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Research Article

Towards the Establishment of Relationship between Macroeconomic Indicators and Cost of Public Educational Buildings in Ghana

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Cost of building is usually influenced by several factors; one of such is frequent changes in macroeconomic variables. The purpose of this study is to establish the need to conduct further research on the impact of changes in macroeconomic components on the cost of public educational buildings. The study adopted the qualitative research approach; purposive and snowballing techniques were used in selecting respondents. Questionnaire survey was used to obtain primary data from respondents who were Quantity Surveyors and Estimators. The questionnaires were analyzed through descriptive analysis. Secondary data was obtained through literature review. The study revealed that respondents were satisfied with cost management procedures and practices and mainly relied on cash flow, progress reporting, and project cost control methods as means of monitoring and managing project cost. Relative important index, prime rate, interest rate, and inflation were some of the macroeconomic components that professionals considered having impact on cost. The respondents also recommended further studies on the impact of macroeconomic variability on cost of public buildings.

1. Introduction

Project cost management is a major concern amongst the parties in the building construction industry. Poorly managed project often results in cost overruns, decreased investor confidence, and negative impact on the overall project performance. Clients are always concerned about their desire to obtain value for money for their investment, while contractors also aim at maximizing profit [1–3].

Cost management is the monitoring of cost expenditure within budget having the knowledge of how and why cost difference occurs and taking effective actions based on relevant information [4, 5].

According to Eldash [6], cost management is the total process which ensures that contract sum is within the client's approved budget. It is the process of helping the team to design a cost rather than Quantity Surveyor/Estimator costing a design. The main advantages of cost management are to provide direction for project cost management during the project life cycle [7]. The project management book [8] also stated that cost management is predominantly concerned with cost of resources required to complete a project during execution stage which include the cost of tendering, construction, maintaining, and supporting results of the project. Shash and Ibrahim [9] also indicated that project cost can be improved if macroeconomic indicators are accurately established. Liu and Zhu [10] concluded that cost of a particular project is influenced by different set of factors at various stages of project. Estimators usually consider pertinent factors and that most of the critical factors are of qualitative nature. One of such challenges facing the construction industry is the effects of changes in macroeconomic indicators in developing economies including Ghana [11].

According to the working group, 55 of the International Council for Research and Innovation in Building and Construction, the collapse of the management of macroeconomic indicators was one of the pivotal events of the global financial

crisis and that serves as good lesson for the global construction industry in the future [12]. The highlights of the main causes of unsustainable growth were identified to include political instability, high inflation rate, increasing foreign debt, bad governance and policy implications, exchange rate volatility, low rate of saving and high rate of consumption, trade imbalance, spend more earn less, energy, and water shortage. Macroeconomics is a branch of economics which studies how the aggregate economy behaves. It focuses on the way the economy performs as a whole. Macroeconomics is the branch of economics which studies the behavior and performance of an economy as a whole. It focuses on the aggregate changes in the economy such as unemployment, growth rate, gross domestic product, and inflation.

Macroeconomics helps to understand the functioning of a complicated modern economic system. It describes how the economy as a whole functions and how the level of national income and employment is determined on the basis of aggregate demand and aggregate supply, to achieve the goal of economic growth, higher level of GDP, and higher level of employment. It analyzes the forces which determine economic growth of a country and explains how to reach the highest state of economic growth and sustain it and also how to bring stability in price level and analyze fluctuations in business activities. It suggests policy measures to control inflation and deflation [13–16]. Various studies have identified macroeconomic indicators to include gross domestic product (GDP), consumer price index, currency exchange rate, and interest rate [14]. Halim (2017) [15] identified macroeconomics as dependent and independent variables. The dependent variable is the GDP and the independent variable includes exchange rate, interest rate, and inflation. Mohsen (2014)[13] in analyzing the temporal relationship between highway construction cost and macroeconomics also considered amongst earlier identified indicators Producer Price Index, GDP Implicit Price Deflator, Money Supply, and Unemployment Rate Prime Rate. In a conceptual study, Inflation, Market price, Industrial Production Price Index, Consumption Price Index, Money Supply, Treasury Bill, GDP, GDP savings, National Income, Consumption, oil prices, Exchange Rate and Interest rates and only Inflation, Market price, Industrial Production Price Index, Change in risk, Yield Curve, Consumption Price Index, Money Supply, Treasury Bill, GDP and GDP savings having positive relationship with stock prices were identified as macroeconomic variables [16]. The stability of macroeconomic variables promotes profitability of businesses which propels them to a stage where they can access financing for sustaining growth. According to Olanrewaju et al. (2013) these macroeconomic indicators, oil price, exchange rate, unemployment and underemployment, inflation, and external reserve in Nigeria, had been relatively unstable since the economic recession in 2008 and had affected growth [17]. In Ghana [18] identified several macroeconomic indicators that affect growth to include inflation, fiscal policy, unemployment, budget deficits, taxation, interest rate and exchange rate, and government expenditure. Fiagboh (2013)[19] on time series analysis considered macroeconomic variables to include government expenditure, aid, money supply, Terms of Trade, and exchange rate. Unemployment rate, and Real GDP and monetary factor which is measured by Exchange Rates changes as significant macroeconomic variables for the performance of firms in United Kingdom[20]. Therefore, it is apparent that the behavior of the macroeconomic variables plays a major part in determining the nation's backbone in surviving the economic downturn [15]. One of the constraints to trade credit policy in the Ghanaian construction industry is the unstable nature of macroeconomic variables [21]. The main objective of this study is to establish the need to conduct further research into the impact of the dynamics of macroeconomic variables on estimating cost of public educational buildings in Ghana.

