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Building Materials Price Changes and the Inflation Rate in Ekpoma

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Abstract

This study investigated the relationship between the shifts in the inflation rate and the price of building materials in Ekpoma to aid in mitigating the adverse effects of the inflation rate on the construction industry. It examined the annual changes in building material prices due to the inflation rate, the nature of the influence of the inflation rate on the prices of building materials and determined the relationship between the inflation rate and the prices of building materials within Ekpoma. Data on the inflation rate was collated from the Central Bank of Nigeria, while prices of the building materials were obtained from a market survey. Findings revealed that the inflation rate has the highest value in 2023, while the prices of the building materials had an upward trend from 2018 to 2023. From the annual change in the variables, a 1% increase in the inflation rate will lead to the highest growth in the prices of Cement by 4.63%. Correlation analysis revealed that some building materials had no relationship with the inflation rate, while the other materials had a relationship of varying degrees with the inflation rate. Regression analysis indicated that the price of 30 tonnes of Granite would experience the highest increase of ₦15961 for every unit increase in the inflation rate. It was recommended that the government exercise its political will to address the impact of the inflation rate on building material prices. This action will promote the provision of sustainable and affordable housing solutions.

Keywords: Materials, Prices, Inflation, Correlation, Annual Change, Regression Analysis

1. Introduction

The construction industry plays a fundamental role in the economic development of any region, and Ekpoma, a growing urban centre in Nigeria, is no exception. In recent years, the prices of building materials in Ekpoma have experienced significant fluctuations, reflecting broader economic trends and impacting both the construction sector and the local economy. Studying the effects of inflation on the prices of construction resources should focus on building materials because executing construction projects significantly depends on construction materials [10]. Building materials represent about 60% of the project cost [2]. Building materials, including cement, steel, and timber, are essential for construction projects. Inflation has become a significant problem, hurting the construction industry. Inflation is causing an increase in the prices of materials, machinery and other inputs to construction projects [6]. Due to inflation, building material prices, labour wages and machinery hire rates change every year [6]. In Ekpoma, these prices have shown notable volatility, prompting concerns among builders, developers, and policymakers. This study aims to investigate the relationship between the prices of building materials and shifts in the inflation rate in Ekpoma. Understanding this relationship is crucial for stakeholders to make informed decisions and for policymakers to develop strategies to stabilize the market. The primary objective of this research is to analyze the trends in building material prices and their correlation with inflation rates in Ekpoma. It examined the annual changes in building material prices due to the inflation rate and determined the relationship between the inflation rate and the prices of building materials within Ekpoma. By shedding light on the interplay between building material prices and inflation in Ekpoma, this study aims to contribute to the body of knowledge in economic and construction research. The findings could inform policy decisions and help stabilize the construction market, ultimately supporting sustainable development in the region. They will also aid in actualizing the sustainable development goal (SDG) 8 (Decent work and economic growth) through the promotion of planning, which will benefit economic growth, SDG 9 (Industry, Innovation and infrastructure) through the containment of pressure from inflation which will promote industry, innovation and infrastructure, and SDG 11(Sustainable cities and communities) through the promotion of the efficient use of resources and the contribution to resilient communities. Section one

of this study presents an introduction, rationale and outline of the study. Section two presents the methodology used, while section three covers results and discussion. Section four covers the conclusion, and section five covers the recommendations.

2. Methodology

This study has seven (7) variables: The inflation rate, which is the independent variable, and the prices of the selected building materials, which collectively form the dependent variables. Data was collected from official sources and market surveys. Scatter plots were used to assess the behaviour of the data, whether linear or nonlinear. The feedback from the scatter plots guided the choice of correlation analysis [5]. The annual change (AC) for each variable was computed. This aided the examination of the annual changes in building material prices due to the inflation rate. The calculated values for the annual change were used for the correlation analysis. Correlation was carried out to investigate how changes in the inflation rate are associated with changes in the price of the building materials [5]. Regression analysis estimated the relationship between the inflation rate and the prices of the selected building materials in Ekpoma. Minitab version 17 and Statistical Package for Social Sciences (SPSS) version 29 were used for the data analysis.

