INFLUENCE OF MATERIALS PRICE FLUCTUATION ON PERFORMANCE OF BUILDING PROJECTS IN ABUJA, NIGERIA

The prevailing unpredictable and erratic price fluctuations of materials and less satisfactory practice of compensation are the major hindrances in the growth of the Nigerian construction industry. The rate of fluctuation claims on prices of materials is alarming. This leads to disputes in most building projects and usually affects the cost, time and even quality performance of building projects. Fluctuation in the cost of building materials poses a significant threat to both the building sector and people aspiring to own houses. The study assessed influence of materials price fluctuation on performance of building projects in Abuja, Nigeria by examining the causative factors and its effect on projects performance, the impact of materials price fluctuation claims on cost and time performance of building projects and established strategies for minimising the effects of materials price fluctuation. The study adopted a survey design approach using quantitative data. Data were collected through well-structured questionnaire administered on 189 respondents; also 23 archival data on material price fluctuation claims on completed building projects in the study area were obtained. The collected data were analysed using Percentages, Relative Important Index (RII), Mean Item Score (MIS) and Pearson Correlation Moment. Result reveals that the main factors responsible for material Price fluctuations are; Exchange rate of national currency, Cost of transportation, Inflation of building materials price, Cost of energy (electricity, gas). The result reveals further that materials price fluctuation claim positively correlates with total project cost and time with coefficient strength level (r value) of 0.95 and 0.62 respectively. It is recommended that drastic steps should be taken by the Government to stabilise exchange rate, reduce cost of energy, regulate cost of production, and contractors should also have appropriate planning, maintain current information, payments within stipulated time and understanding of project requirement. The study will help building construction contractors in making a logical contingencies decision on material prices.

INTRODUCTION

1.1 Background to the Study

Project performance can be assessed by the level of cost, time and quality of projects delivered to clients. Envisaging the performance of project is essential in order to guarantee acceptable standards and ensure quality. Therefore, it is important to be accustomed with the technique leading to evaluate building project performance (Iwaro & Mwasha, 2012).

However, price fluctuations of construction materials in today's unstable market make it difficult to carry out construction projects due to substantial losses of estimated profits which hinder the growth of the construction industry (Ayodele, 2011). The market price fluctuation and deficiencies of construction inputs are greatly hindering the growth of the construction industry, swift increases and falls in prices lead to failure to complete projects within the predetermined margin of time, quality, and planned cost (Zewdu & Aregaw, 2015).

Kasimu (2012) attributed that the consequences of integrated planning and implementability and fluctuation in market price of the inputs required for the construction are the primary problems of the construction industry. Anjiba and Adu (2018) cites a lack of ability to access sufficient working capital and poor workmanship and engineering competence as a major factor affecting the efficiency of projects in Nigeria. Aside from that, there are a range of difficulties including; high inflationary patterns which create an unpredictable market environment, poor organisation practices, weak organisation structures and difficulties in accessing project finance (Badu *et al*., 2012). Infrastructure plays a very important role in the growth process of an economy. In fact, development economists have considered infrastructure to be a precondition for industrialisation and economic development (Owolabi-Merus, 2015). Improving infrastructure is key to reducing poverty, increasing growth and achieving the Millennium Development Goals (MDGs). The need

for infrastructure development is indeed crucial for developing countries, especially Africa. The lack of modern infrastructure has been regarded as an impediment to economic development and a major constraint (Jerome, 2011).

Building materials play a crucial role in enhancing sustainability of buildings and contributing to economic wealth of the nation (Akadiri, 2011). Karana *et al.* (2010) indicated that stable market condition, in respect of the expertise involved in the building construction process, determines the strength, functionality and quality of the building. The prevailing unpredictable and erratic price fluctuations of materials, labour and equipment and less satisfactory practice of compensation are the major hindrances in the growth of the Nigerian construction industry; thus, the situation makes project owners sustain losses and suffering that could result therein (Iya & Aminu, 2014).

The study looked into the possible causes of material price fluctuation, the effect of materials price fluctuation factors on project performance, the impact of materials price fluctuation claims on the cost and timeliness of construction projects in Abuja, Nigeria and establish strategies for minimising the adverse effects.

1.2 Statement of the Research Problem

The prevailing unpredictable and erratic price fluctuations of materials, labour and equipment and less satisfactory practice of compensation are the major hindrances in the growth of the Nigerian construction industry; thus, the situation makes project owners sustain losses and suffering that could result therein (Iya & Aminu, 2014). Price fluctuation of materials in erecting building structures according to Oladipo and Oni (2012) affects housing cost and the economy resulting to low GDP. Kasimu (2012) attributed that the primary construction industry's problem can be divided into two major categories. The first is related to integrated planning consequences and implement ability, the second problem is related to market price fluctuation and deficiencies of the inputs needed for the construction. Hatamleh *et al.* (2018) added that materials price changes can have an impact on clients, contractors and the project itself, Among the different stake holders involved in the building sector, contractors are the ones at the front line to play the largest role in realising projects. Hence, on due course of their operation they are the ones to first face the problems and challenges encountered within the industry.

The rate of fluctuation claims on prices of materials is alarming. This causes disputes in most construction projects, affecting project timeliness, cost and even quality output. This constant claim may therefore be as a result of inadequate understanding of the strategies for minimising the adverse effects of materials price fluctuation. These concerns provide the basis for this study. The research would therefore, increase awareness among the project parties in the Nigerian construction industry.

1.3 Research Questions

To give direction to this study and achieve its objectives, the following research questions are asked:

i. What factors contribute to material price fluctuation in building construction projects?
ii. What are the effects of material price fluctuation factors on cost, time and quality performance of building projects?
iii. What impact do fluctuation claims have on building project time and cost performance?
iv. What strategy could be adopted to minimise the adverse effects of material price fluctuation on building projects?

1.4 Aim and Objectives

The aim of this research is to determine influence of materials price fluctuations on project performance with a view to minimising the resulting effects.

The objectives set towards achieving this aim are to:

i. Examine the factors responsible for material price fluctuation in building construction projects.
ii. Examine the effects of material price fluctuation factors on cost, time and quality performance of building projects.
iii. Determine the impact of materials price fluctuation claims on time and cost performance of building projects.
iv. Establish strategies for minimising the adverse effects of materials price fluctuation.

1.5 Scope of the study

This study covered material price fluctuation on the performance of building projects in Abuja, Nigeria, using quantitative research approach. Abuja was chosen since it is one of the urban cities in Nigeria that has a good number of construction activities, high concentration of built environment professionals including Architects, Quantity surveyors, Structural engineers and Builders. The study focused on small, medium and large building construction projects in Abuja that have used a significant amount of materials.

1.6 Justification for the Study

Building materials price fluctuation have resulted in dramatic performance of building projects in Nigeria. In this regard, efforts were made by several researchers to address the implication of material fluctuation. For example, Haruna *et al.* (2018) conducted a study on building materials price fluctuation in Adamawa state, Nigeria and noted that fluctuation in the cost of energy, the naira exchange rate was many of the elements for the unstable building materials cost in Nigeria.

Abiodun *et al.* (2017) identify influencing factors on performance of construction contractors in Akure, Nigeria and concluded that material prices escalation, Inadequate supply of materials and the project team leader motivating skills are the major factors. Anjiba & Adu (2018) Evaluate fluctuation claim risk on projects cost performance in the south region of Nigeria and concluded that a direct relationship exists between fluctuation cost and cost variation in the region as a result of changes in the basic prices of materials and labour.

However, none of the aforementioned authors have identified the influence of materials price fluctuation on performance of building projects. There has been no known research work seeking to identify the influence of materials price fluctuation on performance of building construction projects in Abuja, Nigeria.

This research gap will create awareness and provide understanding and guidance on the effective way to minimise the adverse effect of material price fluctuation and dispute in building construction due to material price fluctuations. The recommendations of this study, if appropriately employed would benefit the Quantity Surveyor in estimating and the construction industry at large. The study will also improve the performance and skills of contractors in the industry.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Price Fluctuation

The rise or fall in price of products, resources, and services on the market is referred to as price fluctuation. Price changes can occur in any economy, including foreign markets, local markets, and labour markets. The ins and outs for fluctuation are many, the major ones being Government's rules on price of oil, excess or shortage supply at market and decrease or increase in demand of some item (Oghenekevwe *et al.*, 2014).

2.1.1 Trend in price of building materials in Nigeria

The pace at which building materials prices fluctuates literally on daily basis as a result of the collective effect of high-interest rate, massive depreciation of naira is alarming. Jagboro & Owoeye (2004) noticed that surge in building materials prices will lead to construction costs fluctuation and subsequent projects abandonments. Other risks linked to regular increases in the cost of construction materials are poor workmanship. According to Long (2017) the domestic demand for cement is put at 18million metric tonnes annually, while the actual supply is 6.5million metric tonne of cement annually leaving a shortfall of 11.5million metric tonnes. The difference of about 11.5million tonnes of cement are being imported annually. This shortfall has always accounted for the galloping cost of cement every year. According to recent survey, Nigeria imports cement with about 55.5% dependence on importation (Oladipo & Oni, 2012). Straub (2011) observed that over the years, the costs of building materials exert an upward pull on the general level of total construction cost. However, most of the experts were of the opinion that the continued cost increase of construction to s greater extent, results from fluctuation in the costs of building materials (Stanley *et al*., 2014).

2.2 Performance of Building Projects

Cost, time and quality factors are the most important factors responsible for poor performance of projects in Nigeria (Elinwa & Joshua, 2001). Disputes can arise as a result of questions about contributing factors, understanding of contracts and the significance of the claims. Poor output in the building sector is obviously a source of leakage. The problem of project performance in Nigeria is severe, particularly given the country's current economic situation.

2.2.1 Quality performance

The totality of characteristics needed by a product or service to satisfy a specific need, or fitness for purpose, is known as quality performance (Wuni & Shen, 2020). In other words, in the construction industry, quality is measured by the ability to meet predetermined standards.

To complete a project that meets the owner's quality expectations, all project participants must be aware of them and incorporate them into the contract price and other contract documents (Ugwu & Haupt, 2007).

2.2.2 Time performance

Time output is critical for construction projects to be completed on time, since users, clients, stakeholders, and the general public typically view project success from a macro perspective, with the completion time appearing to be the first criterion for project success (Mo, 2016). Time variance is one technique for evaluating project performance in construction projects, and the factor of time may indicate to project managers that the project is not running as smoothly as planned (Salter & Torbett, 2003).

Furthermore, one of the most critical needs of clients in the construction industry is the timely completion of projects. Construction time is defined as the time elapsed between the start of site

work and the completion and handover of a building to the client. The construction time of a building is typically specified prior to the start of the project. Construction time may also be estimated using the client's brief or details gathered by the construction manager (Adedeji & Fa, 2012).

2.2.3 Cost performance

The degree to which general circumstances encourage the completion of a project within the projected budget is referred to as cost performance (Marovic *et al*., 2014). According to Salter and Torbett (2003), Cost variance is the most widely used method for assessing design efficiency. It encompasses not only the tender sum, but also the total cost of a project from start to finish, including any costs incurred as a result of variations, modifications made during construction, and costs incurred as a result of legal claims, such as arbitration and litigation. It can be calculated in terms of cost per unit, net variance over final cost (Muhwezi *et al*., 2014). Cost variance is a critical metric for assessing project success because it shows whether the project is on budget or not.