2. Literature Review

2.1. The Ghanaian Building Industry. According to the World Bank [22], the government of Ghana needs about 2.3 billion dollars annually over a ten-year period to bridge the infrastructure gap. This poses a great challenge for the government who is currently faced with the task of optimizing and managing its debt stock. The ministry of education happens to be one of the key sectors of the economy that receives huge investments for capital projects. Government spending within the educational sector in 2018 was increased from 11% to 9.26 billion, but less than 2% was for infrastructure development [23]. Additionally about 75 % of all Ghana Education Trust Fund (GET-Fund) allocations are dedicated to infrastructure development [24]. While 20% of the District Assembly Common Fund by law is supposed to be invested in educational infrastructure [25]. This amount covers construction of buildings, information, communication and technology facilities, and other teaching learning materials for primary, secondary, and tertiary institutions under education ministry. This indicates that there is a need to ensure value for money for the budgetary allocation for infrastructure. The Ghanaian building industry is challenged with budget overruns. According to Frimpong et al. [26], 75% of water drilling projects completed between 1970-1999 were over the actual project cost and schedule, and 25% were finished on time and within budgets. Nicco-Annan [27] surveyed nonbanking financial institutions and indicated that cost overruns ranger between 60-180%. Laryea [28] concluded that cost of consultants' estimates often exceeded by 40% on the average and that of contractors' increased by 6%. Osei-Tutu and Adjei-Kumi [29] concluded that in Ghana the cost of traditional residential buildings has been increasing by 17.33%. Devi and Ananthanarayanan [30] also after studying cost overrun of 20 countries across five continents concluded that megascale projects could experience cost overrun ranging between 20.4% and 44.7%. The construction industry continues to operate in very volatile economic conditions and competitive environment. Price fluctuation in global commodities and the disparity between the Ghanaian currency and other international currencies continue to have effect on the importation of materials for the building industry [31]. These leave the construction industry vulnerable to fluctuation in global commodity prices due to the instability of both international and local markets

[32]. Quartey and Afful-Mensah [33] also concluded that the Ghanaian economy is faced with huge interest rate, double inflation figures, and high taxes, making it difficult for small, medium, and large scale construction firms to access funding for projects. The highly unstable economic parameters and high inflationary trends contribute to project cost overruns, inaccuracies, and unreliability of cost management practices [34]. An assessment of GET-Fund projects in Ghana revealed that only 2 out of 10 projects in Ashanti Region were completed within project budget [33]. In an attempt to minimize the impact of economic factors influencing cost of buildings, [34–36] developed a Framework for the computation of construction cost indices using rate, but previous work by Asumadu-Yeboah [37] concluded that the contractors were not satisfied with the level of compensation and that the indices have not been consistent to the unstable economic conditions in Ghana. Kissi et al. [38] also considered the need to develop Tender Price Index to predict estimate for tender in the Ghanaian building industry with the aim of improving the level of accuracy and reliability of early design estimate. Bediako et al. (2015) [39] concluded that inflation rate, monetary policy rate, and exchange rate were the indicators that influenced the performance of cement prices in Ghana. In assessing the performances of macroeconomic of Ghana, inflation, employment GDP, commodity price (gold and Cocoa), government expenditure, and government revenue were considered as the indicators [40]. Eleven macroeconomic indicators were identified to influence the forecast sale of large development and construction firms in Taiwan. The factors were money supply, consumer price index, producer price index, unemployment rate, GDP, national consumption expenditure, and debt-to-GDP ratio [41]. Heng (2013) [42] in developing construction price prediction model considered national income, population, unemployment rate, and interest rate as the main macroeconomic variables. Kim et al. (20110)[43] in their study used current ratio of liquidity ratio, and debt ratio for leverage ratio. Gross National Income, index of liquidity, exchange rate, interest, and consumer price index were the macroeconomic variables in analyzing the relationship between Korean financial crisis of the Korean Construction industry and the fluctuations of macroeconomic variables. In assessing the impact of macroeconomic fluctuations during insolvency, the gross domestic product, consumer price index, Korea composite stock price index, currency exchange rate, certificate of deposit interest rates and corporate bond yields as macroeconomic variables, real gross domestic product, real interest rate, and unemployment rate were the macroeconomic factors that were analyzed in the changes of housing prices in United States of America [44]. Baffoe-Bonnie (1998)[45] also established that stock of houses sold, housing prices, mortgage rates, consumer price index, changes in employment or employment growth, and money supply were macroeconomic indicators effecting housing prices and stock of house. This study seeks to evaluate and establish the need to conduct further research on the impact of changes in macroeconomic constituents on the cost of public educational buildings using fuzzy set logic and vector error correction model respectively.

