

# Effect of Cost Trend of Building Materials on Rental Values of Residential Properties In Enugu Metropolis, Enugu State, Nigeria From 2010-2022

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**Abstract:** This paper determined the effect of cost trends of building materials (cement, reinforcement bars (16mm, 12mm, 10mm and 8mm), river sand, plaster sand, quarry stone (12mm-19mm aggregate and 25mm aggregate) and blocks) on rental value of residential properties (single room apartment, single room apartment ensuite, one bedroom apartment, two bedrooms apartment and three bedrooms apartment) in Enugu State, Nigeria from 2010-2022. The study was conducted using existing literature and field survey. Market survey were conducted in the two major building material markets in Enugu State; Enugu South International Building Material Market (New Kenyatta) in Enugu South Local Government Area and Enugu East Building Material Market, Abakpa, in Enugu East Local Government Area. Questionnaires were sent to few construction professionals (Architects, Builders and Quantity Surveyors) to authenticate the data that were collected from the market survey, and interviews were conducted on Estate Surveyors and Valuers. The data were analyzed using the least square method of regression analysis. The investigations revealed that the selected building materials experienced rapid changes and significant increase in prices within the years under investigation (2010-2022) and the increase increased the cost of construction and rental values of a single room apartment, single room apartment ensuite, one bedroom apartment, two bedrooms apartment and three bedrooms apartment in Enugu Metropolis in Enugu State, Nigeria from 2010-2022. The study recommends appropriate legislation and enforcement to provide a lasting solution to bring about stable building material prices, conduct research to recognize new locally available building materials, encourage the manufacturing of building materials from locally available materials, encourage and provide incentives to, and create an enabling environment for stakeholders in the manufacturing of building materials.

**Keywords:** Cost, trend, Building materials, Rental values, Residential properties.

## I. Introduction

Construction projects involve extensive use of materials. According to Obiegbu (2003), the construction industry is vulnerable to cost in prices of materials. Materials need for construction works could amount to about 35 – 45 percent of the total project cost while in some other projects, it may be as high as 60 percent. Idoro and Jolaiya (2010) found that building materials alone account for 50% to 60% of project cost and controls about 80% of its schedule. Nwachukwu (2004) further explained that in most capital projects, materials account for more than 50 percent of their production cost. Materials resources are thus the heart and life wire of any construction system. This simply means that increase in cost of materials affects the total cost of construction and subsequently housing supply in no small measure.

Cost trends is thus, felt in the construction sector of the economy by the increase in construction material prices. These increase gives rise to cost overruns, claims, housing supply shortage leading to high cost of urban housing accommodation, construction cost estimate, losing usefulness within short periods, difficulty in forecasting and planning and frequent contract price variations, all of which often leads to project abandonment. (Nwuba, 2004). Cost trends effect on project appraisal is very significant, and could pose difficulties to property developers. In order to factor cost risk into pre-contract investment analysis, the appraiser thus requires an understanding of the relationship between cost trends and building material prices. The cost of building materials poses a significant threat to both the construction industry and people aspiring to own houses (Anosike, 2009; Mekson, 2008; Mohammed, 2008; Njoku, 2007). Supporting this view, Jagboro and Owoye (2004) earlier established that increase in the prices of building materials has multiplier effects on the industry while Idoro and Jolaiya (2010) affirmed that many projects were not completed on time due to the persistent high cost of materials.

Globalization and high returns on investment attracts investors to Nigeria, however, with the ravaging effect of persistent price increase in Nigeria, some of these investors are discouraged from investing in the

construction sector. For instance, a bag of 50kg cement, which is valued at N1,350.00 in 2006, goes as high as ₦1,850.00 in 2009 (Anosike, 2009) depicting about 37% increment; the bag goes as high as ₦2,000.00 in 2012 during the peak season (Akanni, Oke, and Omotilewa, 2014) and goes as high as ₦4,500 in early 2023. The increase has been noted to be high, hence, this work is aimed at investigating the effect of cost trends of building materials (cement, reinforcement bars (16mm, 12mm, 10mm and 8mm), river sand, plaster sand, stone/coarse aggregate (12mm-19mm aggregate and 25mm aggregate) and blocks) on rental value of residential properties (single room apartment, single room apartment ensuite, one bedroom apartment, two bedrooms apartment and three bedrooms apartment) in Enugu Metropolis, Enugu State, Nigeria from 2010-2022.

## **II. Factors Affecting the Cost of Building Materials**

Building materials were naturally occurring in the ancient times and had been playing an important role in the construction industry, for instance, stone, wood, straws, clay, lime, and brick (Akanni, Oke and Akpomiemie, 2014; Taylor, 2013). As the building techniques were improving, simple composite materials, combined by means of mixing and/or heat treatment were developed. A typical example is concrete. Due to advances in science and technology at the beginning of the 20th century, materials with better performance and durability were introduced, for example, reinforced concrete, steel, plastics, and metal (Taylor, 2013). Meanwhile, there are some established economic factors that contributes to the increase in building material prices. These are: Demand and supply, transportation, government policies, raw materials and input costs, inflation, crude oil price, exchange rate and import duties.

### **2.1 Demand and supply:**

According to Lipsey and Chrystal (2007), when the demand for building material is higher than the supply or when the material is not available to be supplied, it can contribute to increase in the prices of building materials. Orbals (2004) noted that the demand for cement and reinforcement bars has been on the increase with no matching supply to that effect.

