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# APPRAISING THE CAUSES AND EFFECTS OF CONSTRUCTION MATERIALS PRICE FLUCTUATION ON BUILT ENVIRONMENT PROJECT DELIVERY IN ABUJA METROPOLIS

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## Abstract

The developmental nature of Abuja metropolis makes it crystal clear that construction project development will continue to be a priority. However, the persistent and unabated rise in construction material prices has led to delay in the delivery of construction projects and in some cases, projects abandonment which has to a large extent stalled the developmental stride of the metropolis. This study thus, appraises the causes and effects of construction materials price fluctuation on Built Environment (BE) project delivery in Abuja metropolis, with an aim to providing mitigating measures. Semi-structured questionnaires were administered to 331 construction professionals within Abuja metropolis BE and 293 were properly filled and returned. Frequency, Percentile and Mean Index Score (MIS) were employed to rank the severity of the identified causes, effects and the mitigating measures. The findings of this study revealed that building material price inflation, instability of crude oil prices and suppliers materials hoarding are the top factors causing changes to construction material prices with mean scores of 4.78, 4.76 and 4.66 respectively, while market condition instability, increment in the duration of contract period and poor project management are the top effect of construction materials price fluctuation on the metropolis BE project delivery. This study concluded that, clear plans and strategies before starting a project, implementation of effective materials management policies and thorough cross checking of estimates based on the updated price information as the top mitigating measures for cushioning the effect of construction materials price fluctuation on Abuja metropolis BE. This study therefore, recommended that, satisfactory considerations of these mitigating measures are imperative to enhancing the delivery of construction projects within Abuja BE on the side of the contractor. Subsequently, on the side of the government, there is need to increase local production capacity and maintain the stability of exchange rates. The practical implication of this is that, construction professionals can deliver projects to the complete satisfaction of all stakeholders within Abuja metropolis.

**Key Words:** Construction Materials, Price Fluctuation, Built Environment, Project Delivery, Abuja Metropolis.

## 1.0 Introduction

The problem of inconsistent building materials price fluctuation has consistently been prevalent in the construction industries of developing nations. Nigeria's construction industry is affected by this scourge and subsequently, Abuja metropolis Built Environment (BE) project delivery. The importance of construction materials to project delivery in the BE cannot be overemphasized (Muhammed & Muhammed, 2021). This is because construction materials when assembled properly and appropriately forms the purpose of any construction structure, and constitute about 50 per cent of the total project cost according to Caldas et al. (2015). Similarly, studies of Arayela (2005), Ogunsemi (2010) and Adedeji (2010) posits that construction materials makes up to 65, 50-60, and 60 percent respectively of the cost of construction projects. Abuja BE project delivery are influenced by so many factors including construction materials price fluctuation, incompetent project management, fraudulent contractors and political favouritisms (Muhammed et al., 2022), resulting into increase in the cost of initial project estimates, delay in project completion and sometimes outright abandonment of the construction projects especially public construction projects (Hafez, 2014). The flow of construction materials in the BE is a crucial requirement for the timely completion of construction projects (Kini 1999; Abdel-Wahab et al., 2018). However, the fluctuating cost of building materials during construction projects are affected by demand and supply, quality, place, time, currency exchange rate, pressure from inflation, material specification, materials availability and accessibility of alternative materials (Oladipo & Oni, 2012; San Ong, 2020), which has subsequently affected the BE construction output in recent times in Abuja metropolis both within and outside the municipal areas. This has nevertheless threatened the planned expansion efforts of the construction projects required for the continued growth and development of the metropolis by both public and private investors (Haruna et al., 2018). Similarly, according to Abdulkareem (2021), people experienced difficulties in building houses of their own, owing to high cost of building projects, ensuing from astronomically high prices of construction materials in Abuja. According to Jithin et al. (2020), the inconsistencies in the construction material prices has become a regular issue bedevilling all the construction stakeholders including clients, consultants and contractors. The same can also be said of other nations such as Ethiopia, where Hailu, et al. (2015), posits that inconsistent prices of construction materials is prevalent and affects the BE project delivery. Ibrahim & Elshwasdfy, (2021), also lays emphasis on the construction project costs in Egypt and Kamaruddeen et al. (2021), similarly highlights cost causing factors threatening the construction industry of Malaysia.

Consequently, in Nigeria, cost of construction projects has been identified as most costly (Abu et al., 2021), particularly in Abuja metropolis. This is attributable to the inconsistencies of construction materials prices prevalent in the construction industry as one of the major causes (Marzouk & El-Rasas, 2014). Additionally, the Senate of the Federal Republic of Nigeria as posited by Melaye (2015) cited in Abu et al. (2021), bemoaned the increasing high cost of construction projects within the Abuja BE as "exploitative and unnecessary". The Senate further posited that, this emerged as a result of the discriminatory and loop-sided payment for the awarded contracts despite the high interest rate, inflation rate and the continued increase in the prices of construction materials. It needs not be emphasized that Abuja metropolis as the capital city of Nigeria needs the best possible infrastructural facilities in order to be able to compete with the other world renown capitals such as Berlin, Washington, Paris, Madrid and a host of others. Despite the need for such, infrastructural deficit is still largely prevalent in the capital city (Muhammed & Abubakar, 2019; Makun & Bashir, 2019 Ozioma et al., 2020). Notwithstanding the previous studies conducted in this area, following the continued inconsistencies experienced in construction materials prices, and the need to lessen the effect on the BE project delivery in Abuja metropolis, as well as the uneconomical nature of the construction materials price escalation (Dikko, 2012; Muhammed & Adindu, 2021; Muhammed & Muhammed, 2021), this study will therefore, appraises the causes and effects of construction material price fluctuation on the project delivery in Abuja metropolis BE with a view to providing mitigating measures to cushioning the effect of material price fluctuation on the BE project delivery.