3. Research Methodology

This was a preliminary survey to establish the need to evaluate the impact of variations in macroeconomic variables on cost of public educational buildings in Ghana. Data collected were done through both primary and secondary sources. For the secondary data, a critical literature review was conducted and in collecting primary data, open ended questionnaire was used to obtain information from registered Quantity Surveyors and Estimators in public institutions in Ghana. Purposive and snowballing sampling techniques were used. These two techniques were adopted due to the fact that the research was interested firstly in a sample that will give best perspective on the phenomenon of understudying and secondly in attaining the sample size because of the difficulties encountered in assessing the population. In all, a total of forty (40) responded. Quantity surveyors (20) and estimators (20) responded. Field data gathered through the questionnaire survey were subjected to descriptive analysis using frequency, percentage, and bar charts in order to present the pictorial overview of stakeholder understanding. Relative Important Index (RII) ranking was applied to identify the most significant macroeconomic variables.

4. Data Analysis and Discussions

4.1. Background of Respondents. Questionnaires were administered to Quantity Surveyors and Estimators who were working in public institutions in Ghana. They were from technical universities, research institutions, development offices of Kwame Nkrumah University of Science and Technology and University College of Education Winneba-Kumasi Campus and others consulting firms who represent the government on building projects. The demographic information about the respondents including years of experience and professional qualification is shown in Table 1. Most of the respondents had obtained master degree in construction management (Master of Science/Philosophy). Also most of the respondents (65%) were registered members of the Ghana Institution of Surveyors and 35% of them were not. In terms of working experience, 10% of the respondents had over 16 years working experience, 20 % had over 11 years working experience, 40% had over 6 years working experience, and 30% of the respondents had working experience between 0-5 years.

4.2. Cost Management. The study sought to find out from the respondents their involvement in building construction cost management and the methods used. Ninety percent (90%) of them were actively involved in cost management. The respondents also indicated that cash flow, progress report, and cost control were the methods mostly used by the respondents for this study to monitor cost of building projects during construction. None of the respondents used combination of any of the listed methods.

4.3. Satisfactory Level of Cost Management. The survey indicated that all most 73% of the respondents were satisfied with cost management practices and procedures and at least 27% of them were not satisfied. 27% of the respondents

Table 1: Background information about respondents.

1	*Education Level*	*No*	*%*
	HND		
	BSc	12	30
	MSc/MPhil.	26	65
	PhD	2	5
	Total	*40*	*100*
2	*Professional Qualification*		
	GhIS	26	65
	Non GhIS	14	35
	Total	*40*	*100*
2b	*Years of Experience*		
	0-5 years	12	30
	6 -10 years	16	40
	11 - 15 years	8	20
	16- above	4	10
	Total	*40*	*100*

Source: Authors' Construct, 2018.

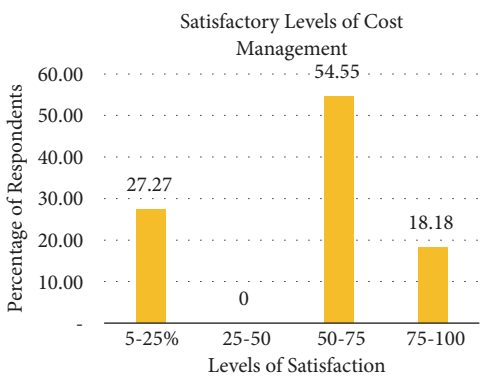

Figure 1: Details of respondents who were satisfied with cost management practices and procedures.

ranked their level of satisfaction between 5 and 25%. A little over 18.18% of the respondents rated their level of satisfaction between 75% and above. None of the respondents ranked their level of satisfaction between 25-50% as shown in Figure 1. The 27% dissatisfied respondents indicate the need to find more reliable methods of cost management in building construction. Figure 1 is a graph showing the level of cost management satisfaction by cost engineers (Quantity Surveyors/Estimators) who were the main respondent for this study.

