is not at all good, a reputation that has spread far beyond the people directly concerned with producing these sometimes aptly named guess estimate.

Cartledge (1973) pointed that unless cost control is applied at the pre-tender stage, the effect effectiveness of cost control is seriously curtailed for the duration of the project. The objective of cost control is not only to determine the probable cost of a building, but also by closely relating the cost to the design, by means of an elemental cost plan, to control the design development throughout the project.

The Aqua group (1976) describe the three basic operations involved in pre-tender cost control as follows;

1) *Preparation of approximate estimates giving estimates of the cost of the whole or part of the project at various stages before the tenders are invited.*

2) *Preparation of a cost which apportions the estimated expenditure among the various elements of the building enabling those concerned with the design to know the expenditure is being incurred, where if additional expenditure is considered desirable on one aspect of the building, economics can be effected elsewhere and generally to enable the architect and the quantity surveyor working together to ensure that the building owner is getting the best value for his money.*

3) *The exercise of cost control by the regular checking of the cost plan as the design is developed thus ensuring that changes in the proposed expenditure are brought to light at an early stage enabling modifications to be made elsewhere in the design if necessary.*

The integration of cost matters into the design process is shown in figure 2.1 below;



FIGURE 2.1: INTEGRATING COST MATTERS AND ACTIONS
SOURCE: AQUA GROUP (1976); Tenders and Contracts for Building; Granada Publishing.

2.4 STAGES OF PRE-TENDER COST CONTROL

2.4.1 CONSTRUCTION BRIEF The philosophy of Pre-tender cost control is on the premise that a certain amount of unnecessary cost is inevitable in building design due to the inherent complexity of the process Zimmerman and Hart (1992).

Significant cost savings can therefore be achieved by the identification and subsequent elimination of this unnecessary cost.
The organised construction is now characterised by modern clients representing large organisations and companies, with rigidly fixed budget and overall annual expenditure. The financial targets for future building programmes are generally fixed in advance and cannot be exceeded. It is for this type of client body that cost control can offer a really necessary service. Assurances will be required early on in the design development that an idea which appears to be perfectly feasible on paper will not run into difficulties when put into practice. The initial brief for a building must of necessity be a broad and flexible statement of objectives in fairly abstract terms. It must be able to define comprehensively matters such as;

i) Site

ii) building type

iii) requirements

iv) general comfort standards

v) cost limit

The design of even relatively straight forward buildings requires the interdependent working of a number of specialist designers and Consultants. Such a team will often be working together for the first time. Its work does not form a simple sequence of activities but will depend upon a complex pattern of multi-dependencies.

2.4.2 PRELIMINARY APPROXIMATE ESTIMATE

The approximate estimating techniques was probably developed in the early nineteen century. It attempted to give a forecast of the probable tender figure, however, the technique was crude and not so accurate. It was subsequently realised that by the use of cost planning techniques and the methods of cost analysis, probable cost can be reasonably accurately determined early in the design process.

The Quantity Surveyor adopts various methods of approximate estimating depending upon the circumstances in order to arrive at the estimate. James (1955) attempted to give a broad classification of various pre-contract approximate estimating classification. Figure 2.2 below gives the broad classification depending upon the stage and level of available information.

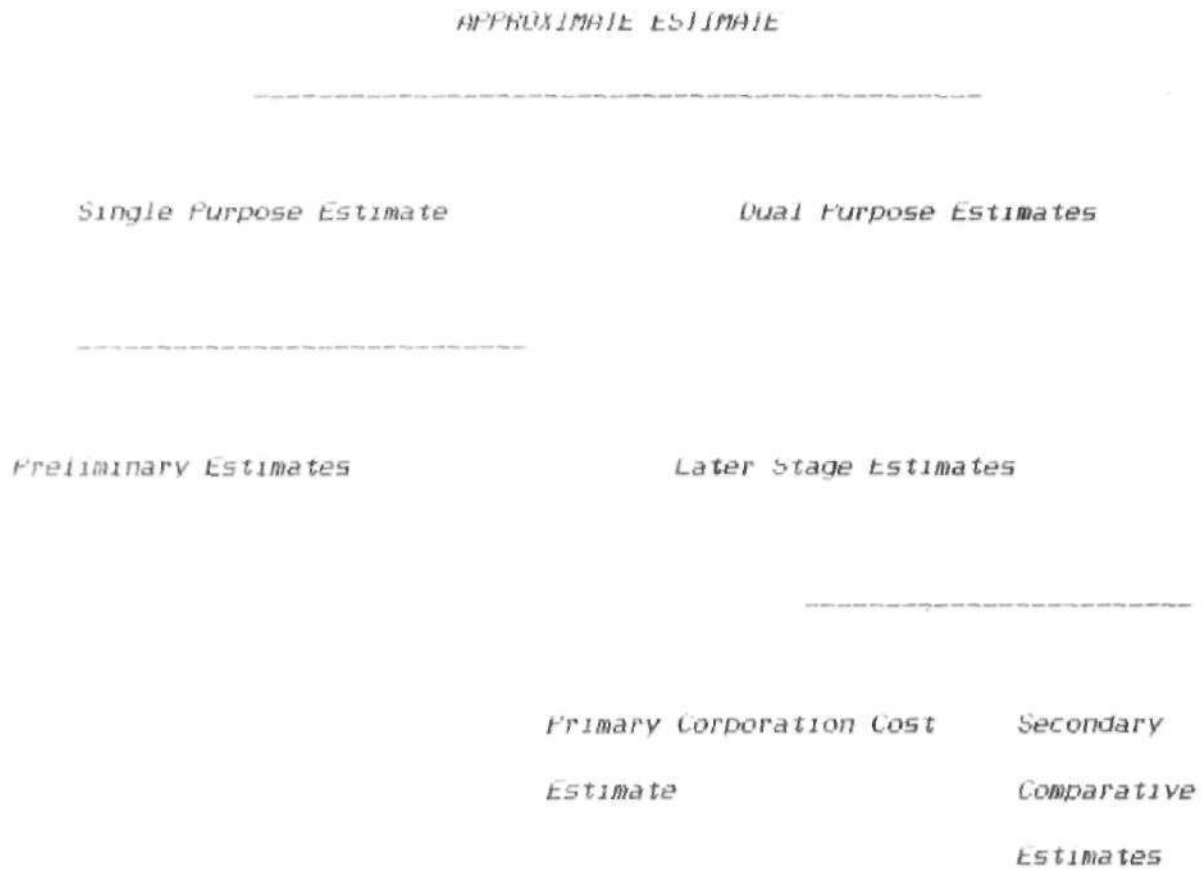


FIGURE: 2.2: (TYPES OF ESTIMATING TECHNIQUES)

SOURCE: SEELEY I.H: Building Economics

Depending upon the design stage, time and available information various analytical methods of approximate estimating are employed. These methods as outlined by Seeley (1984) are:

i) Interpolation

ii) Unit Method

iii) Cubic Method

iv) Storey enclosure

v) Superficial

Cartledge (1973) has given a breakdown of estimating methods employed at each stage of the Pre-Contract building process as below:-

Design Sequence	Method Used
1. Inception	interpolation
2. Feasibility	"
3. Outline proposals	"
4. Scheme Designs	Unit Method
5. Detail Designs	Approximate quantities
6. Production information	"
7. Bill of Quantities	"
8. Tender Action	"

TABLE 2.1: BREAKDOWN OF ESTIMATING TECHNIQUES

SOURCE: Cartledge P.D; Cost planning and Building Economics

INTERPOLATION METHOD

This method as shown in table 2.1 is mostly employed in the first three stages of the building process. it makes use of cost analysis from a similar Project on the basis of similarity between the major elements which contribute the largest percentage to the overall cost of the building. A unit rate is arrived by taking from cost analyses and cost records.

