SGI-JOURNAL OF SOCIAL SCIENCE AND HUMANITIES
VOLUME. 7
ISSUE. 3
SEPT., 2026

ENVIRONMENTAL MANAGEMENT ACCOUNTING AND RESOURCE EFFICIENCY: AN EMPIRICAL STUDY OF NIGERIA LISTED OIL AND GAS UPSTREAM FIRMS

[1]Babarinde Thomas Ayobami PhD, [2]Okunade Richard Adeleye, [3]Olurin Enitan Olurotimi PhD & [4]Bamidele Comfort Olaitan PhD
[1&3]Department of Accounting and Finance, Mountain Top University, Ibafo, Ogun State, Nigeria.
[2]Department of Accounting, Babcock University, Ogun State, Nigeria.
[4]Department of Accounting, Osun State College of Technology, Esa Oke, Osun State, Nigeria.
tababarinde@mtu.edu.ng
leyeokunade@yahoo.com
eoolurin@mtu.edu.ng
bamidelecoscotechesaoke@edu.ng

Abstract
This study investigates the relationship between Environmental Management Accounting (EMA) and resource efficiency in Nigeria's upstream oil and gas firms, specifically focusing on carbon accounting and environmental cost. Drawing on the Resource-Based View (RBV) theory, which emphasises the utilisation of internal resources and capabilities for competitive advantage, the study employs an ex post facto research design using secondary data from company reports, financial statements, and environmental disclosures. Regression and correlation analyses are conducted to examine the impact of EMA dimensions on net profit margins. The regression analysis yields inconclusive results, indicating no statistically significant relationship between carbon accounting, environmental cost, and net profit margin individually. However, the overall model is significant, suggesting the presence of unaccounted factors influencing net profit margin variability. Correlation analysis reveals significant positive relationships, indicating that increased carbon accounting and environmental cost are associated with higher net profit margins. These findings suggest that effective implementation of EMA practices, particularly in carbon accounting and environmental cost management can enhance resource efficiency and financial performance in Nigeria's upstream oil and gas sector. Recommendations include further investigation of additional variables, encouraging EMA adoption and strengthening practices, and conducting longitudinal studies to assess the sustained impact of EMA initiatives on financial performance.
Keywords: Carbon Accounting, Environmental Cost, Resource Efficiency.

I. Introduction

Environmental issues and sustainability have become increasingly important on a global scale due to their potential consequences for ecosystems, public health, and economic progress. The recognition of these issues has led to a growing emphasis on incorporating environmental considerations into the decision-making processes of businesses across different sectors, including the upstream oil and gas industry. According to Schaltegger et al. (2017), organisations in this industry have recognised the significance of managing their environmental performance while considering the financial implications. As a result, Environmental Management Accounting (EMA) has emerged as a valuable tool to address these concerns.

EMA provides organisations with a framework to assess and manage their environmental performance by integrating environmental factors into traditional management accounting systems. It enables firms to measure and monitor the environmental impacts of their operations, identify areas for improvement, and implement strategies to enhance sustainability. As noted by Schaltegger et al. (2017), EMA supports the identification and evaluation of costs associated with environmental activities, such as

pollution control measures, waste management, and resource conservation. By quantifying these costs, organisations can gain a better understanding of the financial implications of their environmental performance and make informed decisions to optimise both environmental and financial outcomes.

The integration of EMA into business decision-making processes offers several benefits for organisations in the upstream oil and gas industry. Firstly, it helps companies identify potential risks and liabilities associated with environmental impacts. By assessing the environmental costs of their operations, firms can proactively address compliance issues, reduce the likelihood of environmental incidents, and mitigate financial and reputational risks (Schaltegger et al., 2017). Secondly, EMA enables organisations to enhance their resource efficiency and reduce waste generation by identifying opportunities for process improvements and adopting cleaner technologies. This not only helps organisations meet regulatory requirements but also leads to cost savings and improved operational efficiency.

Furthermore, EMA facilitates the integration of environmental considerations into investment appraisal and capital budgeting processes. Traditional financial evaluation techniques often fail to adequately account for environmental costs and benefits, leading to suboptimal investment decisions. EMA provides a comprehensive approach by considering both financial and environmental aspects when evaluating investment alternatives. This allows organisations to make more informed decisions that align with their environmental and financial objectives (Schaltegger et al., 2017).