This study is designed to:

1. Identify the causes of construction materials price fluctuation in Abuja metropolis.
2. Determine the effect of building materials price fluctuation on built environment project delivery.
3. Explore the mitigating measures for cushioning the effect of construction materials price fluctuation within Abuja metropolis BE.

## 2.0 Literature Review

### 2.1 Causes of Building Materials Price Fluctuation

Arijeloye & Akinradewo, (2016) puts it that the overall construction expenditure comprises of 50 to 70 percent of construction materials. Several factors influence the cost of construction materials prices (Omede & Saidu, 2021). According to Haruna et al. (2018), one of the factors responsible for construction materials price fluctuation is supplier default which comes about as a result of the market monopoly enjoyed by the supplier who intentionally keeps pushing up the prices and limiting output with little or no responsiveness towards the needs and requirements of the customers. It is the position of Adegbembo & Adeniyi (2015) that market stockpile similarly causes construction materials price fluctuation. When such happens, ‘artificial scarcity’ is created leading to the astronomical high prices of the available and accessible construction materials. Political, social and environmental problems arising from government decision making also contribute to the causes of building materials price fluctuation (Mansfield et al., 2014). Demand and supply movement significantly impacts construction material prices (Omede & Saidu, 2021). The prices of energy such as gasoline and electricity also impact construction building material prices according to the Bureau of Economic Research (BER, 2008). Anderson (2011), opines that volatility experienced in the prices of crude oil similarly affects construction materials price level. In consonance, the study of Muhammed & Muhammed (2021), on the correlation between petroleum pump price volatility and selected building materials prices of construction projects in Nigeria, 2011 – 2020, denotes a very high correlation between construction materials prices and crude oil pump prices. They posit further that exchange rate volatility is also one of the major macroeconomic variables that consistently affect construction sector material prices. This is because the higher the exchange rates, the higher the prices of building materials (Turro & Penyalver, 2019), especially for those materials that are consistently imported into Nigeria. Import duty charges applied by the authorities are sources of astronomically high prices of construction materials according to Yahaya, (2021). This has effect on the construction materials subsector of different countries such as Nigeria, Malaysia, Kenya, India, Oman and a host of other nations. Similarly, bank interest rate and the foreign exchange market unpredictability is a cause of foreign exchange rate depletion of the country which increasingly affects the country, leading to an import dependence level of almost 60 percent of its raw materials according to the studies of Jagboro & Owoeye, (2014) and Ikechukwu, (2021). Furthermore, with high interest rate, people are encouraged to save which end up reducing their spending rate with a rise in the cost of borrowing also prevalent. For instance, the interest rate of the Central Bank of Nigeria (CBN) as at August 2022 was 14 per cent (Central Bank of Nigeria, 2022).

Muhammed & Muhammed, (2021), also sees currency devaluation as an instrument for improving a nation’s balance of trade by authorities via export boosting in the period where trade deficit may become a challenge for the nation. The devaluation brings about the same value of currency being able to buy more of the other currency (Omede & Saidu, 2021). In a country where such is experienced, it is highly likely the building materials prices would also be affected when the imports are largely sold at higher prices while the exports are being sold at a lower price. Ihuah, (2015), opines that human factors are part and parcel of the fluctuation in the prices of building materials. He states further that human factors are the organizational, environmental, individualities and job factors which are influential to the work of a person that can affect the health and safety status. Another cause of construction materials price hike is

building wastes which are made up of concretes, woods and bricks that are damaged or unexploited as a result of one reason or the other (Haruna et al., 2018). Observational research posits that this amounts to as high as 10 to 15 percent which is considerably higher than 2.5 to 5 percent normally assumed by the quantity surveyors (Omede & Saidu, 2021). According to Merriam-Webster (2022), “force majeure is an event that cannot be reasonably anticipated”. This includes but not limited to war, tornado and hurricane, and is related to the concept of an ‘Act of God’. For such an act to happen, it must have been reasonably unanticipated, unpredictable and external to the parties of the contract. Example of such is the Covid-19 pandemic whose impact is still keenly felt today in all aspect of the national economy.

## 2.2 Effects of Building Materials price fluctuation on BE project delivery

Cost variation is one of the effects ensuing from the increase in the prices of construction materials. This is known when there is a deviation between final cost and initial cost of a project (Ikechukwu et al., 2017). It is the amount by which the actual cost exceeds the initial cost during any stage of the Project Life Cycle (PLC) (Lukale, 2018). A study carried out in Malaysia to determine the factors causing cost overrun in the construction project has it that cost variation is one of the factors that cause project cost overrun according to Kamaruddeen et al. (2020), and this is largely as a result of construction materials price fluctuation. Possible total project abandonment is a factor that can arise from the inconsistencies in construction material prices. Haseeb et al. (2011), sees construction project abandonment as putting an end to every work or longtime suspension of construction activities. Moreover, the prevalence of uncompleted and completely abandoned construction projects are induced by financial challenges and materials cost variations (Ayodele & Alabi, 2011). It is suggested by the study of Idoro & Jolaiya, (2010), that high cost of building materials and inflation are the major proponents of uncompleted and substandard projects. Obviously, building materials price increase considerably affects the construction sector industrial performances while inflation increasingly leads to a rise in building material prices. These factors are impactful to South Africa’s housing sustainability (Alabi & Fapohunda, 2021). Aluko (2008), typifies project abandonment as one that have negative environmental consequences on the society which he viewed as one of the aftermaths of construction materials price fluctuation in Nigeria. These include flooding, air and water pollution, drugs addict hideouts, traffic congestion in some cases and neighborhood health hazards which ensued from the continued low volume of production prevalent within the Nigerian construction industry (Ganiyu, 2016), owing to the subsequent rise in the prices of construction materials. This led to the suffering of the populace as a result of government incapability to deliver affordably adequate and sustainable housing units. The acquisition and usage of poor-quality construction materials as a result of the increment in construction material prices is also a possible cause of building collapse according to Chendo & Obi (2015). The adoption of such material induces building structural damages and unprecedented mishaps (Ganiyu, 2016). Building collapse is induced either by man-made or natural factors (Amadi et al., 2012), and posits further that frequent collapse of buildings is prevalent in developing countries such as Nigeria.