In adopting the interpolation method, the development is normally broken into three stages;

i) Main building

ii) External works

iii) Preliminaries and Contingencies

It would indeed be unprecedented good fortune to discover an exactly similar building on which to base the estimate. No two buildings are exactly the same and hence adjustments for the differences must be made;

i) Items that are not included in the project (new) must be deducted from the cost analysis,

ii) Items to be installed by the client himself and thus not forming part of the contract must also be deducted,

iii) Allowance for items not included in the cost analysis at their current rate,

iv) Adjustments must be made in price levels where the information obtained from the cost analysis is outdated. There are generally three factors that affect the overall price level vis-a-vis,

a) The location of the proposed project,

b) The type of contract that is used

c) The Market conditions at the time tenders are sent out,

d) Types of building materials whether obtainable locally or not.

The estimate prepared at this stage in the cost plan and must therefore be pointed out to the client that it is based on a cost analysis with a

certain set of fully described finishes. The design target is thereby achieved here after making allowances for the following:

i) Price Risk, i.e anticipated cost fluctuation before tenders are invited,

ii) Design Risk; This is normally obtained from experience where percentage cost is allowed for anticipated variations and charges in the design,

Adjustments can therefore be made from this stage where the estimated cost exceeds the owners targets, until it falls within target. The feasibility report is now within the clients budget, giving both the technical and financial viability of the Project.

UNIT METHOD

This is also adopted at the early stages of building process. It can be used to arrive at the probable cost of construction based on the number of persons or units of accommodation that the building is to house.

The building cost is expressed in terms of accomodation as outlined by Barthurst et al (1980) in terms of;

a) Schools - Cost per student plac

b) Hospitals - Cost per bed

c) Theatres - Cost per seat

d) Hostels - Cost per residential place.

The total estimated cost of the proposed building is determined by multiplying the total number of units accomodated in the building by the unit rate. In arriving at the unit rate, carefui analysis of recently completed buildings of the same type is considered and making adjustment for differences in prices level and any variations in site conditions, design, construction form and materials.

Although the method has great merit of speed, it lacks precision and cannot make a reasonable and accurate allowance for the size and shape of the building. For all intent and purposes this method can only be used to establish overall target cost or calculating a cost for investment as pointed out by Seeley (1987). This method can only be applied to limited number of cases and often advisable to express costs in ranges with more precise costs to be determined at a later stage by more reliable estimating methods. Seeley (1987) is of the opinion that even under such a circumstance it is necessary to use this method with the greatest care and skill and with only a full appreciation of its limitations.

CUBIC METHOD

This method entails taking the cubic content of the proposed building by applying the rules prescribed by the Royal Institute of British Architect which provide for multiplying the length, width and height of each part of the building, with the volume expressed in cubic metres. However, the method of determining the height depends on the type of roof and the usage of the roof. This method has largely died out as a result of a number of

limitations. It therefore calls for the exercise of careful judgement coupled with an extensive knowledge of current prices and trends.

A primary weakness of the cube method in its deceptive simplicity. It is easy matter to calculate the volume of a building but much more difficult to assess the unit rate on account of the large number of variables which have to be considered.

SUPERFICIAL OR FLOOR AREA METHOD

The total floor area of the building on all floors is calculated using the internal dimensions of the external walls with no deduction for internal walls, partitions etc. In cases where columns to frames are situated inside the external walls these columns are ignored and the dimensions taken from the internal face of the perimeter walls.

This is more popular method of estimating, as it is comparactively easy to calculate the floor area of a building and the costs are expressed in a way which is fairly readily understood by a building client.

More recent than the cube method, it first came into use for such projects where the storey heights are reasonably constant. However, it has inherent weakness and in particular it cannot directly take account of changes in plan shape or total height of the building.

Special items such as piling, air conditioning are however normally covered by lump sums which are added to the overall cost calculated on a floor area basis.

STOREY ENCLOSURE METHOD

This method had never achieved wide acceptance because it was quickly superceded by the ELEMENTAL ESTIMATE. It was however, the first attempt to compensate for the limitations of the other methods earlier described.

The various floor areas, roof and containing walls are measured, each is allocated a weighted figure and the resultant figures totalled to give the number of storey enclosure units. The rules are as outlined below:

1) Twice the area of the lowest floor, however in the case of basement it is multiplied by three. Internal dimensions of external walls are considered.
2) The area of the roof measured flat on the roof to the extremities of the eaves.
3) Twice the area of the upper floors, plus the addition of a factor.
4) The area of external walls: Any part of an enclosing wall below ground level is multiplied by two rules, and these are likely to apply equally to every building. Furthermore, the units tend to be abstract, not relating to the physical form of the building or the clients accomodation requirements and thus suffers from deficiences

2.5 COST PLANNING METHODS AND PRODUCTION OF COST PLANS

The methods described earlier can be used to establish the client brief and also give idea on the probable construction cost. However, as the sketch drawings are produced, there is a need to evaluate the cost effects of each decision clearly before it is implemented. As pointed out by Bradon et al (1984) that sometimes the amount of effort required to keep the design development within cost limits actually stems from unwise decisions made at earlier stages without the benefit of cost investigation. In order for the cost limit to be attained realistically, cost plans are produced. This will probably be based upon the last of the elemental estimates but developed in as much detail as a full cost analysis and will form the basis for the system of cost control. The cost plan is produced as soon as the sketch drawings are available so as to see whether the architects initial solution is possible within the cost limits which have been set.

Seeley (1988) however pointed out that various method of cost planning have been evolved over the years but there is no universal system which can be satisfactorily applied to every type of job. The choice of one method is highlightedly seen will therefore depend on the available information as function, or building morphology or/and structural information. There are broadly two methods by which cost plans are produced.

2.5.1 ELEMENTAL METHOD

In the elemental system the total cost of the work is obtained by some approximate estimating methods (described earlier) based on the available sketch plans prepared. This method is often described as 'designing to a cost', as the method is based on the proposition that the client is not only able to set a limit to the amount of money that he wishes to spend on the building, but it is willing to agree to the expenditure of a fixed amount to provide a certain quantity of building. The building is broken down into various elements of construction and each element is allocated a cost based on cost analyses of previous completed buildings of similar type. However, Brandon et al (1984) is of the view that using 'short list' of consolidated elements at this for preparing the cost plan is preferable as the only reasonable items will be the main floor and wall areas. Barthurst et al did not however agree with that, in his opinion since the cost plan is referenced to an earlier cost analysis information from similar building type then in consultation with the architect the analyses most closely reflect his proposals in relation to the standard of specification and general design can be applicable. The Quantity factors are checked against those assumed in the estimate and any necessary adjustments to costs will then be made where differences occur. The quantity factors include the ratio of enclosing walls to floor area and the ratio of roof to floor area.