Client satisfaction is thus a critical problem for construction companies, which must continually strive to boost their efficiency in order to compete in the global marketplace.

2.3 Materials Price in Relation to Projects

The construction industry is a business sector, which carries out an enormous amount of revenue. Among the parties involved, contractors and consultants are purely of business organisations, the

others may or may not be of business organisations. Maximisation of profits is the contractor's main business goal. the goal of contractor is to make the positive difference between total cost and total revenues as large as it can (Hatamleh *et al*., 2011). And from the contractors and consultants, Contractors are the ones who have to tender for the majority of their jobs while also dealing with the challenges and risks that come with tender submission. Contractors are involved in a wide range of operations that are influenced by market conditions. In this regard, the overall market condition plays a role in influencing contractors in a variety of ways; capacity and performance being the vital ones (Rodrigues-da-Silva *et al*, 2014). This research, however, takes only the performance aspect for consideration. Contractors are directly linked with suppliers, sub-contractors and the labour force. In principle contractors cannot sustain and suffer permanently from price fluctuations on the market. The project owners or clients shall sustain such fluctuations.

2.4 Factors Responsible for Building Materials Price Fluctuation

Economic factors, stakeholder factors, building production related factors, and external factors have all been identified as contributing factors to fluctuation in building materials. (Mojekwu *et al*., 2013).

2.4.1 Economic related factors

The economic factors responsible for material price fluctuation in are:

2.4.1.1 Supply and demand

Demand and supply interaction, according to Shah (2019), plays a major role in the price of materials. When the economy is perfectly functioning and supply and demand at a given price are understood, the natural and reasonable inference is that the quantity supplied to the market would be identical to the quantity demanded. As a result, the price of goods supplied would be the same as the price of goods sold. There may be more products brought to the market at a given time and sold at such a price that not all of them are purchased by consumers. As a result, fluctuation puts the prices of these goods in jeopardy.

2.4.1.2 Energy costs

The non-monetary costs (such as the environmental impact) and monetary cost of energy production, transmission, and use. The prices of oil, energy bills, biomass, renewables, and other fuels change rapidly and are vital data points for people and business professionals alike (Kanimozhi & Latha, 2014). Building contractors and clients are frequently better prepared to make decisions if they have access to current price trend data.

2.4.1.3 Raw materials and input costs

Raw material expenses, according to Omotosho (2006), are the costs of the materials that go into a final produced product. They're one of three costs that go into a company's cost of goods sold (COGS). Labour costs and remuneration expenses are the other two. Because raw materials are used directly in the production of a product or the distribution of a service, they are classified as direct costs on an income statement. Raw material prices are called variable costs because they fluctuate with output volumes.

2.4.1.4 Inflation

According to Fichtner (2011), Inflation is a nominal measure of the rate at which an economy's overall price cost of a selected basket of materials and services rises over time. That's when the general level of prices rises to the point that a unit of currency buys less than it did previously. Inflation, which is often expressed as a percentage, denotes a decline in the buying power of a country's currency.

2.4.1.5 Crude oil prices

Crude oil is used to make a variety of items. These include transportation fuels like gasoline, diesel, and jet fuel, as well as heating and energy generation fuel oils. The spot price of different barrels of oil is measured by crude oil prices. Furthermore, according to Ftiti *et al*. (2011), The volatility of some building materials, such as PVC, a polymer whose raw material is crude oil, is primarily driven by the global crude oil price.

2.4.1.6 Exchange rates

The sum at which one currency is exchanged for the other is known as the exchange rate between two currencies, and it is used to determine the strength of one currency against another. The degree to which exchange rate fluctuations affect building material prices is determined by the types and quantities of materials imported by a country at a given time, the need to import raw materials used in the domestic manufacture of building materials, and whether locally produced materials (such as copper, timber, and steel) are internationally traded commodities (Kasimu, 2012).

2.4.1.7 Import duties

Import duty is a tax levied by a country's customs authority on imports and certain exports. The import duty is usually determined by the item's value. Import duty is also known as a customs duty, tariff, import tax, or import tariff, depending on the context. It is a method of adjusting a country's balance of payments (Stanley *et al*., 2014).

2.4.1.8 Interest rate

An interest rate is the amount of interest due per period expressed as a percentage of the amount lent, deposited, or borrowed (called the principal sum). The total interest on a lent or borrowed amount is determined by the principal amount, the interest rate, the frequency of compounding, and the length of time it is lent, deposited, or borrowed (Oladipo, 2012). It is known as the percentage of a loaned amount that a lender charges the borrower as interest, usually expressed as an annual percentage. It's the interest rate that a bank or other lender charges to borrow money, or the interest rate that a bank pays savers to keep money in an account.

2.4.1.9 Currency devaluation

Currency devaluation, according to Adamu (2013), is a deliberate reduction in the value of a country's currency in relation to another currency. Devaluation is a tactic used by monetary authorities to increase a country's trade balance by increasing exports at times when the trade deficit threatens the economy's growth. Following devaluations, the same quantity of a foreign currency buys more of the country's currency than before the devaluation. This ensures that the country's goods and services are likely to be cheaper in international markets, making them more attractive. When a government notices frequent capital outflows (or capital flight) from a nation, or if there is a large trade deficit, devaluation is typically the result (where the total value of imports outweighs the total value of exports).

2.4.2 Building production related factors

The following are the building production-related factors that influence the price of building materials:

2.4.2.1 Ordering and delivering process

The order-to-delivery process (ODP) is the primary method whereby contractors and consumers coordinate with suppliers, complete the final sale agreement, and receive payment. The ODP (order-to-delivery process), also known as the OCP (order-to-cash process), is a critical core business process in the construction industry. It's a contractor-facing procedure that's important for operational efficiency and customer satisfaction. Is it possible to differentiate and gain a competitive advantage through the order processing process? Yeah, most definitely. Firms should work to develop a standard ODP that results in efficient construction (Fagbenle *et al*., 2011).

2.4.2.2 Human factors

Human factors, according to Ihuah *et al.* (2014), are "environmental, organisational, career, and person characteristics that influence work behaviour in a way that can affect health and safety." This description considers three interconnected factors: the work, the person, and the organisation:

i. The job: including aspects such as task nature, workload, working climate, display and control design, and the function of procedures
ii. The individual: including his or her knowledge, abilities, personality, attitude, and risk perception. Individual attributes influence behaviour in a diverse way. Some characteristics, like personality, cannot be changed or improved; others, like skills and attitudes, can.

iii. The organisation: including job habits, organisational culture, personnel, communications, and leadership. These factors are often overlooked during job design, but they have a significant effect on individual and group behaviour.

2.4.2.3 Design changes

Changes in building projects will inevitably occur, and they cannot be prevented. Changes disrupt construction project efficiency, particularly in terms of time and expense. Changes in construction projects can be caused by a variety of factors, design change is one of the most important factors (Famiyeh *et al*., 2014). The owner, design manager, construction management consultant, and contractor are internal factors that influence design changes, while external factors include political and economic factors, the natural environment, technical advances, and third-parties.

2.4.2.4 Material wastage

Construction waste is any unused material that is produced during the construction process, either directly or inadvertently. This involves construction materials like nails, insulations, shingles, electrical wiring and roofing, as well as site planning waste like, tree stumps, dredging materials and debris. Many building waste materials, such as bricks, concrete, and wood, are lost or unused during construction for various reasons (Anjiba & Adu, 2018). According to observational analysis, this may account for as many as 10% to 15% of the total materials used in a house, a much higher percentage than the 2.5-5 percent commonly believed by the construction industry and cost estimators. Since there is so much variation between building sites, there is a lot of room for waste reduction.

2.4.3 Stakeholder related factors

The following are stakeholder-related factors that influence the price of building materials:

2.4.3.1 Supplier default

According to Nega (2008), the key cause of supplier default is that certain suppliers have a monopoly on the market by holding prices high and limiting production, demonstrating slight or no knowledge of customers need. According to the researchers, due to increased demand for certain construction materials, some manufacturers wait for a large number of orders to accumulate, causing difficulties in importing raw materials as well as increased exchange rates.

2.4.3.2 Transportation

According to Ogunbayo *et al*. (2016), transportation and logistics are at the heart of integrating supply chain management in the construction industry, which will give you a competitive edge. An efficient transportation and logistics system ensure that the right supplies arrive on schedule and at a lower cost.

2.4.3.3 Planning

Construction planning entails defining all of the steps needed to construct a building, dividing them into specified tasks, logically organizing these steps, and deciding the materials, manpower, and equipment required. Construction planners supervise the process of visualising a finished building and working backward to figure out how to get it done (Oghenekevwe *et al*, 2014).

2.4.3.4 Market stockpile

In the building industry, a market stockpile is a large supply of materials that has been accumulated in expectation of potential difficulties. One of the major causes of fluctuating material costs,

according to Rajaprabha *et al*. (2016) is industry stockpile; he attributed the fear of fluctuation to material reserves and a reluctance to send large quantities to the market despite surging prices that offer huge opportunity to drive up the price. The scarcity of materials increases as they are stockpiled, causing prices for those that are available to rise.

2.4.4 External factors

The external factors responsible for building materials price fluctuation are:

2.4.4.1 Force majeure

Force majeure is a French word that simply means "greater force," according to Zwedu (2015). It's similar to the idea of a natural disaster, such as a hurricane or tornado, for which no one can be held responsible. Human activities, such as conflict, are also covered by force majeure. In general, incidents that constitute force majeure must be unforeseeable, external to the contracting parties, and inevitable. Different jurisdictions identify and apply these principles differently.

2.4.4.2 Weather conditions

The state of the atmosphere in terms of temperature, wind, clouds, and precipitation are referred to as atmospheric conditions. Although building materials are an important part of any construction project, climate change would have an effect on the cost and use of building materials prior to and during construction, either directly or indirectly (Ofori *et al*., 2012).

2.4.4.3 Government policies

A government policy statement is a declaration of a government's political activities, plans, and intentions concerning a specific cause or, at the time of taking office, an entire legislative session.

In some countries, the head of government or a minister of parliament makes the announcement. (Ayodele, 2011).

2.5 Effects of Material Price Fluctuation Factors on Performance of Contractors

Economic effects, building output effects, stakeholders' effects, and external effects have been classified as the effects of material price fluctuation factors on contractor performance.

2.5.1 Economic related effects

The economic related effects of material price fluctuation factors on performance of contractors are:

2.5.1.1 Supply and demand

There may be more products brought to the market at a given time and sold at such a low price that not all of them are purchased by consumers, and vice versa. By so doing fluctuation threatens the prices of these materials, with a rise in demand; the price factors will dramatically decrease due to the high volume of materials needed to meet the demand. This trend is directly proportional to the cost and time of building project under construction (Onyechi, 2010).

2.5.1.2 Energy costs

According to Oyediran (2016), increasing energy costs have a knock-on impact on most construction material manufacturing operations, as suppliers are forced to raise building material prices to compensate for the energy costs.

2.5.1.3 Raw materials and input costs

Raw material costs, as well as other factors such as oil, gas, and electricity, are the main causes of price fluctuations in building materials such as roofing, cement, membranes, and water proofing. The cost of production has an effect on the product, either by raising or lowering the price or by lowering or raising the product's quality (Ugochukwu, 2015).