Chendo & Obi, (2015) exemplifies that the prevalent building collapse in Nigeria is induced by man-made factors. In consonance, Adama et al. (2017) posits from his study that the fundamental basis for building failure and collapse is occasioned by the inconsistencies in the prices of building materials and further findings indicates the presence of substandard building materials in the Nigerian construction industry (Aziz, 2013), as low quality materials induces higher cost of construction projects beyond the initially projected cost estimates. Unemployment is another factor that has effect on construction materials price increase according to Ayodele & Alabi (2011). Owing to the difficulties of the construction contractors to forecast expected profits accruable from projects as well as their inability to get the needed contracts, many contracting firms retrench most permanent staff as they result to hiring and firing approaches which significantly reduces the labor force, despite the industry comprising of diverse personnel who are skilled and unskilled (Akanni et al., 2014). In some extreme cases, it is not just about laying-off of workers but closure of construction firms as many young firms

closes within the first five years of their establishments (Aje et al., 2016). Oladipo & Oni (2012), reveals that macroeconomic indicators on building materials cost are an important inducer of the level of unemployment prevalent in the country. Besides, the unemployment rate also impacts the Gross Domestic Product (GDP) of the nation (Muhammed, 2016). Therefore, in summary, the economic boost expected from the construction industry to the economy is ruined. Also, fraudulent practices of the construction practitioners are prevalent in the construction industry when there are high prices of construction materials. These fraudulent practices are frequented and almost always happen during the payment chain (Alabi & Fapohunda, 2021). It is known that this is mostly done by workers at the nadir of construction work where prices of materials and work done are inflated. According to Alex (2019), another division may amplify the cost to vendors by brokering a deal with them in order to get their share when the payment is done. This result into multiple payments for a single construction material procured for the construction project within the BE.

## 2.3 Relevant Theories

### 2.3.1 Contingency Theory

The basis of this study is emphasized by the contingency theory brought about by Fred Fiedler in 1960s. The theory is of the position that organizations must make decision on the basis of the appropriate technique and the prevalent economic conditions (Burns & Stalker, 1961). The theory opines that no entirely suitable management systems are required for organizations in all circumstances (Otley, 1980; Islam & Hui, 2012). The theory is of a necessity to this study because of the prevalent inconsistencies in the construction market ensuing from the constant fluctuation in the prices of construction materials where the construction firms are expected to come up with varying management techniques to accommodate and manage these factors at varying times of their arrival in order to allow for the success of the construction project delivery within the BE.

### 2.3.2 Transaction Cost Theory

Cosmos (1931), puts forth the transaction cost theory which is also a guide for this study. The theory posited that an ideal organizational structure is one that attains economic productivity by lessening exchange cost when negotiations are made for the services to be delivered (Asikogu et al., 2021). The theory advocates that different types of transaction create coordination cost of controlling, monitoring and running of projects in order to attain top performances. Thus, the theory opines that such cost and cost of production are to be distinguished and that there is need for the firm's decision makers to make a decision during negotiation to minimize the transaction cost that augers well with the firms cost performance targets (Cuypers et al., 2021). The theory underpin the importance of this study in that the construction professionals in the BE more often does not make the necessary provisions for the inconsistencies in the prices of construction materials at best and sometimes does not make at all, at worst. This underscores the importance of creating mitigating measures as a plan towards restricting the effect of the fluctuation in building materials prices in order to allow for better project delivery of the construction professionals within the BE.

## 2.3 Conceptual Framework

The model depicted by figure 1 show the relationship between the variables considered for this study. The causes of construction material price fluctuation which are typified from various studies to include inflation, supplier stockpiling of construction materials, exchange rates, interest rates, import duty on imported materials, transportation cost, building materials inflation and prices of crude oil and so on are used in this study and their effects on the BE construction project delivery is likewise delineated. These variables, in line with the contingency and transactional cost theories requires proper management

through forecasting and ensuring reduced productivity challenges during planning by lessening exchange cost effect during negotiation as part of the mitigating measures in order to adequately prepare for the inconsistencies in the prices of construction materials in order to enhance the BE project delivery.

