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Environmental Cost Accounting and Firm Value of Listed Multinational Firms in Nigeria

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ABSTRACT

Nigerian atmospheric and social environments had suffered environmental abuse and degradation occasioned by the indiscreet acts of firms in a bid to improve their values. This study investigated environmental cost accounting and firm value of listed multinational firms in Nigeria. The study adopted ex-post facto and longitudinal research designs, and population comprises 50 multinational firms listed on Nigeria Exchange Group as at 31st December, 2022. The population formed the sample size of the study using census sampling method. The data obtained were from secondary source through published annual reports between 2008 and 2022. Descriptive statistics and panel regression analysis were used for the analysis. In the findings, environmental cost accounting' results revealed that environmental prevention cost; environmental internal failure cost, and environmental external failure cost have positive relationship on firm value. However, environmental protection cost showed an insignificant effect. It was concluded that environmental cost accounting significantly influence firms' value. The study recommended that multinational firms should maximize opportunities of the identified environmental accounting to improve their environmental responsibility and promote business operation in line with global best practices.

Keywords: Environment, development, trade and sustainability

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1 INTRODUCTION

Environmental cost accounting can be used to develop environmental cost models usable to predict the costs of various environmental options or liabilities for environmental clean-up. It also helps to identify areas of wastage and potential savings (Alawode & Adegbie, 2020). Environmental costs accounting is aimed at availing future effective information for decision-making and environmental policies; and this would purposefully indicate all the environmental social costs of all the processes and activities with the help of measurement and accounting disclosure on the environmental performance (Hanane, 2014).

Uwuigbe (2012) assessed environmental accounting in Nigeria with utilization of firm size as a proxy for firm characteristics for 5 years alongside financial leverage and net profit for the measurement of the firm in a given period. This assisted in establishing various ministries and extra-ministerial departments in different parts of the country for environmental stability. Makori and Jagongo (2013) discussed environmental cost recognition and firm value in India from data collected at the Bombay stock exchange. Analysis, conclusion and recommendation were made to provide more information on environmental disclosure index. Inconclusive of the various authors regarding environmental cost accounting and firm value as discussed above necessitates the current study to further examine environmental cost accounting and firm value in Nigeria.

Abdulrahman (2018) disclosed that firm value has been a major instrument used to assess effectiveness of firm performance at any given period with a long run of promoting firm survival both at local and external markets. It was also disclosed that environmental changes have brought evaluation beyond financial both to consider non-financial performance as anchored current study of firm's social and environmental performance. Votsi et al. (2017) disclosed that inappropriate attention on environmental issues by both government and private firms brought negative consequences such as health challenges and global warming; the challenges were addressed by setting up regulatory bodies and accountability for the firm operation which brought emergence of environmental accounting concept in various operations.

Environmental cost accounting has been a great instrument used to predict various costs incurred to cater for environmental liabilities on cleaning up, identification of wastage and increased in firm savings with the help of measurement and accounting disclosure on environmental performance (Hanane, 2014). Makori and Jagongo (2013) discussed environmental cost recognition and firm value in India from data collected at Bombay stock exchange. Analysis, conclusion and recommendation were made to provide more information on environmental disclosure index. Inconclusive of the various authors regarding environmental cost accounting and firm value as discussed above necessitates the current study to further examine environmental cost accounting and firm value in Nigeria.

The research question is to investigate how environmental cost accounting affect firm value of listed multinational firms in Nigeria, by specifically exploring the relationship that exist between environmental prevention cost, environmental internal failure cost, environmental external failure cost and firm value. The hypothesis of the study is stated in the null form i.e. environmental cost accounting does not significantly affect firm value of listed multinational firms in Nigeria.

The outcome of this study would also serve as a benefit to the Nigerian Exchange Group in the area of rating and valuation of firms in different sectors and maintaining global best practices; considering concentration of these multinational firms in Nigeria stock market.

Furthermore, the outcome of this study would be beneficial to the society as it would form a yardstick used to evaluate a firm's ability to create value and how interrelated dimensions create value to make an informed decision regarding their environmental responsibility in a corporate business environment.

This study covered environmental cost accounting and focused on 50 multinational firms that were listed on the Nigerian Exchange Group as at 31st December 2022. The study covered a period of 15 years from 2008 to 2022.

2 LITERATURE REVIEW

2.1 Conceptual Review

2.1.1 Environmental Cost Accounting

Environmental cost accounting is a monetary value for preventing and reducing environmental impact, cost restoration and damage prevention that has to do with cost management control (Tochukwu, 2018). Environmental cost accounting involves the prevention of environmental impact that occurs within the firm area to prevent pollution and environmental hazard to ensure environmental performance and resource recycling (Agboola & Oroge, 2019). Ben-Bouzian and Ben-Dhab (2012) stated that environmental cost accounting revolves around shareholders' concerns about the environmental impact of the operation of a firm in a given period in conjunction with economic performance. The overall activities of environmental cost accounting are to enhance environmental dissemination to reduce environmental issues and improve firm value (Tochukwu, 2018).

