



## Effects of Environmental Management Dynamics on Firm Value of Listed Manufacturing Firms in Nigeria

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### ABSTRACT

Manufacturing activities has brought about environmental health hazards to business environments. Curbing these hazardous substances, positions manufacturing firms in sustainable business operations. Based on this backdrop, this study examined the effect of environmental management dynamics on firm value of listed manufacturing firms in Nigeria. The study focused on the influence of carbon emission control cost on firm value. The study population consists of 103 manufacturing companies listed on the Nigerian Exchange Group as at 31st December, 2024. Data collected were captured from 2015-2024, from the annual reports and Social Mitigation Plan Review, of the manufacturing firms. These data were analyzed using descriptive statistics, correlation, unit root test and the regression analysis with the aid of STATA 14. From the analysis, it was found that carbon emission control cost has positive and significant effect on firm value of listed manufacturing firms in Nigeria. It was concluded that carbon emission control cost should be increased, since it drives a positive and significant growth in firm value. The study recommends that manufacturing firms in Nigeria should keep preventing environmental hazards, rather than remediating.

**Keywords:** Firm value, Tobin's Q, carbon emission control, Nigeria, environmental strategies

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## 1 INTRODUCTION

In developed countries like the United States of America (USA), Canada and United Kingdom, the issue of business activities leading to environmental hazards have become important and necessary control measures have been put in place to either reduce the hazards, encourage voluntary attribution of cost to environmental issue drivers or adequate environmental degradation remediation programs using the greening of investment portfolios, usually driven by shareholders, sustainable manufacturing and environmental pollution (SMEP) programme and many others (Pacini & Attafuah-Wadee, 2022). Environmental issues are not only prominent in developed economies but also, in developing economies. Cases of environmental hazards in Ghana, South Africa and Nigeria have been reported by scholars like Dian, et al. (2019) and Ofoegbu and Megbuluba (2016).

In Nigeria, environmental hazards caused by manufacturing industry are also prominent, because several cases of poor remediation policies, improper waste management of chemicals and other dangerous materials injection into the environment have been recorded. Stakeholders such as the National Environmental Standards and Regulations Enforcement Agency (NESREA) and Environmental Health Council of Nigeria (EHCON) made propositions to environmental regulators to compel manufacturing industries to account for their activities (Adegbe, et al., 2021). Although the FGN has taken up enquiring into environmental issues caused by industries in Nigeria but efficient and unified standards linking to the sustainable development goals (SDGs) have not been encouraged (Ezeagba, et al. 2017).

Evidence from literature revealed that the firm value is positively influenced by the level of environmental disclosures of various firms in different scope of studies (Olonite, et al., 2024; Damieibi, 2023; Igbekoyi, et al., 2021). However, contrary results on environmental accounting and firm performance were submitted by Kolawole et al. (2023); Olaoye and Alao (2023) and Emeka et al (2019) as the studies submitted a negative relationship between environmental accounting disclosure and firm performance. The inconsistencies in the findings or related studies overtime is an indication that the issues of environmental accounting is inconclusive. It was also observed that the disclosure components of environmental accounting have been the major focus of most studies such as the studies of Oyedokun et al. (2019), Uniamikogbo and Ali (2021), Emmanuel, (2021), and Chude et al. (2022) while the cost implication of the environmental accounting issues have received less attention.

There is need to make a shift from the perspective of disclosure in previous studies to explore the cost component of the environmental management dynamics of manufacturing firms, so as to determine if they can influence the value of firm. An exploration of the likely influence of the cost may gear manufacturing firms into improving the level of their compliance to environmental issues. This study will endeavor to fill the gap by considering the cost component of environmental management. The study specifically intends to explore the effect of carbon emission control on firm value of listed manufacturing firms in Nigeria. To achieve the objective of this study, the following null hypothesis was formulated:

**H<sub>01</sub>:** Carbon emission control cost has no significant effect on firm value of listed manufacturing firms in Nigeria.

## **2 LITERATURE REVIEW**

### **2.1 Conceptual Review**

#### **2.1.1 Firm Value**

The concept of firm value has been explained in several ways. Oyedokun et al. (2019) describe it as the assets owned by a firm as well as the net worth of owners of the firm. Daeli and Endri (2018) viewed it as the present value of a series of cash inflows that an organization will generate in the future. Mohammed (2017) opines that firm value is the investors' perception of the value of the success of the firm in relation to its stock price; while Brown (2022) states that the value of a firm represent the total worth of firm, encompassing financial value, goodwill and equity. The essence of financial management is to get the most out of available resources to maximize the value for the firm. Well-managed firms usually have improved value, which reflects stakeholders' perception and public image, a low level of information asymmetry, improved profitability, and reduced capital costs, which environmental consciousness guarantees (Sabrin et al., 2016).