The total cost is therefore arrived at by totalling the individual allocated element cost. However, as the proposed building will certainly be of a different size and shape than the analysed building and rather different in specification, such as price, quantity and quality. Adjustment is therefore made on each of the elements to update the cost and to also make projections between the date of preparation of the cost plan and the date of tender for the proposed building.

2.5.2 COMPARATIVE COST PLAN

The establishment of the Preliminary cost estimates is similar to that described in elemental cost plan, it uses the sketch plans but does not use a fixed budget like the elemental system. This method is often described as 'costing to a design'. A cost study of various alternative ways of achieving a design is carried out and the cost of each alternative approach. This cost study limit laid down by the building owner. This cost study is usually an approximate estimate (earlier described).

Barthurst et al argued that comparative cost plan system starts from the premises that the client should set out with a particular standard of building in terms of amenity etc. The client in giving a cost limit will expect this to be treated as an upper limit.

In so doing the architect will prepare a number of alternative design solutions that will never be utilised. The Quantity Surveyor prepares estimates for the alternatives based on approximate quantities.

The comparative cost plan is a statement of the estimated cost consequences of decisions the architect may take. It thus acts as a guide towards an economic design.

The selections made are totalled up and the total cost computed. Provided the total does not exceed the original upper estimate figure the architect can proceed to prepare working drawings.

Seeley (1988) highlighted that the comparative system does not seek to enforce rigid cost limits for the design of particular elements (as different alternative ways are considered), but rather to maintain flexibility of choice of a combination of possible design solutions, that will serve the purpose to be achieved. It is therefore more concerned with the comparison of alternative possibilities within a total sum, rather than attempting to control the design prepared in relation to targets for limited sections of the work.

The comparative system differs from the elemental system in that although the building may be broken down into similar elements for the consideration of cost implications, a theoretical cost allocation to a particular element based on previous experience, is not accepted as a valid factor for controlling the design of the element.
It further endeavours to shows the effect of choice of one component of the building in others.

2.6 COST CHECKING PROCEDURE

Cost checking commences after the production of a satisfactory cost plan agreed by all parties and the more detailed design of the elements is prepared.

The cost checking differs with the planning method used in preparing the cost plan. In the case of elemental system as each element is designed, the draft drawings and specifications are passed to the quantity surveyor to check based on approximate cost set out in the agreed cost plan. If it proves impossible to keep within the cost set for the element under consideration it is necessary to adjust the costs of other elements to make a balance or perhaps draw some money from the reserve set aside in the cost plan. If the design solution for an element shows a saving, the surplus money can be fed into the reserve or spent to improve the remaining elements.
Edwards (1978) stated that it is time-consuming to make accurate checks of all the work elements at each design stage, therefore some

Priority must be set down to reduce the amount of costing and the subsequent cost effects. He therefore gave priority categories which may often have significant cost effects.

The priorities can be established as follows;

1. *High cost elements; Elements where any variation in cost can have a significant effect on the general balance.*
2. *Condition effects; Where elements may be affected by site or ground conditions and market effects.*
3. *Control effects; Specialists and consultants may effect costs by radical quotations based on varity individuality or quality.*
4. *Inspection checks; Where quality must be seen and confirmed before any decision.*

The cost checking phase is comparative system differs from that in elemental system. In this case, the architect having already decided main lines of his design solutions in his cost plan requires only to follow this closely so that they should not stray from the estimated cost computed in the cost plan. However, the quantity surveyor must still check the elemental drawings prepared by the architect to ensure that the specifications decided upon in the cost plan are kept

It should be known here that cost checking procedures are quite the most time-consuming and error-prone part of the design cost control process, adequate care must be taken to ensure targets are not exceeded.

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Cartledge (1973) stated that one of the principles of cost checking is to determine whether the cost targets, allocated to the elements at the previous stage, are realistic now that details of the proposed design are available. He further stated that, this is the most important control process in the pre-contract design sequence, furthermore, this is where effective team work and good communications are essential to enable the drawings to be prepared in the order and at a time, when the members of the design team require for cost checking.

The technique used to perform cost checking is approximate quantities which until the detail elemental designs are completed has been impossible to employ. In this method composite price rate items are obtained by combining/grouping bill items. James (1955) described the process as one of coalescing of items in single omnibus description measurement. Items measured in square metres normally only include all incidental labours and finishings to both sides. Doors and windows are usually enumerated as extra over the walling and associated finishings.

CHAPTER THREE

RESEARCH PROCEDURE

3.1 DATA COLLECTION

3.1.1 Preamble

In accordance with the objectives of and methodology for, this research spelt out in sections 1.3 and 1;4; a questionnaire on the Pre-tender cost control for construction projects was prepared (see Appendix C). This was considered a veritable means of obtaining information from Consultancy firms mostly Quantity Surveying. Most of the questionnaire was self-administered. The rest administered with the aid of friends, were mostly, followed up by oral interview.

3.1.2 Structure of Questionaire

The underlying philosophy was simplicity of format and wide coverage of relevant issues to facilitate ease of response by busy executives. A covering letter was attached to each of the questionnaire explaining the research objectives, assuring respondents of the confidentiality of the information supplied and imploring their expeditious response.

The Forty enquires listed in the questionaire can be categorised into three sets of information on;

i) Factors and basis of pre-tender cost control - Enquiries 15-39

ii) The firm and its operations - Enquiries 1-9

iii) The respondent - Enquiries 10-14 & 40.

3.1.3 **Distribution and Response**

It is apparent that research on pre-tender cost control can only be effectively conducted at the source of the cost estimates i.e quantity surveying firms and essentially technical personnel of the firms. The questionnaire was therefore administered to various cadre of this personnel at the various quantity surveying firms. The initial step, however, was to compile a list of quantity surveying firms whose head offices are located in the study area, (Kano, Kaduna & Abuja).

Self-administration of the questionnaire was largely adopted in view of the high degree of apathy of most respondents when a questionnaire is administered by post. Though costly, tedious and time consuming, this approach made possible the sixty-five percent response received Another benefit was the opportunity to clarify a number of the enquiries and establish good relations for further discussions on the topic. It can therefore be reasonably assumed that the responses are objective, well intentioned, reliable and a sound basis for the subsequent analysis.

The forty-five fully completed copies of the questionnaire received (out of the 60 administered) within a three-month period of extensive travelling and intensive effort is appreciable considering that, taken together, they represent feedback on an approximate of one hundred on-going projects.

Those firms who were reluctant to participate in the survey did so for a number of reasons; some explicit, others reasonably presumed

- not convinced that information would be held in confidence.
- lack of time
- lack of enthusiasm because of the firms present financial and operational predicament.
- inexplicable apathy

In the following section, the data arising from the questionnaire are tabulated and analysed according to these categories: the firms and its operations, the respondent, and factor and basis of pre-tender cost control for construction firms.

3.2 TABULATION AND ANALYSIS

For ease of comparison and deductions, the data tabulation is in percentage except where otherwise stated.

