AN APPRAISAL OF METHODS OF APPROXIMATE ESTIMATION FOR CONSTRUCTION PROJECTS IN NIGERIA.

by

Adamu Abdullahi[1*],Yahaya Ahmed[2*], Musa Usman Dogara [2*].

[1*]Department of Quantity Surveying, Federal Polytechnic, Nasarawa, Nasarawa, Nigeria.

[2&3*]Department of Estate Management & Valuation, Federal Polytechnic, Nasarawa, Nasarawa, Nigeria.

(adamunbiya@gmail.com)

Abstract

At the project's early design stage, the approximate estimate method is the first of the six basic phases (that are concepts and feasibility studies, start up and implementation operation or utilization, procurement construction, engineering and design,) of a building project's cycle. In order to determine the approximate estimated total and final contract sum, this study was conducted. To ascertain the approximate estimated sum and final contract sum, an oral interview and questionnaire survey were conducted on quantity surveying firms offering consultancy services in Kaduna state metropolis. On each of the carefully chosen venues visited, questionnaires were given to the staff. A structured questionnaire was sent to 120 respondents, and 85 of them completed it and returned it, or 65% of the total. The results of this study show that the factors that determine the approximate estimated total and final contract sum included the unit method, superficial technique, cubic method, store enclosure method, approximate quantities method, and elemental method. However, approximation is one of the most effective methods for reducing construction costs since cost guidance is crucial and a lack of it has a negative impact on the execution of a building process in line with the client's requirements. Therefore, Quantity Surveyors should use the approximate quantity method when approximating the cost of building works, provide clients with a preliminary budget estimate so that they are aware of their financial commitment to any project, and take into account the effects of design options before beginning any building project.

Introduction

Oboirien (2006) defines approximate estimating as simply the projection of a project's potential cost prior to the creation of specific designs and contract documents. Before undertaking extensive designs, the quantity surveyor informs the building clients of the anticipated cost estimates. The first of the six main phases of a construction project cycle, which are concepts and feasibility studies, engineering and design, procurement construction, start up and implementation operation or usage, is the approximate estimation approach during the early design stage of a project.

According to Atkinson (1999), the constant collapse of buildings was caused by improper approximation estimation at the early design stage. After the project was awarded, delays, unfinished construction projects, and the termination of contractors' work all contributed to a significant loss in contractor profit. However, the majority of issues that arise throughout the construction process will be further diminished with the right implementation of current approximate estimate methodology. Due to the frequent use of accurate estimate techniques, most client requirements for real building costs have not been in line with the cost plan presented at the design stage.

The effect of approximating at the early design stage, according to Oboirien (2006), "affects the architectural idea, appraisal of technological process options, size and capacity decisions, and comparative economic studies. According to Mosaku (2002), who agreed with this statement, early design is the cornerstone of the entire design process because its considerations are turned into contract agreements that may be utilized as a guide during construction.

On the other hand, approximate estimating methods (preliminary estimates) have been sought after since the dawn of time. However, contact must be made through the proper or relevant channels in order to receive useful counsel. Different dimensions may be included in the

preliminary estimate. It might be economical or legal. In any case, it is a recommendation on what to do to prevent errors in the future. Depending on the risk taken and the outcome, these errors could be harmful. 2005 (Jackson). However, previous studies has identified the most reliable method of approximate estimating which include; unit method, cubic method, superficial or floor area method, storey enclosure method, approximate quantities, elemental cost analysis and comparative estimates. Therefore, this study aim to ascertain the approximate estimated sum and final contract sum. It is necessary for preliminary estimating to be as accurate as possible since it does not only establish the cost limit, but it also operates throughout the cost advice system at the early design sage

Preliminary Estimating

Jackson (2005) asserts that through cost planning, the likely cost of a structure can be fairly and accurately estimated at an early stage of the design process, often even before the design has even begun. Utilizing preliminary estimating during the initial design phase of a project helps achieve this. Creating estimates essentially has two main goals:
1. To tell the client about the costs associated with his proposed project and provide value for money.
2. To give the architect or engineers the ability to manage the project's cost during the design stage and keep the client's spending in line with the goal of obtaining the needed building quality.

    i. According to Mosaku (2002), the preliminary estimate is a step in the process of providing information on the price of a building, and the cost guidance is intended to reflect on the many cost planning procedures, which are crucial in the early design stages of a project.
    ii. There are numerous approaches to early estimation.
    a. The quantity of information and time available at the early design stage will determine their choice and applications.
    b. The building economist's experience
    c. The project's nature and type.
    d. The quantity and format of the accessible cost data.