2.5.1.4 Inflation

Inflation is defined as the general upward trend in the prices of goods and services in a particular economy; it is a measure of how prices rise over time. According to Rakhra and Wilson (2017), the theory behind inflation and how it affects building material prices is that there is a time lag between an increase in inflation and the effective resulting increase in building material prices.

2.5.1.5 Crude oil prices

Bureau of Economic Research (BER) (2008) observed that in Nigeria, the Production Price Index (PPI) of various materials increased in tandem with increasing diesel costs. Oil rates, according to Ber (2008), affect 96 percent of transportation, resulting in higher material delivery prices. It also has an effect on 43% of industrial goods, 21% of residential and commercial use, and 3% of electricity. As a result, rising oil prices raise the cost of everything you buy, causing inflation.

2.5.1.6 Exchange rates

The extent to which exchange rate fluctuations affect building material prices is determined by the types and quantities of materials imported by a country at any given time, the need to import raw materials used in the domestic manufacture of building materials, and whether locally produced materials (such as copper, timber, and steel) are internationally traded commodities (Khumpaisal, 2007).

2.5.1.7 Import duties

Import duties are levied on goods and products imported into Nigeria to protect local manufacturers from clients looking for lower-cost goods from abroad. Import duties on building materials have been discovered to have an impact on building material prices in countries such as Nigeria, Malaysia, Uganda, India, Kenya, and Oman, by increasing the prices of products imported due to an imbalance in the import and export rates (Fitcner, 2011).

2.5.1.8 Interest rate

Bank interest rates are high, and the foreign exchange market is unpredictable, resulting in a serious depletion of a country's foreign exchange reserves, which has a negative impact on industry, which imports about 60% of its raw materials (Jagboro & Owoeye, 2004). Oladipo (2012), on the other hand, opined that due to a lack of capital or the skyrocketing cost of borrowing, many construction and lucrative real estate projects and housing have been placed on hold or abandoned halfway across the country. Apart from increasing the cost of borrowing, a high interest rate reduces spending because people are more likely to save. The interest rate set by the Central Bank of Nigeria in April 2018 was 14 percent.

2.5.1.9 Currency devaluation

Pinto *et al*. (2011) in his book "fixed price Vs. fluctuation" identified the major cause of fluctuation in building projects' cost as materials price increase which he pointed out "devaluation of naira" to be the cause and suggested price control as an obvious solution in controlling it. He expressed the view that in all his period of stay in Nigeria, he has only witnessed a case of reduced cost or price of material and part of the country in 2011, from his suggestion; one can deduce easily that

fluctuation cost in question is more of inflation. The research conducted by Mac-Barango (2013) showed that inflation in Nigeria was largely determined by the absence of fiscal prudence on the part of the government, parallel exchange rate shocks and outputs. Mac-Barango (2013) noted in their view and concluded that the backward- and forward-looking expectations, industrial output, net export, current money supply, changes in exchange rates were key determinants for inflation.

2.5.2 Building production related effects

The building production related effects of building material price fluctuation factors on contractors' performance are:

2.5.2.1 Ordering and delivering process

According to Lam *et al*. (2007), the manner in which the ordering and delivery of materials are done on site contributes to the problems of fluctuation in the cost of building projects. Ideally, site managers will require materials to arrive on site just when they are needed and in required quantity to avoid wastage in one hand and shortages on the other hand. He further pointed out that cost of storage and insurances, valuable working capital might become tied down in stock of materials. Briscoe added that when materials and component arrive late on site, costly delays in construction programme may result; hence the constructor could face the resulting labour cost which often would have been met which will result to extension of completion time.

2.5.2.2 Human factors

Material, machinery, and manpower are the three most common resources used in construction (3Ms). More threats are posed by labour than by building materials and machinery (Ihuah *et al*., 2014). Windapo & Cattell (2012) conducted a study to compare perceptions of the respondents to

factors that could affect future prices of building materials in Nigeria, labour cost was found to have the highest correlation with building material prices, followed by transportation cost. Notably, poor communication between management and labour can lower labour morale, lowering output while increasing project costs. Fagbenle *et al*. (2011) identified effective communication management as a critical factor in improving human resource management in construction. This highlights the importance of having an efficient and effective project manager whose role includes liaising between labour and management.

2.5.2.3 Design changes

Due to the absence of a thorough briefing on the project's economic, functional, and technical requirements by the clients, design changes are associated with additional work (Jari & Bhangali, 2013). According to Kulkami *et al.* (2017), design change orders leading in additional work can account for up to 50percent of cost overrun – a significant amount! Furthermore, in construction projects, additional work is a significant factor contributing to cost increases and schedule delays. Quantity surveyors' lack of satisfactory experience can be blamed for incorrect estimation methods (Jari & Bhangali, 2013). All of these factors, it is arguable, have a significant impact on material costs.

2.5.2.4 Material wastage

Akamoah *et al.* (2018) identified wastage of materials as one of the causes of building materials fluctuation in the construction industry. According to Hasmori *et al*. (2020), materials waste accounts for the bulk of building waste, owing to the use of non-reusable materials, leftovers, and debris. Unfortunately, approximately 9% of the total weight of materials purchased is wasted

(Nagapan *et al*., 2012). Mismanagement of materials during construction can drive up construction costs, whereas good material management can save a project a lot of money (Rammchandra, 2010).

2.5.3 Stakeholder related effects

The stakeholder related effects of building material price fluctuation factors on contractors' performance are:

2.5.3.1 Supplier default

According to the findings of Nega (2008) study, the second significant factor responsible for a rise in construction costs as interpreted by construction professionals interviewed was unethical activities by suppliers. Supplier unable to deliver due to market condition or fraudulent practices result in delay of construction, increase in cost and subsequently use of substandard materials.

2.5.3.2 Transportation

Increased transportation costs, according to Sinclair *et al.* (2002), are the primary cause of increased material costs. Furthermore, high transportation and loading and offloading costs have been described as factors causing price fluctuations in building materials in African countries including Nigeria, Uganda, and Kenya (Onokola & Olajide, 2020).

2.5.3.3 Planning

According to Olukoye *et al*. (2015), one of the most significant factors influencing building material costs is planning. Contractors should make the best use of all resources available to them. Proper scheduling is critical in project resource use, as insufficient planning will raise project costs,

implying that if there is no efficient contractor scheduling and planning on site, construction project delays will occur.

2.5.3.4 Market stockpile

According to Owolabi-Merus (2015), one of the major causes of fluctuating materials prices is market stockpile; he related the fear of fluctuation to material reserves and inability to send big amounts to the market amid soaring prices that provide massive incentive, causing the price to go higher. When supplies are stockpiled, inventory grows, causing prices to rise for those that are still affordable.

2.5.4 External factors

The external related effects of building material price fluctuation factors on contractors' performance are:

2.5.4.1 Force majeure

Revolutions, wars, riots, earthquakes, landslides, fires, political and economic turmoil, and other threats are examples of force majeure (Nega, 2008). The cost of building materials can fluctuate dramatically wherever it occurs, especially when rebuilding is considered.

2.5.4.2 Weather conditions

Weather shifts pose a significant threat to global warming by increasing CO2 emissions from buildings under construction and in use (Windapo & Cattell, 2013). Because the actual site conditions for a construction project are typically unknown until construction begins, certain

changes will occur as a result of adverse weather or changes in sub-soil conditions, and these changes may have a direct effect on the project because most construction is done outside.

2.5.4.3 Government policies

Governments can also use their authority to initiate or halt projects based on political, social, and environmental considerations resulting in material fluctuations (Muhwezi *et al*., 2014). Construction work does not take place in a single location; rather, it is governed by a variety of powers ranging from regulatory oversight to political interference. The shortage of proxy replacements for certain building materials is one of the external factors driving up the cost of construction materials.

2.6 Consequential Effects of Material Price Fluctuation on Building Project performance

According to Smith (2017), every project is a dream until it is completed and to that extent, the phenomenon of fluctuation will continue to be a dreaded but inevitable incursion into most project plans. Fluctuation he said is fallout of inflation adding that inflation is a global economic problem that has defied all theories and measures meant to curb it. In fact, experience has shown that some clients had abandoned their projects due to staggering increase in the cost caused by fluctuation or variation or both. Escalation in contract sums can emanate from several sources including fluctuations. Studies reported by Akinsiku & Akinsulire (2012) shows that the problem of contract cost overrun in Nigeria, and abandonment resulting thereof has reached a shocking stage ranging between 6.67% and 674.65% in an of average of 113.68%. This is worse for government contract where an average increase over contract sums of 186.37% was reported. He further showed that fluctuation was the major source of contract sum overrun accounting for 26.98% of such increase as he concludes his work on “Difference Between the initial and final contract sum of construction

projects. According to the US census Board of the commerce dept. (2005), spending on construction was estimated at a seasonally adjusted annual rate. of 1,108.5b, which is 6.1 percent above the last years rate, it added that although demand for new building projects is growing at a health but not at an excessive rate, construction cost has not demonstrated the same measured stability. External forces have also resulted in phenomenal rate increases for a wide range of integral construction raw material and service supplies. This fact is said to have made long-term cost projections more difficult than ever before. Long (2017) on his contribution pointed out that the economy is humanly regarded as suffering from fluctuation if it is undergoing a period of continuously rising and falling in price of goods and services. The upward and downward adjustment of prices is however subject to delays of varying duration. Prices may be deliberately held down in the short run by the authorities, or if demand is too large or great to be satisfied by current prices. Project abandonment, an increase in construction costs, an extension in the completion period, the use of substandard materials, and a decrease in the construction firm's revenue are all consequences of construction cost fluctuation (Gambo & Ashen, 2012).

2.6.1 Increase in project abandonment

The unplanned suspension of work progress, particularly at the implementation point, such as the refusal or inability to conclude a contract after the realistic completion period, is referred to as project abandonment (Nasar *et al*., 2003). Many building projects are temporarily or indefinitely abandoned, and according to Nasar *et al*. (2003), Many unfinished and abandoned projects are the result of financial and material crises. Fluctuation and the high cost of construction materials are major contributors to unfinished and substandard structures, which have a direct impact on housing delivery. Whereas Aluko (2008) stated the environmental consequences of abandoned projects and described such effects as flooding, traffic congestion, air and water contamination, drug abuse, and

health hazards in the neighbourhood. Furthermore, an increase in contract amount contributes to disputes between contractors and clients, which is likely to result in cases of abandonment where assets are tied down, since such project would not be put to use at the planned time.

2.6.2 Low volume of construction product

As compared to the construction industries of many developed countries, Nigeria's construction output is very poor. According to Ganiyu (2016), the Nigerian construction industry is facing a range of challenges, the majority of which are affecting the performance of its contractors in the delivery of sustainable housing. Similarly, Windapo & Cattell (2012) found that the unpredictability of building material prices is pricing millions of middles- and low-income families out of the home ownership market in Nigeria. The findings of these studies were caused by a rise in the cost of building materials. As of 2004, it has been reported that Nigeria has more than 17 million housing deficits.