Tobin's Q is also known as the market-to-book value ratio, is one metric used to assess a company's value while taking into account, both internal and external market factors. This ratio, which Professor James Tobin created in 1967, is peculiar because it takes into account numerous aspects of company dynamics. The market-to-book value ratio, or Tobin's Q ratio, is determined by dividing the market price of the company's stock plus debt by the value of its assets (Iyoha & Igbinovia, 2023). Additionally, stock market share price fluctuations can be used to gauge a company's value (Nuguyen & Bui, 2018). This suggests that a rise in share price will inevitably raise the firm's worth. High firm value indicates that the company is wealthy, and as a result, the wealth of the company's owners is utilised. Tobin's Q is used in this study to determine firm value since it considers both internal firm dynamics and external market valuation.

#### **2.1.2 Environmental Management Dynamics and Firm Value**

The ultimate objective of environmental management dynamics is to help businesses accomplish sustainable development and take part in successful conservation initiatives while preserving good relations with the community and employees. This process aids organizations in calculating the costs of taking part in conservation initiatives, measuring the advantages of doing so, and successfully informing stakeholders of the evaluation's findings (Endiana, et al., 2020). It is a part of sustainability engagements that focuses on analyzing how corporate activities affect the values of a going concern.

Nigeria is a member of the United Nations, and sustainability practices are comprehensive and essential to achieving the 2030 sustainable development goals. By evaluating environmental activities from the perspective of costs (environmental costs) and benefits or effects (economic benefits), as well as creating environmental protection effects, the goal of implementing environmental management is to increase the effectiveness of manufacturing firms involvement on external sustainability matters (Aifuwa, 2020). The application of environmental management dynamics reveals how much a business or organization contributes positively or negatively to the environment and human well-being (Akinfolarin, et al., 2025; Lusiana, et al., 2021). For the purpose of this study, carbon emission control is adopted as a proxy environmental management dynamics.

##### **2.1.2.1 Carbon Emission Control Cost**

Carbon emission cost is cost spent on excessive carbon ejected into the air by organizations. The aim of the cost is to help remediate carbon hazards in the environment. Communities around the business activities in the Nigerian manufacturing industry are particularly sensitive to toxic compounds in the environment, which compromise their health (Mayndarto & Augustine, 2021). The demand for transparency on healthy and safer environmental condition is gaining attraction as a broad concept that

affects people's quality of life as well as having other substantial societal impact. Carbon emission cost is centered to align manufacturing firms to global best practices on environmental sustainability so as to reduce green cost burden and enhance firms' value (Mousa & Othman, 2020). Carbon emission cost also encourages firms to use raw materials efficiently and to reduce emissions through green process innovation. An array of pollutants, including toxic, hazardous and 'warming' is accountable to manufacturing business activities. Carbon emission cost is considered by environmental regulatory bodies and advocates as a necessary tool to complement improved environmental decision-making by firms (Damieibi, 2023).

Lei et al. (2024) pointed that environmental cost, in particular, the carbon emission cost is positively connected with the quality of sustainability reporting, affirming that with the increase of environmental management intensity, the cyclic ordering of network structure (environmental management dynamics and firm value) is gradually enhanced. Spending on of carbon emission will not only reduce pollution, but also reduce the economic output of the network and reduce enterprise income to a greater extent. However, a contrary report was submitted by Sebrina et al. (2023) who found that most firms do not yet require the preparation of a standalone sustainability report. This study shows that the diffusion of sustainability reports is still shallow compared to mandatory social responsibility reports. The quality of sustainability reports based on carbon cost is also still low, but industry groups vary in quality as it is based on timeliness and stakeholder engagement, and comparability, satisfaction.