2.1 Data collection and assessment

The collection of data was carried out for the independent variable and the dependent variables.

1. **The Inflation rate:** This is the independent variable. The data for the Inflation rate from 2018 to 2023 was collected from the Central Bank of Nigeria database and presented in Fig 1.
2. **The prices of the building materials:** These are the dependent variables. The data for the prices of the building materials was obtained from a market survey. These are presented in Table 1 and Fig 2.

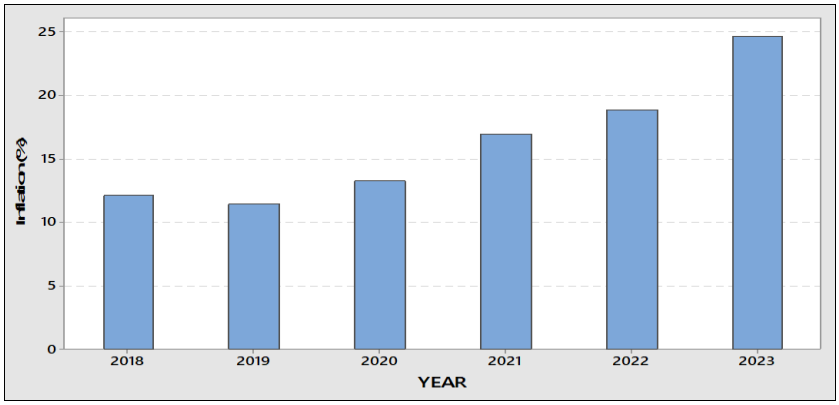

Fig 1: Inflation rates from 2018 to 2023[8]

Table 1: The data on the variables of the study

Year	Cement (₦)	30 tonnes of Granite (₦)	9 tonnes of Sand (₦)	Fibre Reinforced Ceiling sheet (₦)	A piece of 12mm Rebar (₦)	20litres Paint (₦)	Inflation rate (%)
2018	2550	160500	14000	1400	2100	3800	12.10
2019	2600	169500	14000	1600	2350	4000	11.40
2020	3000	184000	14000	2000	2900	4500	13.25
2021	3700	185000	16000	2550	3200	4500	16.95
2022	4500	313000	22000	4000	3400	7500	18.85
2023	5000	365000	26000	4800	4800	9000	24.66