Of the three stated, 55% of the total responses were from Kaduna 22% from Kano and 23% from Abuja.

3.2.1 **Firm History and Operations**

Of the firms surveyed, 64% participate in building construction only, 20% in both building and Civil Engineering, a further 7% in both building and heavy engineering, 4.5% in both building and industrial projects and another 4.5% in both building, civil and industrial project. This shows that the 45 firms considered all participate in building construction.

On the period of existence 9% of the firms indicated they have been in operation for 2 to 5 years, 18% for 5 to 7 years and 73% for over 7 years. The majority of the response is thus from well-established firms.

40% of the firms surveyed indicated they have successfully executed between 16-20 Projects, with 27% indicating between 11-15% Projects a further 16% have executed between 20-30 Projects and 6% have executed over 30 projects. Only 11% have indicated between 5-10 projects. This results indicate that the responses are from well-established and experienced firms who have been in the practice for a relatively long time.

51% of the firms are currently handling between 6-10 projects and 31% between 10-15 and another 2% over 15 projects. This indicates that inspite of the economic problem in the Country the firms have a reasonable number of projects at hand indicating the confidence their clients have in them in view of their past performances.

3.2.2 The Respondent

47% of the respondents indicated ages in the range of 36-40 years, 13% indicated ages in the range 41-50 years, 29% in the range 31-35 years. No respondent was older than 50 years or younger than 25 years. These could reveal the level of experience of the respondent.

The ordinary Higher National Diploma, National Certificate of Education and Degree were the highest qualifications attained by 84%, 16% had attained Post-graduate qualifications. Thus the responses were from informed, experience and knowledgeable Personnels. In addition 27% had acquired membership of their professional bodies.

On their tenure as Company staff, the largest proportion (47%) indicated 6 to 7 years, 24% between 1 and 2 years, 16% indicated 3 to 5 years and 13% over 7 years. This indicates that an over-whelming number of the respondents are fairly well-acquinted with the practice and procedure of their respective organisation.

On whether the respondent had worked elsewhere before joining his present firm, only 51% of the respondents have worked elsewhere. Of these 70% (36% of the total) have for between 1 to 3 years been in their previous organisations, 17% (9% of total) have worked for 3 to 5 years and 13% (7% of total) have worked for over 5 years in

their previous firms before joining their present organisation. This also indicates the wider experience of the respondents.

Principal Partners and Partners represent about 71% of the respondent with a total of 27% from associates and Senior Quantity Surveyors. 3% of the response was from quantity surveyors. This indicates an impressive response with greater percentage from the decision makers of the firms.

3.2.3 Factors and Basis of Pre-Tender Cost Control

60% of the firms surveyed apparently believed that between 51-75% of clients stipulate cost targets to their clients, another 24% are of the opinion that between 26 to 50% do that, only 16% responded for a lower ranking of between 1 to 25%.

This result indicates that, although a greater percentage of the clients stipulate cost limits, ironically only the private sector clients and private developers do so very frequently in the following Percentages 89% and 67% respectively. The public sector clients, though biggest developer, indicates only 22% for stipulating cost limit very frequently.

None of the firms indicated the range of above 75% indicating that some construction projects are just conceivable with no cost-budget or cost limit.

The cost limit is agreed by 82% of the respondents to be established at the inception stage with the remaining 11% indicating feasibility study stage. However, another 7% indicated that the cost limit is established before initiating scheme design.

Four major reasons why the tender cost control is not given considerable attention were identified: Lack of cost information on which to base the techniques/cost models, clients indifferent attitude to initial cost, consultants reluctance and late engagement of Consultants other than the designer. The respondents were requested to indicate which of these reasons are responsible for that. There was an unanimous decision (100%) that late engagement of the Consultants is the prime reason. 89% also indicated that lack of information on which to base the techniques/models is one of the reasons, however only 44% indicated that, it is partly as a result of clients indifferent attitude to the initial cost with only 11% indicating Consultants reluctance as a partial reason, although this may be borne from the fact that the Consultants may not like to be slamed.

On the appointment of quantity surveyor who is the Construction economist, sadly enough 67% of the respondents agreed that, the appointment comes at the scheme design where as ideally 96% agree that the appointment should be at either the inception (44%) or

feasibility stages (52%). Only 3% agree with the appointment of the quantity surveyor at the scheme design. A follow up interview revealed that the appointment of the quantity surveyor is often done through the architect and hence the fact that appointment often comes at later stage (scheme design). This is however, a big predicament as cost control is not given proper attention and consideration.

10% of firms surveyed consider it important and necessary to undertake cost control exercise whenever cost limit is stipulated by the client, although 89% of the firms surveyed responded that when no cost limit is stipulated by the client, the pre-tender cost control is omitted because of its tedious nature. This result establishes one of the reasons why cost control at the Pre-tender is not given much consideration i.e Consultants reluctance which although only 11% of the respondents agree to.

TABLE 3.1 RANKS ASSIGNED TO FIVE PRE-TENDER COST CONTROL OBJECTIVES BY 45 FIRMS

S/NO	OBJECTIVES	FIRMS/RANKING																						
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	12	22	23
1.	Ensuring that resources are put to best use	1	1	1	2	1	1	1	2	1	1	1	1	1	1	1	1	1	3	1	1	1	1	1
2.	Ensuring that clients budget/cost limit is not exceeded	2	2	2	1	3.7	2	2	3	4.0	2	2	2	3.0	5	2	2	3	2	2	5	2	2	2
3.	Curtailing of Unnecessary expenditure	3	3	3	5	3	3	3	1	2	4	3	3	3.0	2	3	3	2	3	1	2	3	3	3
4.	Other 1	4.5	4.5	4.5	3	3.7	4.5	4.5	4.5	4.0	3	4.5	4.5	4.5	3	4.5	4.5	4.5	4.5	4.5	4	4.5	4.5	4
5.	Other 2	4.5	4.5	4.5	4	3.7	4.5	4.5	4.5	4.0	5	4.5	4.5	4.5	4	4.5	4.5	4.5	4.5	4.5	3	4.5	4.5	4
	T_i	0.5	0.5	0.5		2.0	0.5	0.5	0.5	2.0		0.5	0.5	1.0		0.5	0.5	0.5	0.5	0.5		0.5	0.5	0

TABLE 3.1 RANKS ASSIGNED TO FIVE PRE-TENDER COST CONTROL OBJECTIVES BY 45 FIRMS

S/NO	OBJECTIVES	FIRMS/RANKING																					
		24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1.	Ensuring that resources are put to best use.	1	1	3	1	1	1	1	1	1	2	1	1	1	1	1	1	1	3	2	1	1	3
2.	Ensuring that clients budget/cost limit is not exceeded	4	2	2	2	4.0	2	2	3	2	3	2	2	4	2	2	3	2	2	1	2	2	2
3.	Curtailing of unnecessary expenditure.	3	4	1	3	4.0	3	3	2	4	1	3	2	3	3	3	2	4	1	3	3	3	1
4.	Other 1	3.5	4.0	4.5	4.5	3.0	4.5	4.5	4.5	4.5	4.5	4.5	4.0	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
5.	Other 2	3.5	4.0	4.5	4.5	3.0	4.5	4.5	4.5	4.5	4.5	4.5	4.0	4.5	4.5	4.5	4.5	4.0	4.5	4.5	4.5	4.5	4.5
	T_i	0.5	0.5	0.5	0.5	1.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
		$\sum_T T_i = 24.5$																					