## **2.2. Theoretical Review**

### **2.2.1 Sustainability Theory**

Sustainability theory was propounded by Edward Barbier in 1987. The theory assumption hinges on the prioritization of the responsibility of firms to the atmospheric environment, such that the environment will be maintained in a way that will lead to preservation of its green state into the unforeseeable future (Duque-Grisales, & Aguilera-Caracuel, 2019). In Efuntade et al. (2023) and Fakayode and Olayemi (2023), the theory was applied to examined the relationship between environmental management and firm value. This theory has been applied in varying studies such as; sustainability reporting and green practices (Damieibi, 2023). It is relevant to this study because sustainability reporting quality is a responsibility to shareholders, society and the ecosystem, especially in Nigeria where working regulation that enforces sustainability reporting are in progress (Olaoye & Alao, 2023).

Sustainability theory affirms that environmental management strategies has the power to convey social, political, environmental and economic meanings for multiple groups of stakeholders. According to this theory, firms decide what information to disclose in their sustainability reports, which contributes to the firm's interests and therefore leads to better performance and quality. Sustainability theory relates to this current study because when firms are environmentally compliant, their financial performances and the business sustainability reporting are bound to improve with the extent of the compliance (Daeli & Endri, 2018). Sustainability theory is considered in effective environment practices and regulations (laws, acts and cost).

### **2.3 Empirical Review**

The Panel Least Squared (PLS) method of data analysis was employed in a study conducted by Okeke et al. (2021) to examine the impact of carbon emission disclosure on economic value added of oil and gas firms in Nigeria stock exchange during the periods of 0f 2018 and 2019. The relevant variables were taken from the annual reports of the mentioned oil and gas companies, which were secondary sources of data. The variables listed below were used: Economic value added, disclosure of waste treatment and effluent costs, firm size, and revenue growth. The study analyzes the included variables using the Hausman Test, Causality Test, Fixed Effect, and Random Effect. According to the study's analysis, the disclosure of waste treatment and effluent costs significantly affects economic value

added, and the firm's revenue growth significantly increases economic value added. Economic value added is positively and negatively impacted by firm size.

In another research carried out by Olaoye and Alao (2023), the study examined the effect of green accounting practice on business health of listed oil and gas firms in Nigeria. Objectively, the study focuses on the proprietary ratio and earnings per share as the proxies for business health. Ex-post facto research design was adopted to provide important information on phenomenon under investigation without any manipulation of the situation. The philosophical approach that was adopted is positivism. The study adapted and expressed financial performance proxied by return on asset as a function of the adoption of green accounting practice disclosure. Using positivism approach alone will not give a clearer behavioral pattern of environmental accounting practices because the approach can be manipulated by external factors such as the stakeholders' expectation and sustainability pressure. It is believed that the stakeholder and sustainability theory form a better theoretical foundation for environmental accounting practices and firm value. This study improved Olaoye and Alao (2023) study by engaging the use of sustainability theory.

Adegbe, et al. (2021) examined the effect of environmental accounting practices on firm value of quoted manufacturing companies in Nigeria. The study adopted ex-post facto research design and considered a population of 34 manufacturing firms listed on Nigerian Stock Exchange as at 31st December, 2019. The study selected a sample size of 11 companies (that is, 9 consumer goods companies and 2 industrial goods companies) with the use of purposive sampling technique. Descriptive and inferential statistics were carried out. The result, found that environmental accounting practices is positive but has insignificant effect on firm value of quoted manufacturing companies in Nigeria. Adegbe, et al. (2021) only considered 9 consumer and 2 industrial goods companies in Nigeria, but failed to capture other manufacturing firms. This current study affirms that if more manufacturing firms had been captured, the submitted results might have been different.

Similarly, Emeka-Nwokeyi and Osisioma (2019) study investigated the effect of sustainability and ethical disclosure components (social, environmental, and governance) on market value of selected non-financial firms in Nigeria for the period 2006–2015. Using content analysis, relevant disclosure data was extracted along with firm market value from annual reports of selected firms. Analyses were done using pool ordinary least square (OLS) regression technique. The study of Emeka-Nwokeyi and Osisioma (2019) was expected to have captured data up to 2024 because sustainability and disclosure data were available for firms. It is believed that the results of the study might have been different if data up to 2024 were captured and regressed.

The study conducted by Uniamikogbo and Ali (2021) on environmental accounting disclosure and the financial performance of manufacturing firms in Nigeria revealed that environmental accounting disclosure has a significant effect on the share price, return on assets, and return on equity of manufacturing firms in Nigeria. What was expected from Uniamikogbo and Ali (2021) study is that, the study should have used the disaggregated components of environmental accounting disclosure on financial performance. In the study's submission, knowing which components of environmental accounting disclosure that influence financial performance is not visible. This current study will improve on Uniamikogbo and Ali (2021) by using a disaggregated components of environmental cost.