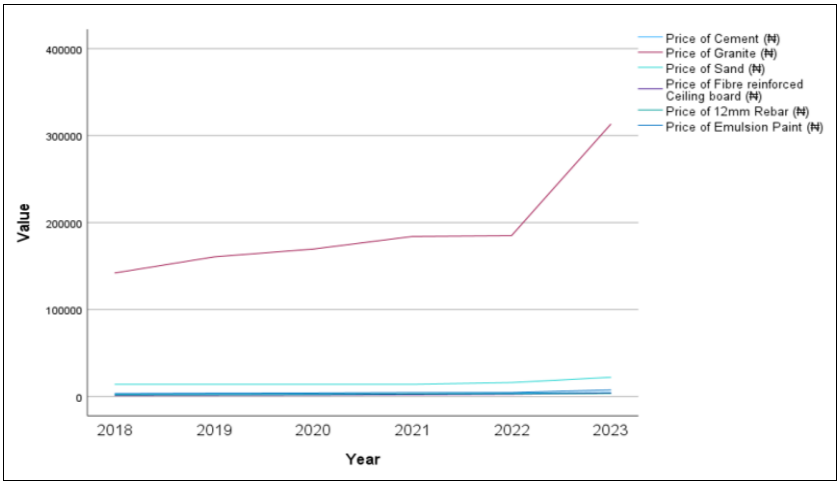

Fig 2: The prices of selected building materials in Ekpoma from 2018 to 2023

2.2 Assessment of the Variables

The data in Table 1 were assessed to determine if the behaviour of the data was linear or nonlinear using scatter plots. These are shown in Figures 3-19. From the figures, the Inflation rate is on the *x-axis*, while the prices of Cement, 30 tonnes of Granite,9 tonnes of Sand, fibre-reinforced ceiling board, 12mm reinforcement bar, and 20 litres of Paint, were represented on the y-axes, respectively. From the scatter plots, the data indicated that the dependent variables (the price of the building materials) have a nonlinear relationship with the inflation rate. The appropriate correlation method to examine the relationship between the independent variable (Inflation rate) and the dependent variables (the prices of the building materials) is the Spearman correlation test.