2.6.3 Poor quality of workmanship

Lam *et al*. (2007), stated that one of the characteristics of a developed construction industry is the production of quality structures and buildings. The quality of construction work is assessed in accordance with the specifications of the relevant standard, and marks are assigned if the workmanship meets these standards (Choge & Muturi, 2014). Oladipo & Oni (2012) predicted great danger for the construction industry and the nation's economy in their research on the trend in the cost of building materials. The researchers also claimed that there were reports of disputes between clients and building contractors over contract amounts being reviewed, so in order to avoid conflicts and stay in business, some contractors used substandard or inadequate materials for construction projects, which led to cases of building collapse. Workmanship is undeniably

critical in project quality (Iwaro & Mwasha, 2012). As a result of rising building material costs, Akamoah *et al*. (2018) discovered poor quality workmanship and stifled creativity in construction methods. As a result of the studies, it was discovered that increases in the cost of building materials result in poor and inefficient rates of profitability for contractors, as attempts to balance out are made by using low quality workmanship, thereby prohibiting new developments in construction methods.

2.6.4 Unemployment of construction workers

Workers in the construction industry are enormously diverse, as the industry employs a wide range of both skilled and unskilled workers (Akamoah *et al*., 2018). According to Ayodele (2011), fluctuating building material costs are destroying the construction industry because many contractors are unable to provide accurate estimates of profit on a project, resulting in layoffs and, in certain instances, firm closure. According to Oladipo and Oni (2012), macroeconomic indicators have an impact on the cost of building materials, which has led to unemployment. According to Akanni *et al.* (2014), a decline in the jobs of labour workers in the construction industry is most likely to have an effect on the nation's gross domestic product (GDP), thus reducing the construction industry's contributions to the nation's economy.

Contractors, clients/owners, and the project itself may all be affected by price fluctuations. The following are the main consequences of price fluctuation on contractors that are not well paid (Ali & Kamaruzzaman, 2010): Profit loss of contractors, project's cash flow problem, project completion delay, poor quality of project outputs, bad contractor reputation (negative review), hindered adequate implementation of innovation by the contractor. According to Olabopo (2011), some of the confrontational consequences of material price fluctuation on contractors include a

rise in repair cost due to substandard products used by the contractor, a high incidence of contractors' fraudulent activities, a delayed investment return on construction projects, and dispute between client and contractors due to an unresolved contract amount.

2.7 Construction Claims

Construction contracts frequently result in claims between the parties. Delays, changes, unforeseeable circumstances, a lack of information, and conflicts can all contribute to this. Claims can be made for items like loss and cost, time extension, and liquidated damages. The contract should specify what constitutes a claim and how it should be handled. There may also be claims related to the hiring of consultants (Love *et al*., 2010).

2.7.1 Contractual claim

According to Ali & Kamaruzzaman (2010), contractual claim arises from the following: variations, extension of time, fluctuations, expense or loss due to the matters that affects regular progress of works. The claim also falls in specific clauses of contract. In standard of contracts that are well, lots of provision entitles both contractor and the employer to make claims for the proper reimbursement such as valuations, ground conditions, variations, late issue of information also delay in the inspection of executed work. Typical construction claims against owners, according to Badu *et al.* (2012) are triggered by a variety of factors like inadequate project planning, scope adjustments, constructive variation orders, mistakes and omissions, contract accelerations, and expediting.

2.7.2 Extra-contractual claims

This form of claim occurs as a result of a contract violation, which may be express or implied, and has no clear contractual grounds. Extra work incurred as a result of the employer's faulty material is one example of an extra-contractual argument.

2.7.3 Ex-gratia claims

Ex-gratia claims are those on which the contractor feels he has moral justification, such as extra expenses incurred as a result of rapidly increasing inflation, despite the fact that there is no basis in the contract or the law.

2.8 Types of claim

Claims have been a common phenomenon that occur among building team, most especially contractors, client, sub-contractor regarding the project performance. Expectation of owners, contractors, sub-contractors, architects, engineers, or material men may be disappointed and disputes may arise at any time between the first bid and last bill. When a contractor's, subcontractors, or other party's success is not compensated by timely payment by the owner, the owner takes a duty of non-performance.

Anjiba & Adu (2018) identified types of claims into four groups, as follows;

i. Change claims
ii. Delay claims
iii. Extra work claims
iv. Contractual claims

2.9 Strategies for Minimising the Adverse Effects of Price Fluctuation.

Even though price fluctuation cannot be accurately predicted, its impact can be minimised. According to Rammchandra (2010) some of the measures to minimizing adverse effect of material price fluctuation on contractors include; Maintaining current information, acceleration of design time, subdivide contracts to small ones at price more manageable. Fischtner (2011) noted that the use of contracting procedures that reduces the overall design–award–construction time, applying early corrective action and understanding project requirements and needs will reduce harsh effect of fluctuation on contractors. Recognising the severity and degree of fluctuation that have hindered the growth of Nigeria's construction industry, project owners are likely to provide contractors with payment protection (Ogbu, 2018). This enables contractors to establish a legal mortgage, providing them with strong backing to prevent untrustworthy owners from making timely fund payments (Ramachanda, 2010). According to Kashimu (2012), different strategies have been identified as follows; good leadership skills, minimising variation, having appropriate planning, timely documentation. In addition, risk management literatures suggest the following methods:

2.9.1 Adoption of value engineering concept

The first is to use the value engineering principle, which entails a thorough examination of each feature and the removal or alteration of something that increases the project's cost without increasing its functional capabilities. By carefully investigating prices, availability of materials, construction techniques, procurement costs, planning and scheduling, cost / benefit values, and other cost influencing products, an increase in the total cost of the project can be realised (Ibn-Homaid, 2002).

2.9.2 Comprehensive and error free designs and specifications

To deliver error free and comprehensive designs and specifications to avoid delay due to missing details or misinterpretations by the contractor, error free design and specification gives a blue print to all the parts which will be needed by the contractor to accurately keep him on tract to deliver the expected quality of the building construction thereby saving time and keeping the cost within the final contract sum Geoff (2008).

2.9.3 Reducing site wastes

Reducing waste on the job site by developing and implementing an effective material policy and material management. Cost-cutting steps include, according to Kasimu (2012), determining firmly the project's specifications and features before getting underway, getting members to sign off on capabilities and responsibilities to prepare the project team to do its best, maintaining vigilance in keeping the project on track by contract clauses that prohibit major changes once the project is underway.

2.9.4 Effective human resource management

Effective human resource management entails effective motivation and project tracking, which includes determining which areas or paths are dead ends and taking corrective action as soon as possible Idoro & Jolaiya (2010).

2.9.5 Improved financial utilisation of contractors

The contractor must locate and buy products that are likely to cause delays or run out of stock. Furthermore, the best defence against shocks is careful planning and continuous review of cash flows. Companies should also measure their profitability in relation to their goals on a regular basis (Mojekwu *et al*., 2013).

2.9.6 Improved contract procedures

Improved contract procedures are also thought to lessen the impact of market fluctuations, particularly price increases, on construction contractors (Nwachukwu *et al*., 2014):

i. Contract award time: Contract award and change order processes should be free of excessive administrative constraints.
ii. Keeping current information: Update control information on a regular basis with current prices, indexes, and patterns.
iii. Design time: To reduce total project time, expedite engineering/design activities.
iv. Subdivide contracts: The overall risk is minimised by splitting a huge risky endeavour into many smaller ones at manageable and predictable costs.
v. Payment: If payments are overdue, contractors can suffer greatly due to inflation and high interest rates. As a result, payments to contractors must be made quickly (Stukhart, 2012).
vi. Innovative contracting: Contracting procedures that reduce the overall design–award–construction time should be used. Such procedures could include beginning work with partial designs and utilising prequalified contractors on a cost-reimbursement basis while firm quantities and prices are negotiated later (Stukhart, 2012).

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Research Design

Research design according to Sridhar (2011) is a plan for conducting a study that maximises control over factors that could undermine the validity of the findings. Designing a study enables the researcher to plan and carry out the study in such a way that the intended results are obtained, increasing the chances of obtaining information that is relevant to the real situation.

The study adopted quantitative method. The nature of the research requires both well-structured survey questionnaire and archival project data in quantitative form.

3.2 Research Population

Population is defined as the aggregate or totality of all the objects, subjects, or members that meet a set of criteria (Blaxter *et al*., 2010). The unit of analysis may be an individual, a community, an organisation, a nation, an object, or any other entity from which you want to draw scientific conclusions (Blaxter *et al*., 2010). The targeted population for this research constitutes 250 building contractors within Abuja who are registered with Corporate Affairs Commission (CAC) through Vconnect which is the largest local search engine and Information service provider in Nigeria. Its objective is to bridge the gap between Information seeker and businesses by providing comprehensive information about businesses, products and services. Moreover only 23 of the population had historical records of cost and time claims due to material price fluctuation. Abuja was chosen as a study area in this context because it is one of the metropolitan cities of Nigeria that has a high presence of construction activities.

3.3 Sample Frame

According to Howell (2013), a sampling frame is the source material or system from which a sample is drawn. It was also claimed that it is a list of all those who can be sampled from a population, which could include individuals, families, or organisations. This is a part of the target population that is easily available (usually a list of contact information) from which a sample can be taken (Howell, 2013l). For the purpose of this study, the sample frame for this research consisted of registered building contractors working within Abuja.

3.4 Sample Size

According to Brink (2016), a sample size is a subset of a population, or a percentage of the total population chosen to participate in the study. The sample size, which is calculated by the sampling frame, is the number of observations used to measure estimates of a given population. This is a small subjects or event or objects taken from a large group called population or universe. This is a small group of subjects, events, or objects drawn from a larger group known as the population or universe. The population size for this study is 250 building contractors, and the sample size of the population was determined using the Morgan Table with a 5% limit of error and a 95% confidence level. This is reduced to 152 which show the minimum number of questionnaires to be administered, 189 questionnaires were administered which is the sample size for the study.

3.5 Sampling Technique

According to Blaxter *et al*. (2010), sampling techniques aid a researcher in selecting elements that make up a population. Probability sampling, in which each member of a given research population has a chance of being chosen, is one of the most popular methods. Such as stratified random

sampling, simple random sampling, systematic random, and cluster sampling methods (Kanika, 2015); and non-probability sampling, which entails a situation in which the population does not have an equal chance of selection.; rather, selection occurs based on some factor such as purposive sampling, quota sampling, convenience sampling, and so on (Kanika, 2015). It is virtually impossible to collect data from every single person in a given population of interest. Unless the study population is very small, a subset of the population known as a sample would be chosen, which must be general enough to apply to the entire population (Han *et al*., 2011). The selection of sample components that will provide a representative view of the whole is referred to as sampling technique (Han *et al*., 2011). A simple random sampling technique was adopted by assigning a consecutive number to the population (1-250), and then Pseudo Random Number Generator (PRNG) was used to generate a sequence of numbers in order to allow each set of data an equal chance of being selected within the population.

3.6 Method of Data Collection

Primary or secondary data can be used for research. Primary data are unprocessed information gathered through the use of a questionnaire, an interview, an observation, or a combination of all of these research tools. It is derived directly from different sources, including the respondent and the region under investigation. Secondary data are information that has been processed and is stored in a database for various purposes. They can be found in published materials and are only obtained for research purposes (Sekaran, 2010).

This study relied on primary data gathered from building construction contractors in Abuja through a well-structured questionnaire. The questionnaire includes tables and checkboxes to allow respondents to easily select choices. The questionnaire was designed in such a way that

respondents could choose from the response options presented. The questionnaire represents the study's main areas of interest, presenting information related to the study goals and answering the research questions. The questionnaire used a 5-point Likert scale to ask questions.