In a more elaborated study, Igbekoyi, et al. (2021) investigated environmental accounting disclosure and financial performance of listed multinational companies in Nigeria. This study was conducted by firstly assessing the level of compliance, and then exploring the effect of environmental disclosure on financial performance with a focus on multinational companies in the face of continued environmental abuse witnessed in the Nigerian business space owing to the non-availability of sustainability reporting legal framework. The study used secondary data obtained from the published annual reports of the companies from 2011 to 2020. Data collected (Environmental disclosure index, return on asset, earnings per share), were analyzed using descriptive statistics and panel regression

analysis. Financial performance of listed multinational companies before the adoption of the International Financial Reporting Standards (IFRSs) are debatable in compare its IFRSs adoption. Since Igbekoyi, et al. (2021) did not consider a triangulated pre-post analysis review, the retrieved data were expected to have commenced from 2014 or 2015 and not 2011. This current study will improve on Igbekoyi, et al. (2021) study by capturing data from 2015, which serve as the period after the grace period.

A more recent study was conducted by Iyoha and Igbinovia (2023) as the study examined environmental information disclosures and value of agro-manufacturing firms listed on the Nigerian Exchange Group (NXG). The conflicting arguments between free market capitalism and eco-modernist theorists and the paucity of empirical evidence on the place of carbon accounting, environmental consciousness, environmental disclosures, and firm value relying on the submissions of the signaling and legitimacy theories necessitate the study. The study adopted an ex post facto research design. A census of the entire five (5) agricultural firms, twelve (12) industrial goods firms, and three (3) consumer goods firms to make a sample size of twenty (20) firms listed in the NXG from 2014 to 2020 was taken. The panel least squares estimation technique is adopted. The study found a positive and significant effects of environmental information disclosures on value creation.

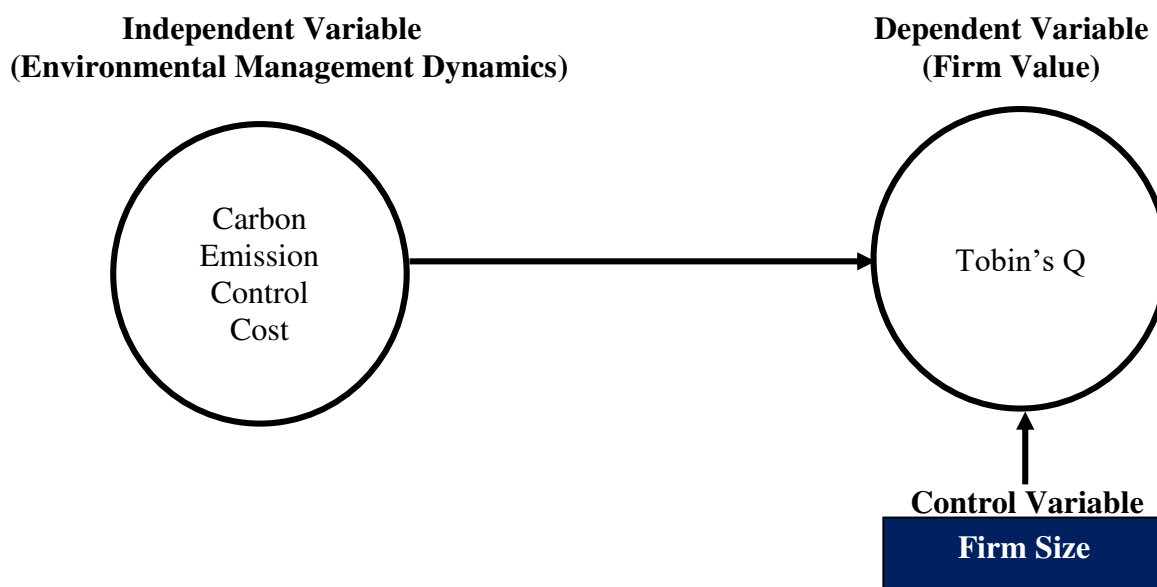
Shittu et al. (2024) examined the different cost components involved in environmental cost accounting. The research involved gathering data from the annual reports, environmental impact assessments, environmental and social mitigation plan reviews, environmental audit reports, and sustainability reports of manufacturing companies listed on the Nigeria Exchange Group as of December 31, 2023. The data covered an 11-year period from 2012 to 2022, which was analyzed using descriptive statistics and regression analysis. The research discovered that environmental prevention costs has a negative but significant impact on firm value, while environmental remediation costs has a positive and significant impact. Environmental waste management costs has a positive but insignificant impact on firm value.