### **2.2 Transportation:**

High transportation cost according to Sinclair, Artin and Mulford (2002) has also been attributed to the high cost of building materials. Mathews (2009), Mwijagye (2010) and Editor (2011) also supported the claim that increasing transportation and freight costs have been identified as one of the factors responsible for building material price increase in African countries such as, Nigeria, Uganda, and Kenya.

### **2.3 Government policies:**

Government policies set the economic environment in which all sectors operate including the building material sector. Government fiscal policies has been identified as one of the factors affecting the cost of building materials in Nigerian construction industry (Obadan, 2001; Adekoya, 2003).

### **2.4 Raw materials and input costs:**

Prior (2011) and Iyengar (2011) acknowledged that rising cost of raw and natural materials which include oil, gas and energy are some of the key causes of increase in the prices cement, roof members and water proofing.

### **2.5 Inflation:**

Inflation is the general upward trend of prices of goods and services within an economy, it is essentially a measure of how the prices of goods and services increase over time (Fichtner, 2011). One of the major constraints in the Nigerian construction industry today has been the rapid inflation in the cost of building materials. Windapo, Ogunsanmi, and Iyagba (2004) observed that the situations arising from the rapid increase in the cost of building materials may degenerate to acute shortages of housing with the millions of middles - and low-income families being priced out of the market for home ownership all across Nigeria.

### **2.6 Crude oil price:**

The global crude oil price is the main driver behind the volatility of some materials such as PVC, which is a polymer whose raw production material is crude oil.

### **2.7 Import duties:**

Import duties are charges on goods and products brought into the country. They are put in place to protect local producers from clients trying to outsource cheaper goods from overseas. Import duties on materials have been noted to affect the construction industry and building material prices in so many countries including Nigeria.

## **2.8 Exchange rate:**

The degree to which building material prices are affected by exchange rate depend on the types and quantities of materials being imported at a specific time, the need to import the raw materials for production of building materials locally, and whether local materials (such as copper, timber and steel) are internationally traded commodities (Busreport, 2006; and Mohamed, 2006). Some building construction materials and their components are source from overseas. Likewise, some of the materials produced locally also depend to some extents on foreign inputs. According to Oyediran and Odeniyi (2009), import-dependent materials are subject to foreign exchange, Fluctuations and inflations from the economy of the country where those materials were imported. Oyediran and Odeniyi (2009) further explained that the over dependence of Nigeria on importation has not changed rather the dependence on foreign materials is on the increase. It requires huge capital in foreign currencies to procure these resources; therefore, any variation in the Naira-foreign currency value is bound to have a negative or positive effect on the prices of these products.

### **III. Implications of Rising in the Cost of Building Materials**

Fluctuation in construction costs and the eventual abandonment of projects, completion at the expense of other projects, delay in progress of project works, valuable projects not being commissioned, low rate of employment of construction workers, poor workmanship as a result of the use of low-quality materials, and inhibited innovations in construction methods and material research were identified by Aibinu and Jagboro (2002); Jagboro and Owoeye (2004); Idoro and Jolaiya (2010) and Oladipo and Oni (2012) as the possible implications of the rising cost of building materials.

#### **3.1 Quality of workmanship is affected:**

According to Lam, Chan, Wong, and Wong (2007), one of the hallmarks of a developed construction industry is in the output of quality buildings and structures. The quality of workmanship in construction work is assessed according to the requirement of the relevant standard, and marks are awarded if the workmanship complies with the standard (Construction Industry Development Board, 2011). The study of Oladipo and Oni (2012), which reported the trend in the cost of building materials has envisaged great danger for the construction industry and the nation's economy in that, there were instances of conflicts between building contractors and their clients over upward review in contract sum, and in an attempt to avert such conflicts and remain in the business, some contractors resorted to the use of substandard or insufficient materials for construction projects, which had contributed to cases of building collapse in the nation.

#### **3.2 Risk of project abandonment:**

Abandonment of projects has become a national menace in Nigeria's infrastructural development as most clients are not adequately advised about the financial implications of the project to be embarked on (Ayodele and Alabi, 2011; Idoro and Jolaiya, 2010). According to these authors, the predominance of many uncompleted and substandard buildings was connected to the inflation and high cost of building materials. Their studies also affirmed that the situation has a multiplier effect on the industry and has led to fluctuation in the construction cost.

#### **3.3 Volume of construction output is affected:**

According to Fagbenle, Adeyemi, and Adesanya (2004), the output of the construction industry in Nigeria is quite low when compared with construction industry of many developed countries.

#### **3.4 Rate of employment is affected:**

The construction industry's workforce is extremely diverse and includes different types of individuals working within construction such as unskilled workers, skilled workers, craft, managerial roles, and administrative workers. Maintaining and attracting the right people within the construction industry is a priority due to the scarcity of both skilled people and experienced managers. Ayodele and Alabi (2011) found that inflation in the costs of building material is killing the construction industry as many contractors are unable to forecast accurately the expected profit on the project, and the situation had contributed to laying-off of the workers and closure of firms in some extreme cases.