It must be underlined that no preliminary estimate can be any better than the information on which it is based, according to Atkinson (1999). The design team and the building client must cooperate fully and communicate openly throughout early

estimating. According to Milligan (2003), who emphasizes the significance of accuracy, "———————a thoughtless inaccuracy at preliminary estimate stage could entangle the entire design team in a considerable embarrassment later when the full cost plan is developed." According to Ayeni (1997), who agreed with this assertion, sufficient information should be made available before the preliminary estimations could be created because:

1. Draw rough floor plans and elevations; the drawings don't have to be very detailed—in fact, they can't—but they should try to suggest, whenever feasible, the kind of accommodations that will be offered in a specific region.
2. A general description of the expected general standard. This might be an allusion to another undertaking.

3. The suggested site's location so that any modifications for unusual site circumstances can be made. The provision required for the preliminary and contingency items may be impacted by this aspect.

Approximate Estimate's Purpose and Format

Oboirien (2006) asserts that the quantity surveyor plays a crucial role in cost evaluation by advising on the likely cost of a certain design proposal and its variations. He makes suggestions for more cost-effective ways to accomplish comparable goals.

However, no approximation can be more accurate than the data it is based on. In fact, comprehensive cooperation and communication between the architect, quantity surveyor, estimator, and construction client are required from the start of the project in order to produce a realistic estimated estimate. It is advised that cost estimates be withheld from the client until some drawings, even rough sketches, have been done and the site has been inspected. Oboirien (2006) asserts that the quantity surveyor plays a crucial role in cost evaluation by advising on the likely cost of a certain design proposal and its variations. He makes suggestions for more cost-effective ways to accomplish comparable goals.

However, no approximation can be more accurate than the data it is based on. In fact, comprehensive cooperation and communication between the architect, quantity surveyor, estimator, and

construction client are required from the start of the project in order to produce a realistic estimated estimate. It is advised that cost estimates be withheld from the client until some drawings, even rough sketches, have been done and the site has been inspected. Prior to preparing a preliminary estimate, it is imperative to do a thorough site assessment. It would be impractical to assume that the site is level, devoid of obstacles, with a water table below the foundation and that the soil has an average load-bearing capability (Jackson, 2005).

Techniques for Rough Estimating

The most popular techniques for determining a preliminary estimate for a prospective project are as follows:

    i.   Unit Approach
    ii.   Storey Enclosure Method
    iii. Cubic Method
    iv.   Superficial or Floor Area Method
    v.   Cubic Method
    vi.   Approximate Quantities
    vii. Analysis of component costs in
    viii. Comparative Estimate

Unit Method

Therefore, I bed $= \frac{N5,000,000}{100}$

I bed   N50, 000 (Unit Cost)

If a similar hospital with 250 beds is offered in the same setting, the contract price is calculated as follows;

$$= N4250x50, 000$$
$$= N5x5x500, 000$$
$$= N\ 4\ 125xl00, 000$$

Approximate contract sum = N 12.5m

The unit cost N50,000/bed) is typically determined by carefully examining the unit costs of several recently finished structures of the same type. It is taken into account that site conditions, design, form construction, material, processes, and cost variances that have emerged since the structures were built. Cost variations resulting from various design and construction techniques are challenging to estimate, and usually there is not enough information available to make a realistic assessment. It pertains to schools, hospitals, parking lots, etc (Jason, 2014).

Approximate Quantities

The most accurate technique of approximating estimates is to use approximate amounts priced at rates produced at the moment the numbers are computed, maybe using a single price-rate method as a safety net. It requires more labor than any information previously described would allow, and occasionally a lack of knowledge would prevent its usage. The price document resembles condensed bills of quantities, and the process is occasionally termed as rough quantities. However, it offers a great starting point for cost analysis while a project is being designed in detail (Doloi, 2011).

Bill elements can be combined or grouped to create composite rates. A brick work item, for instance, will typically include all incidental labor and finishing to both faces when measured in square meters. In order to prevent having to modify the walling, doors and windows are typically listed as extra-over the walling and related finishes. Additionally, a door item will be thorough, encompassing the frame or lining, architraves, glass, ironmongery, and decorating (Liu et al., 2003).

A series of prices for composite items should be constructed from a number of priced bills. The range of variance between these prices should be closely examined in order to identify the underlying causes of these variations. It is also beneficial to look at the link between the gross cost of composite or all-in products, such as brick walls that include finishes and all incidental labor, and the net cost of the major components, such as brick walls for different thicknesses. Because of the various strategies used by contractors, the priced preliminaries in a bill of quantities must be evaluated before any rates are determined (Lim, 2017).

