

Employing Cost Modelling Tools in Land Management and Development.

Tochukwu Blessed ENYINNA, Nigeria

Keywords; Cost management, Land management, Affordable housing, Implementation of plans

SUMMARY

One of the basic uses of land is for the provision of shelter. The world has been affected by various challenges such as the Covid 19 pandemic, natural and man-made disasters which has had effect on the goals of achieving a sustainable environment. Efforts are being made to achieve recovery, building back better and creating a world where efficient housing and infrastructure is provided. The need for the right tools and techniques to realize these goals cannot be overemphasized. There is also increasing demand for effective planning and better ways of managing the limited resources as development requires unique design practices. This could be achieved through inputs from professionals in: Surveying and geoinformatics, Urban and Regional planning, Architecture, Quantity surveying, Estate Surveying and management, Building Technology and engineering, Civil/ structure and services. The above professions all have their tools which works to actualize an efficient built environment. This study aims to assess cost modelling tools in Quantity surveying for management of resources in relation to cost where the Quantity surveyor advises on the finance of construction works. Finance is the most important factor that could lead to either uncompleted or abandoned construction and it is critical to the completion of construction projects. A lot of researches have been done on financial planning in land management and development but not much has been done on the use of cost modelling tools for this purpose. The study made use of primary data obtained from Architects, Quantity Surveyors and Engineers to assess cost modelling tools for the management of finance in construction, the level of usage of these tools and the solutions it would proffer to challenges in land management and development with the aim of enhancing efficiency in the built environment.

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1. INTRODUCTION

Land development through infrastructure impacts economic growth although it is affected by changes in our environment such as climate, natural disaster and other causes, combating these changes requires the use of the right techniques especially in the area of cost. Most developers have little level of education or knowledge of cost management and this has hindered the practice of cost control. These brings about the need to advocate for inputs from professionals. Although it is sometimes a challenge but establishing a preliminary estimate for any infrastructural project is important. According to Larry (2001), cost estimating is of paramount importance to the success of a developmental project. There is a need to study the present available tools of cost management for land development and make improvements for future innovations and improved infrastructure. Future innovations which are achievable includes: mobile buildings, green buildings, earthquake resistance buildings, flood resistance buildings and so on. These innovations as well require techniques to manage through adapting and development of skills beyond the traditional portfolio so that better decisions can be made throughout the design, construction and operation of built assets. The use of the modelling tools would provide holistic and consistent guidelines and enable the developer carry out project cost control. According to Ibrahim and Amund, 2010 with the right techniques, the developer can provide himself with all the resources needed to establish the estimate in the best possible conditions and to avoid unintended consequences clearly seen in over-or-under estimates. We can examine the development of land using proper planning tools and ensure that the needed benefits are derived and the world's infrastructural needs are adequately provided for. This research advocates on the financial management tools and the proper allocation and use of resources in order to actualize the goals of providing better infrastructure and affordable housing for all.

2. LITERATURE REVIEW

Cost modelling is an efficient estimating tool that provides the baseline for subsequent cost control of project developments. The primary function of cost models is to provide reliable cost forecasts (Elhag and Boussabaine, 1998). More specifically, the management decisions supported by cost models include: forecasting the total cost of construction, comparing design alternatives, forecasting the economic effects upon society of changes to design codes and regulations (Skitmore and Marston, 1999). Land development requires innovation. Over the last few decades, a lot of technical solutions have emerged to provide financial appraisal to developmental projects. As a tool for cost estimating, cost modelling provides a guide in planning and establishing of cost estimates during the preliminary stages of a development and helps the developer forecast and plan in line with realizable goals.