### **IV. Methods and Data Used**

The selected building materials that were investigated in this work are; cement, reinforcement bars (16mm, 12mm, 10mm and 8mm), river sand, plaster sand, quarry stone (12mm-19mm aggregate and 25mm aggregate) and blocks from the year 2010 to 2022 and the effect of cost trend on the rental values of a single room apartment, single room apartment ensuite, one bedroom apartment, two bedrooms apartment and three bedrooms apartment in Enugu Metropolis in Enugu State, Nigeria.

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The objective of this research was achieved through the review of existing literature and field survey. Market survey were conducted in the two major building material markets in Enugu State; Enugu South International Building Material Market (New Kenyatta) in Enugu South Local Government Area and Enugu East Building Material Market, Abakpa in Enugu East Local Government Area. Questionnaires were sent to few construction professionals (Architects, Builders and Quantity Surveyors) to authenticate the data that were collected from the market survey and interviews were conducted on Estate Surveyors and Valuers. The lowest and highest prices of each of the selected building materials were collected for each of the year under research and their average prices were determined. The average annual rental values of residential buildings (single room apartment, single room apartment ensuite, one bedroom apartment, two bedrooms apartment and three bedrooms apartment) were also collected. The data collected were analyzed using the least square method of regression. The lowest and highest prices of the selected building materials and their average prices from 2010-2022 are presented in Tables 1 to 5, while the average annual rental values of residential buildings in Enugu metropolis from 2010 – 2022 are presented in Table 6. The data in Tables 5 and 6 were used for the regression analysis.

**Table 1:** Prices of 50kg Cement and 225mm Sandcrete Block in Enugu State, Nigeria

Years	Prices of Cement (₦)		Average Prices of Cement (₦)	Prices of Block (₦)		Average Prices of Block (₦)
	Lowest	Highest		Lowest	Highest	
2010	1450	1500	1475	90	100	95
2011	1450	1700	1575	90	100	95
2012	1500	1750	1625	90	100	95
2013	1450	1680	1565	85	110	97.5
2014	1350	2100	1725	110	110	110
2015	1780	1850	1815	110	120	115
2016	1480	2450	1965	120	120	120
2017	2450	2820	2635	130	140	135
2018	2350	2430	2390	130	140	135
2019	2300	2450	2375	140	140	140
2020	2330	2500	2415	140	160	150
2021	3240	3650	3445	160	180	170
2022	3600	4400	4000	220	260	240

Source: Researchers Field Survey (2023). ₦ = Naira.

**Table 2:** Prices of Reinforcement Bars in Enugu State, Nigeria

Years	Prices of Reinforcement (₦)											
	16mm		Avg (₦)	12mm		Avg (₦)	10mm		Avg (₦)	8mm		Avg (₦)
	Lowest	Highest		Lowest	Highest		Lowest	Highest		Lowest	Highest	
2010	1950	2050	2000	1120	1140	1130	900	950	925	650	750	700
2011	2160	2350	2255	1200	1400	1300	950	970	960	780	800	790
2012	2250	2350	2300	1450	1600	1525	900	1100	1000	800	800	800
2013	1950	2250	2100	1100	1280	1190	880	930	905	620	700	660
2014	1860	2150	2005	1060	1230	1145	770	940	855	600	700	650
2015	2950	3200	3075	2050	2200	2125	1500	1600	1550	900	1000	950
2016	3300	3400	3350	1950	2400	2175	1050	1700	1375	1000	1150	1075
2017	2920	3200	3060	1700	1800	1750	1200	1350	1275	900	1000	950
2018	3500	3600	3550	2500	2600	2550	1900	2000	1950	1200	1300	1250
2019	3800	3900	3850	2380	2900	2640	2200	2400	2300	1500	1650	1575
2020	3800	3950	3875	2600	3640	3120	1950	2640	2295	1650	1750	1700
2021	4500	7000	5750	3000	4450	3725	2500	2900	2700	1750	2000	1875
2022	5700	8300	7000	3500	4350	3925	2800	3550	3175	2200	2400	2300

Source: Researchers Field Survey (2023). Avg = Average, ₦ = Naira.

**Table 3:** Prices of Sand in Enugu State, Nigeria

Years	Prices of Sand (₦)					
	River Sand			Plaster Sand (Soft Sand)		
	Lowest	Highest	Average (₦)	Lowest	Highest	Average (₦)
2010	6500	6500	6500	5000	5500	5250
2011	6500	7500	7000	5500	6000	5750
2012	7000	8000	7500	6000	6000	6000

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2013	8500	8500	8500	6000	7500	6750
2014	8500	9000	8750	7500	7500	7500
2015	8500	9000	8750	7500	8000	7750
2016	9000	10000	9500	9000	9000	9000
2017	10000	12000	11000	10000	12000	11000
2018	12000	12000	12000	12000	12000	12000
2019	12000	12000	12000	12000	12000	12000
2020	12000	12000	12000	12000	12000	12000
2021	15000	20000	17500	15000	20000	17500
2022	20000	25000	22500	20000	25000	22500

Source: Researchers Field Survey (2023). ₦ = Naira.