The questionnaire was divided into two (2) main sections: Section A - was related to demographic information of the respondents and their firms. Section B – was divided into four (4) parts: Part 1 - asked questions on factors responsible for material price fluctuation in building construction projects. Part 2 - asked questions about effects of material price fluctuation factors on performance of projects (cost, time and quality). Part 3 - asked questions about strategies for minimising the adverse effects of materials price fluctuation.

Also, 23 projects contractors out of the research population that keep record of fluctuation claims due to materials price changes, time extension due to material fluctuation claims were collected which was an archival record on fluctuation claims, initial and final contract sum; initial and final contract duration and time extension due to fluctuation claims were collected in table form (Table proforma).

3.7 Method of Data Analysis

Analysis of quantitative data can be categorised into two main branches, namely; the descriptive methods and the inferential. The descriptive methods describe the vital properties and characteristics of the data by utilising measures of central tendency such as mean/median/mode and measures of distribution such as standard, range, deviation and variance. Using tables, charts, and graphs, data may be accurately summarized and interpreted (Jackson, 2010).

Inferential statistics, on the other hand, is concerned with using data from a survey to draw conclusions about the wider population from which the sample was taken. Inferential statistics seek to draw conclusions from a study and generalise them to the entire population. Using probability theory, it analyses the probability of the sample's properties. Hypothesis checks and analysis of variance are the most commonly used methodologies (Jackson, 2010).

For the purpose of this research descriptive method of data analysis was first employed. Demographic information of respondents was analysed using frequencies percentages and tables.

The collected data on factors responsible for materials price fluctuation was analysed using Relative Importance Index (RII) to show relatively the importance of the fluctuation factors in building projects.

Materials price fluctuation factors effects on time, cost and quality performance of contractors were analysed using the Mean Items Score (MIS) to show the weighted average among the factors which will give premise for rankling the effects.

Finally, the strategies for minimising the adverse effects of materials price fluctuation on contractors was analysed using the Relative Important Index (RII) to determine the most effective strategy.

Also, Pearson Moment Correlation analysis was performed to determine the relationship between fluctuations claims and final contract sum; and time extension due to fluctuation claims and final contract durations.

3.7.1 Mean Item Score (MIS)

This method of analysis was employed in determining the materials price fluctuation factors on time, cost and quality performance of contractors, in determining the consequential effects of materials price fluctuation in project performance of contractors. The ranking assumes that the factor with the highest mean item score is ranked first, followed by others in descending order.

Since the data will be collected using a 5-point Likert scale, the formula for the mean item score is as follows:

$$\text{MIS} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{n_5 + n_4 + n_3 + n_2 + n_1}$$

Where n is the frequency of each rating, and

n_1 = the number of respondents who said “not applicable” or “strongly disagree.”

n_2 = the number of respondents who said "low" or "disagree"

n_3 = the number of respondents who said "moderately applicable" or "indifferent."

n_4 = the number of respondents who said "applicable" or "agree"

n_5 = the number of respondents who said "highly applicable."

Mean Items Score (MIS) was used to show the weighted average among the factors which will give premise for rankling the effects.

3.7.2 Relative Importance Index (RII)

The relative importance index was used to determine the importance of the known factors that cause material price fluctuation, as well as strategies for reducing the negative effects of material price fluctuation. The RII was used for two purposes: rating and determining the importance of various factors in the data collected.

The ground for the ranking is that the factor with the highest RII score is ranked first, followed by others in descending order.

The Relative Importance Index (RII) according to Megha & Rajivis (2013) is written as:

$$RII = \frac{\sum W}{A*N}$$

Where W is the weighting assigned by the respondents to each factor (ranging from 1 to 5), A is the highest weight, and N is the total number of respondents.

Relative Importance Index (RII) was used to show relatively the importance of the fluctuation factors in building projects.

3.7.3 Decision rules for the Likert scales

Morenikeji (2006), stated that, the outcome of Mean Item Score (MIS) on a Five-Points Likert scale could be decided on the following; 4.50-5.00 for Very High; 3.50-4.49 for High; 2.50-3.49 for Moderate; 1.50-2.49 for Little; 0.1-1.49, and Very Little. This was adapted and converted to RII on a scale 0 to 1.

Table 3.1: Decision Rule for MIS and RII

SN	Cut-off Point for MIS 5-Points	Cut-off Point for RII 5-Points	Decision
1	4.50-5.00	0.90-1.00	Very High (VH)

2	3.50-4.49	0.70-0.89	High (H)
3	2.50-3.49	0.50-0.69	Moderate (M)
4	1.50-2.49	0.30- 0.49	Little (L)
5	0.1-1.49	0.10-0.0.29	Very Little (VL)

Source: Morenikeji, 2006.

3.7.4 Correlation analysis

Correlation coefficient is defined as a measure of association between two variables that ranges from –1 to 1 (Fisher, 2015). The correlation coefficient would be either 1 or –1 if the two variables are perfectly linearly related. The sign is determined by whether the variables are associated positively or negatively. If there is no linear relationship between the variables, the correlation coefficient is 0. There are two kinds of correlation coefficients in use; the Pearson moment correlation coefficient is one, and the Spearman rank correlation coefficient is the other, both of which are based on the rank relationship between variables. The Pearson product-moment correlation coefficient is more commonly used to assess the relationship between two variables (Alfalou, & Brosseau, 2010).

For the purpose of this study, The Pearson moment correlation was used to determine the relationship between fluctuations claims and final contract sum; and time extension due to fluctuation claims and final contract durations. It can be calculated by the formula:

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2]\,[(n\sum y^2) - (\sum y)^2]}}$$

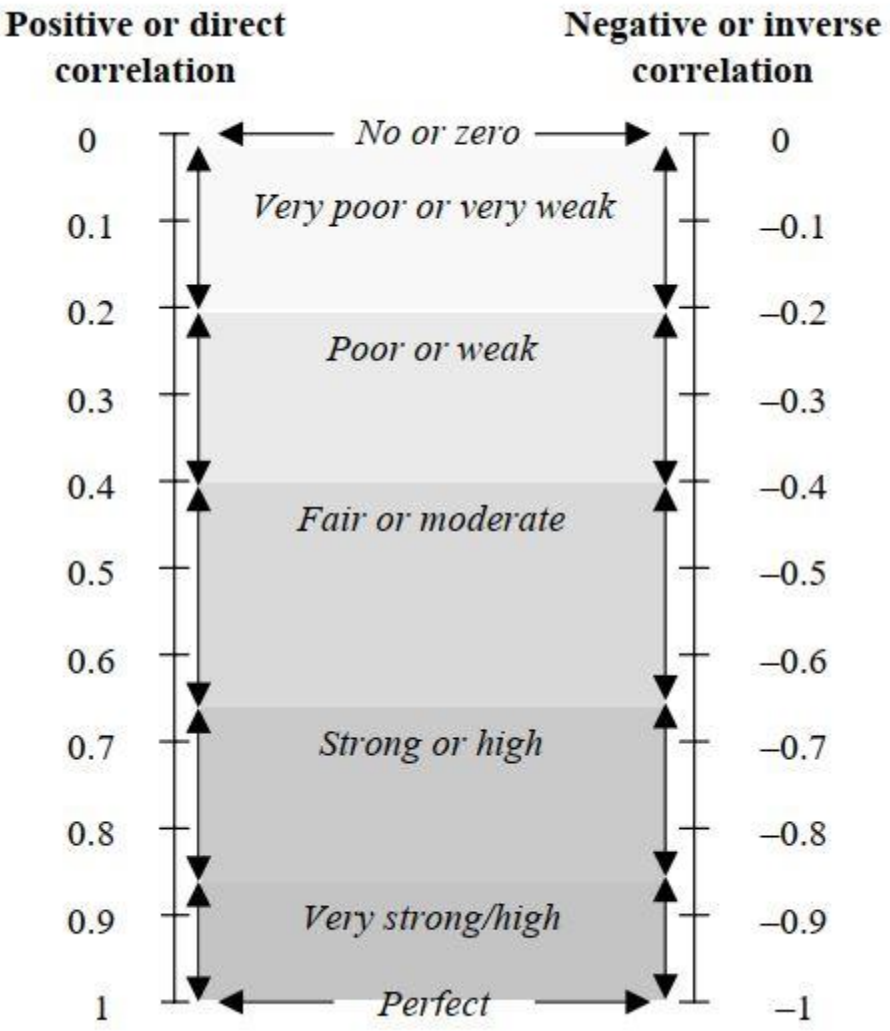
Where: r = Pearson correlation co-efficient

x = the dependent variable (final contract sum/time)

y= the independent variable (fluctuation claim due to material price changes)

n= number of data/observations (23)

Table 3.2: Decision Rule for Pearson Correlation Coefficient



Source: Alfalou and Brosseau, 2009.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Characteristics of Respondents

170 of the 189 questionnaires distributed to Abuja building contractors were returned, with 162 deemed suitable for analysis. Due to incorrect filling and vital missing information, the remaining 8 eight were dropped. The 162 questionnaires analysed had a response rate of 65 percent, which was deemed acceptable for this study.

Akintoye (2010) stated that a survey's results could be considered biased and of little significance if the response rate was less than 20-30%.

The characteristics of the respondents are shown in Table 4.1. According to the table, the respondents with the most years of experience were those with 11-20 years of experience (30.2%), followed by those with 6-10 years of experience (6-10 years) (24.7 percent). This shows that the majority of respondents have worked on large-scale building projects. The respondents' level of education was sampled in order to determine the highest ladder each of the respondents had reached. However, it was unsurprising that the majority of the respondents (24.1%) had a Bachelor's Degree, followed by 19.8% who had a Master's Degree. In terms of professional membership, 80% of respondents were members of their professional bodies, with just a small percentage of the population not belonging to any. As a result, respondents in this study had impressive academic backgrounds, as evidenced by either professional accreditation from professional institutes or academic achievement in recognised academic institutions; thus, their responses to the research questions can be trusted.

Table 4.1: Characteristics of Respondents

Category	Classification	Frequency	Percentage
Years of experience	1-5	24	14.8
	6-10	40	24.7
	11-15	49	30.2
	16-20	26	16.0
	Above 20	23	14.1
	Total	162	100.0
Highest range of contract sum involved in	1-10 Million	35	21.6
	11-50 Million	40	24.7
	51- 100 Million	45	27.8
	101- Above	42	26.0
	Total	162	100.0
Academic qualification	OND	18	11.1
	HND	30	18.5
	PGD	28	17.3
	B.Sc./B.Tech.	39	24.1
	M.Sc./M.Tech.	32	19.8
	PHD	15	9.3
	Total	162	100.0

Professional Qualification	MNIA	35	21.6
	MNIOB	31	19.1
	MNSE	36	22.2
	MNIQS	36	22.2
	None	24	14.8
	Total	162	100.0

Source: Researcher's field survey (2021).

4.2 Factors Responsible for Material Price Fluctuations in Building Construction Projects

A total of twenty-two factors were reported from the literature, and respondents were asked to rate them on a Likert scale of 5 to 1, with 5 indicating strong agreement and 1 indicating strong disagreement.