TABLE 3.2 Objective True Ranking

MEAN, M = ----- = 133.6

OBJECTIVES	SUM OF RANKS Rj	SUM OF SQUARE DEVIATIONS (Rj - m)2	TRUE RANKING
Ensuring that resources are put to best use	58	5715.36	1
Ensuring that clients budget/cost limit is not exceeded	109.1	5741.21	2
Curtailing of unnecessary expenditure	113	424.36	3
OTHER 1	192.2	3433.96	4
OTHER 2	195.2	3794.56	5
	668.1	13,939.60	

Pre-tender cost control objectives as earlier mentioned in the literature were identified viz: Ensuring that resources are put to best use; ensuring that clients budget/cost limit is not exceeded, curtailing of unnecessary expenditure. The respondents were requested to rank these objectives, adding any others of importance. At most two more objectives were identified, referred to in the table as other 1 and other 2. The feedback is shown in Table 3.2 in which adjustments have been made for tied ranks.

To test the degree of agreement of the firms in ranking the objectives, the Kendall co-efficient of concordance, W was calculated (see Segel, 1956) as follows:

$$W = \frac{12S}{K^2 (N^3 - N) - K \sum T}$$

where

S = $(Rj - \frac{\sum Rj}{2})^2$ i.e sum of squares of the observed deviations from mean of Rj.

K = Number of sets of rankings i.e number of firms

N = Number of entities ranked

T = Correction factor for tied observations

$$= \frac{(t^3 - t)}{12}$$

t = Number of observations in a group tied for a given rank.

From table 3.2; S = 13,959.60, K = 45, N = 5 = 24.5

Substituting these in the formula for W, it is found that W = 0.71.

The significance of W can be tested. Although N, the number of entities ranked is less than 7, K (the number of firms) exceeds 20 so that the "small samples" test suggested by Siegels (1956) cannot apply. The "Large Samples" test is consequently adopted. In this case, the expression K(N-1)W is approximately distributed as chi square with (N-1) degree of freedom (df).

From the foregoing therefore, X2 = 45(5-1) 0.71 = 127.8. From statistical tables, (Fister & Yates) thus X2 has probability of occurance under the null hypothesis that the K rankings are unrelated of P 0.001. This enables us to reject the null hypothesis at the 1% level of significance and to conclude that there is considerable agreement in the ranking among the firms surveyed.

Following Siegels suggestion, the true ranking of the objectives has been derived by the order of various sums of ranks Rj as shown on table 3.3. It follows then that Ensuring that resources are put to best use is the most important objective; Ensuring that clients budget/cost limit is not exceeded and curtailing of unncessary expenditure are second and third respectively. The two other objectives identified by the respondents are obtaining value for money and low cost in use which ranked fifth and ensuring that project cost overruns are minimized.

100% of the firms surveyed indicated that, the superficial method of estimating is employed, however depending upon the time and information available 89% agree that the interpolation is also used. 84% indicated the application of the combination of interpolation and superficial methods. Majority of the respondents indicated their reasons for the use of interpolation and superficial as their simplicity and practicability. Furthermore, they are more realistic and give fairly accurate estimate.

A follow up oral survey indicates that the other methods (unit, cubic & storey en-closure) are not practicable in the Nigerian context as the information required (historical cost data, cost indices etc) is often not available.

As discussed in the literatue review, the cost plan shows the breakdown of cost per each element. All the firms surveyed (100%) prepare cost plans and favour the use of elemental cost plan which provides information for further cost analysis, gives the cost effects of each element, and allows for cost reconciliation easier at the post contract stage, the cost plan is evidently prepared at the scheme design stage as indicated by all the firms surveyed (100%). However, 55% of the firms also indicated that apart from the elemental cost plan, a hybrid of elemental and comparative is employed, depending upon the line and information available.

100% of te respondents agree that cost checking is very important, however, the mode it is carried out varies, while 38% agree that all elements must be cost checked, the remaining 62% indicated that it is not necessary to cost check all elements but a certain cretrion is employed. 72% indicated that only high cost elements might be cost checked i.e where vanstuin in cost can have significant effect 18% agree on cost checking those elements affected by site conditions while 10% indicated cost checking those elements where specialists and sub-contractors may have effects on their cost.

However, a follow up interview reveals that, when the time between production of cost plan and going to tender is adequate, most of the firms prefer to cost check all the elements.

66% of firms surveyed indicated that their firms do not <u>normally</u> undertake pre-tender control exercises, however, all the firms agree that they perceive the need now or in the near future to adopt pre-tender cost control technique as a valuable tool before preparing tenders. The remaining 44% of the firms however, indicated that their firms undertake pre-tender cost control exercises, and have found the exercise to be beneficial.

This results indicated the necessity for carrying out research work in the field of Pre-tender cost control.

Firms surveyed were requested to indicate the criterion/criteria, from a list of criteria, they normally adopt for Pre-tender cost control. 100% firms indicated that, Preliminary cost estimate; preparation of cost plan, cost checking; are vital pre-requisite tools when carrying out cost control exercise. 89% further agree that confirmation of cost target by the client after the final cost checking is also necessary in order to go ahead with the detail design. Clients brief is however not given considerable attention as only 11% of the firms surveyed indicated that it is a valuable stage.

The result indicated that Preliminary cost estimate; preparation of cost plan, and cost checking in that sequence are necessary for proper cost control exercise.

Although 67% of firms indicated they employ computer in their various cost control exercises, a follow up oral interview reveals that, most of the firms only employ the use of Personal Computers and do not have the relevant software applications for carrying out the cost control exercise. The remaining 23% however agree, they use manual approach for the exercise

CHAPTER FOUR

PROPOSAL FOR AN EFFECTIVE PRE-TENDER COST CONTROL

4.1 BASIC DEDUCTIONS

In section 2.4.0, it is seen that a number of estimating techniques have been discussed with a view to understanding the literature. These techniques have been applied elsewhere, however each category has some limitations to its practical applicability to the Nigerian Construction Industry. For instance, in a nutshell recounts once again major shortcomings of existing methods capitalising on the common problem of lack of reliability.

The need to adopt an approach incorporating a thorough consideration and assessment of cost control at the Pre-tender stage cannot be overemphasised. It is essential therefore to propound a model which is easy to comprehend without sacrificing accuracy and reliability in order to fulfil such a need.

Furthermore, it has been established in section 3 that the Nigerian Construction Industry's current Pre-tender cost control practice is faulted with lack of reliability, simple cost effect and yet highly reliable. Before any improvement on the current practice is

suggested, it is worthwhile revisiting the factors influencing cost estimation methods. These had been identified as follows:

4.1.1 Level of information: Where information is very scanty, the unit method may be most appropriate. In some cases, developers budget may be applicable especially where the information available has to do more on the return on the project than any other information.