**Table 4:** Prices of Quarry Stone in Enugu State, Nigeria

Years	Prices of Quarry Stone (Chippings) (₦)					
	12.5mm – 19mm Aggregate			25mm Aggregate		
	Lowest	Highest	Average (₦)	Lowest	Highest	Average (₦)
2010	47000	47000	47000	39000	39000	39000
2011	47000	55000	51000	39000	48000	43500
2012	65000	70000	67500	50000	62000	56000
2013	65000	70000	67500	50000	62000	56000
2014	69000	72000	70500	58000	65000	61500
2015	72000	72000	72000	65000	68000	66500
2016	70000	72000	71000	65000	68000	66500
2017	75000	75000	75000	68000	68000	68000
2018	75000	75000	75000	68000	68000	68000
2019	75000	78000	76500	68000	72000	70000
2020	78000	78000	78000	73000	73000	73000
2021	90000	95000	92500	85000	90000	87500
2022	140000	155000	147500	130000	135000	132500

Source: Researchers Field Survey (2023). ₦ = Naira.

**Table 5:** Average prices of selected Building materials (₦) in Enugu state

Years	50kg Cement	Reinforcement				Sand		Quarry Stone		225mm Block
		16mm	12mm	10mm	8mm	River Sand	Plaster Sand	12mm–19mm Agg.	25mm Agg.	
2010	1475	2000	1130	925	700	6500	5250	47000	39000	95
2011	1575	2255	1300	960	790	7000	5750	51000	43500	95
2012	1625	2300	1525	1000	800	7500	6000	67500	56000	95
2013	1565	2100	1190	905	660	8500	6750	67500	56000	97.5
2014	1725	2005	1145	855	650	8750	7500	70500	61500	110
2015	1815	3075	2125	1550	950	8750	7750	72000	66500	115
2016	1965	3350	2175	1375	1075	9500	9000	71000	66500	120
2017	2635	3060	1750	1275	950	11000	11000	75000	68000	135
2018	2390	3550	2550	1950	1250	12000	12000	75000	68000	135
2019	2375	3850	2640	2300	1575	12000	12000	76500	70000	140
2020	2415	3875	3120	2295	1700	12000	12000	78000	73000	150
2021	3445	5750	3725	2700	1875	17500	17500	92500	87500	170
2022	4000	7000	3925	3175	2300	22500	22500	147500	132500	240

Source: Researchers Field Survey (2023). ₦ = Naira.

**Table 6:** Average Annual Rental Value of Residential Apartments (₦) within Enugu from 2010 – 2022.

Years	Residential Properties					Mean
	A Single Room	Single Room (ensuite)	1 Bedroom	2 Bedrooms	3 Bedrooms	
2010	48000	80000	120000	200000	300000	149600
2011	48000	80000	120000	200000	300000	149600
2012	60000	100000	150000	250000	400000	192000
2013	60000	100000	150000	250000	400000	192000

2014	80000	150000	200000	300000	500000	246000
2015	80000	150000	200000	300000	500000	246000
2016	80000	150000	200000	300000	500000	246000
2017	100000	180000	300000	400000	600000	316000
2018	100000	180000	300000	400000	600000	316000
2019	120000	220000	400000	550000	700000	398000
2020	120000	220000	400000	550000	700000	398000
2021	150000	250000	450000	650000	800000	460000
2022	150000	250000	450000	650000	800000	460000

Source: Researchers Field Survey (2023). ₦ = Naira.

### **V. Analysis of Data and Results**

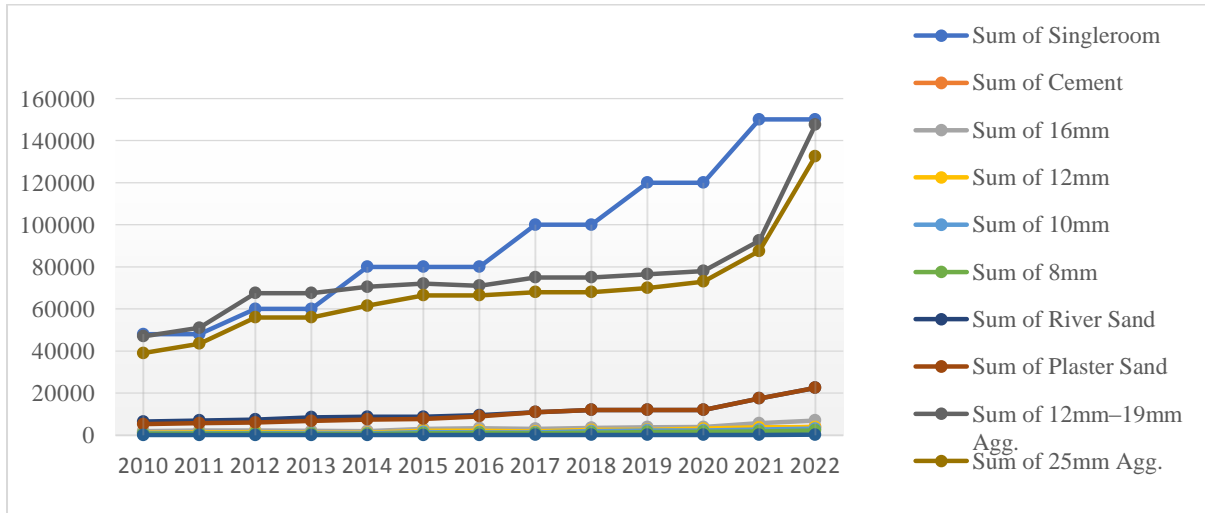
Below are the results of the data collected from the field survey. The result in table 7 indicates that cement, reinforcement bars (16mm, 12mm, 10mm and 8mm), river sand, plaster sand, quarry stone (12mm-19mm and 25mm Agg.), and Block has a positive relationship on the construction cost of single room apartment such that an increase in 16mm, 12mm, 10mm, 8mm, river sand, plaster sand, 12mm-19mm, 25mm Agg. and Block cost will lead to increase in the construction cost of single room apartment and the rental value at an average of 49.66, 37.45, 17.92, 31.68, 60.16, 14.85, 9.11, 4.60, 6.06 and 921.75 respectively. More so, the result further indicates that the rate at which the independent variables explain what happens on the dependent variable is 99.43% which is believed to be high by the researcher.