## **2.4 Gap in Literature**

From the literatures reviewed, there exist a conceptual gap. Past studies have focused majorly on the concept of disclosure and not the cost element. The cost element of environmental management is crucial to any organization as it affects its firm value. There also exist mixed results from past studies, as the studies of Adegbe, et al. (2021), and Kolawole (2023) submitted a positive results while that of Olaoye and Alao (2023) and Chude, et al. (2022) submitted a negative results. From the review, most studies have focused on the oil and gas industry, non-financial industry, multinational firms and aviation industry than the manufacturing industry as retrieved from the studies of Damieibi (2023), and Huang and Fu (2022). In addition, most studies have only retrieved data up to 2023. Despite the fact that some studies has been conducted on environmental management strategies and how it affects firm value in Nigeria, the few studies that focused on manufacturing firm, have only focused on the return on asset and return on equity such as Adegbe, et al. (2021) and Kolawole (2023). Not much studies have been focused on Tobin's Q. Based on this backdrop, this current study intends to fill the gaps.

## 2.5. Conceptual Framework

**Figure 2.1.** A diagrammatical representation showing the association between the dependent, independent as well as the moderating variables.



*Source: Author's Design (2025)*

## 3 METHODOLOGY

A Longitudinal research design was employed for this study. The study's population consists of all publicly traded manufacturing firms on the Nigerian Exchange Group (NGX) from 2015 to 2024, a sample size of 14 listed manufacturing firms on the Nigerian Exchange Group (NGX) was purposefully selected. The decision of the sampled firms was based on the fact the manufacturing firms are among Nigeria's top thirty capitalized firms according to the Society for Corporate Governance Nigeria and the firms must meet up with the following criteria: the firms have been listed on Nigerian Exchange Group (NGX) from 2015 to 2024 and they have their annual and Sustainability Report accessible on their website for the period under study. Data were extracted from the published reports on the websites of the quoted manufacturing firms under study.

### 3.1. Model Specification

The model used in this study was adapted from the model of Amaegbu & Onyali (2021), given as follow:  $ROI_{it} = \alpha + \beta_1 EPC_{it} + \beta_2 EDC_{it} + \beta_3 EMEC_{it} + \mu_{it} \dots i$

Where: ROI is return on asset, EPC is Environmental Prevention Cost, EDC is Environmental Education Cost, and EMEC is Environmental Management and Education Cost.

This study improves on Amaegbu & Onyali (2021) model by considering the effect of carbon emission cost and a control variable on the model. It is believed that firms are of different sizes and ignoring to control the effect of the sizes in a model can give a robust results. This study adapts Amaegbu & Onyali (2021) model by making the dependent variable Tobin's q and adding a control variable, thus we have:

$$\text{Tobin's } Q_{i,t} = \alpha_0 + \beta_1 CECC_{i,t} + \beta_2 FMS_{i,t} + e_{i,t} \dots \dots \dots ii$$

CECC = Carbon Emission Control Cost

FMS = Firm Size

$\alpha$  = Constant;  $i$  = of a particular firm;  $t$  = Time Series;  $\beta_1$ , = Regression of the Independent Variable;  $\beta_2$  = Regression of the Control Variable;  $e$  = Error Term. The apriori expectation of this study is that  $CECC > 0$ .

The data collected for the research was analyzed using the Panel Least Square (PLS) for the regression analysis of the econometric statistical package “STATA 14”. The descriptive statistics, correlation analysis and the unit root diagnostic tests was carried out on the data to determine its appropriateness, checking for robustness.

### 3.2 Measurement of Variables

**Table 3.1 Variables Measurements**

| S/N | VARIABLES                                                   | DESCRIPTION                                                   | MEASUREMENT                                                                                                    | SOURCES                                               |
|-----|-------------------------------------------------------------|---------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| 1.  | <b>Dependent Variable</b><br>(Firm Value)<br>Tobin's Q      | This is the market-to-book value ratio of a firm.             | It is measured by dividing the market price of the company's stock plus debt by the value of its total assets. | Iyoha and Igbinoia, (2023) and Cheska, et al. (2022). |
| 2.  | <b>Independent Variable</b><br>Carbon Emission Control Cost | This represents the cost incurred on carbon emission control. | The total amount expended on carbon emission control and maintenance.                                          | Brown (2022); Farber, (2019).                         |
| 3.  | <b>Control Variable</b><br>Firm Size                        | This represents the total assets of the firm.                 | Log of Total Asset.                                                                                            | Effendi (2021) and Akpan and Nkanta (2023).           |