Environmental cost accounting is prepared to ensure effectiveness and efficiency of cost estimation on operation of a firm to ensure the well-being of various stakeholders that promote the good image of a firm (Ben-Bouzian& Ben-Dhab, 2012). It was finalized that the law-abiding trait of a firm would be ensured and promote competitiveness in the field of environmental operation. It was ascertained that effective environmental cost accounting process in various areas of firm operation would reduce cost operation and solve ecological issues (Hanane, 2014). The effective environmental cost accounting process involves collecting, analysing and properly presenting environmental cost accounting information in such a way that would impact decision-making.

Environmental cost accounting is used to develop environmental cost models to predict the costs of various environmental issues for identifying various wastages and losses (Norhasimah, 2016). It is proxied in the context of this study with; prevention costs, detection costs, internal failure costs and external failure costs. Environmental prevention cost is incurred by a firm for preventing environmental pollution in the operation of a firm. Environmental detection cost is incurred in ensuring a compliance with the rules and regulations. Environmental internal failure cost is incurred by a firm to prevent contaminants and waste that are yet to be discharged into the environment. Environmental external failure cost is incurred by a firm to prevent contamination and waste in the environment.

2.1.2 Firm Value

Firm value is described as the improvement in a firm occasioned by efficient and effectiveness in the firm's operation in conjunction with effective organization management (Garg, 2015). Firm value is used to assess the achievement of firms over a given period through various means (Arumona et al., 2020). Verma (2019) stated that firm value is a means of actualizing firms' objectives by considering various environmental factors inherent in the operation of a firm. The firm value is a method of achieving the firm's policies and visions that will be reflected in the firm value (Okafor, 2018).

The business owners including other stakeholders are demanding more information from firms to provide reports that provides the overall performance of an organization on changes such as ozone depletion, global warming and diverse practices over world; and this serves as a reliable place where information can be gotten for the assessment of firms' value in the world (Emeka-Nwokeji & Osisioma, 2019). Firm value shows prosperity of the business owners that serve as a responsibility of the management to maximize the values of a firm that form the major vision of a firm (Okafor, 2018). The firm value shows the success achieved in the operation of a firm which forms the major interest of stakeholders that will also be used for prediction (Oyedokun et al., 2019).

Firms are created for the maximization of firm value which serve as a means of increasing shareholder wealth through high return on investment with the use of market price (Sucuahi & Cambarihan, 2016). Pumlee et al. (2015) argued that corporate environmental accounting and stock price movement would improve the firm value and this could be measured through growth in market share, return

on equity and liquidity. Similarly, Agustia et al. (2019) also submitted that shareholders' wealth can also be accessed through stock market price which reflects investment funding decisions and asset management with consideration of environmental issues from the operation of a firm. Solomon (2020) stated that firm value can be measured by dividing total market value with total asset value for a given period. Firm value is a process of sustainable and product differentiation that can assist in cost saving on resource utilization that would produce a multiplier effect on firm value (Oyedokun et al., 2019). This study however, proxied firm value with Tobin's Q; because it is an accounting variable for determining firm incremental value alongside with firm's appraisal.

Arifiyanto (2016) explained that one of the indicators of measuring the variable of company performance from the investment perspective is by using Tobin's Q. Garg (2015) also stated that incremental value on the operation of a firm in conjunction with effective organization management as measured as total market value divided by total asset value. The measurement has been tested in various situations of top management. Tobin's Q measurement includes a simple but good measurement so that investors could get interesting information related to the investment. This is used to measure the firm value that displays management performance to and determine the condition of investment opportunities and the growth level of a firm. Tobin's Q value is determined by the sum of the market value of an investment divided by debt value.

2.1.3 Environmental Cost Accounting and Firm Value

Musharof (2019) thought that environmental cost accounting is a vital instrument for information dissemination on firm performance that could be used by various stakeholders; the study also emphasized that business requires resources for smooth operation in the changes of environmental activities. The study stated that there is a need to reduce environmental costs for effective and efficient operation.

Okpala and Iredele (2019) discussed environmental, social accounting and firm value in Nigeria with divergent opinions on its relationship. Fasua and Osifo (2020) said that some firms were created purposely for wealth maximization without considering the immediate environment; they further established that oil and gas with other companies created lots of threats to the firm environment which caused emissions, social failure, greenhouse gasses and pollution in some of the host communities with the aims of achieving firm objectives which assist in cost estimation and benefit analysis.

Nguyen and Tran (2020) discussed issues on firm's cost of capital and environmental accounting; they said that many firms have wound up due to fraud committed through environmental protection agencies, and suggested possible solutions through mandatory environmental information disclosure for truthful reputation. Daniel and Ambrose (2013) said that environmental accounting discloses more information on firms' value by considering the effects of environmental social cost on firms' activities in an ecological environment.

Alicia *et al.* (2020) discussed world environmental problems and possible means of safeguarding ecological systems should be the main goals of firms operating in a particular period; this strategy would improve the firm value of an organisation if adequately implemented in firms' strategy policy. Yongliang *et al.* (2020) discussed public concerns about environmental problems that led to the formation of environmental regulations for listed firms in China and this would reduce the menace of ecological issues in the environment.