4.4. Macroeconomic Variables Considered in Cost of Building Construction. The macroeconomic indicators that were considered for this study were summarized from the above literature as shown in Table 2. Respondents were asked to identify which of the macroeconomic components do have impact on cost of public building construction. From Table 2, macroeconomic variables that were considered by thirty or more of the Quantity Surveyors and Estimators were interest rate, prime rate, taxation, inflation, and exchange rate. The respondents also identified the following as the less influential variables: employment (population), crude oil price, government expenditure/revenue, and gross domestic product.

The significance associated with each factor by the respondent (group) was then used to conclude the relative importance index (RII) of each factor, using the formula adopted from the works of [46, 47]. Therefore, RII values for each factor in this study were estimated using the formula thus:

$$RII = \left(4n_4 + 3n_3 + 2n_2 + n_1\right) 4N) \quad (1)$$

where
n_4 is very significant,
n_3 is significant,
n_2 is low significance, and
n_1 is not significant.

N is total number of respondents as indicated for each group and the numbers 4, 3, 2, 1 to n4, *n*3, *n*2, *n*1 are constant to each category. The RII underscores the relative importance of each variable and is ranked for each group of the respondents in the study. The degree of association of these factors (using the various group scoring of these RII values in Table 2) demonstrates whether their contributing influence has significant strength as a macroeconomic indicator.

The respondents were forty (20 professional quantity surveyors and 20 freelance estimators). Based on the various scoring, the impacts were characterized. The rankings of the macroeconomic variables made it possible to detect the most principal variables. The relative importance index as categorised by the respective groups provides the study overall ranking as shown in Table 2. The study reveals that the average ranking, inflation, prime rate, exchange rate, interest rate, and taxation were the most significant macroeconomic variables. Foreign direct investment gross domestic product,

Table 2: Macroeconomic variables.

Item	Selected Macroeconomic Indicators	Professional Quantity Surveyors		Estimators		Average	
		RII	Rank	RII	Rank	RII	Rank
1	Taxation	0.963	5	0.950	4	0.96	4
2	Interest	0.975	2	0.950	4	0.96	4
3	Consumer Price Index	0.838	10	0.788	10	0.81	10
4	Exchange Rate	0.975	2	0.963	3	0.97	3
5	Gross Domestic Product	0.763	11	0.600	11	0.68	11
6	Unemployment	0.525	13	0.425	13	0.48	13
7	Foreign Direct Investment	0.600	12	0.525	12	0.56	12
8	Loans	0.913	7	0.875	6	0.89	7
9	Grant	0.875	9	0.875	6	0.88	8
10	Inflation	1.000	1	0.975	1	0.99	1
11	Producer Price Index	0.888	8	0.875	6	0.88	8
12	Prime Rate	0.975	2	0.975	1	0.98	2
13	Money Supply	0.950	6	0.850	9	0.90	6

Source: Authors' Construct, 2018.

unemployment and consumer price index were amongst the least influential variables. The table also reveals that the rankings between the estimator and the professional Quantity Surveyors did not indicate much difference. The first five variables by the Quantity Surveyors were the same as the Estimators. These were inflation, prime rate, exchange rate, interest rate, and taxation. Also the least ranked macroeconomic variables by both Quantity Surveyors and Estimators were consumer price index, gross domestic product, foreign direct investment, and unemployment.

5. Conclusions and Recommendation

The primary objective of this study was assessing the need for further research on the impact of changes in macroeconomic components and the cost of public educational buildings in Ghana, but it also is imperative to assess the professionals on project cost management procedures and practices. The study revealed that professionals (Quantity Surveyors and Estimators) have in-depth knowledge about building cost management considering their years of practicing in the building industry. Cash flow, progress reporting, and project cost controlling methods were the main procedures and practices of managing and monitoring cost of building. Though most of the respondents were satisfied about their cost management practices and producers, about 27% of them were dissatisfied. The survey also revealed that professionals have knowledge about some macroeconomic variables, such as taxation, interest rate, prime rate, exchange rate, and inflation. All the respondents recommended the need for further research on the relationship between macroeconomic variables and the general construction industry in Ghana as already recommended by Kissi et al. [48] and Oteng-Abayie and Dramani [49]. Future study will evaluate and establish a relationship between the variations in macroeconomic indicators and cost of public educational buildings using fuzzy set and vector error correction model.

Data Availability

The data was analyzed using excel spreadsheet. Questionnaires and the analysis spreadsheet are attached as supplement sheets (available here).

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Supplementary Materials

Questionnaires used to obtain information from professionals (Quantity Surveyors/Estimators) of the development offices of public universities in Ghana. *(Supplementary Materials)*

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