*Source: Author's Compilation, 2025*

## 4 DATA ANALYSIS AND DISCUSSION OF FINDINGS

### 4.1 Descriptive Statistics

On the descriptive analysis table, carbon emission control cost (CECC) average is 0.001 with standard deviation of 0.435. The standard deviation value shows that there is low variability in Tobin's q across the sampled listed manufacturing firms. The listed manufacturing firms with the least value is Tobin's q has 0.0324 while the maximum Tobin's q recorded in the industry is 0.2583. The total sum of Tobin's for the sampled manufacturing firms is 10.48. Data for the study positively skewed and normally peaked having skewedness value of 1.3945 and kurtosis of 1.002. Further test for data normality through Jarque-Bera test shows statistics of 2.119, and probability value of 0.001. This imply that data for Tobin's q is not normally distributed.

In addition, carbon emission control cost (CECC) average is 2.104 with standard deviation of 0.1435. The standard deviation value shows that there is low variability in carbon emission control cost across the sampled listed manufacturing firms, with the least value of 2.738 while the maximum recorded in the industry is 3.021. The total sum of the sampled manufacturing firms is 18.48. Data for the study is positively skewed and normally peaked having skewedness value of 0.6293 and kurtosis of 1.584.



Further test for data normality through Jarque-Bera test shows statistics of 3.033 and probability value of 0.000. This imply that data for carbon emission control cost is not normally distributed.

Firm Size (FMS) average is 4.022 with standard deviation of 0.0004. The standard deviation value shows that there is extremely low variability in firm size across the sampled listed manufacturing firms. The listed manufacturing firms with the least leverage is 3.007 while the maximum recorded in the industry is 6.011. The total sum of firm size for the sampled manufacturing firms is 24.01. Data for the study is positively skewed and normally peaked having skewedness value of 2.003 and kurtosis of 2.104. Further test for data normality through Jarque-Bera test shows statistics of 5.731 and probability value of 0.001. This imply that data for leverage is not normally distributed.

**Table 4.1: Descriptive Statistics**

| Variables      | Tobin's Q | CECC  | FMS   |
|----------------|-----------|-------|-------|
| Observations   | 30        | 30    | 30    |
| Mean           | 0.001     | 2.104 | 4.022 |
| Std. Deviation | 0.435     | .1435 | .0004 |
| Minimum        | .0324     | 2.738 | 3.007 |
| Maximum        | 2.583     | 3.021 | 6.011 |
| Sum            | 10.38     | 18.48 | 24.01 |
| Skewness       | .3945     | .6293 | 2.003 |
| Kurtosis       | 1.002     | 1.584 | 2.104 |
| Jarque-Berra   | 2.119     | 3.033 | 5.731 |
| Probability    | 0.001     | 0.000 | 0.001 |

*Source: STATA 14 Result, 2025.*

## 4.2 Test of Variables

### 4.2.1 Pairwise Correlation Matrix

It is demonstrated that there is a positive correlation between carbon emission control cost (CECC) and firm value (Tobin's q). The coefficient value is 0.0473 while its probability value is 0.0001 making the correlation significant. From the same table, it is revealed that Firm Size (FMS) has coefficient value of 0.2945 and probability value of 0.0103. The explanatory and control variables are positive. The overall implication of this relationship is that the function of carbon emission control cost on firm value of listed manufacturing firms in Nigeria is direct as Tobin's q reacts based on the activities of carbon emission control cost.

**Table 4.2: Correlation Analysis of the Variables**

| Variables | Pairwise Correlation | Tobin's q | CECC    | FMS    |
|-----------|----------------------|-----------|---------|--------|
| Tobin's q | Coefficient          | 1.0000    |         |        |
|           | Sig.                 | -         |         |        |
| CECC      | Coefficient          | 0.0473*   | 1.0000  |        |
|           | Sig.                 | 0.0001    | -       |        |
| FMS       | Coefficient          | 0.2945*   | 0.0320* | 1.0000 |
|           | Sig.                 | 0.0103    | 0.0045  | -      |

*Source: STATA 14 Result, 2025*

### 4.2.2 Panel Unit Root Test of the Variables

Augmented Dickey-Fuller (ADF) and Phillips- Perron (PP) test for unit root were used to determine the order of integration. Schwarz Information Criterion (SIC) and Akaike Information Criterion (AIC) are used for determination of appropriate lag order selection for each test. The results of unit root tests indicate all the variables are integrated of order I(I). The stationarity tests were performed

first in levels and then in first difference to establish the presence of unit roots and the order of integration in all the variables. The results of the ADF and PP stationarity tests for each variable show that both tests fail to reject the presence of unit root for the variables under study.