Uwuigbe (2012) assessed environmental accounting in Nigeria with the utilization of firm size as a proxy for firm characteristics for 5 years alongside financial leverage and net profit for the measurement of the firm in a given period. This assisted in establishing various ministries and extra-ministerial departments in different parts of the country for environmental stability.

Makori and Jagongo (2013) discussed environmental cost recognition and firm value in India from data collected at the Bombay stock exchange. Analysis, conclusion and recommendation were made to provide more information on environmental disclosure index.

Inconclusive of the various authors regarding environmental cost accounting and firm value as discussed above necessitates the current study to further examine environmental cost accounting and firm value in Nigeria.

2.2. Theoretical Review

2.2.1 Legitimacy Theory

Dowling and Pfeffer (1975) put forward the concept of legitimacy theory, which is grounded in the notion of organizational legitimacy. The notion of legitimacy posits that companies consistently strive to align their operations with the norms and expectations of the society in which they operate. According to this view, the corporation is obligated to fulfil the demands of external stakeholders by engaging in necessary steps to reveal its operations. This disclosure should be conducted in a manner that aligns with both legal and economic norms. The underlying principle of this notion is that management accounting's role in sustainable development and accounting for sustainable development is employed as a means of communication to inform or alter the public's view of the entity's activities (Mishra and Siddiqui, 2014). The objective of this theory is to elucidate the association between a business entity and the community, elucidate the rationale behind businesses' disclosure of information pertaining to social and environmental matters, demonstrate the utilization of legitimacy strategies by businesses, and evaluate the impacts that these disclosures have on the broader public and society.

Uyagu et al. (2017) argued that a firm's size was a great factor influencing firm values in a business environment with the influence of pollution and other hazard issues, and said further that the stronger firms could easily be accessible and imparting the immediate environment through the help of stakeholders that were concerned about environmental activities than smaller firms. Moreover, as proved by Malaysian researchers Uyagu et al. (2017) said that larger firms had more resources, innovations, ideas and human resources that would force their responsibility for environmental accounting that would be expected by society; and form the legitimacy theory as mentioned above, it was noted the larger firms disclosed more environmental information than smaller firms.

Khalid et al. (2021) discussed issues on environmental accounting that resulted from undisclosed voluntary information which made up of macro-theory and organizational theory. The macro-theory of legitimacy did not voluntarily disclose environmental accounting information while organization theory voluntarily declared its financial and environmental accounting information to the stakeholders and society at large. It was deduced that large and international firms would voluntarily disclose their environmental accounting information compared to small firms with small capital to be legally bound. Lawal (2016) discussed existence of a firm for satisfying stakeholders' interest during its operation in a given period.

2.3 Empirical Review

Igbru and Agbasi (2016) examined environmental cost accounting and firm value in Nigeria from 2010 - 2014. The data were analysed through descriptive statistics, correlation and regression analysis; the results showed a significant relationship exists between corporate social responsibility, employee health and safety cost, waste management and firm performance while community development cost displayed insignificant relationship with firm performance.

Nguyen and Tran (2020) discussed issues on firm's cost of capital and environmental accounting; they said that many firms have wound up due to fraud committed through environmental protection agencies, and suggested possible solutions through mandatory environmental information disclosure for truthful reputation.

Alicia et al. (2020) discussed world environmental problems and possible means of safeguarding ecological systems should be the main goals of firms operating in a particular period; this strategy would improve the firm value of an organisation if adequately implemented in firms' strategy policy. Yongliang

et al. (2020) discussed public concerns about environmental problems that led to the formation of environmental regulations for listed firms in China and this would reduce the menace of ecological issues in the environment.

Oshiole et al. (2020) examined effect of environmental cost disclosure on profitability of oil and gas firms in Nigeria. Secondary data was used to collect financial report of the firm within period of 2010-2019 with the utilization of ordinary least square regression for data analysis and discovered significant relationship between variables.

Nwaimo (2020) researched effect of environmental cost on performances of firms in Sub-Sahara African countries, Ghana. Secondary data were used for collecting financial information on firm performance with the utilization ordinary least square regression analysis and discovered positive relationship exited among variables and recommended proper care environmental sustainability in the environment.

Chiamogu and Okoye (2020) examined environmental cost accounting and financial performance of oil and gas firms in Nigeria. Secondary data were used for financial information collection within 2011-2019 with the utilization of ordinary least square regression analysis. The result discovered positive relationship existed between environmental cost accounting and financial performance.

Oraka (2021) examined effect of environmental costs on financial performance of Oil and Gas companies in Nigeria. Secondary data were used to source financial information with utilization of ordinary least square regression analysis within 2000-2021. The results displayed that environmental management accounting significantly affected financial performance of firms in Nigeria.

Ofurum and Iwunna (2022) examined environmental cost disclosure on financial performance of listed oil and gas firms in Nigeria. Secondary data were used to collect financial information from listed oil and gas in Nigeria with utilization of ordinary least square for data analysis. The results showed positive relationship between variables.