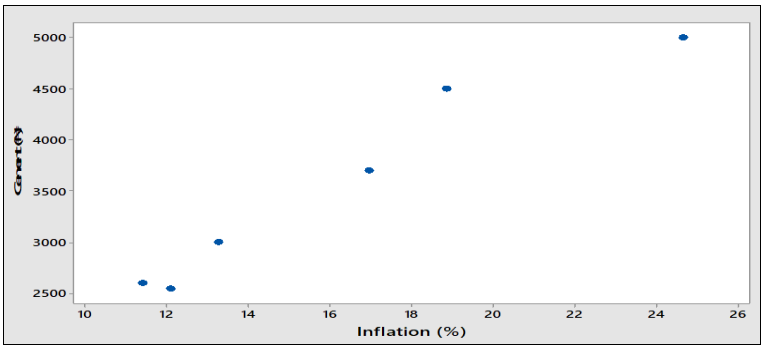

Fig 3: Scatter plot of the Price of Cement and the Inflation rate

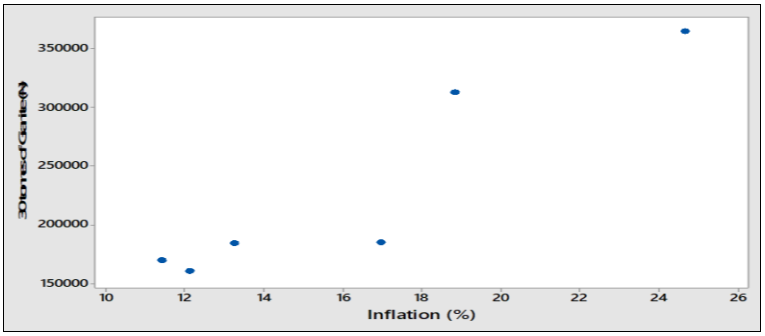

Fig 4: Scatter plot of the price of 30 tonnes of Granite and the Inflation rate

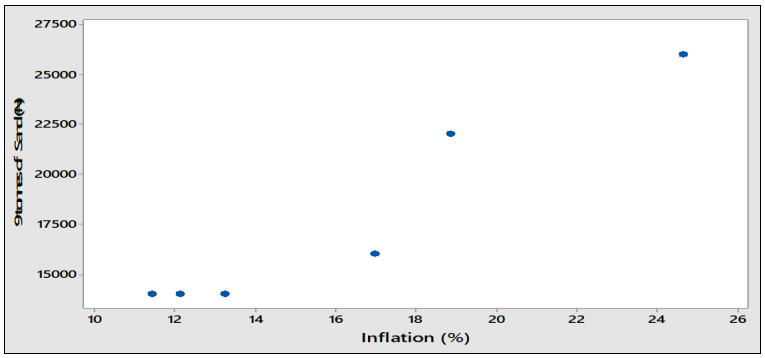

Fig 5: Scatter plot of the price of 9 tonnes Sand and the Inflation rate

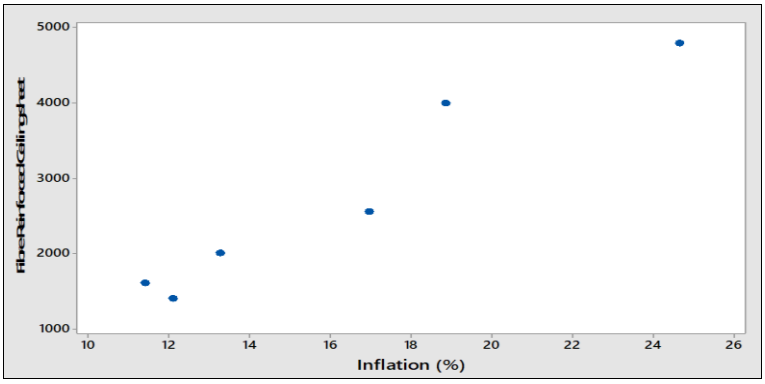

Fig 6: Scatter plot of the price of Fibre-reinforced ceiling board and the Inflation rate

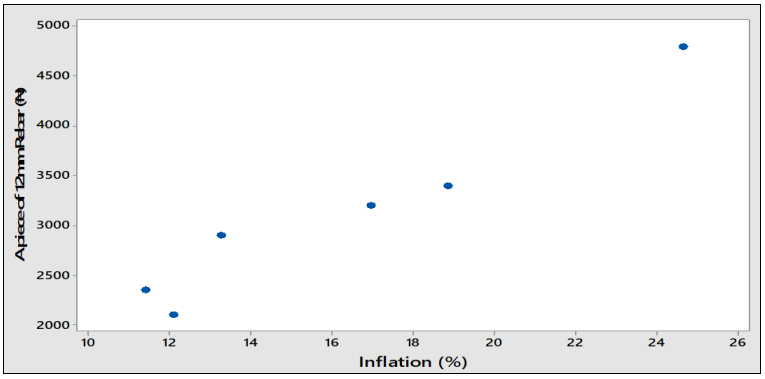

Fig 7: Scatter plot of the price of 12mm Reinforcement bar and the Inflation rate

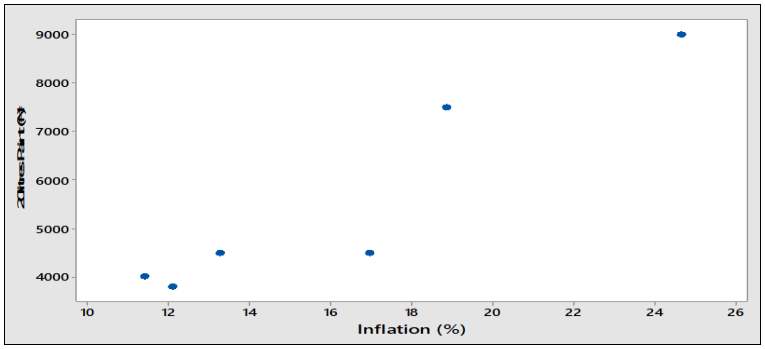

Fig 8: Scatter plot of the price of 20 litres of Paint and the Inflation rate

2.3 Analysis of the Annual Change

The annual change (AC) is computed by subtracting the current year's value from the previous year, dividing by the previous year, and multiplying by 100. This is depicted in equation (1).

$$\text{Annual change (AC)} = \frac{\text{(Current year - Previous year)}}{\text{Previous year}} \text{ X } 100 \quad (1)$$

The annual change is computed for each variable. Its value is either negative or positive. A positive value indicates an increase in the value of the specific variable from the previous year. In contrast, a negative value indicates a decrease in the value of the particular variable of the prior year. Using equation (1), values for the annual change of each variable were computed and presented in Table 2.