**Table 7.** Impact of cement, reinforcement, sand, stone and block in the construction cost of a single room apartment

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	12514.69	31003.37	0.403656	0.7255
Cement	49.66126	23.33170	2.128488	0.1671
16mm	37.45888	11.18113	3.350187	0.0787
12mm	17.92864	19.00342	0.943443	0.4450
10mm	31.68770	21.63234	1.464830	0.2806
8mm	60.16442	34.15108	1.761714	0.2202
River Sand	14.85954	9.893615	1.501932	0.2720
Plaster Sand	9.110531	10.85694	0.839144	0.4897
12mm-19mm Aggr.	4.607121	1.578300	2.919040	0.1001
25mm Aggr.	6.069692	1.860753	3.261955	0.0825
Block	921.7548	484.5172	1.902419	0.1975
R-squared	0.994335	Mean dependent var		92000.00
Adjusted R-squared	0.966008	S.D. dependent var		35090.36
S.E. of regression	6469.591	Akaike info criterion		20.20812
Sum squared resid	83711208	Schwarz criterion		20.68615
Log likelihood	-120.3528	Hannan-Quinn criter		20.10986
F-statistic	35.10232	Durbin-Watson stat		3.197982
Prob(F-statistic)	0.028008			

Regression Output

More so, Figure 1 further strengthens the conviction that increase in the cement, reinforcement bars (16mm, 12mm, 10mm and 8mm), river sand, plaster sand, quarry stone (12mm-19mm and 25mm Agg.), and Block cost has positive and significant influence on the construction cost of building a single room apartment as the trend is seen to be moving positively high at the right-hand direction.



**Fig. 1.** Trend in the cost of single room apartment as a result of increase in the cost of cement, reinforcement, sand, stone and blocks within the period of 2010-2022

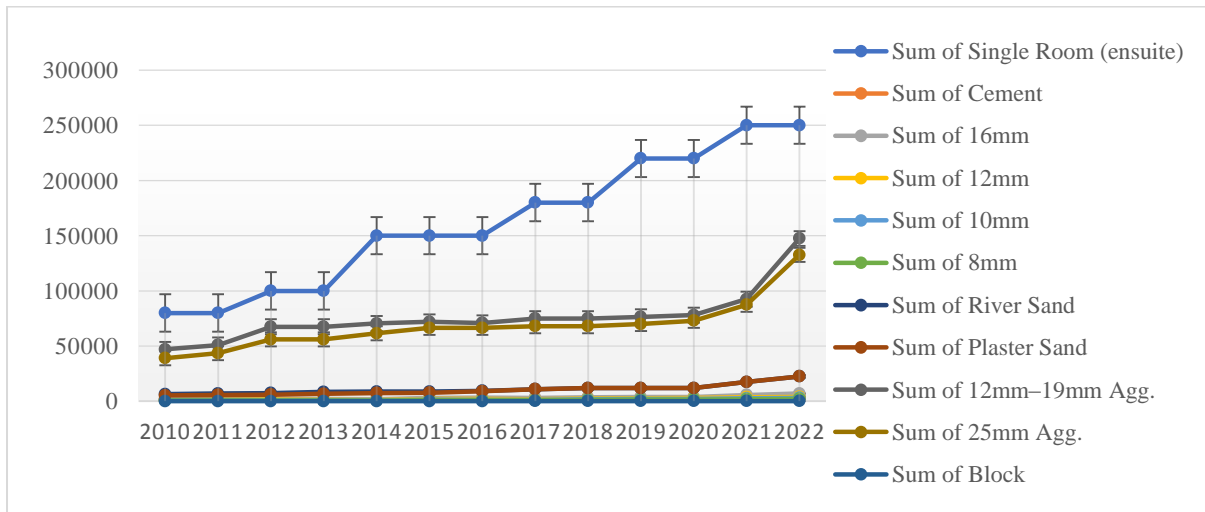
The result in Table 8 indicates that all the observed construction materials; cement, reinforcement bars (16mm, 12mm, 10mm and 8mm), river sand, plaster sand, quarry stone (12mm-19mm and 25mm Agg.), and Block have positive relationship on the construction cost of single room ensuite apartment, this implies that an increase in the cost of the identified construction materials will lead to increase in the construction cost of single room ensuite apartment. Furthermore, the result indicates that the identified construction materials have significant impact on the construction cost of single room ensuite apartment and the rental value.