Despite the growing recognition of the importance of integrating environmental considerations into business decision-making processes, there are still significant challenges that organisations face in effectively implementing such practices. One of the key challenges is the lack of comprehensive and standardised methods to assess and manage the environmental impacts of business activities. Traditional accounting systems often fail to capture the full scope of environmental costs and benefits, leading to incomplete and inadequate decision-making information (Schaltegger et al., 2017).

Moreover, the upstream oil and gas industry, in particular, faces unique environmental challenges due to its extraction and production processes. These activities can have substantial ecological consequences, including habitat destruction, water and air pollution, and greenhouse gas emissions. The integration of environmental considerations into decision-making processes in this industry is crucial not only for mitigating these environmental impacts but also for addressing the increasing demands for sustainability from stakeholders, including investors, regulatory bodies, and the public (Schaltegger et al., 2017; Lenzen et al., 2018).

Additionally, the financial implications of environmental management decisions pose a significant challenge for organisations. Balancing environmental performance with financial sustainability requires organisations to carefully evaluate the costs and benefits of different environmental management strategies. Without proper tools and frameworks, organisations may struggle to make informed decisions that optimise both environmental and financial outcomes, potentially leading to suboptimal resource allocation and missed opportunities for cost savings (Schaltegger et al., 2017).

This study investigates the integration of EMA, specifically carbon accounting and environmental costs, within Nigerian upstream firms and explores the relationship between these environmental management accounting practices and resource efficiency, as measured by the net profit margin.

II. Literature Review

Carbon Accounting

Carbon accounting is a vital component of Environmental Management Accounting (EMA), a field that focuses on quantifying and tracking greenhouse gas (GHG) emissions generated by business operations (Schaltegger & Csutora, 2012). It enables companies to identify emission sources, assess their carbon footprints, and devise strategies to mitigate them.

Numerous studies have emphasised the significance of carbon accounting in environmental management and sustainability. According to Schaltegger and Csutora (2012), carbon accounting plays a critical role in enhancing accountability and transparency in business operations. It assists companies in comprehensively assessing their carbon emissions across various scopes, including direct emissions from their activities and indirect emissions from their value chain.

Implementing carbon accounting practices provides several benefits to organisations. It allows them to identify emission hotspots and prioritise reduction efforts accordingly (Kolk, 2015). By quantifying their carbon footprints, companies can set emission reduction targets, track progress over time, and evaluate the effectiveness of implemented mitigation strategies (Debnath, 2018; Delmas & Pekovic, 2013).

Nigerian upstream firms, which are involved in the exploration and production of oil and gas resources, face unique challenges and opportunities regarding carbon accounting. The oil and gas sector is a significant contributor to global GHG emissions, making it crucial for Nigerian firms in this industry to measure and manage their carbon emissions effectively (Ite et al., 2020). Through carbon accounting, these companies can gain insights into emission sources, such as flaring, venting, and fuel combustion, and identify potential areas for improvement (Ite et al., 2020).

Furthermore, engaging in carbon accounting practices demonstrates the commitment of Nigerian upstream firms to addressing climate change challenges and aligning their operations with global sustainability goals. It showcases their awareness of the environmental impact of their activities and their willingness to take responsibility for reducing their carbon footprints (Ukpo, 2023; Senlong, 2023). This aligns with the broader international efforts to transition to a low-carbon economy and mitigate climate change effects (Barron, 2019).

Environmental Cost

Environmental costs encompass the monetary outcomes that organisations face as a result of the ecological effects caused by their operations (Schaltegger et al., 2017). These expenses arise from diverse origins, including the reduction of emissions, management of waste, and remediation endeavours. Incorporating environmental costs into a company's accounting systems allows for an accurate assessment of the financial consequences associated with its environmental performance and enables effective resource allocation.

Research conducted by Schaltegger et al. (2017) emphasises the significance of incorporating environmental costs into accounting systems. The authors highlight that environmental costs have a substantial impact on the financial performance of companies, and their exclusion from accounting practices can lead to distorted financial statements. By integrating these costs, firms can measure their environmental impact accurately and make informed decisions regarding resource allocation.