**Table 4.3: Unit Root Test**

| Variables | In-Level I(0)           |                 | First Difference I(I)   |                 | Order of Integration    |                 |
|-----------|-------------------------|-----------------|-------------------------|-----------------|-------------------------|-----------------|
|           | Augmented Dickey Fuller | Phillips-Perron | Augmented Dickey Fuller | Phillips-Perron | Augmented Dickey Fuller | Phillips-Perron |
| Tobin's q | -0.2637                 | -0.0372         | -1.3950*                | -0.3229*        | I(I)                    | I(I)            |
| CECC      | -1.0372                 | -1.0104         | -1.1995*                | -1.2841*        | I(I)                    | I(I)            |
| FMS       | -1.3921                 | -1.0563         | -1.0012*                | -1.1893*        | I(I)                    | I(I)            |

Source: STATA 14, 2025

#### 4.2.4 Multicollinearity Test

Post estimation tests are conducted to verify the validity of the assumptions of the regression model, such as the presence of multicollinearity. This occurs when two or more explanatory variables are highly correlated, making it possible to predict one variable from the other with some degree of accuracy. The Variance Inflation Factor (VIF) is used to assess the independence of the explanatory variables. According to the evidence in Table 4.4, it appears that there is no multicollinearity issue. The VIF values for all the variables are less than 10 and the tolerance values for all the variables are greater than 0.10. These values meet the criteria to use the regression coefficient to confidently predict the impact of independent variables on dependent variables, so the results of the study can be considered valid.

**Table 4.4. Tolerance and VIF Value**

| Variable                            | VIF  | 1/VIF    |
|-------------------------------------|------|----------|
| <b>Carbon Emission Control Cost</b> |      |          |
| CECC                                | 1.01 | 0.058293 |
| Mean VIF                            | 0.35 |          |

Source: STATA 14 results, 2025

#### 4.2.5 Post-Estimation Test

Error test for model specification is conducted using Ramsey RESET test. It evaluates the suitability of the functional model specified for the regression. The study assess if a non-linear version of the connection between the dependent variable and the independent factors would be more suitable. The results shows probability of 0.0351 and this indicate that the model has no omitted variable bias and misspecification. The heteroscedasticity test was conducted to check the validity of homoscedasticity assumption that variance in the residuals are constant as the absence of homoscedasticity violate the assumption and may lead to wrong inference. Heteroscedasticity test was conducted using Breusch-Pagan/Cook-Weisberg test and the result revealed an absence of heteroscedasticity given the probability value of 0.1310 which is higher than 0.05. Likewise, variables for the study is also tested for auto-correlation using Wooldridge test for autocorrelation in panel data. Autocorrelation depicts how closely variable value is correlated across time. The result as presented in table 4 shows the probability of 0.0001 which is significant indicating that there is problem of auto-correlation hence the null hypothesis that there is no first-order correlation is rejected.

Furthermore, the cross-sectional dependence test is carried out and the result is presented in Table 4.5. The result indicate that null hypothesis which implied there is no cross-sectional dependence is strongly rejected as the statistics shows 0.420 with probability value indicated 0.0010. Hence, there is sufficient evidence to conclude that carbon emission control cost under random effect condition exhibits cross-sectional dependence. However, all the observed estimation problems are to be corrected using the Panel Least Square regression analysis with the option that the standard error is independent-corrected. The Hausman test was also conducted to specify the appropriate model between fixed-effect model and random effect model and the result favour the fixed effect model as the probability shows 0.0002 implying that difference in coefficient is not systematic.