**Table 8.** Impact of cement, reinforcement, sand, stone and block in the construction cost of a single room ensuite apartment

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	56186.91	58586.13	0.959048	0.4387
Cement	73.09981	44.08921	1.657998	0.2392
16mm	76.53427	21.12864	3.622300	0.0685
12mm	41.73535	35.91019	1.162215	0.3651
10mm	66.04200	40.87798	1.615589	0.2476
8mm	113.8318	64.53425	1.763897	0.2198
River Sand	16.78624	18.69566	0.897868	0.4640
Plaster Sand	6.702398	20.51603	0.326691	0.7749
12mm-19mm Aggr.	10.24775	2.982465	3.435999	0.0753
25mm Aggr.	13.77996	3.516208	3.918983	0.0594
Block	1712.704	915.5775	1.870627	0.2023
R-squared	0.993272	Mean dependent var		162307.7
Adjusted R-squared	0.959633	S.D. dependent var		60848.70
S.E. of regression	12225.39	Akaike info criterion		21.48092
Sum squared resid	2.99E+08	Schwarz criterion		21.95896
Log likelihood	-128.6260	Hannan-Quinn criter		21.38267
F-statistic	29.52751	Durbin-Watson stat		3.254047
Prob(F-statistic)	0.033189			

Regression Output

More so, Figure 2 further strengthens the conviction that increase in the cement, reinforcement bars (16mm, 12mm, 10mm and 8mm), river sand, plaster sand, quarry stone (12mm-19mm and 25mm Agg.), and Block cost has positive and significant influence on the construction cost of building a single room ensuite apartment as the trend is seen to be trending up indicating a positive relationship.



**Fig. 2.** Trend in the cost of single room ensuite apartment as a result of increase in the cost of cement, reinforcement, sand, stone and blocks within the period of 2010-2022

The regression result in Table 9 indicates that all the variables under study; cement, reinforcement bars (16mm, 12mm, 10mm and 8mm), river sand, plaster sand, quarry stone (12mm-19mm and 25mm Agg.), and Block have positive relationship on the construction cost of one bedroom apartment, this implies that an increase in the cost of the identified variables will lead to increase in the construction cost of one bedroom apartment and the rental value.

**Table 9.** Impact of cement, reinforcement, sand, stone and block in the construction cost of one bedroom apartment

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5684.649	83889.34	0.067764	0.9521
Cement	209.5119	63.13123	3.318672	0.0800
16mm	162.6364	30.25405	5.375692	0.0329
12mm	83.69366	51.41972	1.627657	0.2451
10mm	141.8471	58.53308	2.423366	0.1363
8mm	315.1818	92.40644	3.410821	0.0763
River Sand	35.40487	26.77028	1.322544	0.3170
Plaster Sand	21.59646	29.37685	0.735152	0.5388
12mm-19mm Aggr.	13.18546	4.270585	3.087507	0.0908
25mm Aggr.	17.61357	5.034850	3.498331	0.0729
Block	3287.617	1311.013	2.507692	0.1290
R-squared	0.996749	Mean dependent var		264615.4
Adjusted R-squared	0.980494	S.D. dependent var		125340.6
S.E. of regression	17505.51	Akaike info criterion		22.19892
Sum squared resid	6.13E+08	Schwarz criterion		22.67696
Log likelihood	-133.2930	Hannan-Quinn criter		22.10067
F-statistic	61.31984	Durbin-Watson stat		2.794745
Prob(F-statistic)	0.016150			

Regression Output

To further strengthen the result of table 9, Figure 3 is presented. The pattern of the trend in Figure.3 indicates that all the observed variables is seen trending up which implies that all the observed variables have positive relationship in the construction cost of building one bedroom apartment on the average.



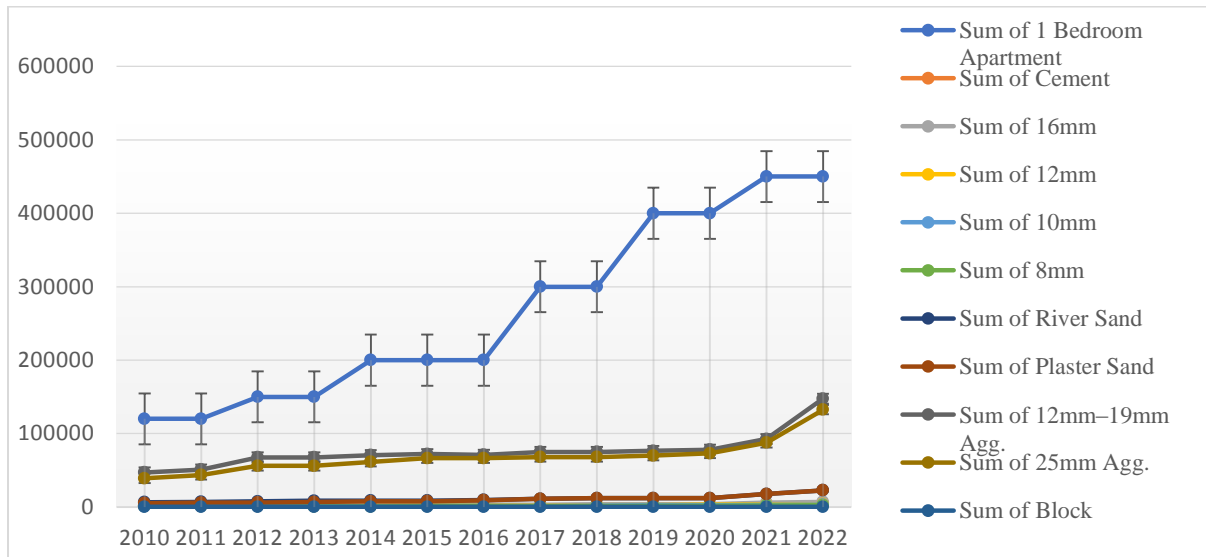


Fig. 3. Trend in the cost of one bedroom apartment as a result of increase in the cost of cement, reinforcement, sand, stone and blocks within the period of 2010-2022.