Table 2: Data on the annual change of the variables (AC)

Year	Cement	30 tonnes of Granite	9 tonnes of Sand	Fibre Reinforced Ceiling Board	12mm Reinforcement bar	20litres Paint	Inflation
2018-2019	1.96	5.61	0.00	14.29	11.90	5.26	-5.78
2019-2020	15.38	8.55	0.00	25.00	23.40	12.50	16.23
2020-2021	23.33	0.54	14.29	27.50	10.34	0.00	27.98
2021-2022	21.62	69.19	37.50	56.86	6.25	66.67	11.17
2022-2023	11.11	16.61	18.18	20.00	41.18	20.00	30.84
Average	17.86	23.73	17.49	32.34	20.29	24.79	21.56

2.4 Spearman Correlation Analysis

Spearman Correlation was used to determine a simple linear relationship between the variables [1]. It has a statistical coefficient (ρ) ranging from -1 to +1. A value of +1 implies an entirely positive correlation, a value between +0.70 – +0.99 means a strong positive association, a value between +0.50 to +0.69 means an average positive correlation, a value between +0.01 to +S0.49 means a weak positive correlation, and a value of 0 means there is no relationship [9]. Meanwhile, the sign also classifies the relationship [5]. The relationship is direct if the correlation coefficient is positive, while the relationship is inverse if the correlation coefficient is negative. The annual change (AC) values in Table 2 were used for the Spearman correlation analysis, and the coefficients are presented in Table 3.

Table 3: Spearman Correlation Coefficients

S. No	Dependent variable(s)	Spearman Correlation Coefficient (ρ)	Relationship with the Inflation rate	Strength of the relationship with the inflation rate
1	Price of Cement	+0.300	Direct relationship	Weak relationship
2	Price of Granite	0	No association	No association
3	Price of Sand	+0.308	Direct relationship	Weak relationship
4	Price of Fibre-reinforced ceiling board	+0.100	Direct relationship	Weak relationship
5	Price of 12mm reinforcement bar	+0.500	Direct relationship	Average relationship
6	Price of Paint	0	No association	No association

2.5 Regression analysis

Regression analysis is "a statistical method for analyzing the relationship between two or more variables in such a manner that one of the variables can be predicted or explained by the information on the other variables" [3]. Regression analysis will help to estimate the relationship between the variables and aid in making predictions. A simple linear regression equation is depicted in equation (2).

$$Y = a + bX \quad (2)$$

Where
Y - Explanatory or independent variable,
a - The intercept (value of *y* when *x* = 0),
b - The slope of the line,
X - The outcome or dependent variable.

Table 4: Results for Regression Analysis

S. No	Dependent variable	Parameter	Unstandardized Beta Coefficient (B)	Regression equation
1	Cement	Intercept	365.5	= 365.5 + 197.1 Inflation
		Inflation rate	197.1	
2	30 tonnes of Granite	Intercept	-29058	= - 29058 + 15961 Inflation
		Inflation rate	15961	
3	9 tonnes of Sand	Intercept	1921	= 1921 + 972.0 Inflation
		Inflation rate	972	
4	Fibre Reinforced Ceiling sheet	Intercept	-1557	= - 1557 + 264.3 Inflation
		Inflation rate	264.3	
5	12mm Reinforcement bar	Intercept	139.8	= 139.8 + 184.3 Inflation
		Inflation rate	184.3	
6	20litres Paint	Intercept	-951	= - 951 + 401.3 Inflation
		Inflation rate	401.3	

The values from Table 1 were used for the regression analysis, and the results were presented in Table 4.

3. Result and Discussion

The analysis will be presented based on the assessment of the variables, analysis of the annual change, the correlation analysis and the regression analysis.

3.1 The assessment of the variables

It can be observed from Figure one that there was a fluctuation in the inflation rate, with a downward trend occurring between 2018 and 2019. From 2020 to 2023, the inflation rate took an upward trend, while the highest inflation rate was in 2023. From Fig 2, the prices of the building materials were on an upward trend from 2018 to 2023, with the highest prices in 2023.