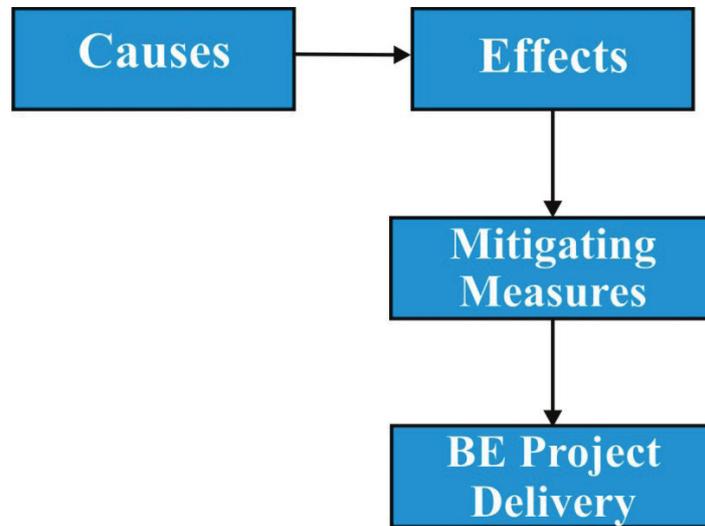


Figure 1: Model developed for this study

Source: Authors Construct, (2022).

### 3.0 Methodology

The approach of qualitative methodology was applied for this study by employing semi-structured questionnaire to the targeted respondents. According to Kothari (2004), the data generated via this technique can be exposed to arduous qualitative analysis, which is far easier with less inaccuracy (Devault, 2020). As posited by Okolie & Mba (2020) and evidenced in the study of Atanda (2021), the total number of the combined practicing builders, quantity surveyors and architects within Abuja metropolis was 1,950 determined from their NIB, NIQS and NIA branches in Abuja metropolis as at May, 2020. Subsequently, according to Saunders et al. (2014), a sample size refers to the participants selected to represent the entire population. The sample size for this study is determined using Yamane (1973), simplified formula for sample size calculation.

$$n = \frac{N}{1 + N(e)^2}$$

Where;

n = sample size,

N = population,

e<sup>2</sup> = Margin of error (assumed 5% or 0.05),

1 = unity or constant value

$$n = \frac{1950}{1 + 1950(0.05)^2} .$$

$$n = 331$$

The above result indicates a selection of **331** respondents for this study.

The questionnaire used for this study is sectioned into two divisions, with the first section comprising of the demography of the respondents who are made up of construction professionals including Material Managers, Inventory Officers, Supervisors, Suppliers, Project Managers and Site Managers. The second section is apportioned into three parts, comprising the causes of construction material price fluctuation, effects on BE project delivery and the mitigating measures. With regards to the prescription of Enshassi et al. (2009), this study uses a 5-point Likert scale ranging from 1 to 5 as follows: “1 = Not significant”, “2 = Slightly significant”, “3 = Moderately significant”, “4 = Very significant”, and “5 = Extremely significant” as applied in the study of Muhammed et al. (2022). The collected data were analyzed using Frequency, Percentile and Mean Index Score (MIS).

## 4.0 Results and Discussion

### 4.1 Background Information of respondents

This study uses 331 questionnaires out of which 293 were returned which indicates 89 percent response rate. Out of the returned 293 responses, 226 of these were males and 67 were females which indicate about 77.1 and 22.9 response rates respectively from both gender. Educational status of these respondents comprises of mostly construction professionals with first degree, followed by respondents with Higher National Diploma (HND), Master’s Degree, National Diploma (ND) and PhD with 132, 77, 54, 17 and 13 respondents at a response rate of 45.1, 26.3, 18.4, 5.8 and 4.4 respectively. The age bracket of the respondents were categorized into 20 – 30, 31 – 40, 41 – 50, 51 – 60, and 60 and above years, with responses of 99 (33.8), 76 (25.9), 80 (27.3), 33 (11.3) and 5 (1.7) percent simultaneously, and connotes that the construction industry is dominated by youths with each respondent having at least a year experience in construction materials procurement. The professionals with the highest response rate are the Project Managers with 80 responses which depicts a response rate of 27.3 percent. This was followed by Materials Managers, Site Managers, Inventory Officers, Suppliers and Supervisors with responses of 72, 64, 42, 18 and 17 which indicate a response rate of 24.6, 21.8, 14.3, 6.1 and 5.8 percent respectively. Similarly, experiences gathered by the construction professionals within 1 – 5 years have responses from 156 respondents which indicates 52.9 percent response rate, followed by the respondents with an experience level between 6 – 10 years and above 10 years which depicts 29.4 and 17.7 percent response rate correspondingly. Most of these respondents have their sites located within Abuja Municipal Area Council (AMAC) and rightly so, have 171 responses against the 122 responses of the construction professionals having their sites located outside of the AMAC, which indicates a corresponding 58.4 and 41.6 percent response rate.

**Table 1:** Background Information of Respondents

<b>Profile</b>	<b>Frequency</b>	<b>%</b>
<b>Gender</b>		
Male	226	77.1
Female	67	22.9
<b>Education</b>		
National Diploma (ND)	17	5.8
Higher National Diploma (HND)	77	26.3
First Degree	132	45.1
Master's Degree	54	18.4
PhD	13	4.4
<b>Age</b>		
20 - 30 years	99	33.8
31 - 40 years	76	25.9
41 - 50 years	80	27.3
51 - 60 years	33	11.3
61 and above	5	1.7
<b>Profession</b>		
Materials Manager	72	24.6
Inventory Officer	42	14.3
Supplier	18	6.1
Supervisor	17	5.8
Site Manager	64	21.8
Project Manager	80	27.3
<b>Experience</b>		
1-5 years	155	52.9
6-10 years	86	29.4
Above 10 years	52	17.7
<b>Site Location</b>		
Municipal Area Council	171	58.4
Outside of Municipal Area Council	122	41.6

Source: Researchers Field Survey, (2022).