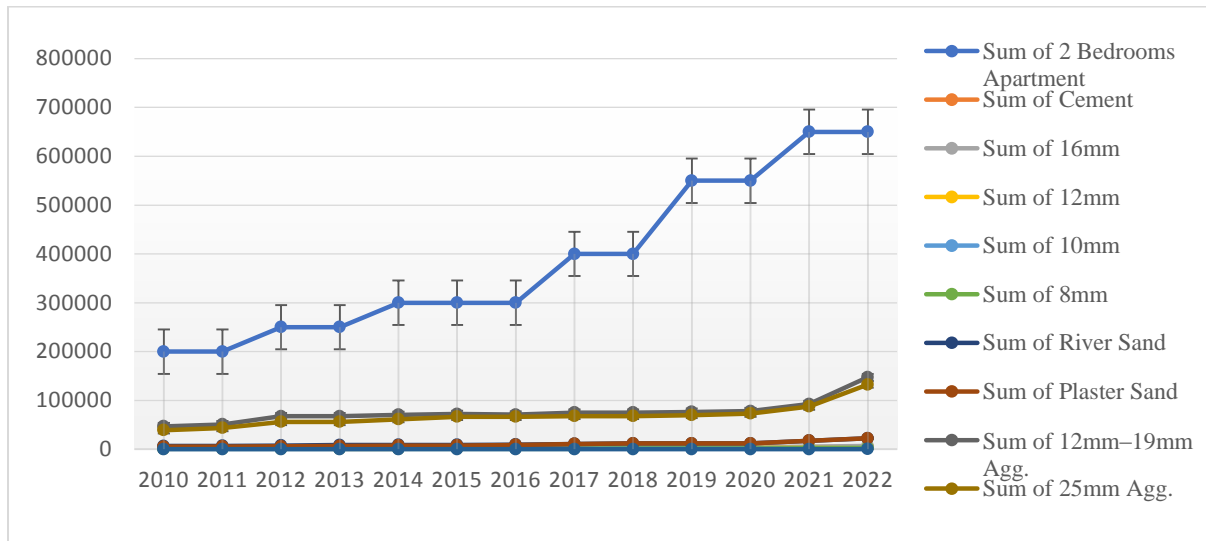
The regression result in the Table 10 indicates that cement, reinforcement bars (16mm, 12mm, 10mm and 8mm), river sand, plaster sand, quarry stone (12mm-19mm and 25mm Aggr.), and Block have positive relationship on the construction cost of two-bedroom apartment, this implies that an increase in the cost of the identified variables will lead to increase in the construction cost of two-bedroom apartment on the average. Furthermore, the result further indicates that all the identified variables have significant impact on the construction cost of two-bedrooms apartment and the rental value.

**Table 10.** Impact of cement, reinforcement, sand, stone and block on the construction cost of two-bedrooms apartment

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	30847.87	136717.2	0.225633	0.8424
Cement	283.1633	102.8871	2.752176	0.1106
16mm	197.5295	49.30602	4.006195	0.0570
12mm	123.5353	83.80041	1.474161	0.2784
10mm	161.5418	95.39329	1.693429	0.2325
8mm	483.6169	150.5978	3.211314	0.0848
River Sand	88.93025	43.62840	2.038357	0.1784
Plaster Sand	69.45141	47.87642	1.450639	0.2840
12mm-19mm Aggr.	19.18623	6.959912	2.756677	0.1103
25mm Aggr.	25.12593	8.205461	3.062098	0.0921
Block	4770.223	2136.601	-2.232622	0.1552
R-squared	0.994943	Mean dependent var		384615.4
Adjusted R-squared	0.969660	S.D. dependent var		163789.3
S.E. of regression	28529.30	Akaike info criterion		23.17576
Sum squared resid	1.63E+09	Schwarz criterion		23.65379
Log likelihood	-139.6424	Hannan-Quinn criter		23.07750
F-statistic	39.35213	Durbin-Watson stat		2.860312
Prob(F-statistic)	0.025029			

Regression Output.

More so, Figure 4 further strengthens the conviction that increase in the identified construction materials: cement, reinforcement bars (16mm, 12mm, 10mm and 8mm), river sand, plaster sand, quarry stone (12mm-19mm and 25mm Aggr.), and Block cost have positive and significant influence on the construction cost of building a two-bedrooms apartment and the rental value as the trend is seen to be moving positively high at the right-hand direction.



**Fig. 4.** Trend in the cost of two-bedrooms apartment as a result of increase in the cost of cement, reinforcement, sand, stone and blocks within the period of 2010-2022.