According to Table 4.2, the exchange rate of national currency, cost of transportation, inflation of building materials, and cost of energy (fuel, electricity, gas) were ranked as the top four significant factors responsible for material price fluctuations in building construction projects, with RII values of 0.95, 0.93, 0.92, and 0.91, respectively.

Though, with RIIs of 0.61, 0.56, and 0.53 respectively, frequent weather condition change, frequent design change, and material wastage on site are among the least rated factors responsible for building materials price fluctuation.

However, a close examination of the results in Table 4.2 reveals that all 22 of the listed 22 factors responsible for fluctuating building material prices had an average RII value of 0.77. This means

that, to a large degree, all 22 factors have a strong tendency to affect material prices during building construction.

Table 4.2: Factors Responsible for Material Price Fluctuations in Building Construction Projects

S/N	Material Price Fluctuations Factors	RII	RANK
1	Currency exchange rate	0.95	1
2	Transportation cost	0.93	2
3	Inflation of building materials	0.92	3
4	Energy cost (fuel, electricity, gas)	0.91	4
5	Government policies on materials	0.86	5
6	Import duties rates on materials	0.81	6
7	Raw materials and input costs of building materials production	0.80	7
8	Interest rate on materials	0.80	8
9	Political instability of the nation	0.77	9

10	Rapid devaluation of national currency	0.77	10
11	level of supply and demand	0.77	11
12	Unstable crude oil prices	0.76	12
13	Ordering and delivering process of building materials	0.75	13
14	Suppliers' capability on materials delivery	0.75	14
15	Availability of substitute product	0.74	15
16	Ineffective planning	0.72	16
17	Market stockpile of needed materials	0.71	17
18	Human factors	0.71	18
19	Force majeure (An act of God)	0.71	19
20	Frequent weather condition change	0.61	20
21	Frequent design changes	0.56	21

22	Material wastage on site	0.53	22

Source: Researcher's field survey (2021).

4.3 Effects of Material Price Fluctuation Factors on Cost Performance of Projects

Table 4.3 indicates how much each of the identified factors has effect on performance of projects (cost, time and quality).

The study reveals that inflation of building materials, import duty rates on materials, cost of transportation, exchange rates of currency and cost of energy (fuel, electricity, gas) has very high effect on cost performance of contractors with MIS value of 4.92, 4.87, 4.76, 4.72 and 4.50 respectively. While factors with the least effect on cost performance on contractors according to the table are: availability of substitute products and frequent weather condition change with MIS score of 3.13 and 2.76 respectively.

Table 4.3: Effects of Material Price Fluctuation Factors on Cost Performance of Building projects

S/N	Materials price fluctuation factors	MIS	RANK	Effects
1	Inflation of building materials	4.92	1	Very high effect
2	Import duty rates on materials	4.87	2	Very high effect
3	Cost of transportation	4.76	3	Very high effect

4	Exchange rates of currency	4.72	4	Very high effect
5	Cost of energy (fuel, electricity, gas)	4.50	5	Very high effect
6	Interest rate on materials	4.45	6	high effect
7	Rapid devaluation of national currency	4.42	7	high effect
8	Ineffective Planning	4.30	8	high effect
9	Material wastage on site	4.21	9	high effect
10	level of supply and demand	4.00	10	high effect
11	Unstable crude oil prices	3.98	11	high effect
12	Raw materials and input costs	3.81	12	high effect
13	Market stockpile of needed materials	3.80	13	high effect
14	Human factors	3.76	14	high effect
15	Ordering and delivering process	3.71	15	high effect

16	Force majeure (An act of God)	3.68	16	high effect
17	Political instability of the nation	3.55	17	high effect
18	Government policy	3.52	18	high effect
19	Suppliers default	3.39	19	Moderate effect
20	Frequent design change	3.16	20	Moderate effect
21	Availability of substitute product	3.13	21	Moderate effect
22	Frequent weather condition change	2.76	22	Moderate effect

Source: Researcher's field survey (2021).

4.4 Effects of Material Price Fluctuation Factors on Time Performance of Building Projects

The study reveals in Table 4.4 that market stockpile of needed materials, ineffective planning, level of supply and demand and ordering and delivering process are the factors that have most effects on time performance of building projects with MIS score of 4.84, 4.61, 4.55 and 4.52 respectively. However unstable crude oil prices and raw material and input cost are the factor that has little effects on projects time performance with MIS score of 3.13 and 3.07 respectively.

Table 4.4: Effects of Material Price Fluctuation Factors on Time Performance of Building Projects

S/N	Materials price fluctuation factors	MIS	RANK	Effects
1	Market stockpile of needed materials	4.84	1	Very high effect
2	Ineffective planning	4.61	2	Very high effect
3	Level of supply and demand	4.55	3	Very high effect
4	Ordering and delivering process	4.52	4	Very high effect
5	Suppliers capability on materials supply	4.43	5	High effect
6	Cost of energy (fuel, electricity, gas)	4.43	6	High effect
7	Inflation of building materials	4.25	7	High effect
8	Cost of transportation	4.00	8	High effect
9	Political instability of the nation	3.99	9	High effect
10	Availability of substitute product	3.88	10	High effect
11	Exchange rate	3.84	11	High effect

12	Human factors	3.55	12	High effect
13	Frequent weather condition change	3.54	13	High effect
14	Government policies on materials	3.45	14	Moderate effect
15	Frequent design changes default	3.44	15	Moderate effect
16	Force majeure (An act of God)	3.41	16	Moderate effect
17	Increasing interest rate	3.39	17	Moderate effect
18	Rapid devaluation of national currency	3.37	18	Moderate effect
19	Material wastage on site	3.36	19	Moderate effect
20	High import duties rates on materials	3.30	20	Moderate effect
21	Raw materials and input costs	3.13	21	Moderate effect
22	Unstable crude oil prices	3.07	22	Moderate effect

Source: Researcher's field survey (2021).

4.5 Effects of Material Price Fluctuation Factors on Quality Performance of Building Projects

Table 4.5 also reveals that material price fluctuation factors with most effect on quality performance are: raw materials and input costs, cost of energy (fuel, electricity, gas), Inflation of building materials and planning with MIS score of 4.01, 3.98, 3.96, 3.95 and 3.82 respectively. However, ordering and delivering process and frequent design change were raked low with MIS score of 1.68 and 1.69 respectively.

Table 4.5: Effects of Material Price Fluctuation Factors on Quality Performance of Building Projects

S/N	Materials price fluctuation factors	MIS	RANK	Effects
1	Raw materials and input costs	4.01	1	High effect
2	Cost of energy (fuel, electricity, gas)	3.98	2	High effect
3	Inflation of building materials	3.96	3	High effect
4	Exchange rate of currency	3.95	4	High effect
5	Ineffective planning	3.82	5	High effect
6	Cost of transportation	3.80	6	High effect

7	Increasing interest rate	3.73	7	High effect
8	High import duties rates on materials	3.66	8	High effect
9	Force majeure (An act of God)	3.65	9	High effect
10	Political instability of the nation	3.57	10	High effect
11	Rapid devaluation of currency	3.51	11	High effect
12	Government policies on materials	3.47	12	Moderate effect
13	Human factor	3.34	13	Moderate effect
14	Unstable crude oil prices	3.32	14	Moderate effect
15	Market stockpile of needed materials	3.30	15	Moderate effect
16	level of supply and demand	3.11	16	Moderate effect
17	Availability of substitute product	3.04	17	Moderate effect
18	Frequent weather condition change	2.89	18	Moderate effect

19	Material wastage on site	2.71	19	Moderate effect
20	Frequent design change	2.71	20	Moderate effect
21	Ordering and delivering process	1.68	21	Little
22	Suppliers default	1.39	22	Very Little

Source: Researcher's field survey (2021).

4.6 Effects of Material Price Fluctuation Factors on Performance of building Projects (cost, time and quality)

Table 4.6 shows responses on effects of materials price fluctuation factors on performance of building projects (cost, time and quality), which includes: inflation of building materials (4.38), cost of energy (4.30), planning (4.24), cost of transportation (4.19) and exchange rate of currency (4.17) are the factors with most effect on building project performance.

Table 4.6: Effects of Material Price Fluctuation Factors on Performance of Building Projects (cost, time and quality)

S/N	Materials price fluctuation factors	Cost		Time		Quality		Average		Effects
		MIS	Rnk	MIS	Rnk	MIS	Rnk	MIS	Rnk	
1	Inflation of building materials	4.92	1	4.25	7	3.96	3	4.38	1	High effect
2	Cost of energy (electricity, gas)	4.50	5	4.43	5	3.98	2	4.30	2	High effect
3	Planning	4.30	8	4.61	2	3.82	5	4.24	3	High effect
4	Cost of transportation	4.76	3	4.00	8	3.80	6	4.19	4	High effect
5	Exchange rate of currency	4.72	4	3.84	11	3.95	4	4.17	5	High effect
6	Market stockpile of needed materials	3.80	13	4.84	1	3.30	15	3.98	6	High effect
7	Import duties rates on materials	4.87	2	3.30	20	3.66	8	3.94	7	High effect
8	level of supply and demand	4.00	10	4.55	3	3.11	16	3.89	8	High effect
9	Interest rate on materials	4.45	6	3.39	17	3.73	7	3.86	9	High effect
10	Rapid devaluation of currency	4.42	7	3.37	18	3.51	11	3.77	10	High effect
11	Political instability of the nation	3.55	17	3.99	9	3.57	10	3.70	11	High effect
12	Raw materials and input costs	3.81	12	3.13	21	4.01	1	3.65	12	High effect
13	Force majeure (An act of God)	3.68	16	3.41	16	3.65	9	3.58	13	High effect
14	Human factors	3.76	14	3.55	12	3.34	13	3.55	14	High effect
15	Government policies on materials	3.52	18	3.45	14	3.47	12	3.48	15	Moderate effect
16	Unstable crude oil prices	3.98	11	3.07	22	3.32	14	3.46	16	Moderate effect
17	Material wastage on site	4.21	9	3.36	19	2.71	20	3.43	17	Moderate effect
18	Availability of substitute product	3.16	20	3.88	10	3.04	17	3.36	18	Moderate effect
19	Ordering and delivering process	3.71	15	4.52	4	1.68	21	3.30	19	Moderate effect
20	Frequent design changes	3.13	21	3.44	15	2.71	19	3.09	20	Moderate effect
21	Suppliers default	3.39	19	4.43	6	1.39	22	3.07	21	Moderate effect
22	Frequent weather condition change	2.76	22	3.54	13	2.89	18	3.06	22	Moderate effect

Source: Researcher's field survey (2021).

4.7 Impact of Materials Price Fluctuation Claims on Cost Performance of Building Projects

The correlation analysis performed to assess the relationship between materials price fluctuation claim amount and overall project cost is shown in Table 4.7, and it reveals a very strong, positive

correlation with a strength level (r value) of 0.95. This means that persistent fluctuations in material costs would result in a related rise in the final project cost.

Furthermore, the impact of fluctuations claims on total project costs ranges from 0.48 percent to 7.02 percent, with an average of 3.75 percent.