## 4.2 Causes of Building Materials Price Fluctuation

Table 2 shows the findings on the identified causes of building materials price fluctuation in Abuja metropolis BE and reveals that building materials price inflation is ranked 1<sup>st</sup> with a mean score of 4.78 depicting that the major causes of the fluctuation experienced in construction materials prices arises from inflation of the building materials just as in Omoregie & Radford, (2006) and Abu et al. (2021). This is down to the human nature of the people in the metropolis as many are in for quick money. This is followed by the instability of the crude oil prices with a mean score of 4.76 and ranked 2<sup>nd</sup>. Nigeria's economy is mostly focussed and dependent on crude oil prices as most of the respondents view it as important to the fluctuation experienced in the construction material prices. In consonance, the study of Muhammed & Muhammed (2021), denotes a very high correlation between construction materials prices and crude oil pump price volatility. There is also a case of materials hoarding by the suppliers being ranked 3<sup>rd</sup> with a mean score of 4.66, as this is a prevalent issue in the Nigerian construction industry especially when there is an information about the near future scarcity of some materials. The supplier deliberately hoards the materials and therefore, creates 'artificial scarcity' leading to the subsequent increase in the prices of materials. Material high import duty rates and transportation cost are ranked 4<sup>th</sup> and 5<sup>th</sup> respectively with corresponding mean scores of 4.62 and 4.57. Construction professionals see that the increment in duty rate of construction materials imported are of high consequence to the inconsistencies experienced in the prices of construction materials. The transportation within the Abuja environment is also a contributing factor that brings about 'artificial increase' in the prices of construction materials. This is so, because of the distance between the location of the supplier usually outside of the Municipal areas and that of the site leading to more expenses incurred during the course of transporting the construction materials to the site especially those sites located in Asokoro, Maitama and Central Business District (CBD) areas of AMAC in the metropolis. The challenges of exchange rate is also a high factor impacting construction materials price changes with a mean score of 4.56 and ranked 6<sup>th</sup>. This is occasioned by the ceaseless and continued rise in the rate of US dollars which is the most transacted foreign currency in Nigeria against the local Naira currency which has being a factor in the inconsistencies experienced in the prices of construction materials.

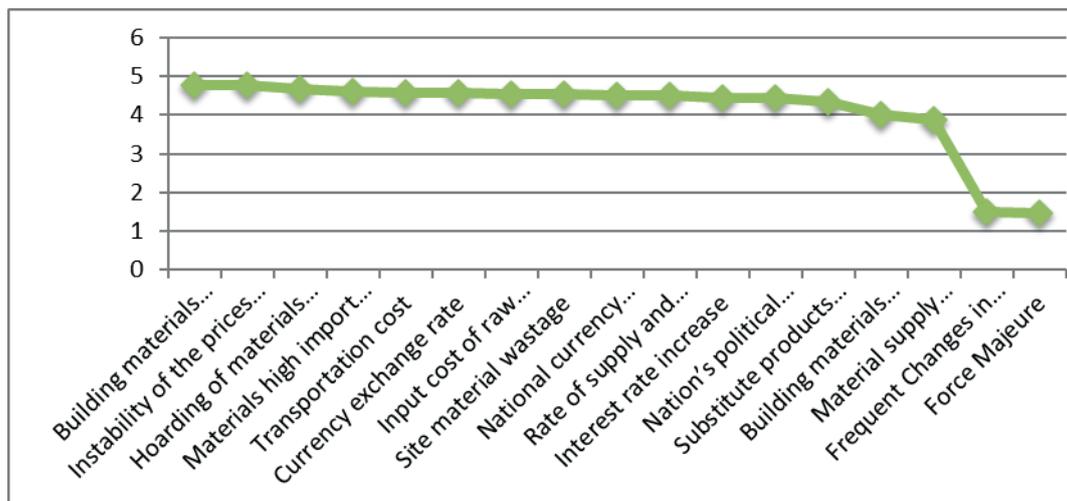
Input cost of raw materials into production and site material wastages are seen as factors that similarly affect construction materials with mean scores of 4.54 each and both ranked 7<sup>th</sup>. The amount of raw materials inputs that goes into production of construction materials also have an effect on the prices of the materials alongside material wastages on site. The amount of construction materials used on site will either increase or decrease the demand for more materials. It is a known fact that the higher the demand, the higher the cost and vice versa. This takes us to National currency devaluation, and supply and demand rates which are ranked 9<sup>th</sup> and 10<sup>th</sup> with mean scores of 4.51 and 4.50 respectively. The lower the value of the national currency and the higher the demand for imported construction materials, the higher the cost of those construction materials. Conversely, the lower the demand and the higher the value of the national currency, the lower the cost of these imported construction materials. These findings are similar to the findings of Mbachu & Nkado (2004), Khyomesh, (2011) and Aysha, et al. (2015). Interest rate increase, political instability of the country as well as substitute products accessibility also considerably affects construction materials prices with respective mean scores of 4.45, 4.44 as well as 4.34 and ranked 11<sup>th</sup>, 12<sup>th</sup> as well as 13<sup>th</sup> correspondingly. Consequently, the processes of ordering and delivering of building materials, and supply inadequacies of the material suppliers has mean scores of 4.00 and 3.89, and correspondingly ranked 14<sup>th</sup> and 15<sup>th</sup> with considerably reduced influences on construction materials price variation. The least selected factors are frequent weather changes and force majeure correspondingly ranked 16<sup>th</sup> and 17<sup>th</sup> with mean scores of 1.48 and 1.47 respectively. This is so because, there are usually low issues of weather changes in Nigeria as the weather is mostly divided into rainy and dry seasons, and in the dry season is where most external construction works for instance; road works are expected to be carried out. The case of 'act of God' such as war, earthquake, tsunamis and flood are not something we do experience in Abuja metropolis and rightly so, is ranked the least

factor. These findings are largely consistent with the findings of Olawale & Sun, (2010) in Nigeria and Sambasivan et al. (2017) in Tanzania.