4.1.2 Time factor: This refers to the time the Consultant has at his disposal to prepare the estimate. Provided enough time is given, he can research for relevant data which shall aid in giving a good estimation. It is however known that clients are always in haste and hence want their cost Consultant to produce estimate usually in unrealistic time period.

Where very small time is given, the consultant may adopt a very fast, but less accurate method at the particular instance.

4.1.3 Experience of the Surveyor: This will determine the proficiency with which a method is used. Where the Consultant is highly experienced and is used to one particular method, there may be an inertia in wanting to use another method even though such methods may prove the best at the particular instance.

4.1.4 Data available: The nature of cost data available will determine a method to use in estimating. Where data on elemental costs are available, the user may be forced to use elemental cost estimating method.

4.2 IMPROVEMENT OF EXISTING METHODS

It is not an independent method per se but rather a refinement extension of any of the existing methods that gives them more validity and reliability. Part of the data required depends on the technique used in establishing the initial Preliminary cost estimate (PCE). The remaining data required is the same irrespective of the technique used to establish the initial Preliminary cost estimate.

The various types of information/data required for the technique of ascertaining initial Preliminary cost estimate had been discussed in the literature. The remaining information required relates to historical data on some base project. The method draws strength from a vital underlying assumption. The assumption is that there is likely to be a strong relationship between Preliminary Cost Estimates (PCE), Priced Bill of Quantities (PBQ), Contractors Tender Sum (CTS), and Final Account Sum (FAS). This assumption is reasonable considering the fact that the Preliminary Cost Estimate would be equal to Priced Bill of Quantities if it were detailed and accurate which will be approximately equal to Contractors tender sum with any possible difference arising strictly out of the differences

in provision for overheads and profits and equal to Final Account barring any variations and changes in the economic climate.

From the foregoing, it could be established that this accuracy of cost estimation is progressive. At the initial stages, the Preliminary cost estimate is established; then the bill is priced after it has been produced by the Consultant. The priced bill of quantities is used as a basis for comparison with the tenderers quotations. Eventually the contract is let at a sum which is considered a reasonable and best cost for the project. Upon the execution of all necessary construction works, the final cost (completion cost) is arrived at. This final cost is the actual cost of the project. It is a crystallisation of all the information on the project which has been interpreted and translated to financial terms.

The thesis upon which this work rests is that the completion cost the Consultant is endeavouring to estimate with precision at the very initial stage. A very accurate estimate will mean that intial estimate (Preliminary Estimate) is equal to Final (Completion) cost. However, this is rarely the case. Thus there exist disparity between the two. This disparity is acceptable within a reasonable limit and permisible by the client. Admitting the fact of the dynamism of economic situation which renders cost estimation unrealistic, it should still be possible to reduce this variation. It is this that will grant any estimate an acceptance.

Granting the fact of progressive cost estimating based on the design procedure, the following relationship shall be explored:

PCE & PBQq - (1)

PCE & CTS - (2)

and PCE & FAS - (3)

PCE is the Preliminary Cost Estimate

PBQq is the Priced Bill of Quantities Sum

CTS is the Contract Sum (lender figure of the successful Contractor

FAS is the completion Cost/Amount in the final account.

These assumed linear relationship can be further specified by introducing constant factors. These constant factors are the reliability factors being sought.

Thus, relationship (1), (2) and (3) above becomes;

$$PCE = f(PBQq) \quad - \quad (4)$$

$$PCE = K(CTS) \quad - \quad (5)$$

$$PCE = q(FAS) \quad - \quad (6)$$

respectively f, K, q are the constants.

From the above relationship, the values of f, K and q are obtainable thus:

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$$f = PCE/PBOq \quad - \quad (7)$$

$$k = PCE/CIS \quad - \quad (8)$$

$$q = PCE/FAS \quad - \quad (9)$$

Substituting these values in equation (4), (5) and (6) will give us new Preliminary Cost Estimate in each case. Thus we have

$$PCE/f = PBOq \quad - \quad (10)$$

$$PCE/k = CIS \quad - \quad (11)$$

$$PCE/q = FAS \quad - \quad (12)$$

It could be observed that f, k and q are operators on the initial Preliminary cost Estimate. These operators or reliability factors are the cost implications of the information that the quantity surveyor does not have and thereby accounting for the variabilities in each stage being considered. It must be said that by information here is meant both soft and hard information. These could be incompleteness and in-conclusiveness in design, market factors, clients intervention, management practices of the Contractor etc. In short, any factor that is cost significant, which the best of cost Predictor could least envisage in any particular project but has now led to the divergence from the originally estimated amount.

From equations (10), (11), and (12) we have the refined Preliminary estimate(s) called NEW PRELIMINARY COST ESTIMATES using f, k and q factors respectively,

$$NPCEf = 1/f(PCE) \quad - (13)$$

$$NPCEk = 1/k(CTS) \quad - (14)$$

$$NPCEq = 1/q(FAS) \quad - (15)$$

Since these are theoretical derivations, a further testing has to be done. This is done by comparing the deviations using the NEW PRELIMINARY ESTIMATES and the original PRELIMINARY Estimates from the various progressive costs.

The method outlined above is however seriously faulted by the vagaries of unforseen macroeconomics determinants.

The effect by hyper-inflation can seriously cause a draw back and render the whole exercise unworkable. Furthermore, other factors like exchange rate, interest rate and direct governmental, fiscal and monetary policy charges could seriously affect the validity of the method.

COSTS AND ESTIMATES FOR FIFTEEN (15) PROJECTS

					Calculated correcting fac.		
PROJECTS	PRE. COST EST.	PRICED BOQ(CONS.)	CONTRACT SUM	FINAL SUM	f(a/b)	K(a/c)	a(a/a)
1	2,650,500.00	2,450,650.00	2,985,685.05	3,645,460.85	1.82	0.89	0.73
2	205,500,000.00	197,645,586.53	198,860,490.63	215,605,863.07	1.04	1.08	0.95
3	7,325,500.00	7,468,308.25	7,896,583.14	9,684,564.22	0.98	0.93	0.77
4	2,000,000.00	1,956,473.36	2,231,763.47	3,021,453.61	1.02	0.90	0.66
5	11,464,315.00	10,965,451.19	10,515,218.35	12,245,319.93	1.05	1.09	0.94
6	2,315,800.00	2,303,413.13	2,186,317.25	2,531,451.43	1.01	1.06	0.91
7	10,475,000.00	10,865,618.32	11,002,124.85	12,163,431.78	0.96	0.95	0.86
8	1,650,000.00	1,543,465.27	1,622,132.07	1,685,285.15	1.07	1.02	0.98
9	32,650,000.00	30,463,315.25	31,515,465.52	33,465,345.11	1.07	1.04	0.98
10	5,715,500.00	6,225,150.22	5,986,415.73	6,515,713.32	0.92	0.96	0.88
11	1,250,000.00	1,156,680.30	1,226,865.07	1,461,123.23	1.08	1.02	0.86
12	1,295,400.00	1,302,295.32	1,292,378.06	1,486,626.19	0.99	1.00	0.87
13	1,384,650.00	1,350,611.11	1,302,605.05	1,415,627.19	1.03	1.06	0.99
14	3,500,000.00	3,687,917.28	3,596,011.23	4,371,623.18	0.95	0.97	0.80
15	226,400.00	219,986.29	206,184.43	336,491.15	1.03	0.79	0.67
			SUMMATION		16.02	14.71	12.85
			MEAN		1.068	0.981	0.856
			STAN. DEVI.		0.213	0.079	0.109

Table 4.1

4.3 A HYPOTHETICAL ILLUSTRATION

4.3.1 Brief Project details

Assume that XYZ Nig Plc is a financial institution with it's head office in Lagos willing to construct a branch office in Kaduna. It is willing to start the Project in the next fiscal year (1996) and has therefore finalised arrangement to commit N50 million for the structure. The executive board of the institution has sat at various times and deliberated on the issue which was finally approved but under the condition that the project completion cost should NOT exceed the approved amount of N50 million. Any other cost overrun can not therefore be entertained.