2.1 CONQUERING NEW FRONTIERS IN LAND DEVELOPMENT

Our environment has experienced changes that tends to be constant. New innovations in construction such as 3D printing, prefabrication of structures, the use of robots in construction sites, digital twin has evolved. These has brought about new and upcoming construction industry trends as different levels of information management, data sharing and collaborative working is needed. There has always been a growing and continuous demand for development of land. Development and management of land is a necessity as infrastructure has always had an impact on welfare. Ayodele (2004), and Adebayo (2006) describe a sustainable socio-economic development as a situation where the following attributes do not decrease over time; real income: improved healthcare and nutritional status; educational achievement; access to good infrastructures; fair income; distribution and increase in basic freedom. The demand for shelter and basic infrastructure will always increase. The UN projects that the global population will increase from a population of around 8 billion in 2022 to 10.4 billion by the end of the century. This means that there needs to be speedy growth in infrastructural development. Cost control techniques efficiently manages financial aspects of development. Cost estimating tools and techniques for proper land management and development require improvement for sustainable development. New frontiers in development involves better management systems

for development, and the use of proper management tools. Using obsolete methods and concepts without constantly upgrading members knowledge and practices do not help in the practice of cost control (Song, 2014). This brings about the need for improvement to overcome major factors that mitigates against land development.

2.2 INVESTMENT CHALLENGES IN LAND DEVELOPMENT

Development projects are encountered with serious risk and under conditions of uncertainty in the completion of the project. There are significant challenges that could affect investment in land development. Bowen et al, 1998 in their research observed that failures in the construction process are due to methods that fail to consider the uncertainties of the construction process. Some of the challenges that could affect development investments includes; issues on financial management, government policies, insecurity, natural disasters etc. Among these factors that could play a part in limiting development investment goals, ignoring the cost control process is a major factor. The practice of cost control is a required task for the survival and growth of every construction organization in every nation. According to Bahaudin et al., 2012; Adjei et al., 2017 The practice of PCC assists organizations to eliminate and/or reduce unnecessary wastage of resources in the execution of construction projects. Bahaudin et al. (2012) explained that when construction work commences, the budgeted cost of the construction project serves as the baseline for the contractor or whoever is undertaking cost control to use it to check and control the construction costs. Cost not being properly managed could lead to total failure on any project development. A project is commonly acknowledged as successful when it is completed on time and within budgetary costs. In other to advise the developer about the cost limit to be anticipated in the development and avoid unintended consequences there is a need to utilize a mathematical model. Cost modelling also known as Target Value Design is used both in forecasting construction costs for clients and in estimating resource costs for contractors. Cost modeling involves; preparation of cost estimates, cost budgeting, Cost planning, monitoring and control to ensure that the clients budget is not exceeded, Cost studies and research.

2.3 THE USE OF COST MODELLING TOOLS IN LAND MANAGEMENT AND DEVELOPMENT

The inputs from professionals is a prerequisite for the successful use of cost modelling techniques. As known generally, The Quantity Surveyor is a construction cost expert who has acquired requisite skills and knowledge in construction cost economics and management for effective delivery of construction projects. NIQS, (2012); defines the quantity surveyor as a cost and procurement management expert who is concerned with financial probity and achieving value for money in the conceptualization, planning and execution of building, civil and other heavy engineering projects. Apart from construction projects, cost modelling is applied in manufacturing, business enterprises and other organizations. In development planning, it is necessary for a developer to have a probable value for the project's cost for purposes of determining the economic appeal of continuing with design and construction. At this stage, some quick techniques are usually employed, exploiting minimal available information to prepare a conceptual estimate. Pushkar (1999) in his thesis work cited that the purpose of estimating is to determine the forecast costs required to complete a project by the contract plans and specifications. Two distinct paradigms of cost modelling techniques exist which are; product based where the completed building is modelled and process based where the construction production process is modelled (Skitmore and Marston 1999). There are three estimating models that can be used for modelling which includes the

- Parametric model,
- Analogy model,
- Analytical model.

The analytical model is used more as it explains better and resorts to computer support. It provides better knowledge of the exact structure of the product and detailed description of works. The model is developed like the Building Information modelling systems and seeks to enhance each activity separately and to breakdown each activity into elementary tasks where the run time is known thanks to projected time unit.

- Works break-down structure;
- Risk management;
- Determining equipment in need necessary to the works on site;
- Determining the overall scheduled time and contract period;
- Determining the real number of labour necessary to the work on site and management personnel;
- Determining the best operational planning resorting to data processing;
- Determining the cost estimate of a construction project.