**Table 2: Identified causes of Building Material Price Fluctuation**

Factors	Mean	SD	Rank
Building materials price inflation	4.78	.715	1
Instability of the prices of crude oil	4.76	.427	2
Hoarding of materials by suppliers	4.66	.584	3
Materials high import duty rates	4.62	.593	4
Transportation cost	4.57	.794	5
Currency exchange rate	4.56	1.054	6
Input cost of raw materials into production	4.54	.500	7
Site material wastage	4.54	.610	7
National currency devaluation	4.51	.775	9
Rate of supply and demand	4.50	.606	10
Interest rate increase	4.45	.973	11
Nation's political instability	4.44	.836	12
Substitute products accessibility	4.34	1.027	13
Building materials ordering and delivering process	4.00	1.198	14
Material supply inadequacies of Suppliers at needed times	3.89	1.270	15
Frequent Changes in Weather	1.48	.577	16
Force Majeure	1.47	.670	17

Source: Researchers Field Survey, (2022).



**Figure 2: Performance Index of the identified causes of construction materials price fluctuation**

Source: Researchers Field Work, (2022).

### 4.3 Effect of building materials price fluctuation on Built Environment project delivery

Table 3 illustrates the effect of price variation of building materials with fluctuation in prices leading to market condition instability ranked 1<sup>st</sup> with a mean score of 4.86, and shows that inconsistent construction prices consequently leads to distortion in the prices of construction materials in the BE (Frimpong et al., 2003; Baloyi & Bekker, 2011). This leads to 'increment in the duration of the contract with an increasing work' and culminating into 'poor project management' as they are correspondingly ranked 2<sup>nd</sup> and 3<sup>rd</sup> with mean scores of 4.82 and 4.80 respectively, and in close proximity with the rankings of Ameh et al. (2010). This shows that market condition instability, duration of contract period and additional works, poor project management highly affects the BE according to Omoregie & Radford, (2006), which ensued from the inconsistencies experienced in construction material prices. These inconsistencies also increasingly leads to the reduced quality of design and specifications, causes initial cost estimate variation and raw materials shortage on site with mean scores of 4.78, 4.75 and 4.74, and ranked 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> respectively, which is consistent with the study of Ahmed et al. (2020). The variation also have effect on the wages of workers on site considerably and ranked 7<sup>th</sup> with a mean score of 4.73. This invariably leads to the shortage of workers on site and thereby, extending the period for project delivery. Incompetency of project team is ranked 8<sup>th</sup> with a mean score of 4.72 which connotes that the project team management also experience problems within the BE when there are variations in the prices of construction materials (Omoregie & Radford, 2006). 'Slow payment of completed work' and 'complexity of design and construction' are consequently ranked 7<sup>th</sup> with a mean score of 4.71 each. This is occasioned by the differences in the initial budget caused by the fluctuation in the prices of construction materials. These are considered to also have high effects on the Abuja BE project delivery performances. Cash flows and financial difficulties, ineffective planning, design changes and funding problems are ranked 11<sup>th</sup> 12<sup>th</sup> 13<sup>th</sup> and 14<sup>th</sup> with mean scores of 4.67, 4.66, 4.58 and 4.54 which are respectively perceived by the construction professionals as seemingly having high effects on the project delivery of the BE. Fraudulent practices and kickbacks, inconsistent construction industry practices and increase in the cost of land acquisition are the lowest ranked factors with mean scores of 4.18, 3.89 and 2.75, and ranked 15<sup>th</sup>, 16<sup>th</sup> and 17<sup>th</sup> respectively. This is so because, these factors are already prevalent in the construction industry and are thereby not occasioned by the increasing cost or fluctuation in the cost of construction materials. This however differs from their position in the study of Abu et al. (2021).

**Table 3 Effect of Building Materials Price Fluctuation on the BE project delivery.**

Factors	Mean	SD	Rank
Fluctuation leads to market condition instability	4.86	.348	1
Increment in duration of contract period and additional works	4.82	.383	2
Poor projects management	4.80	.402	3
Reduce quality of design and specifications'	4.78	.416	4
Causes variation in original cost estimate	4.75	.518	5
Shortages of materials for workers on site	4.74	.439	6
Fluctuation in the wages of labourers	4.73	.572	7
Can lead to incompetent Project team	4.72	.450	8
Slow payment of completed works	4.71	.774	9
Complexity of design and construction	4.71	.579	9
Cause cash flow hitches and financial difficulties	4.67	.980	11
Causes ineffective planning	4.66	.474	12
Causes design changes	4.58	.571	13
Funding Problems	4.54	.704	14
Fraudulent practices and kickbacks	4.18	.793	15
Inconsistent practices in the construction industry	3.89	.928	16
Increase cost of land acquisition	2.75	1.222	17

Source: Researchers Field Work, (2022).