Table 4.7: Impact of Materials Price Fluctuation Claims on Cost Performance of Building Projects

A	X	Y	Percentage Contribution

S/N	(Initial project cost)	(Final project cost)	(Material fluctuation claims)	X^2	Y^2	XY	amount of claim to final cost
1	36.89	42.73	1.48	1826.02	2.19	63.24	3.46
2	92.00	100.30	0.48	10060.14	0.23	48.14	0.48
3	40.98	46.10	2.36	2125.19	5.55	108.57	5.11
4	46.08	51.84	1.50	2687.81	2.25	77.77	2.89
5	45.51	49.20	1.80	2420.77	3.24	88.58	3.66
6	213.65	250.00	6.08	62500.00	36.97	1520.02	2.43
7	276.93	301.50	3.12	90902.53	9.73	940.68	1.03
8	87.30	116.10	5.17	13479.21	26.71	600.00	4.45
9	14.20	19.80	1.25	392.04	1.57	24.83	6.33

10	20.10	25.79	0.27	665.07	0.07	6.91	1.04
11	6.79	8.99	0.40	80.85	0.16	3.57	4.42
12	87.38	106.14	2.56	11264.85	6.55	271.71	2.41
13	142.00	150.13	6.80	22537.58	46.24	1020.85	4.53
14	130.61	155.63	8.09	24219.14	65.42	1258.70	5.20
15	48.26	66.76	4.20	4456.30	17.64	280.37	6.29
16	35.00	40.05	2.00	1603.67	4.00	80.09	4.99
17	1,380.00	1500.00	36.28	2250000.00	1316.24	54420.03	2.42
18	22.23	28.23	1.68	796.73	2.82	47.42	5.95
19	19.23	31.33	2.20	981.27	4.84	68.92	7.02
20	100.00	145.00	8.32	21025.00	69.22	1206.40	5.74
21	500.00	523.70	12.00	274261.69	144.11	6286.78	2.29

22	1,600.80	1790.00	28.00	3204101.43	784.03	50121.09	1.56
23	740.09	760.00	18.55	577600.53	344.10	14098.01	2.44
		$\sum X$ = 6309.30	**$\sum X$ = 154.59**	**$\sum X^2$= 6579987.83**	**$\sum Y^2$ =2893.89**	**$\sum XY$= 132642.68**	**Ave.= 3.75**

Source: Researcher's field survey (2021).

Applying the Pearson co-efficient correlation formula;

$$\text{Pearson Correlation coefficient } (r) = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][(n\sum y^2) - (\sum y)^2]}} = 0.95$$

4.8 Impact of Materials Price Fluctuation Claims on Time Performance of Building Projects.

The correlation analysis performed to determine the relationship between time extension due to material price fluctuation claim and final contract duration is shown in Table 4.8. The strength level (r value) of 0.62 indicates that there is a fair, positive correlation. As a result, time extensions due to material fluctuation claims will result in an increase in the overall project duration.

Moreover, the percentage impact of time extension due to fluctuations claims to a total project duration ranges from 7.87% to a maximum of 46.67% with an average of 27.27%.

Table 4.8: Impact of Materials Price Fluctuation Claims on Time Performance of Building Projects

S/N	A Initial project duration (weeks)	X Final project duration(weeks)	Y Time extension due to material fluctuation	X^2	Y^2	XY	Percentage Contribution time claim to final project duration

			claim (weeks)				
1	30	56	10	3136	100	560	17.86
2	22	36	6	1296	36	216	16.67
3	24	40	8	1600	64	320	20.00
4	24	42	12	1764	144	504	28.57
5	26	38	4	1444	16	152	10.53
6	12	20	8	400	64	160	40.00
7	22	28	4	784	16	112	14.29
8	32	44	5	1936	25	220	11.36
9	42	61	18	3721	324	1098	29.51
10	12	30	14	900	196	420	46.67
11	14	28	11	784	121	308	39.29

12	14	32	7	1024	49	224	21.88
13	28	38	3	1444	9	114	7.89
14	38	46	9	2116	81	414	19.57
15	30	38	6	1444	36	228	15.79
16	36	50	10	2500	100	500	20.00
17	52	72	15	5184	225	1080	20.83
18	32	40	6	1600	36	240	15.00
19	30	48	13	2304	169	624	27.08
20	24	39	10	1521	100	390	25.64
21	18	27	6	729	36	162	22.22
22	54	70	15	4900	225	1050	21.43
23	32	55	12	3025	144	660	21.82

	$\sum X$ =	**$\sum Y$=**	**$\sum X^2$=**	**$\sum Y^2$**	**$\sum XY$**	**Ave.=**
	978	**212**	**245556**	**=2316**	**=9756**	**27.27**

Source: Researcher's field survey (2021).

Applying the Pearson co-efficient correlation formula;

Pearson Correlation coefficient **(r)** $$\frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][(n\sum y^2) - (\sum y)^2]}} = 0.62$$

4.9 Strategies for Minimising the Adverse Effects of Materials Price Fluctuation on Building projects

Table 4.9 shows that the strategies considered to be very effective by the respondents were: having appropriate planning with RII rating of 0.99, maintaining current information (0.98), on time payments of funds (0.98), adoption of value engineering concept (0.97), improved financial utilisation of contractors (0.96), maintenance of control and effective administrative system (0.96), minimising variation (0.96) and understanding project requirements and needs (0.95).

However, the strategies considered to be less effective by the respondents were: Effective contractor and workers relationship (0.69) and reducing site wastes (0.68)

Table 4.9: Strategies for minimising the adverse effects of materials price fluctuation on building projects

S/N	Strategies	RII	RANK

1	Having appropriate planning	0.99	1
2	Maintaining current information	0.98	2
3	On time payments of funds	0.98	3
4	Adoption of value engineering concept	0.97	4
5	Improved financial utilisation of contractors	0.96	5
6	Maintenance of control and effective administrative system	0.96	6
7	Minimising variation	0.96	7
8	Understanding project requirements and needs	0.95	8
9	Use contracting procedures that shorten the overall design–award–construction time	0.86	9
10	Subdivide contracts to small ones at price more manageable	0.84	10
11	Good relationship with stakeholders	0.80	11

12	Accelerate design time	0.79	12
13	Timely documentation	0.78	13
14	Effective communication with workers and stakeholders	0.77	14
15	Good leadership skills	0.77	15
16	Effective human resource management	0.76	16
17	Comprehensive and error free designs and specifications	0.75	17
18	Applying early corrective action	0.73	18
19	Effective contractor and workers relationship	0.69	19
20	Reducing site wastes	0.68	20

Source: Researcher's field survey (2021).

4.10 Discussion of Findings

This section addresses the study's findings by relating them to current literature reviews.

4.10.1 Factors responsible for material price fluctuations in building construction projects

The top four important factors accountable for material price fluctuations in building construction projects, according to the study, are the exchange rate of national currency, cost of transportation, inflation of building materials, and cost of energy (fuel, electricity, gas). These findings confirmed the submissions of Hatamleh, *et al*. (2018) and Idoro & Jolaiya (2010) in the factors responsible for building materials price fluctuation. Thus, exchange rate of the national currency is a major factor because of its volatile nature which affects the cost of importing building materials as finished good or as raw material. When the local currency is strong, price tend to reduce and vice versa. Transportation was considered to be an important factor due to nature of roads, taxes and cost of energy in transporting materials to the needed locations which can fluctuate the cost of material supply. The finding also indicated that building materials inflation is a high factor in material price fluctuation; contractors are exposed to material inflation since it involves a truly excessive use of building materials for erecting building. Price stabilisation appears to be an uphill task given the current rate of inflation ravaging global economies, particularly in developing countries (Ihuah, 2014). The findings also identified cost of energy (fuel, electricity, gas) as an important factor because production and transportation cost which rest entirely on the use of energy has been accepted as a factor responsible for fluctuation in building materials costs in a developing country as Nigeria (Windapo & Cattell, 2012).

It was noted that material wastage on site was a low factor affecting building material price fluctuation this also align with Idoro & Jolaiya (2010).

4.10.2 Effects of material price fluctuation factors on performance of building projects (cost, time and quality)

In terms of the effects of material price fluctuation factors on cost performance of building projects, findings from the study reveal that, inflation of building materials, import duty rates, cost of transportation, exchange rates of currency and cost of energy has the most effect on cost. Inflation in cost of building materials has a great effect on cost performance since it involves an enormous use of building materials for erecting building. This agrees with Abiodun (2017) & Ayodele (2011) who stated that, as prices are inflated, different suppliers and manufacturer will set different prices depending on the type of strategies they want to adopt in profit making and to gain advantage over their competitor which leads to price fluctuation therefore having cost effects on projects during procurement. One of the primary goals in any economy is to reduce level of inflation as this will balance the cost of materials. Also, the findings identified import duties rates and exchange rates of currency on materials as factors with high effect on cost performance of building projects. These confirm the study of researchers such as (Kasimu & Akinsiku 2012) who discussed trade policy of import duties and interest rates on construction materials, since there are taxes imposed by the government on goods from other countries. Depending on the rates which materials are taxed and the current exchange rate, this will have effect on cost of imported goods as foreign materials are more desirable by many. Their study also suggests that clients are encouraged to support domestic market. Cost of energy (fuel, electricity, gas) and transportation cost was considered to be a factor that has high effect on cost performance of building projects because energy is the backbones of production, transportation and construction which changes in cost will have direct effect on the cost performance.

In terms of the effects of material price fluctuation factors on time performance of contractors, findings from the study reveal that, market stockpile of needed materials, planning, level of supply and demand and ordering and delivering process are the top ranked factors with the most effect on

time performance, this aligns with what Ayodele, (2011), Mac-Barango (2013) & Onyechi (2010) highlighted that materials delivery time, hoarding of materials, supplier capability and level of supply and demand not only have effect on cost but affects timing which will have great impact on project time performance. The study also reveals planning as a factor with high effect on time performance of projects, this agrees with MO (2016) and Owolabi-Merus (2015) who stated that contractors should make effective use of all resources, that proper scheduling and planning is critical in project resource utilisation, and that insufficient planning will result in time overlap.

In terms of the effects of material price fluctuation factors on quality performance of projects, findings from the study reveal that, raw materials and input costs, cost of energy (fuel, electricity, gas), Inflation of building materials and planning are the factors with major effects on projects quality performance. This was quite different from what was observed in the study of Adamu (2013) and Straub (2011), who noted that training/meeting, equipment and raw materials and assessment system in organisation were the factors with highest effects on quality performance.

However, the table reveals that material fluctuation factors with overall effect on contractors' performance (cost, time, quality) are: cost of transportation, Inflation of building materials, cost of energy (fuel, electricity, gas) and exchange rate of national currency while the factors with the least effects are frequent design change and ordering and delivering process.

4.10.3 Impact of materials price fluctuation claims on time and cost performance of building projects

According to the findings, constant fluctuation claims due to material prices will result in a corresponding increase in the final project cost. Furthermore, the impact of fluctuation claim on total project costs ranges from 0.48 percent to 7.02 percent, with an average of 3.75 percent and a

correlation value of 0.95. this shows that there is a direct relationship between materials price fluctuation claim sum and total project cost. Therefore, cost of project can be significantly explained by material price fluctuation claims in the study area.

In terms of time performance, the findings indicated that time extension due to fluctuation claims will lead to a corresponding increase in the final project duration. Moreover, the percentage impact of time extension due to fluctuations claims to a total project duration ranges from 7.87% to a maximum of 46.67% with an average of 27.27% and correlation value of 0.62. This shows that there is a direct relationship between time extension due to fluctuation claims and final project duration.