Cost Estimation

According to Elinwa, A.U., and Joshua, M. (2001), cost estimation entails creating an approximation of the costs of the resources required to fulfill project tasks. The distinction between cost estimating and pricing should be kept in mind when a project is carried out under contract. Cost estimating entails evaluating the most likely quantitative outcomes.

• How much will it cost the performing company to deliver the requisite good or service? Pricing is a matter of business judgment.
• The price that the performing organization will charge for the good or service that makes use of the cost estimate as just one of several factors. Price books, monthly cost data, building cost information services, priced bills of quantities, and price lists are the several sources of cost information that are required for cost estimation. However, previous studies has identified the most reliable method of approximate estimating which include; unit method, cubic method, superficial or floor area method, storey enclosure method, approximate quantities, elemental cost analysis and comparative estimates (Jackson, 2005). Therefore, it is necessary for preliminary estimating to be as accurate as possible since it does not only establish the cost limit, but it also operates throughout the cost advice system at the early design stage. To this, it is necessary to ascertain the approximate estimated sum and final contract sum.

Methodology

The physical observation, a structural questionnaire, and an oral interview with pertinent research participants in the consultancy services were used in this study. These are groups of data that the researcher directly gathered through questionnaire surveys that (consultants) in the building business completed. To ascertain the approximate estimated sum and final contract sum, an oral interview and questionnaire survey were conducted. The literature review must be used to create questionnaire items according to Kumar's definition from 2005. On each of the carefully chosen venues visited which is the Kaduna state metropolis, questionnaires were given to the staff. A structured questionnaire was sent to 120 respondents, and 85 of them completed it and returned it, or 65% of the total. Percentile technique, T-test, and averages were each used to present and analyze the collected data. Percentages based on respondents' tendencies were calculated. The results of the questionnaire, which is well-structured for speed and accuracy, were used to create the pro-forma data, which included a variety of approximate estimating methods as well as their approximate estimated sum and final contract sum in comparison to the percentage difference and also the percentage frequency.

Findings

Table: 1 Estimated and Final Contract Amounts with their Respective Percentage Differences.

METHOD OF APPROXIMATE ESTIMATING		Approximate estimated contract sum	Final contract sum	Difference (F/C sum-A/E sum)	$\% D = \dfrac{FC_{sum} - A/EC_{sum}}{A/EC_{sum}} \times 100$
Unit method	i.	80,000,000.00	83,648,000.00	3,648,000.00	4.56
	ii.	50,000,000.00	52,450,000.00	2,450,000.00	4.90
	iii.	100,000,000.00	104,150,000.00	4,150,000.00	4.15
	iv.	150,000,000.00	157,650,000.00	7,650.000.00	5.10
	v.	60,000,000.00	62,382,000.00	2,382,000.00	3.97
Superficial method	i.	60,000,000.00	62,004,000.00	2,004,000.00	3.34
	ii.	40,000,000.00	41,460,000.00	1,460,000.00	3.65
	iii.	50,000,000.00	52,015,000.00	2,015,000.00	4.03
	iv.	60,000,000.00	62,286,000.00	2,286,000.00	3.81
	v.	45,000,000.00	46,899,000.00	1,460,000.00	4.22
Cubic method	i.	120,000,000.00	125,916,000.00	5,916,000.00	4.93
	ii.	60,000,000.00	63,210,000.00	3,210,000.00	5.35
	iii.	90,000,000.00	94,302,000.00	4,302,000.00	4.78
	iv.	70,000,000.00	73,570,000.00	3,570,000.00	5.10
	v.	80,000,000.00	84,360,000.00	4,360,000.00	5.45

Storey enclosure method	i.	45,000,000.00	47,511,000.00	2,511,000.00	5.58
	ii.	52,000,000.00	54,652,000.00	2,562,000.00	5.10
	iii.	80,000,000.00	84,824,000.00	4,824,000.00	6.03
	iv.	60,000,000.00	63,474,000.00	3,474,000.00	5.79
	v.	73,000,000.00	77,547,900.00	4,547,900.00	6.23
Approximate Quantities method	i.	84,000,000.00	84,999,600.00	996,600.00	1.19
	ii.	60,000,000.00	61,008,000.00	1,008,000.00	1.68
	iii.	120,000,000.00	123,000,000.00	3,000,000.00	2.50
	iv.	78,000,000.00	79,996,800.00	1,996,800.00	2.56
	v.	150,000,000.00	151,965,000.00	1,965,000.00	1.31
Elemental method	i.	90,000,000.00	92,520,000.00	2,520,000.00	2.80
	ii.	70,000,000.00	72,121,000.00	2,121,000.00	3.03
	iii.	60,000,000.00	61,620,000.00	1,620,000.00	2.70
	iv.	54,000,000.00	55,679,400.00	1,679,400.00	3.11
	v.	85,000,000.00	87,465,000.00	2,465,000.00	2.90