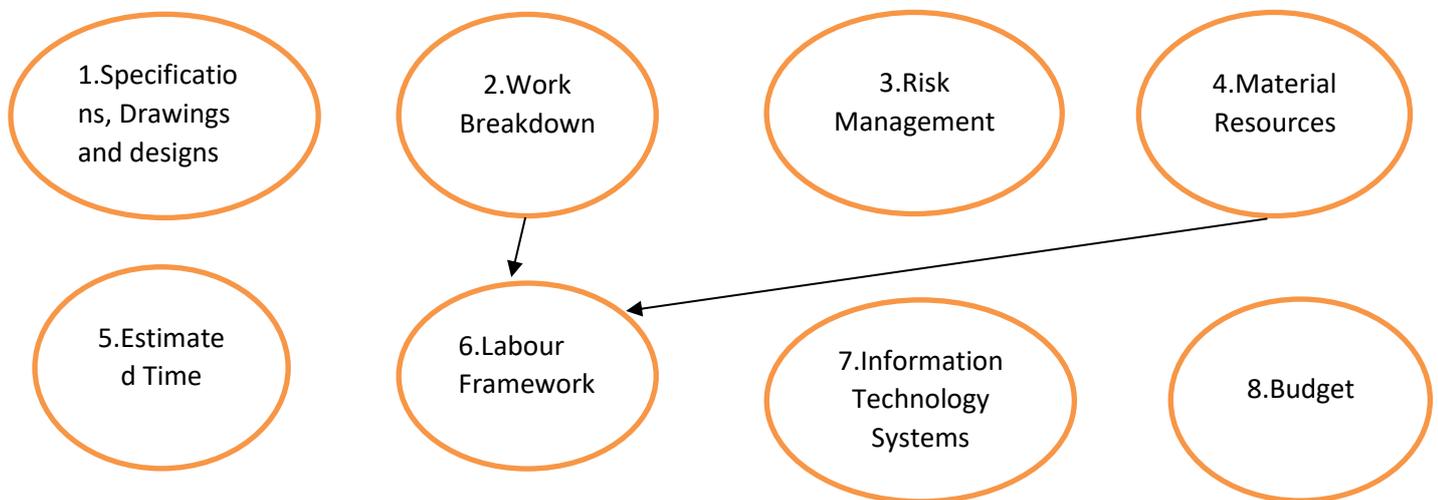


FIG 1.1 COST MODEL USING THE ANALYTICAL METHOD.

There are computer software that has been developed for cost modelling. These softwares can also be improved upon to adjust to necessary client requirements and efficient cost management of projects. There are some estimating methods in use, varying from the very approximate to the very accurate (Akintola and Eamon, 2000). They include; Clear estimates software, Cost Adviser Professional software, Planhub software etc.

Cost Adviser Professional software is an expert software application that will allow you to produce:

- Early cost advice for construction projects
- Simple estimates
- Cost plans
- Construction cost models
- Bills of quantities
- Life cycle cost models

Using the app, simply select a building type from the list, enter a few basic details: You can create your early cost advice cost model in just a few minutes.

The screenshot displays the 'Cost Adviser Professional' software window. The title bar reads 'Cost Adviser Professional ~ New office development'. The menu bar includes 'File', 'View', 'Edit', 'Benchmark', 'Library Management', 'Tools', 'CostAdviser Store', and 'Help'. Below the menu bar is a toolbar with various icons for navigation and editing. The main content area is titled 'CostAdviser Professional' and contains a questionnaire with 17 numbered questions. The questions and their corresponding input fields are as follows:

Question	Input
1 Please select a building type	~ Offices, air-conditioned: 3-5 storey
2 What is the gross internal floor area of the building? (m2)	6000
3 What is the gross internal footprint area of the building? (m2)	1500
4 What is the area of the site? (m2), or How many times bigger is the site compared to the building footprint?	2500
5 What is the average storey height for the building? (m)	3.500
6 Are the foundations piled?	<input type="checkbox"/> Yes
7 How many stairs will there be on the ground floor?	3
8 How many passenger lifts will there be?	1
9 Which description best describes the building shape on plan?	Rectangular (ratio of sides say 3:1)
10 What is the specification level of the proposed building?	Typical/normal
11 What is the access to or set-up of the site like?	Normal
12 When is construction due to start on site?	01 September 2022
13 What is the construction period? (weeks)	67
14 What is the location factor for the development?	97
15 What is the currency for the cost model?	£
16 What format do you want for the cost plan rates (rounded to...)?	Nearest 1.00
17 How will the cost model be priced?	<input checked="" type="radio"/> Using CostAdviser default UK pricing <input type="radio"/> Using my own pricing

At the bottom right of the window, it says 'Premium licence'. There is also a link for 'View location factors'.