Lawrence and Bernard (2023) examined environmental costs and financial performance of industrial goods in Nigeria. The study focused on how environmental cost accounting could be effectively managed for improvement on firm value within the period of 2011-2020 and used panel regression analysis. It was discovered that there was positive relationship between variables and recommended that big firms should be adequately involved in environmental controlled.

3 METHODOLOGY

The study applied *ex-post* facto research design for data collection that covered from 2008 to 2022; the population which formed sample size contained fifty (50) multinational firms in Nigeria. The study used a model applied in Solanke et al. (2024) on environmental financial accounting and firm value of listed firms In Nigeria. $FV_{it}=\beta_0 + \beta_1 WTD_{it} + \beta_2 DOL_{it} + \beta_3 GW_{it} + \beta_4 DFW_{it} + \beta_5 DNRE_{it} + \mu_{it} \ldots\ldots\ldots i$

Where:

FV= Firm value

EFA= Environmental Financial Accounting

To achieve objective assess how environmental cost accounting affected firm value, the model is stated thus: $FV_{it}= \beta_0 + \beta_1 EPVC_{it} + \beta_2 EDTC_{it} + \beta_3 EIFC_{it} + \beta_4 EXFC_{it} + \mu_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots ii$

FV= Firm value (Tobin's Q)

EPVC =Environmental prevention costs

EDTC = Environmental detection costs

EIFC =Environmental internal failure costs

EXFC = Environmental external failure costs

The *a priori* expectation of this equation based on the evidence of literature reviewed is that environmental cost accounting would have positive effect on firm value. The expectation is

econometrically stated thus: β_1-$\beta_4 > 0$. The data were regressed using the Error Corrected Panel data analysis.

Description and Measurement of Variables

Table 1: Measurement of variables

Variables	Description	Measurement	Source
Environmental Cost Accounting			
Environmental prevention costs	This is the cost incurred by a firm for preventing environmental pollution in the operation of a firm	This is measured on the amount spent to prevent, environmental contamination inorder to increase the property's safety with the consideration of measurable instruments stated above.	Agboola and Oroge (2019)
Environmental detection costs	This is the cost incurred in ensuring firm's compliance to the rules and regulation.	This is measured on the amount spent in ensuring environmental law compliance with the consideration of measurable instruments stated above.	Tochukwu (2018)
Environmental internal failure costs	This is the costs incurred by a firm for the purpose of preventing contaminants and waste that yet to be discharged into the environment	This is measured on actual value spent in preventing contaminants and waste that yet to discharge in to the environment with the consideration of measurable instruments stated above.	Agboola and Oroge (2019)
Environmental external failure costs	This is the costs incurred by a firm for the purpose of preventing contaminants and waste after they have been discharged into the environment	This is measured on the value spent in preventing contamination and waste after they have been discharged into the environment with the consideration of measurable instruments stated above.	Tochukwu (2018)
Dependent variable			
Firm Value	This is the incremental value in the operation of a firm for a given period in conjunction with the effective organization management.	Tobin's Q is total market value divided by total asset value	Agboola and Oroge (2019)

Source: Researcher's Computation, 2024

4 DATA ANALYSIS AND DISCUSSION OF FINDINGS

4.1 Descriptive Statistics

Table 2: Descriptive Statistics

Variables	Obs	Mean	S.D	Std. E	MIN	MAX	SUM	SKW	KURT	J.B.	P.Value
Tobin's Q	750	.01338	.0191	.0006	0.000	.1370	10.042	2.464	11.203	2897.5	0.0000
Env. Prevention Cost	750	.44686	.3995	.0145	0	2.484	335.14	.1728	2.461	12.672	0.0018
Env. Detection Cost	750	.42028	.4028	.0147	0	1.386	315.21	.1883	1.722	55.489	0.0000
Env. Internal Failure Cost	750	.1612	.3195	.0116		1.386	120.92	1.650	4.280	394.37	0.0000
Env. External Failure Cost	750	.1232	.2825	.0103	0	1.098	92.437	1.993	5.455	690.80	0.0000

Researcher's Computation, 2024

In Table 2, it was indicated that disclosure on environmental prevention cost displayed a mean value of 0.44686 with a standard deviation of 0.3995, and this implied a moderate variation in environmental prevention cost of multinational firms considering its distance to mean value. Also showed a least disclosure on environmental prevention cost scored of 0 and displayed a maximum of 2.4843 with total sum of environmental prevention cost disclosure as 335.14. The data for variable was positively skewed and normally peaked as indicated 0.1728 for skewness and 2.461 for kurtosis. The Jarque berra test for normality showed that data were not normally distributed considering its statistics of 12.672 with a P-value of 0.0018 which indicated significance for null hypothesis test and data abnormality at $P<0.05$

Environmental detection cost displayed a mean value of 0.42028 with a standard deviation of 0.4028, and this implied a moderate variation in firm value considering its distance to mean value. The total sum of environmental detection costs was 315.21 with a minimum environmental detection cost score of 0 and the maximum score was 1.386. The variable data were positively skewed and normally peaked as indicated 0.1883 for skewness and 1.722 for kurtosis. The Jarque berra test for normality showed that data were not normally distributed considering its statistics of 55.489 with a P-value of 0.0010 as indicated a significance of null hypothesis test and abnormality data at $P<0.05$.