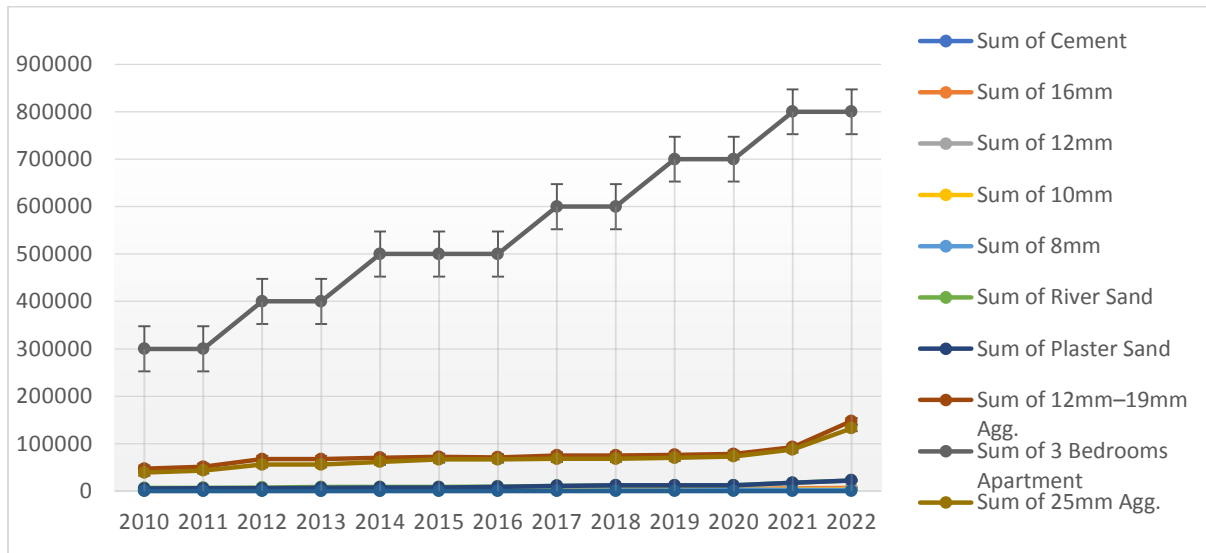
The regression result in Table 11 indicates that all the observed construction materials; cement, reinforcement bars (16mm, 12mm, 10mm and 8mm), river sand, plaster sand, quarry stone (12mm-19mm and 25mm Agg.), and Block have positive relationship on the construction cost of three-bedroom apartment. This implies that an increase in the cost of the identified construction materials will lead to increase in the construction cost of three-bedroom apartment. Furthermore, the result indicates that the identified construction materials have significant impact on the construction cost of three-bedroom apartment and the rental value.

**Table 11.** Impact of cement, reinforcement, sand, stone and block on the construction cost of three-bedrooms

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	239225.4	163928.2	1.459331	0.2819
Cement	242.6535	123.3647	1.966960	0.1881
16mm	229.5852	59.11944	3.883413	0.0604
12mm	77.41093	100.4793	0.770417	0.5216
10mm	169.1460	114.3795	1.478814	0.2773
8mm	322.2622	180.5714	1.784680	0.2162
River Sand	42.14709	52.31180	0.805690	0.5050
Plaster Sand	11.64950	57.40530	0.202934	0.8580
12mm-19mm Aggr.	22.43569	8.345150	2.688471	0.1150
25mm Aggr.	33.02151	9.838601	3.356321	0.0785
Block	6362.760	2561.851	2.483657	0.1310
R-squared	0.993357	Mean dependent var		546153.8
Adjusted R-squared	0.960143	S.D. dependent var		171344.6
S.E. of regression	34207.51	Akaike info criterion		23.53878
Sum squared resid	2.34E+09	Schwarz criterion		24.01682
Log likelihood	-142.0021	Hannan-Quinn criter		23.44053
F-statistic	29.90782	Durbin-Watson stat		2.976284
Prob(F-statistic)	0.032776			

Regression Output.

More so, Figure 5 further strengthens the conviction that the identified construction materials have positive and significant relationship on the construction cost of three-bedroom apartment and the rental value as trend of the identified variables is seen to moving upwards from left to right.



**Fig. 5.** Trend in the cost of three-bedrooms apartment as a result of increase in the cost of cement, reinforcement, sand, stone and blocks within the period of 2010-2022.

### VI. Conclusion and Recommendation

The construction industry is vulnerable to cost in prices of materials. Material resources are the heart and life wire of any construction project. This simply means that increase in cost of material affects the total cost of construction and subsequently housing supply and rental value. The investigations conducted revealed that the selected building materials experienced rapid changes and significant increase in prices within the years under investigation (2010-2022). The key factors that are responsible for the increase in building material prices as identified in the literature of this research include the exchange rates, import duties, energy costs, inflation, government policies, transportation, crude oil prices, raw materials and input cost, supply and demand. The regression analyses were formulated in section 5. They were tested for their significance and found that increase in prices of all the observed construction materials; cement, reinforcement bars (16mm, 12mm, 10mm and 8mm), river sand, plaster sand, quarry stone (12mm-19mm and 25mm Agg.), and Block increased the cost of construction and rental values of a single room apartment, single room apartment ensuite, one bedroom apartment, two bedrooms apartment and three bedrooms apartment in Enugu Metropolis in Enugu State, Nigeria from 2010-2022. In this regard, the study therefore recommends that government should ensure that appropriate legislation and enforcement to provide a lasting solution, and bring about stable building material prices and avoid a scenario of continuous price increase. Efforts should also be intensified to encourage the expansion of building materials manufactures from local materials; conducting research to recognize new locally available building materials for production. Encouraging and providing incentives to, and creating an enabling environment for stakeholders in order to encourage the rapid flow of funds into building material manufacturing, such as tax relief, low interest rate and large capital allowances.

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