Source: Researcher's field work (2010)

Table: 2 Comparison of the Approximate Estimated Sum and the Final Contract Sum for Previously Executed Projects. (T-Test)

Analysis No.	Mean Values		Variables Tested	Observations				Inferences	
	X_1	X_2		Tcal	Ttab	Pvalue	Los	Remark	Action On Hypothesis
1a.	9×10^7	9×10^7	$X_{1=AESumfor}$ Unit Method $X_{2= FinalCSumfor}$ Unit Method	-4.220	2.132	0.013	0.05	SSD	Reject Ho
1b.	5×10^7	5×10^7	$X_{1=AESumfor}$ Superficial Method $X_{2= FinalCSumfor}$ Superficial Method	-14.381	2.132	0.000	0.05	SSD	Reject Ho
1c.	8×10^7	9×10^7	$X_{1=AESumfor}$ Cubic Method $X_{2= FinalCSumfor}$ Cubic Method	-9.178	2.132	0.001	0.05	SSD	Reject Ho
1d.	6×10^7	7×10^7	$X_{1=AESumfor}$ Storey encl. Method $X_{2= FinalCSumfor}$ Storey encl. Method	-7.596	2.132	0.002	0.05	SSD	Reject Ho
1e.	1×10^8	1×10^8	$X_{1=AESumfor}$ Apprx. Qty Method $X_{2= FinalCSumfor}$ Apprx. Qty Method	-4.817	2.132	0.009	0.05	SSD	Reject Ho
1f.	7×10^7	7×10^7	$X_{1=AESumfor}$ Elemental Method $X_{2= FinalCSumfor}$ Elemental Method	-11.002	2.132	0.000	0.05	SSD	Reject Ho

Source: Researcher's field work (2010)

Key
SSD: Statistically Significant Difference
NSD: No Significant Difference
Decision Rule
   i)   If T calculated > T tabulate; SSD and then
        Reject Ho
   ii) If T calculated < T tabulate; NSD and then
        Accept Ho
        If P < 0.05; SSD
        If P > 0.05; NSD

Conclusions from Observations

According to the results of the aforementioned experiment,
1. The mean value of the approximate estimated amount and the final contract sum employing unit, superficial, approximate, and elemental methods are similar.
2. For each of the variables examined, the computed T is higher than the tabulated T.
3. For each, the Probability Valve was less than 0.05.
4. Using the cubic and superficial methods, the mean value of the roughly estimated and final contract sums is not comparable.

The null hypothesis, Ho, was rejected since the variation investigated by the investigation was statistically different.

Discussion of Results

According to the data analysis's findings, the ways of approximating quantities were ordered in order of reliability, with the approach with the greatest reliability rating (60.65%) coming in first. This is consistent with Oboirien's (2006) assertion that the most accurate approach of approximating quantities is to use rates produced at the moment the quantities are computed. The way of approximate estimate most usually employed in providing cost advise to the client is 90% on approximate quantities, according to the respondent. This is also consistent with Oboirien's (2006) assertion that an approximation is a great starting point for cost verification, which is commonly used. Respondent agreed to the use of approximation in 76.67% of the methods used to anticipate construction costs. According to Adetola (2003), a project's budgeted cost should not be surpassed by employing approximative estimating. The variables that affect the approximation

method's accuracy in estimating building costs 50% of respondents agreed that the impact of varying design information availability is the primary. According to King and Cleland (1997), preparation from very comprehensive drawings results in the cost of a project not being known with certainty until the design is complete.

To compare the means of the variables, which represent the six approximate estimating approaches, the T-test was calculated. The outcome demonstrates that there are statistically significant variations among the factors investigated between their approximative estimated contract sum and final contract sum. Ho, a null hypothesis, was not accepted. This data appears to confirm Oboirien's (2006) assertion that one of the most effective tools for reducing construction costs is approximate estimating.

Recommendations

The following advice is being made regarding approximate estimating approaches at the early design stage in light of the findings and the preceding conclusion.