Likewise, environmental internal failure cost displayed a mean value of 0.1612 with a standard deviation of 0.3195 and this moderated variation in internal failure cost multinational firms considering its distance to mean value. The total sum of environmental internal failure cost was 120.92 and standard error of mean was 0.1612 as displayed a minimum environmental detection cost scored of 0 and maximum scored as 1.386. The variable data were positively skewed and normally peaked as indicated 1.650 for skewness and 4.280 for kurtosis. The Jarque berra test for normality showed that data were not normally distributed considering its statistics of 394.37 with a P-value of 0.0000 which indicated a significance for null hypothesis test and data abnormality at $P<0.05$

In table 4.1, environmental external failure cost displayed a mean value of 0.1232 with a standard deviation of 0.2825and this moderated variation in external failure cost of multinational firms considering its distance to mean value. The total sum of environmental external failure cost was

92.437and standard error of mean was 0.0103, and this implied that difference between sampled mean and population mean was 10 per cent. The multinational firm displayed minimum environmental external failure cost as 0 and maximum score was 1.098 where variable data were positively skewed and normally peaked as indicated 1.993 for skewness and 55.455 for kurtosis. The Jarque berra test for normality showed that data were not normally distributed considering its statistics of 690.80 with a P-value of 0.0000 which indicated a significance for null hypothesis test with data abnormality at P<0.05. The descriptive statistics for environmental risk management showed a mean value of 1.3142 with a standard deviation of 0.1793, and this moderated variation in environmental risk management of multinational firms considering its distance to mean value.

4.2 Correlation Analysis

The correlation analysisis conducted to help in detecting likelihood of multicollinearity among variables that could have a devastating effect on standard error of variables. The correlation results that showed relationship between the study variables are presented in Table 3.

Table 3: Correlation Analysis of Hypotheses

VRB	OBS	FV	EPVC	EDTC	EIFC	EXFC
FV	**750**	**1.0000**				
EPVC	**750**	0.2295*	**1.0000**			
EDTC	**750**	0.0815*	0.3950*	**1.0000**		
EIFC	**750**	0.1856*	0.2472*	0.2586*	**1.0000**	
EXFC	**750**	0.0940*	0.2898*	0.2943*	0.5889*	**1.0000**

Researcher's Computation, 2024

For environmental cost accounting, the results in Table 3 revealed that relationship between firm value and environmental prevention costs (EPVC) was positive having a coefficient of 0.2295 and this implies that both move in the same direction as one time increase in environmental prevention costs (EPVC) will cause an increase of 22.95 per cent in firm value of the multinational firms. And the relationship is significant as indicated by the probability value of 0.0000 which is lesser than a 5 percent level of significance. Also from Table 4.2, it is shown that the relationship between firm value and Environmental detection costs (EDTC) is positive having a coefficient of 0.0815 and this implies that both variables have a direct relationship as they move in the same direction as one time increase in environmental detection cost (EDTC) will cause 0.8 per cent increase in the firm value of the multinational firms and the relationship is significant as indicated by the probability value of 0.0255.

Furthermore, Table 3 showed that relationship between environmental external failure cost (EIFC) and firm value was positive having a coefficient of 0.0940 and this implies that both variables have a positive and direct relationship as they move in the same direction as one time increase in environmental. External failure cost (EXFC) will cause a 9.4 per cent increase in the firm value of the multinational firms and the relationship is significant as indicated by the probability value of 0.0100. It is equally observed that none of the relationships between the explanatory variables depicts that there is a problem of multicollinearity as they are not up to 0.7 which is evidence of a strong relationship.

4.3 Panel Unit Root Test

In identifying stationary conditions of the variables, the study uses Levin, Lin & Chu t* and Im-Pesaran-Shin unit-root test. The null hypothesis assumption of the unit root test is that all panels contain unit roots while the alternate hypothesis implies that some panels are stationary and the results of unit root tests were displayed in Table 4.

Table 4: Panel Unit Root Test of Variables
Environmental Cost Accounting

Variable	Levin, Lin & Chu t*		Harris-Tzavalisunit-root test	
	Test-statistics	P-value	Z-Statistics	P-value
Tobin'sQ	-26.7903	0.0000	-3.7592	0.0001
Environmental prevention cost	-6.4051	0.0022	-19.7902	0.0000
Environmental detection cost	-5.5923	0.0053	-22.9937	0.0000
Environmental internal failure cost	-1.7147	0.0432	-8.3227	0.0000
Environmental external failure cost	-2.7015	0.0035	-11.6520	0.0000

Researcher's Computation, 2024

The results of unit root tests displayed in Table 4 showed that all the variables were integrated of order zero which is 1(0) which is significant at 5 percent level of significance. Therefore, we reject the null hypothesis and conclude that the series is stationary. Therefore, it is not necessary to conduct the co-integration test to determine the long-run relationship among the variables. The panel least square is capable of estimating an efficient model and that is less spurious.