The data on the prices of the building materials were presented with the inflation rate in scatter plots. The scatter plots show that each variable displayed a nonlinear behaviour with the inflation rate. This feedback from the scatter plots made Spearman's correlation analysis the suitable method to determine the relationship between the inflation rate and the prices of building materials.

3.2 Analysis of the annual change of the variables

The annual change (AC) was determined for each variable from 2018 to 2023. The value for the inflation rate in 2018 – 2019 was -5.78%. This indicates there was a decrease in inflation. However, for the building materials, the AC of Cement was +1.96%, 30 tonnes of Granite was 8.55%, Fibre reinforcement Ceiling board was +14.29, 12mm Reinforcement bar was +11.90%, and 20 litres of paint was +5.26. These values represented an increase in the price of building materials. The AC value of 9 tonnes of Sand was 0, which indicates no change.

In 2019-2020, the AC of the inflation rate was +16.23%, which represented an increase in the inflation rate. For building materials, the AC of Cement was +15.38%, 30 tonnes of Granite was 8.55%, Fibre reinforcement Ceiling board was +25%, 12mm Reinforcement bar was +23.40%, and 20 litres of paint was +12.50. These values represented an increase in the building materials price value. The AC value of 9 tonnes of Sand was 0, which indicates no change.

In 2020-2021, the AC of the inflation rate was +27.98%, representing an increase in the inflation rate. For building materials, the AC of Cement was +23.33%, 30 tonnes of Granite was 0.54%, 9 tonnes of Sand was 14.29%, Fibre reinforcement Ceiling board was +27.50%, and 12mm Reinforcement bar was +10.34%. These values represented an increase in the building materials price value. The AC value of 20 litres of Paint was 0, which indicates no change.

In 2021-2022, the AC of inflation rate was +11.17%, representing an increase in the inflation rate. For building materials, the AC of Cement was +21.62%, 30 tonnes of Granite was 69.19%, 9 tonnes of Sand was 37.50%, Fibre reinforcement Ceiling board was +56.86%,12mm Reinforcement bar was +6.25%, and 20 litres of Paint was 66.67%. These values represented an increase in the building materials price value.

In 2022-2023, the AC of inflation rate was +30.84%, representing an increase in the inflation rate. For building materials, the AC of Cement was +11.11, 30 tonnes of Granite was 16.61%, 9 tonnes of Sand was +18.18%, Fibre reinforcement Ceiling board was +20, 12mm Reinforcement bar was +41.18%, and 20 litres of paint was +20. These values represented increased building materials prices from the previous year.

From Table 2, when the average AC value for inflation deviated to 21.56%, the average AC values for Cement, 30 tonnes of Granite, 9 tonnes of Sand, Fibre reinforced ceiling board, 12mm reinforcement bar, and 20 litres of Paint were 17.86%, 23.73%, 17.49%, 32.34%, 20.29%, and 24.79% respectively. It also revealed that the highest positive AC was recorded for 30 tonnes of Granite with an increase of 69.10% in 2021- 2022, followed by 20 litres of Paint with a rise of 66.67% in 2021-2022, Fibre reinforced Ceiling board with an increase of 56.86% in 2021 -2022, 12mm Reinforcement bar with a rise of 41.18% in 2022-2023, 9 tonnes of Sand with an increase of 37.50% in 2021-2022, and Cement with a rise of 23.33% in 2020-2021.

Further analysis shows that a 1% increase in the inflation

rate will lead to a rise in the prices of Cement, 30 tonnes of Granite, 9 tonnes of Sand, Fibre reinforced ceiling board, 12mm reinforcement bar, and 20 litres of Paint by 4.63%, 2.70%, 0.81%, 1.50%, 0.94%, and 1.15% respectively.

3.3 Correlation analysis

The Spearman correlation coefficients of the dependent variables and their relationship with the inflation rate are presented in Table 3. A simple linear correlation means there is a relationship between two variables, which implies when one variable changes, it will lead to a change in the other variable, either by an increase or a decrease [1]. Hence, their relationship will be positive when the two variables increase and decrease. However, when one variable increases with a decrease in the other variable, the relationship between them will be negative.