**Table 4.5: Summary of Post Estimation Test Results**

| <b>Ramsey Reset Test</b>                                          |                             |             |
|-------------------------------------------------------------------|-----------------------------|-------------|
| Null Hypothesis                                                   | F-Statistics                | Probability |
| H <sub>0</sub> : Model has no omitted variables (P>0.05)          | 1.03                        | 0.0751      |
| <b>Tolerance and VIF Value</b>                                    |                             |             |
| Null Hypothesis                                                   | VIF                         | Mean VIF    |
| There is no multicollinearity among the variables<br>(1/VIF>0.10) | -                           | 1.22        |
| <b>Breusch-Pagan / Cook-Weisberg Test for Heteroscedasticity</b>  |                             |             |
| Null Hypothesis                                                   | Chi <sup>2</sup> Statistics | Probability |
| Constant variance across the variables residuals (P>0.05)         | 0.09                        | 0.1310      |
| <b>Wooldridge Test for Autocorrelation</b>                        |                             |             |
| Null Hypothesis                                                   | F-Statistics                | Probability |
| No first-order autocorrelation (P>0.0)                            | 65.13                       | 0.0001      |
| <b>Pesaran's Test of Cross Sectional Independence</b>             |                             |             |
| Null Hypothesis                                                   | F-Statistics                |             |
| There is no cross-sectional dependence (P>0.05)                   | 0.420                       | 0.0010      |
| <b>Hausman Test</b>                                               |                             |             |
| Null Hypothesis                                                   | F-Statistics                | Probability |
| Difference in coefficients not systematic (P>0.05)                | 5.18                        | 0.0002      |

**Source: STATA 14 Result, 2025**

### 4.3 Data Analysis

#### 4.3.1 Carbon Emission Control Cost and Firm Value

On Table 4.6, the Coefficient of carbon emission control cost (CECC) confirmed the study apriori expectation, as it signed a positive coefficient of 0.347283. This implies a 34% increase in Tobin's q employed for a 1 unit change in carbon emission control cost. The p-value is 0.001 making carbon emission control cost positive and statistically significant in explaining the variation change in carbon emission control cost of the listed manufacturing firms in Nigeria.

The coefficient of determination as revealed by R-square ( $R^2$ ) indicates that 65.5% of the volatility observed in the model were explained by the influence and variations in the explanatory variable (carbon emission control cost) while the remaining 34.5% is attributed to other factors not included in the model. The Prob (F-statistic) which test the goodness of fit suggest that the model employed in the study is statistically significant given the value of 0.001 which denotes at 5 percent level of significance, the equation in use is statistically valid. This implies the equation is useful in explaining a unit change in firm value of listed of manufacturing firms in Nigeria. The Wald chi2 shows the absence of serial auto-correlation.

The findings of the study corroborate the results of similar study such as Olaoye and Alao (2023) on environmental strategies and financial performance and the findings suggest that environmental cost positively affects firm performance. However, this study disagrees with the study of Shittu et al. (2024) who found a negative relationship and insignificant effect of environmental characteristics on firm performance.

**Table 4.6: Panels Corrected Standard Errors Regression Analysis**

| <b>TobinsQ</b>      | <b>Coef.</b>   | <b>Panel-corrected<br/>Std. Err.</b> | <b>Z</b> | <b>P&gt; z </b> |
|---------------------|----------------|--------------------------------------|----------|-----------------|
| CECC                | .0367483       | .0347283                             | 0.59     | 0.001           |
| FMS                 | .1873321       | .0199022                             | 0.31     | 0.020           |
| _Cons               | 1.292757       | .1903345                             | 1.20     | 0.011           |
| Number of obs       | = 30           |                                      |          |                 |
| R-squared           | = 0.6559       |                                      |          |                 |
| <b>Wald chi2(4)</b> | <b>= 11.02</b> | <b>Prob&gt;chi2</b>                  | <b>=</b> | <b>0.0001</b>   |

*Source: STATA 14 Result, 2025*

## **5 SUMMARY, CONCLUSION AND RECOMMENDATIONS**

### **5.1 Summary**

The study examined the effect of environmental management dynamics on firm value. The study shows that carbon emission control cost has positive and significant effect on firm value of listed manufacturing firms in Nigeria. The results support previous researchers who admit a positive and significant relationship between some environmental management dynamics on firm value of listed firms in Nigeria.

### **5.2 Conclusion**

The study concluded that spending on controlling carbon emission is a significant underlying factor that influence firm value. This study contributes to knowledge by providing evidence of the effect of carbon emission control cost on firm value of listed manufacturing firms in Nigeria.

### **5.3 Recommendation**

From the findings, the study recommends that carbon emission control cost should be maintained and increased by the manufacturing firms in Nigeria as it is significant in explaining a positive and significant variation change in firm value.

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