4.4 Multicollinearity Test

Multicollinearity tests are part of post estimation test to confirm the validity of the assumption of the regression model. In a situation where two or more explanatory variables are highly correlated, meaning that one can linearly predict the other variable with a certain degree of accuracy, then there is a problem of multicollinearity. The Variance Inflation Factor (VIF) value is considered for this purpose to determine the independence of the explanatory variables.

Table 5: Multicollinearity Test of Variables (Tolerance and VIF Value)

Variable	VIF	1/VIF
EXFC	1.61	0.620871
EIFC	1.56	0.642455
EDTC	1.24	0.803228
EPVC	1.24	0.807481
Mean VIF	1.41	

Researcher's Computation, 2024

Based on evidence presented in Table 5, it can be concluded that there is no multi-collinearity problem found in all the variables. This is because the VIF values for all the variables are less than 10 and the tolerance values for all the variables are greater than 0.10 (rule of thumb). Therefore, the study can rely on regression co-efficient to predict the level of impact of independent variables on dependent variables and the outcome of the findings can be considered valid.

4.5. Heteroscedasticity Test

The heteroscedasticity test was conducted to check the validity of assumption that displayed variance in the residuals that violates the assumption which could lead to wrong inference. The test was conducted using Breusch-Pagan/Cook-Weisberg test.

Table 6: Heteroscedasticity Test

Null Hypothesis	Statistics	Probability
Constant variance across the variables residuals (P>0.05)	17.89	0.0000

Researcher's Computation, 2024

The result from Table 6 revealed presence of heteroscedasticity with probability value of 0.0000 that was lower than 0.05. This heteroscedasticity problem was corrected by using panel-corrected standard error (PCSE). The result however showed that for environmental notion accounting there was no heteroscedasticity problem because the probability value of 0.6485 is greater than 0.05.

4.6 Serial Auto-Correlation Test

Autocorrelation depicts how closely its values are correlated across time. It measures how similar two-time series, one current and the other lagged, are to one another over time. The data for the study is also tested for auto-correlation using the Wooldridge test for autocorrelation in panel data. The result of autocorrelation for all the variables is presented in Table 7.

Table 7: Serial Auto-Correlation Test

Null Hypothesis	Statistics	Probability
no first-order autocorrelation (P>0.05)	6.633	0.0131

Researcher's Computation, 2024

The results for environmental cost accounting show a probability of 0.0131 which is significant indicating that there is a problem of Auto-correlation hence the null hypothesis that there is no first-order correlation is rejected. To correct the problem of autocorrelation in the panel data, an AR1 model will be included in the model and the autocorrelation of the model residuals error will be considered.

4.7 Cross-sectional Dependence Test

Cross-sectional dependence is one of the most crucial diagnostics that a researcher should look into before conducting a panel data analysis. Panel-data models are likely to show strong spatial dependence, idiosyncratic pairwise dependence in the disturbances with no particular pattern of common components, and substantial cross-sectional dependence in the errors. These effects may be caused by the presence of common shocks and unobserved components that eventually become part of the error term. The study employed the parametric testing procedure proposed by Pesaran (2004). The Pasaran CD (cross-sectional dependence) test is utilized to ascertain whether the residuals are associated across entities. If the outcome demonstrates Pr 0.05, we reject the null hypothesis and draw the inference that the panel is correlated (cross-sectional dependence).The cross-sectional dependence test is presented in Table 8.

Table 8: Cross-sectional Dependence Test

Null Hypothesis	Statistics	Probability
no cross-sectional dependence (P>0.05)	54.181	0.0000
The average absolute value of the off-diagonal elements	0.598	

Researcher's Computation, 2024

4.8 Environmental Cost Accounting and Firm Value of Listed Multinational Firms in Nigeria

To achieve the objective of assessing environmental cost accounting and firm value of listed multinational firms in Nigeria, the model that is most suitable for application between the 'inside' estimator and the random effects estimator are compared and variables were first tested to determine the model that will produce the fit empirical results that were capable of drawing good inferences and result presented thereof. The tests and the results of the analysis are presented in subsequent subheadings shown in Tables 9 to 12.

Table 9: Fixed Effect Model Regression Results

Variables	Coef.	Std. Err.	t	P>|t|
EPVC	0.70043155	0.3447827	2.03	0.043
EDTC	0.93899195	0.3596846	2.61	0.009
EIFC	1.44324153	0.5705266	2.53	0.012
EXFC	-0.2524408	0.5591933	-0.45	0.652
-cons	5.151226	0.2262414	22.77	0.000
R-sq (within)	0.0331			
Number of obs	750			
F(4,696)	5.96			
Prob> F	0.0001			
Rho	0.71396547			

Source: Researcher's Computation, 2024

Table 9 where the results from the fixed effect of the linear regression were presented, shows that the model explaining the linearity of the outcome and explanatory variable is significant and different from zero having F-cal. value of 5.96 and a probability of 0.0001. Since the fixed effect is tagged within the regression, the R-square indicated 0.0331 percent; this implies a low variation in the outcome variable caused by the joint explanatory variables. The extent of the variance in the output (R-Squared) as explained by the difference across entities is 71.39 per cent as the rho also shows .71396and this is indicated by the intra-class correlation (rho).