The Spearman coefficient between the inflation rate and the prices of Cement, 9 tonnes of Sand, Fibre reinforcement ceiling board, and 12mm reinforcement bar are +0.300, +0.308, +0.100, and +0.500, respectively, as shown in Table 3. This indicates a direct relationship between these building materials and the inflation rate value. This implies that an increase in the inflation rate leads to a rise in the value of the prices of these building materials. However, the direct relationship between the price of the reinforcement bar and the inflation rate is average; between the inflation rate and the prices of Cement, 9 tonnes of Sand, and fibre reinforcement ceiling board are weak.

The Spearman coefficient between the inflation rate and the prices of 30 tonnes of Granite and 20 litres of Paint are 0, respectively. This shows no association between the price of 30 tonnes of granite and the inflation rate, nor between 20 litres of paint and the inflation rate.

The building material with the highest correlation coefficient value with the inflation rate was a 12mm Reinforcement bar with $\rho = +0.500$. At the same time, the fibre-reinforced ceiling board had the lowest correlation coefficient with $\rho = +0.100$.

3.4 Regression analysis

The results of the regression analysis are presented in Table 4. The regression line equation explains the prediction of the variables. Using equation (2), a unit increase in *x* (the independent variable) will result in a change in *y* (the dependent variable). The value of the change in X because of the unit change in Y is restricted to the value of "b", which is the slope of the line.

The regression line equation for the price of Cement was = 365.5 + 197.1 Inflation, for the price of 30 tonnes of Granite was = - 29058 + 15961 Inflation, for the price of 9 tonnes of Sand = 1921 + 972 Inflation, for the price of fibre reinforced ceiling board was = -1557 +264.3 Inflation, for the price of 12mm reinforcement bar was = 139.8 + 184.3 Inflation, and for the price of 20 litres of Paint was = -951 + 401.3 Inflation.

Thus, for every unit increase in the inflation rate, the price of Cement would increase by ₦197.1k, the price of 30 tonnes of Granite would increase by ₦15961, the price of 9 tonnes of Sand would increase by ₦972, the price of 12mm Reinforcement bar would increase by ₦184.3k, and the price of 20 litres of paint would increase by ₦401.3k

The regression models indicated a positive linear relationship between the variables; hence, as the inflation rate increased, the prices of the building materials increased.

4. Conclusion

This study investigated the relationship between the shifts in the inflation rate and the price of building materials in Ekpoma to aid in mitigating the adverse effects of the inflation rate on the construction industry. It examined the annual changes in building material prices due to the inflation rate, the nature of the influence of the inflation rate on the prices of building materials and determined the relationship between the inflation rate and the prices of building materials within Ekpoma. Data on the inflation rate was collated from the Central Bank of Nigeria, while prices of the building materials were obtained from a market survey. Findings revealed that the inflation rate has the highest value in 2023, while the prices of the building materials had an upward trend from 2018 to 2023. From the annual change in the variables, a 1% increase in the inflation rate will lead to the highest growth in the prices of Cement by 4.63%. Correlation analysis revealed that some building materials had no relationship with the inflation rate, while the other materials had a relationship of varying degrees with the inflation rate. Regression analysis indicated that the price of 30 tonnes of Granite would experience the highest increase of ₦15961 for every unit increase in the inflation rate.

5. Recommendations

Arising from the findings, it was recommended that

1. Policymakers can develop strategies to reduce the influence of the inflation rate on the prices of building materials to make housing more affordable
2. Construction businesses can utilize the insights from the annual changes values for the inflation rate and the other variables to plan better, thereby reducing risks and contributing to economic growth
3. The government was called upon to utilize these findings to address the impact of inflation on building materials, enabling sustainable and affordable housing solutions.

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