In the Nigerian context, the incorporation of environmental costs into accounting practices is particularly relevant due to the country's significant reliance on the upstream oil and gas sector. The Nigerian upstream firms play a crucial role in the exploration, development, and production of oil and gas resources, making them key contributors to environmental impacts such as air and water pollution, habitat destruction, and greenhouse gas emissions.

Resource Efficiency

Resource efficiency, as measured by the net profit margin, is a fundamental financial indicator that signifies a company's ability to generate profits by effectively utilising its available resources (Botosan & Plumlee, 2002; Ittner & Larcker, 1997). This indicator provides valuable insights into how efficiently firms utilise various resources such as capital, labour, and raw materials to generate revenue (Gebauer, Fleisch, & Friedli, 2005).

The integration of environmental considerations, such as carbon accounting and environmental costs, is an emerging area of interest in the business world. It involves

incorporating environmental factors into the decision-making processes of companies, with the aim of mitigating negative environmental impacts and promoting sustainability (Jenkins, 2009).

Theoretical Framework

Resource-Based View Theory

The Resource-Based View (RBV) is a strategic management theory that emphasises the significance of internal resources and capabilities in creating and sustaining a competitive advantage for organisations (Barney, 1991). RBV suggests that firms can achieve superior performance by leveraging their unique and valuable resources that are difficult to imitate or substitute by competitors (Barney, 1991).

In the context of Environmental Management Accounting (EMA) and resource efficiency, RBV provides a framework for organisations to identify and exploit their internal resources and capabilities to enhance environmental performance and resource efficiency (Janes & Durden, 2003). RBV recognises that organisations possess a variety of resources that can be utilised to develop environmentally friendly practices and technologies (Janes & Durden, 2003).

One way in which RBV can help organisations enhance their environmental performance is through the development of green technologies. Organisations can invest in research and development activities to create innovative and sustainable technologies that reduce resource consumption and minimise environmental impact (Porter & van der Linde, 1995). By leveraging their technological capabilities, firms can gain a competitive edge in the market and improve their resource efficiency (Porter & van der Linde, 1995).

RBV also highlights the significance of improving process efficiency as a means to enhance environmental performance. Organisations can analyse their internal processes and identify areas where resource wastage occurs (Fahmi et al., 2015). By implementing process improvements, such as lean manufacturing techniques or waste reduction initiatives, firms can optimise resource utilisation and minimise environmental harm (Fahmi et al., 2015).

Additionally, RBV stresses the importance of effective resource allocation for improving environmental performance and resource efficiency. Organisations can use their internal resources, such as financial capital and human expertise, to invest in initiatives that promote sustainable practices and resource conservation (Kouhy & Innes, 1996). By strategically allocating resources to environmentally beneficial projects, organisations can achieve significant improvements in their environmental performance and resource efficiency (Kouhy & Innes, 1996).

Empirical Review

The study conducted by Eboh and Uzor (2022) delves into the intricate relationship between organisational effectiveness and CSR within the Nigerian context. The objective of this inquiry is to determine the impact of environmental considerations, financial expenditures, market superiority, and corporate ethical obligations on the operational efficacy of an organisation. The present inquiry, which adopts a qualitative methodology, heavily relies on the documentary method. As per the research, the influence of social endeavours and competitive edge on an entity's efficacy is noteworthy, and the impact of ecological concerns is also substantial. As per the research findings, in order to augment the legitimacy, competitive advantage, and capacity of organisations to attain enduring objectives, it is imperative for the government to institute policies that will cultivate a favourable commercial milieu for enterprises operating within the country.

During the period spanning from 2012 to 2018, Iliemena (2020) conducted a comprehensive investigation into the impact of environmental accounting practises on publicly traded oil and gas corporations operating within the Nigerian region. The aforementioned feat was achieved by formulating hypotheses, which were subsequently subjected to rigorous testing utilising data extracted from corporate sustainability reports, stock exchange fact books, and the annual reports of select companies. The analysis in

question employed a straightforward linear regression, while the data collection was conducted using an ex post facto research design. The findings indicate that the implementation of environmental accounting practises and accounting methodologies exerts a noteworthy favourable influence on both turnover and the return on capital employed. However, it is noteworthy that the impact on net profit, while positive, is relatively insignificant. The Performance Improvement Theory (PIT), as posited by the study, suggests that companies tend to adopt sustainability accounting practises due to the potential for enhanced corporate performance, which can be achieved through cost efficiencies and a favourable public perception. As per the research's discoveries, the implementation of environmental accounting yields a noteworthy enhancement in the operational efficacy of the corporations that adopt it. Henceforth, corporate entities should integrate environmental accounting into their management accounting and financial reporting frameworks to guarantee enduring corporate viability.