The overall results show that environmental cost accounting has a positive and significant influence on firm value as measured by Tobin's Q. Considering the individual effect of the variables, environmental prevention cost has a positive and significant effect on firm value showing t-cal. value of 2.03 and probability value of 0.043 and environmental detection cost shows a positive and significant effect on firm value having t-cal. value of 2.61 and probability value of 0.009. Environmental internal failure cost has a positive and significant effect on firm value showing t-cal. value of 2.53 and a probability value of 0.012. Likewise, from Table 4.13, the environmental external cost has t-cal. value of -0.45 and a probability of 0.652 implying a negative effect and insignificant relationship.

Table 10: Random Effect Model Regression Results

Variables	Coef.	Std. Err.	t	P>|t|
EPVC	0.7898857	0.3433634	2.30	0.021
EDTC	0.8948615	0.3574221	2.50	0.012
EIFC	1.5437133	0.5633377	2.74	0.006
EXFC	-0.286480	0.5574661	-0.51	0.607
-cons	5.1158471	0.6292837	8.13	0.000
R-sq (within)	0.0523			
Number of obs	750			
F(4,696)	26.50			
Prob> F	0.0000			
Rho	0.68341134			

Source: Researcher's Computation, 2024

Table 10 showed results from random effect of linear regression and model explained linearity of outcome and explanatory variable was significant and different from zero having Wald chi2 of 26.50 and probability of 0.0000. The R-square indicated 0.0523 percent; this implies a low variation in the outcome variable caused by the joint explanatory variables. The extent of the variance in the output (R-

Squared) as explained by the difference across entities is 68 percent as the rho also shows .68341134 and this is indicated by the intra-class correlation (rho). The overall results show that environmental cost accounting has a positive and significant influence on firm value as measured by Tobin's Q.

Considering individual effect of variables, environmental prevention cost has a positive and significant effect on firm value showing z-statistics of 2.30 and probability value of 0.021 and environmental detection cost showed a positive and significant effect on firm value, having z-statistics of 2.50 and probability value of 0.012. Environmental internal failure cost has a positive and significant effect on firm value showing z-statistics of 2.74 and a probability value of 0.006. Likewise, from Table 4.14, the environmental external cost has z-statistics of -0.51 and probability of 0.607 that implying a negative effect and insignificant relationship

4.9 Hausman Test

The Hausman test is used to choose the model that is most suitable for application between 'inside' estimator and random effects estimator. If the null hypothesis is rejected, the treatment of the omitted effects by the "inside" estimator is favoured (i.e., it favour fixed effects but only relative to the random effects). The test is being used in this situation to distinguish between models where the omitted heterogeneity is handled as fixed and correlated with the explanatory factors, and models where it is treated as random and independent of the explanatory variables.

Table11

Null Hypothesis	Statistics	Probability
The difference in coefficients is not systematic (P≤0.05)	9.77	0.0444

Source: Researcher's Computation, 2024

The model interpretation in Table 11 showed chi2 of 9.77 and a p-value of 0.0444 that is insignificant at 0.05 level of significant, implying that variation across entities is assumed to be fixed and correlated with independent variables included in the models; this indicates that best model for interpretation is fixed effect model.

Table 12: Regression of Effect of Environmental Cost Accounting on Firm Value

Variables	Coef.	Std. Err.	t	P>|t|
EPVC	0.2821061	0.0840587	3.36	0.001
EDTC	-0.0001246	0.0893437	-0.00	0.999
EIFC	0.3989418	0.1904984	2.09	0.036
EXFC	0.4872335	0.2165335	2.25	0.024
-cons	5.554662	0.3376233	16.45	0.000
Number of obs	750			
di r(rho)^2	0.04608295			
Wald chi 2(4)	22.92			
Prob> chi2	0.0001			

Source: Researcher's Computation, 2024

The regressed result showing how measures of environmental cost accounting in terms of environmental prevention costs, environmental detection costs, environmental internal failure cost, and environmental external failure costs affect firm value after meeting the basis for a Best Linear Unbias Estimate (BLUE) is shown in Table 12. Bai et al (2013) posited that a feasible GLS estimator is more efficient to analyse a model in the presence of heteroskedasticity, serial and cross-sectional correlations.

All these statistical problems are identified in the model hence the feasible general least square regression (FGLS) was run to cater for the identified statistical problems.

The linearity of the model as revealed by Wald square implies that the variation caused by the variables is different from zero indicating Wald chi2 of 22.92 and probability value of 0.0001 and this imply that the model is significant and fit. Likewise, the calculated r(rho)^2 shows a value of 4.6 per cent which can be considered very low indicating .04608. The overall result shows that the measures of Environmental cost accounting have a significant influence on the firm value of the sampled multinational firms in Nigeria. The individual results for the variables as shown in table 4.22 showed that environmental prevention cost (EPVC) has a co-efficient value of .28210, Z-statistics of 3.36 which is statistically significant at 5 percent with a p-value of 0.001. This implies that environmental prevention costs have a positive and significant effect on the Multinational firm's value. Likewise, from Table 12, environmental detection cost (EDTC) has a co-efficient value of -.0001246, and Z-statistics of -0.00 which is statistically significant at 5 per cent with a p-value of 0.999. This implies that environmental detection cost (EDTC) has a negative and significant effect on the Multinational firm's value.