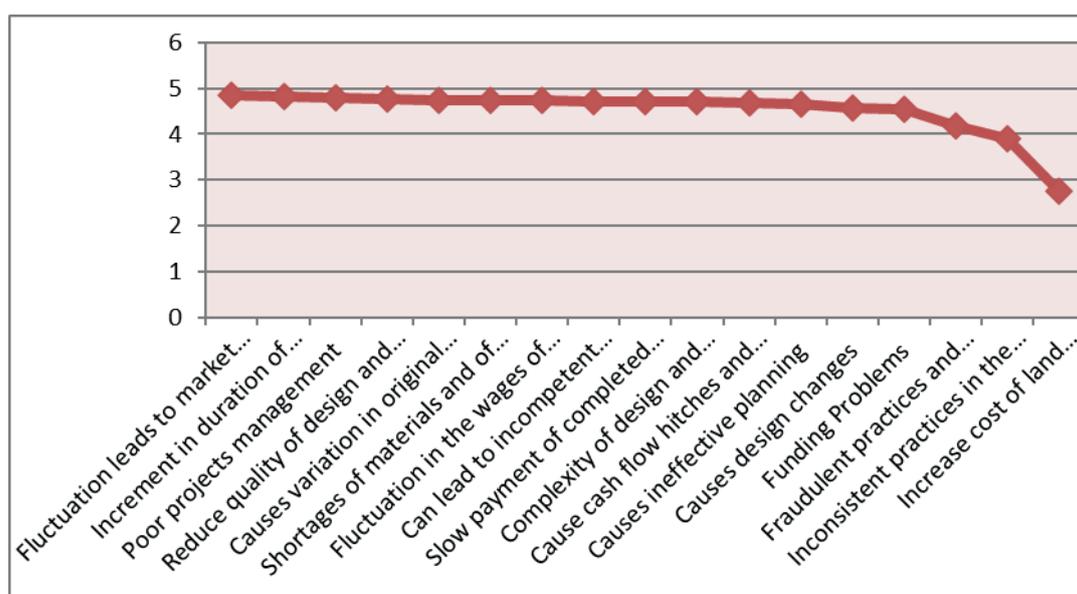


Figure 3: Performance Index of construction materials price variation effect on the BE project delivery.

Source: Researchers Field Work, (2022).

### 4.3 Exploring the mitigating measures for cushioning the effect of construction materials price fluctuation within the Abuja BE.

**Table 5: Mitigating measures for curtailing construction materials price variation within the Abuja metropolis BE.**

Mitigating Measures	Mean	SD	Rank
Clear plan and strategy before starting a project.	4.96	.206	1
Implementation of effective material policy and material management	4.96	.206	1
Thorough crosschecking of estimates based on updated price information.	4.91	.413	3
Elimination of waste at both professional and trade practice levels	4.87	.619	4
Competence and leadership of the project manager	4.82	.825	5
Clients identification of their requirements and needs	4.65	.924	6
Proper coordination and communication among various parties	4.51	1.026	7
Accuracy of bidding documents provided by client	4.38	.825	8
Early project planning and scheduling of labour	4.28	.857	9

**Source: Researchers Field Work, (2022).**

#### 4.3.1 Clear plan and strategy before starting a project (4.96)

The issue of clear planning has seemingly becomes a challenge to the construction stakeholders including clients, consultants and contractors. This is ranked 1<sup>st</sup> with a mean score of 4.96 to depicts the relative importance of having a clear plan and strategy before initiating a project. It is not uncommon to see differences in opinions, understandings and standpoint of the stakeholders during the initial and planning stages and sometime during execution and monitoring stages of the project (Muhammed et al., 2022). It is therefore, a necessity for the stakeholders to continually be on the same page during any phase of the PLC as opined by the construction professionals. Because of the constant differences in the valuation of work scheduled and work done, projects within the Abuja metropolis are delayed leading to the extension of time and in some other cases court process of litigation may ensue. This is mostly as a result of cost variation (Alabi & Fapohunda, 2021), which has brought the differences as work done is almost always undervalued by the clients and the opposite goes for the contractors. This finding is in agreement with the study of Abu et al. (2021), which similarly ranks clear plan and strategy as 1<sup>st</sup> amongst its mitigating measures.

#### 4.3.2 Implementation of effective material policy and material management (4.96)

It is the responsibility of the contractor to have a clear policy on materials demand and supply as well as the management of such materials which is the reason why it similarly, ranked 1<sup>st</sup> with a mean score of 4.96 to underscore the essence of having effective materials management policy in place by the contractor. This is however emphasized by the studies of Arayela (2005), Adedeji (2010), Ogunsemi (2010) and Caldas et al. (2015), who were of the position that building materials makes up to 65, 60, 50 – 60 and 60 per cent respectively of the total construction expenditure. Studies of Omoregie & Radford (2006), Abu (2021) and (Alabi & Fapohunda, 2021), emphasized the importance of effective materials management policy in controlling the effect of construction materials price fluctuation on BE project delivery.

### 4.3.3 Thorough crosschecking of estimates based on updated price information (4.91)

According to Babalola et al. (2021), there is always a potential that labour and material costs will fluctuate unpredictably, to a greater or lesser extent, throughout the project. This is extremely important for all stakeholders. In order to avoid cheating and outright gains made by one party over the other, as well as avoidance of differences as to valuation of work, the construction practitioners see the use of updated price information on regular crosschecking of estimates as invaluable to the BE project delivery and ranked 3<sup>rd</sup> with a mean score of 4.91. In consonance, Abu (2021), also highlighted the need for detailed and accurate estimates as a measure for curtailing construction material price fluctuation effect on BE project delivery in Abuja. This however differs from the position of the studies of Asal (2014) and Kamauddeen et al. (2020). As far as the Abuja metropolis is concerned, it is crystal clear that there will be continued construction project development owing to its developmental nature and it is of essence that updated price information on the fluctuating construction materials prices are usually used by the construction stakeholders before and during construction projects.