FIG 1.2 AN EXAMPLE OF A COST MODELLING SOFTWARE

There is a need for improvement on software to provide solutions for complex projects and in achieving realistic cost estimates.

2.4 SIGNIFICANT BENEFITS OF COST MODELLING TOOLS

Cost models are simple enough and understandable by the users, representative enough in the total range of the implications it may have, and complex enough to accurately represent the system. They are beneficial in assisting developers make critical decisions that affect project success. Cost models are technical aids which enable management decisions to be made in the context of building design (Skitmore and Marston, 1999). It could be done manually or with the use of computers. With these tools we can make a forecast on; contract sum, time, resources in terms of material, labour, plant, profit and overhead. The project team can develop creative ways to balance the components of the project with the client's goals. They would easily manage budgets throughout the project and adjust accordingly with any change encountered while carrying out the project. Through these tools there would be Value for money in land development investment, accountability, design problems identified and solved earlier and Projects delivered on Time.

3. RESEARCH METHODOLOGY

The research design adopted was a descriptive survey study in an attempt to explain the factors that affect effective land development, the cost modelling tools and the significant contributions of these tools in the development planning process and the Level of involvement of Quantity Surveyors in the process. Descriptive survey study was used because it was best suited to answer the 'what' research questions in the study. This study is designed to obtain the relevant factors that affect development planning and to know the level of involvement of young Quantity Surveyors.

3.2 Research Sampling Technique

3.2.1 Population/Sample Population

The target population (N) for the research work is Quantity surveying professionals and other development professionals who are involved in development planning in Nigeria. The sample frame is professionals based in Rivers state. A sample size of Forty (40) professionals is chosen to administer questionnaires. This is because the total number of professionals cannot be ascertained.

3.3 Data Collection

In sourcing data for this research work, both primary and secondary sources were used. Hayatu (2008) citing Thirkettle (1972), described data collected through primary sources as data expressly collected for specific purpose. He further stated the advantage of primary sources of data as exact information required is obtained.

3.4 Data Collection Strategy

The nature of this research work prompted the use of close ended structured questionnaire, which was used to obtain quantitative data from the respondents. The questionnaire was also designed to seek the opinion of the respondents. A total of Forty (40) questionnaires were distributed.

3.5 Data Analysis

The research work adopted statistical measures for analyzing the data which employs the presentation and analysis. While descriptive form of statistical tools such as the weighted mean was employed.

4. FINDINGS AND DISCUSSIONS

Following the administration and subsequent collection of responses the following are the results and interpretation. In Table 4.1 that follows, the administration of questionnaire and response rate calculated are shown.

Table 4.1: Administration of Questionnaire

Variable	Number of respondents	Percentage %
Questionnaires returned	32	80
Questionnaire not returned	8	20
Total	40	100

As indicated above 40 questionnaires were administered to the various respondents, 32 questionnaires were duly answered and returned. A total of 8 questionnaires, were not returned. The total responses yielded the response rate of 80%. The entire respondents were residents of Port Harcourt metropolis.

Table 4.2 Academic Qualifications

Qualification	HND & B.Sc	M.Sc	MBA	Ph.D	Others
Frequency	10	10	4	4	4
Percentage	35.71	35.71	14.28	14.28	14.28

Key: HND = Higher National Diploma, B.Sc = Bachelor of Science, M.Sc = Master of Science, MBA = Master of Business Administration, Ph.D = Doctor of Philosophy

Table 4.2 shows that about 36% of the respondents have a minimum of B.Sc degree in courses related to the Construction. This indicates that the result was gotten from professionals involved in development process.