Furthermore, in Table 4.16, it is observed that environmental internal failure cost (EIFC) has a co-efficient value of 0.3989418, and Z-statistics of 2.09 which is statistically significant at 5 per cent with a p-value of 0.036. This implies that environmental internal failure costs have a positive and significant effect on the Multinational firm's value. Likewise, from Table 4.16, environmental external failure cost (EXFC) has a co-efficient value of 0.4872335; Z-statistics of 2.25which is statistically significant at 5 per cent with a p-value of 0.024. This implies that environmental external failure costs have a positive and significant effect on the Multinational firm's value.

The findings disclosed that Environmental cost accounting was a vital practice that significant in demonstrating environmental responsibilities as displayed consequential on firm value of multinational companies that practice them. Environmental prevention costs for multinational firms will yield positively because prevention of environmental pollution portrays an environmentally responsible firm with awareness of environmental laws, hence preventing pollution occurrence. More so, the positive effect of environmental internal failure cost implies that detection of failure internally is a significant environmental practice and the cost expended to cater for internal failure and external failure of measures put in place to curtail environmental pollution has economic value

The result revealed by the study indicated that Environmental cost accounting has a positive and significant effect on firm value. These findings aligned with the results of Ekubiat (2019) who investigated the effects of environmental cost management on the profitability of the oil sector in Nigeria from 2004-2013 discovered that there is a significant positive effect of environmental management cost on profitability of oil sectors. The same goes for the study of Igbru and Agbasi (2015) as they assessed the effect of environmental cost accounting and firm value performance of Oil and gas companies in Nigeria and the outcome revealed that environmental cost has a positive significant effect on the financial performance of oil and gas firms.

The findings also established the results of Tochukwu (2018) who researched on the effect of environmental costs on firm performance which the result indicated that there is a positive relationship found between environmental accounting cost and performance of selected oil and gas companies. It was further observed that the findings negate the results from Nguyen and Tran (2020) which examined the impact of environmental accounting and the cost of capital of enterprises, it was discovered that environmental accounting hurts the cost of capital which invariable hurt the financial performance of firms.

4.10 Discussion of Findings

The overall result showed that measures of environmental cost accounting displayed a significant influence on firm value of the sampled multinational firms in Nigeria. The results revealed that

Environmental cost accounting displayed a positive relationship with firm value, and these aligned with results of Ekubiat (2019) that investigated effects of environmental cost management and profitability of oil sector in Nigeria from 2004 to 2013 and discovered significant relationship between variables. Likewise, in Igbru and Agbasi (2015) as assessed effect of environmental cost accounting and firm value in Nigeria, and discovered significant relationship between variables. The findings also established in Tochukwu (2018) that examined effect of environmental costs on firm performance, and discovered significant relationship between variables.

4.11 Policy Implication of Findings

It was observed from the findings that environmental cost accounting positively influenced firm value in Nigeria and this calls for management to have an accounting policy that would properly identify the aspect of environmental cost incurred such as prevention cost, detection cost, internal failure cost and external failure cost that positively influence firm value. The policy implication suggested that firm's management should draft a policy that would streamline managerial procedures on environmental issues associated with company projects. More so, government will likely undertake initiatives and policies that could motivate businesses to adopt environmental cost accounting systems.

5 SUMMARY OF FINDINGS, CONCLUSION, AND RECOMMENDATIONS

5.1 Summary

The overall result showed that measures of environmental cost accounting displayed a significant influence on the firm value of the sampled Multinational firms in Nigeria, given thus; environmental prevention cost (EPVC) (Co-eff = 0.28210; Z-statistics = 3.36; P = 0.001); environmental detection cost (EDTC) (Co-eff = -0.0001246; Z-statistics = 0.00; P = 0.999); environmental internal failure cost (EIFC) (Co-eff = 0 .3989418; Z-statistics = 2.09; P = 0.036) and environmental external failure cost (EXFC) (Co-eff = 0.4872335; Z-statistics = 2.25; P = 0.024).

5.2 Conclusion

The study therefore concluded that environmental cost accounting plays significant role in determining value of firms.

5.3 Recommendations

It is recommended that firms should ensure evidence of their preventive and remediation activities regarding preservation of the environment as these are actions that can improve firm valuation as evident in the findings of this study.

5.4 Suggestions for further studies

The fact that this study limits itself to agricultural, basic material, consumer goods, consumer services, financial services, industrial goods, ICT, health care, natural resources, and oil and gas sectors in Nigeria; it is suggested that studies could be undertaken in other sectors such as communication, education, public etc to assess whether there are any similarity factors or differences from conclusion obtained from this study. The result obtained from other sector could be used to compare result gotten from this study, also useful for academic within and outside the university settings.

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