4.3.2 Initial Preliminary Estimate

Various methods of estimation exist. Thus the estimating method is not the pre-occupation here, any of the methods can be applied. The point here is to arrive at the initial Preliminary cost estimate which will be flexible enough to accomodate the clients cost target through completion without encountering cost overuns.

	Assume	Budget	N50,000,000.00
1.	Total Prime Cost Sums (P.C Sums) (including all electrical and mechanical works and other specialists work	(Less)	<15,000,000.00>
2.	Total Provisional Sums	(Less)	<3,500,000.00>
3.	External Works	(Less)	<2,500,000.00>
			21,000,000.00
			29,000,000.00

To obtain the probable Preliminaries cost estimate (29,000,000.00 x 0.856) from Page PCE = (PAS) = N24,824,000.00

The figure of N24,824,000.00 should therefore form the basis of the design.

Using floor area (superficial) method and assuming a rate of N25,000/m2 of floor area (obtained after necessary deduction of all P. C Sums, Provisional sums and External) from similar past but recent project,

Total floor area coverage is therefore = 24,824,000.00 = 9935m2
25,000.00

The design decision is therefore restricted to a maximum of about 990 square metre of floor area.

The probable Consultant Estimate could also be estimated PBUq =

PCE = 24,824,000.00

(F) 1,068 = 23,243,445.69

Add Pic's	15,000,000.00
Provisional	3,500,000.00
External	1,500,000.00
	43,243,445.69

Expected Contractor's Tender sum

CTS = PCE = 24,824,000.00 = 25,304,791.03

(K) 0,981 21,000,000.00

46,304,791.03

==========

Explanation

The Consultant estimate is seen to be lower than the Preliminary estimate. This is often the case as the Consultant did not have enough details at the Preliminary scheme stage. The estimate is mostly optimistic. The Contractors figures however tend to be greater than the Consultant's estimate, this is explained by the fact that the Contractor's profit margin is usually always higher than what the Consultants use.

4.4 MERITS AND LIMITATIONS

4.4.1 MERITS

The following advantages can be identified for the proposed model.

i) Reliability: The model can greatly assist in providing reliable future completion cost of projects which can be integrated at the initial stage and provision made in the capital budget of developers

ii) Simplicity: The model is easy to understand and applied. It is therefore a viable starting procedure for any firm which has before now not considered pre-tender cost control.

iii) Adaptability: The model is easily adaptable to the operations of most firms. It only involves an additional analytic process after obtaining the usual initial preliminary cost estimates.

iv) Encourage Record Keeping The model can act as a catalyst for firms to keep records for future application on proposed projects.

v) Ease and Accuracy: Although the arithmetic involved is not complex, this is done without sacrificing accuracy of the model.

4.4.2 LIMITATIONS

All may not be well with the proposed model, it has its limitations some of which include;

i) The established factors tend to widen in some projects (especially Govt projects) so depending as the nature of the projects, The correction factors must always be established using similar conditions.

ii) Unbiased Initial Preliminary Estimate Since all subsequent arithmetic is based on the initial Preliminary Estimate. The estimate must therefore be carried out with all thoroughness.

iii) Time Lapse: The time between the Preparation of initial Preliminary Estimate, award of contract and final completion is very important and there should not be delays in between. Where the time lapse is so large, the calculated correcting factors tend to widen.

iv) Government Policy: Changes in the governmental policy having a linear relationship with cot will certainly affect the values of the calculated constants.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

It has been shown that Practical Pre-tender cost control Procedure in Nigeria is clearly a cosmetic attempt at realising the value and overall objectives of the techniques application. Against this shady procedural background coupled with lack of comprehensive and reliable data-base and, perhaps even lack of committment by Consultants, the result can only be expectedly dismal, though most of the respondents refused to attribute noticed value failures on projects to these lapses. They preferred to blame the Nigerian situation in terms of the economy, technological and socio political developments. Furthermore, Construction Project design and delivery is fast graduating from defining and actualising functional spaces to the most articulate application of scientific engineering methods to the supply, value, relevance and other implications of functional, aesthetic, qualitative and economic considerations on the project.

The benefits of Pre-tender cost control have been highlighted and included ensuring that resources are put to best use, ensuring that clients budget/cost limit is not exceeded, and curtailing of

unnecessary expenditure. It has therefore been deduced that this technique is relevant irrespective of the economic situation i.e boom or gloom even though rapid inflationary trend can thwart any cost forecasting effort however precise.

The research work, constrained to the North of the Country has revealed that practically no Consultancy firm incorporates any of the Pre-tender cost control techniques in its purest form as defined in chapter 2 of this publication. This has been partly due to lack of cost information on which to base the application of the techniques, clients indifferent attitude to initial cost and late engagement of consultants. The downward economic trend of the nation may, in the imminent future jeopardize the chances of those consultancy firms which are reluctant to adopt and apply the necessary cost control procedures to enhance clients getting good value for their money.

From the study, it has been possible to identify and classify criteria employed for Pre-tender cost control, a number of models have also been discussed and their limitations highlighted. For instance, the most appealing technique in terms of speed of accomplishment, accuracy and reliability of results is the approximate quantities. Sadly, most consultancy firms especially those covered in the practical survey have not fully integrated this versatile technique into their process. This fact and the implied

reluctance to involve computer technology in the industry as well as other hindrances to incorporating a formal analytic tool for Pre-tender cost control have been taken into consideration in proposing a model for Pre-tender cost control.

The proposed model which is meant to serve as an appendix to any of the existing methods, is based on an analytic technique and requires a four-stage approach is anticipated to offer a number of unique advantages including inter-alia reliability, simplicity and enhancement of procedural efficiency. The exploitation of the full benefits of the model calls for wholehearted commitment and co-operation of the technical staff.

Finally, the proposed model is expected to be immensely beneficial to the construction industry which is characterised with excessive cost overruns and project abandonment attributable to escalating cost. It will also provide the spring board to a smooth transition to the potentially more versatile technique of Pre-tender cost control by computer, ecompassing an enviable and dynamic database.

5.2 RECOMMENDATIONS FOR FURTHER STUDIES

In the process of conducting this study, related research areas of interest emerged. These could not be adequately treated within the scope of the topic and hence are being recommended for further studies.

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APPENDIX B

QUESTIONNAIRE ON PRE-TENDER COST CONTROL
FOR CONSTRUCTION PROJECTS

1 What type of Project do you normally undertake?

(a) Building [ ]
(b) Civil Engineering [ ]
(c) Heavy Engineering [ ]
(d) Industrial Project [ ]
(e) Others (Please specify).....
.....