1. Since it is the most dependable method, quantity surveyors should utilize it when approximating the cost of building projects.
2. To educate clients of their financial commitment to any project, approximate estimating should be employed to provide a preliminary budget estimate.
3. Prior to the start of any building project, the impact of the design options should be taken into account.
Since there are more approximation estimating techniques, they should be used independently.

Conclusion

The main reason for uncompleted/abandoned project in Nigerian building industry is as a result of factors that determine the approximate estimated total and final contract sum. Therefore, the results of this study show that the factors that determine the approximate estimated total and final contract sum included the unit method, superficial technique, cubic method, store enclosure method, approximate quantities method, and elemental method. However, approximation is one of the most effective methods for reducing construction costs since cost guidance is crucial

and a lack of it has a negative impact on the execution of a building process in line with the client's requirements.

However, effective approximation estimation techniques at the early design stage have been demonstrated to be a crucial need for project execution success. The most accurate way of estimating is the approximate quantity method of approximate estimate. Since preliminary estimating runs throughout the cost guidance system at the early design stage and not only

establishes the cost limit, it is essential that it be as precise as possible. The client's trust in the Quantity Surveying estimates is undermined by unrealistic estimations. Since cost guidance is one of the most important factors and a lack of it has repercussions for the implementation of a building process in line with the client's requirements, approximate estimating is one of the most effective instruments for reducing construction costs.

REFERENCES

Atkinson,R. (1999), Project Management: Cost, time and quality, two best guesses and a phenomenon, its time to accept other success criteria. *International Journal of project management. 17* (6), 337-342.

Ashwort A. (2002), Pre-contract studies, development economics, tender and estimating. (2nd ed.). Blackwell science publications UK, 87

Ayeni, J. O (1997), *Principle of Tendering and Estimating,* Building Magazine Limited,2nd ed; Lagos, Nigeria.

Cooks I.K. (1998), Economics theory and the construction industry. Macmillan press ltd. London

Doloi H. K. (2011). Understanding stakeholders' perspective of cost estimation in project management. *International journal of project management*, *29*(5), 622-636.

Elinwa A.U. & Joshua, M. (2001), Time Overrun Factors in Nigeria Construction Industry. *Journal of Construction Engineering and Management 127* (57), 419-425.

Godwin O. and Akeem B., W., (2014), Analysis Of Relationship Between Preliminary Estimate, Tender Sum And Final Accounts (A Case Study Of Selected Building Projects In Edo State, Nigeria). Civil Engineering and Environmental Systems 6(6):76-84

Jackson T. (2005), Cost control on building works. *Journal of the Chartered Surveyor 19* (80)

Jason B.(2014), Classification Accuracy is Not Enough: More Performance Measures You Can Use Machine Learning Process. https://machinelearningmastery.com/classification-accuracy-is-not-enough-more-performance-measures-you-can-use/

King W.R. and Cleland, D.J (1997), Strategic planning and policy. Lilton Educational, London.

Lim, Y. M. (2017). *Standard guidelines for bill of quantities customised for building conservation works: The Malaysian context/Lim Yoke Mui* (Doctoral dissertation, University of Malaya). Liu, C., Lyle B., & Langston, C. (2003). Estimating demolition costs for single residential buildings. *Construction Economics and Building*, *3*(2), 33-42.

Milligan R.A. (2003), planning the planning, edited by S.H Wearne, Arnold.

Mosaku T.O (1989), Rational Building process. *Journal of the Nigeria Institute of quantity surveyors. 7*(10)

Nkado R.N. (2008), The Failure Influencing Construction projects Duration and providing unique causes of encountered Delays and Time Extension claims for consideration in Construction management. The Article was retrieved on 8 May 2010 from the website: *http//www.misronet/duration.htm.*

Oberien G. I. (2006), Tendering and estimating for building students. 66-83

Sarah B. (2022), Statistics in a Nutshell, 2nd Edition. Access on 23/08/2022. https://www.oreilly.com/library/view/statistics-in-a/9781449361129/ch01.htmlSeeley I.H (1996), Building economics. Appraisal and control of building design cost and efficiency. (4th ed.) Paigrave Macmillan, London.

Seeley I.H (1997), Quantity Surveying practice.(2nd ed.). Macmillan press Ltd, Hound mills, Basingstoke, and Hampshire. London

Smith R.C. (1992), Estimating and Tendering for Building Work. *4t*h Ed, Longman scientific and Technical, England.

Onukwube H.N. (2002), An Evaluation of Factors which influences Tender Prices of Building works in Nigeria. *The Quantity Surveyor,* **40**(1), 33-44.