Adewuyi and Salawu (2016) examine the role of environmental management accounting (EMA) in promoting sustainable development in Nigeria. The authors surveyed Nigerian organizations to gather empirical data on the adoption and implementation of EMA practices. They analyzed the responses to assess the impact of EMA on various aspects of sustainable development, including environmental performance, cost efficiency, and organizational competitiveness. The findings of the study indicate that organisations that have implemented EMA practices in Nigeria have experienced positive outcomes. The adoption of EMA has led to improvements in environmental performance by promoting resource conservation, waste reduction, and pollution prevention.

Aladesanmi and Oyekanmi (2017) explore the relationship between environmental management accounting (EMA) practices and corporate environmental performance in Nigeria. The researchers surveyed a sample of Nigerian companies and collected data on their adoption of EMA practices and their environmental performance indicators. The study employed statistical analysis techniques to examine the relationship between EMA practices and environmental performance. The findings of the study indicate a significant positive relationship between EMA practices and corporate environmental performance. Companies that adopted EMA practices were found to have better environmental performance compared to those that did not implement such practices. Specifically, EMA practices were found to positively influence waste reduction, energy efficiency, and overall environmental management.

Bebbington et al. (2019) provide an overview of their research. The study focuses on exploring the relationship between environmental management accounting (EMA) and organisational change. The researchers conducted an exploratory study involving interviews with managers from various organisations to gather insights into the integration of EMA within organisational practices. The findings of the study reveal that the integration of EMA practices within organisations can lead to significant organisational change. EMA was found to contribute to shifts in organisational culture, decision-making processes, and the identification of new business opportunities related to environmental sustainability.

Miralles-Marcelo et al. (2021) investigate the extent of integration between environmental and financial reporting in European companies. The researchers conducted an empirical analysis using a sample of European companies and collected data from their annual reports. They examined the presence and disclosure of environmental information within the financial reports, as well as the level of integration between the two types of reporting. The findings of the study indicate that while there is a growing trend towards the integration of environmental and financial reporting, the level of integration remains limited. Also, the study reveals that the main factors influencing the integration of environmental reporting are company size, industry sector, and the existence of environmental management systems.

Hypothesis

(H0): There is no significant relationship between the integration of carbon accounting and

environmental costs and resource efficiency, as measured by the net profit margin, within Nigerian upstream firms.

III. Methodology

The research design used is ex post facto. The population of interest consists of Nigerian upstream firms operating in the oil and gas industry, specifically those engaged in exploration and extraction activities. The method of data collection is secondary sources, such as company reports, financial statements, and environmental disclosures, to obtain the necessary information. In terms of analysis, statistical techniques, such as regression analysis and correlation analysis, were employed to examine the relationship between EMA and resource efficiency, with a particular focus on assessing their impact on net profit margins.

Model Specifications

Net Profit Margin = $\beta_0 + \beta_1$ (EMA) + ε.....(1)
Net Profit Margin = $\beta_0 + \beta_1$ (Carbon Accounting) + β_2 (Environmental Cost) + ε.....(2)
Net Profit Margin represents the dependent variable, while Carbon Accounting and Environmental Cost represent the independent variables representing EMA dimensions. β_0 represents the intercept or constant term, β_1 and β_2 represent the coefficients or effects of Carbon Accounting and Environmental Cost on net profit margin, respectively. The term ε still represents the error term capturing unexplained variation in the net profit margin.