### 4.3.4 Elimination of waste at both professional and trade practice levels

This is invaluable to the contractors as this goes a long way in conserving construction materials as well as the use of accurate materials for a specific construction work and reduces the scarcity of such construction materials. Ranked 4<sup>th</sup> with a mean score of 4.87, accentuated the importance of waste elimination to contractors materials management effectiveness. This is against the position of the study of Abdulkadir et al. (2020) which ranked the factor well below others. This finding is however in consonance with the studies of Arah (2012) and Anago (2012). The effect of waste elimination is in the increased level of construction projects output with the budgeted cost (Muhammed et al., 2022). Ashworth & Perera, (2015), noted that firms that become profitable created revenue from reducing waste to the minimal, tolerable, bearable and acceptable level at both professional and commercial levels.

### 4.3.4 Competence and leadership of the project manager (4.82)

The project manager has the responsibility of successfully delivering projects irrespective of the prevalent market conditions (Ramos, 2014). This is stressed by the mean score of 4.82 and ranked 5<sup>th</sup>. It takes a competent Project Manager to almost always plan ahead and forecast the future possible prices of construction materials using the prevalent market conditions (Ramos, 2014). It is the opinion of the construction professionals that project managers especially that of the contractor to be on its toes throughout the construction process from initiation to the closing stages of the project. The position of project manager's competency is largely in consonance with the study of Abdulkadir et al. (2020).

### 4.3.5 Clients identification of their requirements and needs (4.65)

The professionals also see the importance of clients knowing their entire requirements before the start of the construction project. This is reinforced by its mean score of 4.65 and ranked 6<sup>th</sup>. While it is the responsibility of the contractor to deliver projects at the required specifications and requirements, it remains the duty of the client to provide unambiguous and clear specifications for which the contractor can deliver at minimal fuss in order to curtail the price fluctuation of the construction materials (Nuru, 2015; Olukyode et al., 2015; Muhammed et al., 2022). Abuja metropolis construction professional regularly witnesses the challenges of specification changes during the course of the project work and therefore, does not necessarily come to terms with the clients' decision. This is worsened by the increasingly inconsistent construction material prices and therefore, leads to delay in the completion date of the project in Abuja metropolis BE.

#### 4.3.6 Proper coordination and communication among various parties (4.51)

The performance of individual groups within the team of construction settings is very crucial. This is also a determinant of the overall project performance (Aluko & Mewomo, 2021). It is the responsibility of all parties to the project to properly transfer information ranging from the prevalent market conditions, the rise and fall in wages of labourers as well as progress payment and valuation of works throughout the course of the PLC. The importance of this, is emphasized by its 4.51 mean score that ranked 7<sup>th</sup>. This largely agrees with the study of Abu et al. (2021) and disagrees with the study of Abdulkadir et al. (2020). This indicates that while some of the respondents largely believed that curtailing the prices of the construction materials within Abuja BE can be done through appropriate harmonization and communication amongst the parties to a project, some equally thinks that the factor is generally a practice in the construction industry and thus, does not necessarily affect construction materials price fluctuation.

#### 4.3.7 Accuracy of bidding documents provided by client (4.38)

Most of the construction professionals within the Abuja metropolis BE sees bidding document accuracy as largely critical to curtailing construction materials price fluctuation. This is enhanced by its mean score of 4.38 and ranked 8<sup>th</sup> in table 5. The bidding document accuracy enhances the ability of the BE to complete project on time, cost and scope. This is largely the position of the studies of Akintoye (2000), Ashwoth & Perera (2015) and Abdulkadir et al. (2020). According to Baloyi & Bekker (2011) and Frimpong et al. (2003), accuracy of bidding document is a way to prevent time overrun in South Africa housing projects and ground water projects in developing countries such as Ghana respectively.

#### 4.3.8 Early project planning and scheduling of labour (4.28)

Olatunde et al. (2017), noted that the construction professional team early selection and scheduling of project is significant to the impact and quality of the expected project. This is important for the start and completion of construction projects as prompt project plan and labour scheduling can sway project completion time within the Abuja metropolis BE in the appropriate direction. This is accentuated by its ranking of 9<sup>th</sup> and a mean score of 4.28. Asal (2014), shows that upgrade in the company's quality of planning and scheduling of projects is crucial to the performances of the BE. Ashwoth & Perera (2015), also noted that profitable firms continually increase their level of project planning and scheduling in order to curtail the upshot in the prices of construction materials. This is a necessity for the construction firms in Abuja metropolis as the inconsistencies in the prices of construction materials can endanger their level of profitability.

### 5. Conclusion and Recommendation

The study appraises the causes and effects of construction materials price fluctuation on BE project delivery in Abuja metropolis. This study concludes that overall, clear planning and strategy before starting a project, effective use of materials management policies, thorough crosschecking of estimated via the prevalent market conditions, competent leadership of the project manager, clear and unambiguous requirement of clients, proper communication and coordination among stakeholders, clients bidding document accuracy, and early project planning and labour scheduling are extremely consequential to the Abuja metropolis BE project delivery as depicted by their high mean scores. This study recommends that Abuja BE professionals must give these mitigating measures utmost consideration which require suitable management in planning, monitoring and controlling, in order to deliver project within the estimated time, cost, and specifications irrespective of the prevalent market conditions of the construction materials as enthused by the contingency and transaction cost theories. Consequently, government should endeavour to increase the production capacity of the local construction materials producing companies and ensures the stability of the exchange rate. The practical implication of this study is that, construction professionals can deliver projects to the complete satisfaction of all stakeholders within Abuja metropolis BE.

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