4.10.4 Strategies for minimising the adverse effects of materials price fluctuation on building projects

The strategies for minimising the adverse effects of materials price fluctuation were identified from several literatures and presented to be ranked, eighteen out of the 22 strategies listed were ranked as highly effective strategies, however the top ranked were; Having appropriate planning, maintaining current information, on time payments of funds, adoption of value engineering concept, improved financial utilisation of contractors, maintenance of control and effective administrative system, minimising variation and understanding project requirements and needs. Thus, to minimise adverse effect of material price fluctuation, contractors should have appropriate planning to be able to plan, organize, implement and monitor their project effectively. Maintenance of current information equips the contractors with the necessary tools and strategies to update control information continually with current prices, indices, and trends to curb the adverse effect of material price fluctuation. If payments are delayed, contractors can suffer greatly as a result of

fluctuation/inflation and interest rates. As a result, all payments to be made to the necessary parties must be completed as quickly as possible (Mojekwu *et al*., 2013). This finding is in line with Haruna *et al*. (2018) who concluded that value engineering is a concept that entails a careful analysis of each function and the elimination or modification of anything that increases the project's cost without increasing its functional capabilities. An improvement in the overall cost of the project can be realised by carefully investigating costs, availability of materials, construction methods, procurement costs, planning and organizing, cost / benefit values, and similar cost influencing items.

Furthermore, improved financial utilisation of contractors, maintenance of control and effective administrative system, minimising variation and understanding project requirements and needs were ranked very high as strategies for minimising adverse effect of material price fluctuation which corroborates with the study of (Famiyeh *et al*., 2017).

4.11 Summary of Findings

The summary of the findings made in this research work are as follows:

i. The major factors that influence the price of building materials are the exchange rate of the national currency, the cost of transportation, the inflation of building materials, and the cost of energy (fuel, electricity, gas).

ii. The material price fluctuation factors with the most effect on cost performance of building projects are: inflation of building materials, import duty rates, cost of transportation, exchange rates of currency and cost of energy

iii. The material price fluctuation factors with the most effect on time performance of building projects are: market stockpile of needed materials, planning, and level of supply and demand and ordering and delivering process.

iv. The material price fluctuation factors with the most effect on quality performance of building projects are: raw materials and input costs, cost of energy (fuel, electricity, gas), Inflation of building materials, and planning.

v. Fluctuation claims due to materials prices will lead to a corresponding increase in the final project cost and time of the building project.

vi. The top strategies to minimising the adverse effects of materials price fluctuation on contractors are: having appropriate planning, maintaining current information, on time payments of funds, adoption of value engineering concept, improved financial utilisation of contractors, maintenance of control and effective administrative system, minimising variation and understanding project requirements and needs.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This research set out to assess the factors of building materials price fluctuation and its effect on the performance of building projects, with a view to minimising the resulting effects. Using a survey and historic approach, in which registered building contractors in Abuja metropolis were sampled.

The study concludes that the major factors that trigger price fluctuations in building materials are the exchange rate of the national currency, transportation costs, inflation of building materials, and energy costs (fuel, electricity, gas).These factors have significant effects on building projects cost performance especially in the aspect of inflation of building materials, import duty rates, cost of transportation, exchange rates of currency and cost of energy, in terms of time performance of building projects: market stockpile of needed materials, planning, level of supply and demand and ordering and delivering process has the most effect. While raw materials and input costs, cost of energy (fuel, electricity, gas), Inflation of building materials, and planning has the most effects on quality performance of building projects. Also, Fluctuation claims due to materials prices will lead to a corresponding increase in the final project cost and time of the building project. These adverse effects can however be checked through; having appropriate planning, maintaining current information, on time payments of funds, adoption of value engineering concept, improved financial utilisation of contractors, maintenance of control and effective administrative system, minimising variation and understanding project requirements and needs are the most important measures.

5.2 Recommendations

As a result of the study's findings, the study recommends that:

i. The stability of the Naira exchange rate should be reinforced because instability in the Naira leads to instability in material prices, which affects business prospects.

ii. Clients and contractors can make efficient use of all available resources. Inadequate planning, on the other hand, would increase the project expense, implying that if there is no efficient contractor scheduling and planning on site, construction project delays will occur.

iii. Clients and contractors should be committed to undertake the project activities on time avoiding delays. It is observed that when time passes and projects delay, the magnitude and effect of price fluctuation (price increase) increases. Therefore, it is strongly recommended for the contractors to undertake their projects on time.

iv. Efforts should be made to maintain a stable inflationary trend in Nigeria, and the incessant price increases should be investigated.

v. The government should take immediate action to reduce import taxes, manufacturing costs, and transportation costs for building materials, as well as prioritise research into the development of local building materials.

vi. Furthermore, financial institutions should be encouraged to reduce interest rates paid on facilities obtained from banks or lending agencies as a matter of policy, since high interest rates can stymie investment in capital project growth.

vii. Update control information continually with current prices, indices, and trends. A comprehensive and reliable price database should be established by joint effort of all actors of the construction industry. The database should be updated regularly at short time interval to give realistic price data.

5.3 Contributions to Knowledge

The following are the research results' contributions to knowledge:

1. The study has provided a deeper understanding for construction professionals on the rate of fluctuations in figures while planning for contingencies.
2. The study has increased the understanding of policy makers on impact of exchange rate in infrastructure development.
3. The study has established the extent to which materials fluctuation claims can affect cost and time performance of a building project.
4. The study has established strategies for minimising the adverse effects of materials price fluctuation.

5.4 Areas for Further Studies

The study's findings can point the way for future research in the following areas:

i. The study was limited to building projects in the Abuja metropolis; further research could be conducted in other areas and states throughout the country.

ii. The study assessed the influence of materials price fluctuation on construction projects, further studies could also be conducted to cover a wider range of project stakeholders, such as the clients, consultants etc.

iii. Further studies could also be conducted by assessing the other factors influencing materials price fluctuations, in order to determine the most predominant.

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APPENDICES

Department of Quantity Surveying,

School Environmental Technology,

Federal University of Technology,

P.M.B. 65, Minna, Niger State.

Dear Participant,

Influence of Materials Price Fluctuation on Performance of Building Projects in Abuja, Nigeria

My name is OMEDE, Victor Odoma, a Master student of Department of Quantity Surveying, School of Environmental Technology, Federal University of Technology Minna, Niger State conducting a research on the above title.

I can assure you that the research data will only be used for academic purposes. Particular mentioning of names will not be required anywhere. Your open and prompt response is highly appreciated.

For any clarification on this questionnaire, please contact the researcher on: **08062925975**, or e-mail: omede2121@gmail.com

Thank you very much for your support.

OMEDE, Victor Odoma .
Department of Quantity Surveying,
Federal University of Technology Minna,
P.M B. 65, Minna.

Dr. Saidu, Ibrahim.
Project Supervisor

APPENDIX A

SECTION A: GENERAL INFORMATION

1. Name of the construction firm (optional)_____
2. Position in the firm_____
3. Years of experience in the construction industry: 1-5[ ] 5-10[ ] 11-15[ ] 16-20[ ] Above 20[ ]
4. Highest Qualification: ND [ ] HND [ ] PGD [ ] B.Sc. [ ] M.Sc.[ ]PhD [ ]
5. Professional Membership: None [ ] MNIA [ ] MNIOB [ ] MNSE [ ] MNIQS [ ]
6. What is the range of contract sums for the projects your firm had been involved in Naira?

1m – 10m [ ] 11m – 50m [ ] 51m – 100m [ ] 101 – 500m [ ] 500m – 1b [ ] Above 1b [ ]

SECTION B

Part 1: Which of these factors are responsible for material price fluctuation in building construction projects.

Using a scale of 1 – 5 where 5 = Strongly Agreed; 4 = Agreed; 3 = Neither agree nor disagree; 2 = Disagree and 1 = Strongly Disagreed. What are the factors responsible for material price fluctuations in building construction projects?

S/N	VARIABLES	5	4	3	2	1
1	level of supply and demand					
2	Market stockpile of needed materials					

3	Import duties rates on materials					
4	Cost of energy (electricity, gas)					
5	Frequent weather condition change					
6	Unstable crude oil prices					
7	Raw materials and input costs of building materials production					
8	Availability of substitute product					
9	Interest rate on materials					
10	Political instability of the nation					
11	Ordering and delivering process of building materials					
12	Human factors					
13	Frequent design changes					
14	Material wastage on site					

15	Suppliers default to make materials available at the needed time					
16	Exchange rate of currency					
17	Planning					
18	Inflation of building materials					
19	Force majeure (An act of God)					
20	Cost of transportation					
21	Government policies on materials					
22	Rapid devaluation of national currency					

Part 2: Which of these are the effects of material price fluctuation factors on performance of building projects (cost, time and quality).

Using a scale of 1 – 5 where 5 = Very high effect; 4 = High effect; 3 = Moderate effect; 2 = Little effect and 1 = Very little effect, kindly rate the level of the effects of material price fluctuation factors on performance of building projects (cost, time and quality).

		Time					**Cost**					**Quality**				
S/N	**VARIABLES**	**5**	**4**	**3**	**2**	**1**	**5**	**4**	**3**	**2**	**1**	**5**	**4**	**3**	**2**	**1**

1	level of supply and demand															
2	Market stockpile of needed materials															
3	Import duties rates on materials															
4	Cost of energy (fuel, electricity, gas)															
5	Frequent weather condition change															
6	Unstable crude oil prices															
7	Raw materials and input costs of building materials production															
8	Availability of substitute product															

9	Interest rate on materials															
10	Political instability of the nation															
11	Ordering and delivering process															
12	Human factors															
13	frequent design changes															
14	Material wastage on site															
15	Suppliers default to make materials available at the needed time															
16	Exchange rate of currency															
17	Planning															
18	Inflation of building materials															

19	Force majeure (An act of God)															
20	Cost of transportation															
21	Government policies on materials															
22	Rapid devaluation of national currency															

Part 3: What are the strategies for minimising the adverse effects of materials price fluctuation on building projects.

Using a scale of 1 – 5 where 5 = Strongly Agreed; 4 = Agreed; 3 = neither agree nor disagree; 2 = Disagree and 1 = Strongly Disagreed. What strategy can be used to minimise adverse effect of material price fluctuation on building projects?

S/N	**VARIABLES**	**5**	**4**	**3**	**2**	**1**
1	Adoption of value engineering concept					
2	Comprehensive and error free designs and specifications					

3	Reducing site wastes					
4	Effective human resource management					
5	Improved financial utilisation of contractors					
6	Maintenance of control and effective administrative system					
7	Maintaining current information					
8	Accelerate design time					
9	Subdivide contracts to small ones at price more manageable					
10	On time payments of funds					
11	Use contracting procedures that shorten the overall design–award–construction time					
12	Applying early corrective action					
13	Timely documentation					

14	Good relationship with stakeholders					
15	Having appropriate planning					
16	Understanding project requirements and needs					
17	Minimising variation					
18	Effective contractor and workers relationship					
19	Effective communication with workers and stakeholders					
20	Good leadership skills					

Is there any available link or strategy to minimise effects of materials price fluctuation on contractors? Please comment freely:

_____

_____

_____

_____