IV. Results

Correlation Result

	NET_PROFIT_MARGIN_____	CARBON_ACCOUNTING__TONS_	ENVIRONMENTAL_COST__NGN_
NET_PROFIT_MARGIN_____	1	0.8157072451067169	0.8929288173312806
CARBON_ACCOUNTING__TONS_	0.8157072451067169	1	0.9787756478438014
ENVIRONMENTAL_COST__NGN_	0.8929288173312806	0.9787756478438014	1

Source: Authors' computation using EViews 9

The correlation analysis revealed significant positive relationships between the variables in the study on environmental management accounting (EMA) and resource efficiency in Nigeria's upstream oil and gas firms. The findings indicate that both carbon accounting and environmental cost exhibit strong positive correlations with net profit margin. As carbon accounting and environmental cost increase, there is a tendency for net profit margin to increase as well. These results suggest that implementing effective EMA practices, particularly in terms of carbon accounting and environmental cost management, can potentially contribute to improved resource efficiency and financial performance in the Nigerian upstream oil and gas sector.

Regression Result

Dependent Variable: NET_PROFIT_MARGIN
Method: Least Squares
Date: 05/26/23 Time: 13:47
Sample (adjusted): 1 7
Included observations: 7 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.827534	1.624458	1.125011	0.3235
CARBON_ACCOUNTING__TONS_	-4.68E-05	2.88E-05	-1.629204	0.1786

ENVIRONMENTAL_COST__NGN_	4.16E-09	1.58E-09	2.643154	0.0574

R-squared	0.878167	Mean dependent var	9.528571
Adjusted R-squared	0.817251	S.D. dependent var	2.024610
S.E. of regression	0.865504	Akaike info criterion	2.846518
Sum squared resid	2.996390	Schwarz criterion	2.823337
Log likelihood	-6.962813	Hannan-Quinn criter.	2.560001
F-statistic	14.41595	Durbin-Watson stat	2.773577
Prob(F-statistic)	0.014843		

Source: Authors' Computation using EViews 9

The findings from the regression analysis on environmental management accounting (EMA) and resource efficiency in Nigeria's upstream oil and gas firms yield inconclusive results. The study indicates that neither carbon accounting nor environmental cost individually exhibits a statistically significant relationship with the net profit margin. Although the coefficient for carbon accounting suggests a negative association with profitability, and the coefficient for environmental cost suggests a positive association, both variables fail to reach statistical significance. As a result, it is difficult to determine the specific impact of carbon accounting and environmental cost on the net profit margin in the context of this study.

However, it's worth noting that the regression model as a whole is statistically significant, indicating that there might be other unaccounted factors influencing the variation in net profit margin. The relatively high R-squared value of 0.878167 suggests that the model explains a considerable portion of the net profit margin's variability. Further research and exploration of additional variables may be necessary to gain a more comprehensive understanding of the relationship between EMA dimensions, resource efficiency, and net profit margin in Nigeria's upstream oil and gas firms.

V. Recommendations

Based on the findings and results of the study on environmental management accounting (EMA) and resource efficiency in Nigeria's upstream oil and gas firms, the following recommendations can be made:

Although the current study did not find a significant relationship between carbon accounting, environmental cost, and net profit margin individually, there may be other factors at play. Investigating additional variables can provide a more comprehensive understanding of the relationship between EMA dimensions, resource efficiency, and financial performance.

Despite the lack of statistical significance, the positive correlations between carbon accounting, environmental cost, and net profit margin suggest that implementing effective EMA practices can be beneficial. Encourage upstream oil and gas firms in Nigeria to adopt and strengthen their EMA practices, particularly in terms of carbon accounting and environmental cost management. This can help improve resource efficiency and potentially contribute to better financial performance.

By tracking and analysing data over an extended period, it becomes possible to assess the sustained impact of EMA initiatives on financial performance. Longitudinal studies provide valuable insights into the effectiveness and durability of EMA practices in the context of Nigeria's upstream oil and gas sector.

References

Adewuyi, A. O., & Salawu, R. O. (2016). Environmental management accounting as a tool for sustainable development: Empirical evidence from Nigeria. African Journal of Accounting, Economics, Finance and Banking Research, 12(12), 38-50.

Aladesanmi, O. T., & Oyekanmi, A. A. (2017). The impact of environmental management

accounting on corporate environmental performance in Nigeria. Accounting and Finance Research, 6(3), 200-213.

Bansal, P., & Song, H.-C. (2017). Similar but not the same: Differentiating corporate sustainability from corporate environmental and social responsibility. Academy of Management Annals, 11(1), 105-149.

Barney, J. B. (1991). Firm resources and sustained competitive advantage. Journal of Management, 17(1), 99-120.