Table 4.3: Categories of Professional

Professional Category	Frequency	Percentage
Quantity surveyors	21	65.00
Other Professionals	11	35.00
Total	32	100

As indicated above, the majority of the respondents are Quantity Surveyors'. They constitute 65% and other Development planning professionals constitute 32% of the total study population. This indicates that more of the respondents are Quantity Surveyors involved in development planning.

In the analysis that follows, average ranking or weighting of each identified factors are assigned value in order of ranking

Table 4.4: Factors affecting Investment in land development

Factors	5	4	3	2	1	F	Fx	Score	Rank
Government policies	10	13	6	2	1	32	125	3.91	2
Insecurity	15	6	3	4	4	32	120	3.75	3
Cost management	13	9	8	1	1	32	128	4.00	1
Natural disasters	10	4	12	5	2	32	114	3.56	4

Grand Mean = 3.81

From Table 4.4 above, all the identified factors affecting effective investment in land development are significant. Cost management challenges is ranked 1st; Government policies is ranked 2nd ; Insecurity is ranked 3rd; and Natural disasters is ranked 4th; with corresponding mean scores of 4.00, 3.91, 3.75 and 3.56 respectively.

Table 4.5: The Significant Benefits of Cost Modelling Tools in Land management and development.

Factors	5	4	3	2	1	F	Fx	Score	Rank
A. Value for money in land development investment	20	7	3	1	1	32	140	4.38	1
B. Projects will be achieved on Time	16	9	6	1	-	32	136	4.25	4
C Design problems identified and solved earlier.	15	12	4	1	-	32	137	4.28	3
D. Accountability	19	6	6	1	-	32	139	4.34	2

Grand Mean = 4.31

From Table 4.5 above, all the identified benefits of cost modelling in land management and development are significant. Value for money in land development investment is ranked 1st; Accountability is ranked 2nd: Design problems identified and solved earlier is ranked 3rd; Projects will be achieved on Time ranked 4th; with corresponding mean scores of 4.38, 4.34, 4.28 and 4.25 respectively.

Table 4.6: Level of utilization of Cost Modelling Tools in Land management and development

Factors	5	4	3	2	1	F	F_x	Score	Rank
A Business enterprise	15	5	5	5	2	32	122	3.81	1
B. Manufacturing	12	9	5	2	4	32	119	3.71	2
C. Land development	10	5	6	4	7	32	103	3.21	3

Grand Mean = 3.58

Business enterprise, Manufacturing and land development are the significant areas identified by the study: The use of Cost modelling tools in Business enterprise is ranked 1st with a mean score of 3.81. Manufacturing ranked 2nd with a mean score of 3.71. The use of Cost Modelling in Land development and Management ranked 3rd, with a mean score of 3.21. It therefore reveals that Cost modelling tools are used more in business enterprises while it also shows that it is used less frequently in Land development. Cost modelling tools should be used in these areas.

5. CONCLUSION AND RECOMMENDATIONS

This study has made an attempt to explain the need for cost modelling tools in land development and the techniques involved in the process. It also identified the contributions the Quantity Surveyor has to make. The Quantity Surveyors has a big role to play because cost modelling requires expertise whose training can ensure effective cost management in land development. I would recommend that cost modelling techniques/tools should be used in all areas of land development by experts within the disciplines of the Quantity Surveying profession. There is also need for improvement on software to provide for complex project needs and for realistic cost estimates.

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BIOGRAPHICAL NOTES

Enyinna, Tochukwu Blessed is a practicing Quantity Surveyor. He has vast experience in construction and currently works as a Quantity Surveyor with Juluis Berger Nig. Plc. He is a Probationer of the Nigerian Institute of Quantity Surveyors (NIQS) and a member of the Young Quantity Surveyors Forum (YQSF) an organ of the NIQS where he serves as the General Secretary of the Rivers state Chapter of the forum. He is astute, hardworking, diligent and has exhibited strong leadership traits in all his activities within the different organs of the Nigerian Institute of Quantity Surveyors.

CONTACTS

Tochukwu Blessed ENYINNA.

Nigerian Institute of Quantity Surveyors

Juluis Berger Nig. Plc.

Port Harcourt

Nigeria

Tel. 08140510564

Email praiseblessed32@yahoo.com