2. Please indicate how long the firm has been in operation

(a) Less than 2 years [ ]
(b) 2 - 5 Years [ ]
(c) 5 - 7 Years [ ]
(d) Over 7 years [ ]

3. Please indicate how many projects you have successfully completed

(a) 5 - 10 [ ]
(b) 4 - 15 [ ]
(c) 16 - 20 [ ]
(d) 20 - 30 [ ]
(e) above 30 [ ]

4. Please indicate how many Projects you are currently handling

(a) 2 - 5 [ ]
(b) 6 - 10 [ ]
(c) 10 - 15 [ ]
(d) over 15 [ ]

5. What type(s) of Project do you normally undertake?

(a) Building [ ]
(b) Civil Engineering [ ]
(c) Heavy Engineering [ ]
(d) Industrial Construction [ ]

6. How many technical staff does your firm employ presently?

No.....

7. Give the number for each of the categories below

(a) Post graduate [ ]
(b) Graduate [ ]
(c) HND [ ]
(d) OND [ ]
(e) Others (Please specify [ ]

8. Does your firm use computer in carrying out its Professional undertaking?

Yes . . [ ] No [ ]

9. Name and Address of Firm:

.....
.....
.....

10. Please indicate your age in one of the following categories

(a) Under 25 years [ ]
(b) Under 25 - 30 years [ ]
(c) " 31 - 35 years [ ]
(d) " 36 - 40 years [ ]
(e) " 41 - 50 years [ ]
(f) Over 50 years [ ]

11. Please indicate the highest qualification you have attained

(a) Primary School Leaving Certificate [ ]
(b) Middle School Certificate [ ]
(c) WASC/GCE/SSCE/GRADE II [ ]
(d) OND/HND/NCE/Degree [ ]
(e) Post graduate Diploma/Degree [ ]
(f) Others (Specify).....

12. Please indicate how long you have been on the staff of the firm

(a) Less than 1 year [ ]
(b) 1 - 2 years [ ]
(c) 3 - 5 years [ ]
(d) 6 - 7 years [ ]
(e) Over 7 years [ ]

13. Please indicate how long you have worked elsewhere before joining your present organisation.

.....

14. Please indicate your position or rank in the firm:

(a) Principal Partner [ ]
(b) Partner [ ]
(c) Associate [ ]
(d) Senior Q.S [ ]
(e) Quantity Surveyor [ ]
(f) Assistant Q.S [ ]
(g) Others (Please specify).....

15. It is believed that some clients stipulate to their design team some cost (limits) within which to design their scheme(s). What percentage often do that

(a) 1 - 25% [ ]
(b) 26 - 50% [ ]
(c) 51 - 75% [ ]
(d) above 75% [ ]

16. At what stage of the design process is the cost limit often established?

(a) Inception [ ]
(b) Feasibility [ ]
(c) Others (specify).....

17. The process of controlling Construction which is a very crucial and important too of Project Management is not given considerable attention especially at the design stage. Which of the reason(s) below are, in your opinion, responsible;

(a) Lack of cost information on which to base the techniques/cost models [ ]
(b) Clients indifferent attitude to initial cost [ ]
(c) Consultant's reluctance [ ]
(d) Late engagement of Consultants other than designer [ ]

18. Which of the following class of clients normally give cost limit to their design team and how often?

(a)	Public sector clients	[v.f; f.; l.f;]	[Very frequent, frequent, less frequent]
(b)	Private sector clients	]	
(c)	Individual developers	]	

19. At what stage of the design process is the quantity surveyor often appointed?

(a)	Inception	[ ]
(b)	Feasibility study	[ ]
(c)	Scheme Design	[ ]
(d)	Detail design	[ ]

20. Ideally at what early stage of the design process is the active participation of the Q.S necessary for a thorough cost control exercise?

(a)	Inception	[ ]
(b)	Feasibility study	[ ]
(c)	Scheme Design	[ ]
(d)	Detail design	[ ]

21. Is it true that the design team must undertake pre-tender cost control exercise whenever a client stipulates cost limit?

Yes [ ] No [ ]

22. Delete the otions that do not apply in the statement below:

Most/Many/Few firms omit the tedious pretender cost control exercise when no cost limit is stipulated by a client.

23. Please add any other objectives why cost control should be applied at the design stage, also indicate in order of importance by placing a "1" in front of the most important, a "2" in front of the next important and so on,

(a)	Ensuring that resources are put to best use	[ ]
(b)	Ensuring that clients budget/cost limit is not exceeded	[ ]
(c)	Curtailing of unnnecssary expenditure	[ ]
(d)	Other (Please specify).....	

24. Which of the following estimating techniques do you normally employ in establishing Preliminary cost targets for your clients
(Tick as many as applicable)

(a) Interpolation [ ]
(b) Unit method [ ]
(c) Superficial [ ]
(d) Cubic method [ ]
(e) Storey enclosure [ ]
(f) Others specify .....

25. Please briefly give reason(s) for your choice above

1.. .....

2. .....

26. Which of the methods mentioned in (24) do you see as most efficient in the Nigerian context. (Others specify)

.....

27. Do you prepare cost plan for clierts in your firm?

Yes [ ] No [ ]

28. Which of the known methods do you use in preparing cost plan?

1. Elemental cost plan [ ]
2. Comparative cost plan [ ]

29. Kindly indicate reason(s) for your choice

.....
.....

30. At what stage of the design process do you often prepare cost plan?

(a) Feasibility study [ ]
(b) Scheme Design [ ]
(c) Detail Design [ ]

31. Your consider cost checking to be of any importance to the design cost control process?

Yes [ ] No [ ]

32. If your answer above is YES. Do you consider cost checking all the elements necessarily?

Yes [ ] No [ ]

33. If NO. Which of the listed criteria do you employ when cost checking elements?

1. High cost Elements: Where variation in cost can have significant effect.
2. Condition effects: Where elements may be affected by site conditio
3. Control Effects: Where specialists and sub-contractors may have effects on the cost.

34. Does your firm normally undertakes pretender cost control excercises?

Yes [ ] No [ ]

35. If your answer to question (34) is NO. Do you perceive the need now or in the near future to adopt the pre-tender cost control technique as a valuable tool before preparing tenders?

Yes [ ] No [ ]

36. If your anwer to question (34) is YES. Would you agree that your firm has found the pre-tender cost control technique beneficial overall?

Yes [ ] No [ ]

37. Please indicate the decision criterion/criteria you employ for pre-tender cost control (Tick as many as are applicable)

(a) Clients brief [ ]
(b) Preliminary cost estimate [ ]
(c) Preparation of cost plan [ ]
(d) Cost checking [ ]
(e) Confirmation of cost target [ ]
(f) Others (Please specify).....

38. Please, indicate the specific approach adopted by the firm in the various Pre-tender cost control exercises

(a) Manual approach (Paper computation) [ ]
(b) Computer [ ]
(c) Others (Please specify) [ ]

39. Any additional comments: .....
.....
.....
.....

40. Name of respondent (Optional).....