Barron, O. (2019). Carbon accounting: a critical examination of science, policy, and practice. Routledge.

Bebbington, J., Larrinaga, C., & Moneva, J. M. (2019). Environmental Management Accounting and Organizational Change: An Exploratory Study. Critical Perspectives on Accounting.

Botosan, C. A., & Plumlee, M. A. (2002). A re-examination of disclosure level and the expected cost of equity capital. Journal of Accounting Research, 40(1), 21-40.

Debnath, K.B. (2018). Decarbonization cost of Bangladesh's energy sector: Influence of corruption. A thesis presented for the degree of Doctor of Philosophy. School of Engineering, Cardiff University, Wales, UK. March, 2018.

Delmas, M. A., & Pekovic, S. (2013). Environmental standards and labor productivity: Understanding the mechanisms that sustain sustainability. Journal of Organizational Behavior, 34(2), 230-252.

Eboh, O.S. & Uzor, O.A (2022). Corporate Social Responsibility and Organizational Performance in Nigeria. International Journal of General Studies (IJGS), 2(1), 185 – 201.

Fahmi, A., Kusumawati, A., Kartini, D., & Muljawan, D. (2015). The implementation of lean manufacturing to optimize the environmental aspects of production processes. Procedia Manufacturing, 4, 116-123.

Gebauer, H., Fleisch, E., & Friedli, T. (2005). Overcoming the service paradox in manufacturing companies. European Management Journal, 23(1), 14-26.

Iliemena, Rachael O. (2020). Environmental Accounting Practices and Corporate Performance: Study of Listed Oil and Gas Companies in Nigeria. European Journal of Business and Management, 2(22) 58 – 70

Ite, U. E., Okoro, O. I., & Joshua, O. C. (2020). Gas flaring and carbon emissions in the Nigerian upstream oil and gas sector. Sustainable Energy Technologies and Assessments, 42, 100871.

Ittner, C. D., & Larcker, D. F. (1997). Quality strategy, strategic control systems, and organizational performance. Accounting, Organizations and Society, 22(3-4), 293-314.

Janes, T., & Durden, G. (2003). Resource-based view of environmental management accounting. The British Accounting Review, 35(4), 257-278.

Jenkins, R. (2009). Corporate social responsibility and the resource-based view of the firm. Journal of Business Ethics, 90(1), 125-140.

Kouhy, R., & Innes, J. (1996). Resource accounting and environmental costing in the UK water industry. Management Accounting Research, 7(1), 51-66.

Lenzen, M., Kanemoto, K., Moran, D., Geschke, A., & Foran, B. (2018). International trade drives biodiversity threats in developing nations. Nature, 555(7696), 67-70.

Miralles-Marcelo, J. L., Roca-Saavedra, J. L., & Velasco-Garrido, M. L. (2021). Integration of

Environmental and Financial Reporting: An Empirical Analysis of European Companies. Journal of Cleaner Production.

Porter, M. E., & van der Linde, C. (1995). Toward a new conception of the environment-competitiveness relationship. Journal of Economic Perspectives, 9(4), 97-118.

Schaltegger, S. & Csutora, M. (2012). Carbon accounting for sustainability and management. Status quo and challenges. Journal of Cleaner Production, 36, 1-16, https://doi.org/10.1016/j.jclepro.2012.06.024.

Schaltegger, S., Hansen, E. G., & Lüdeke-Freund, F. (2017). Business models for sustainability: Origins, present research, and future avenues. Organization & Environment, 30(4), 425-442.

Senlong, E.N. (2023). A New Dawn in Regulations Development in Nigeria's Upstream Petroleum Sector. Nigerian Upstream Petroleum Regulatory Commission. March 2023, Vol. 3. https://www.nuprc.gov.ng/wp-content/uploads/2023/04/Upstream-Gaze-NUPRC-Magazine.pdf

Ukpo, T. A. (2023). Energy Transition and Future of Hydrocarbons in Nigeria's Oil and Gas Industry: An Independent Synopsis. Nigerian Upstream Petroleum Regulatory Commission. March 2023, Vol. 3. https://www.nuprc.gov.ng/wp-content/uploads/2023/04/Upstream-Gaze-NUPRC-Magazine.pdf