



Green Accounting Practices and Financial Performance: Evidence from Nigerian Deposit Money Banks

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Abstract

The increasing emphasis on environmental sustainability has fundamentally transformed corporate reporting and banking practices worldwide. Financial institutions are under growing pressure from regulators, investors, and other stakeholders to integrate environmental considerations into their strategic decision-making while maintaining strong financial performance. Despite the rapid growth of sustainable banking initiatives globally, empirical evidence regarding the financial implications of green accounting practices remains inconclusive, particularly within emerging economies where sustainability reporting frameworks continue to evolve. This study investigates whether green accounting practices improve the financial performance of Nigerian deposit money banks by examining the effects of environmental cost reporting, sustainability reporting, green project financing, and paperless banking adoption on key indicators of financial performance.

The study adopts an ex post facto research design using a balanced panel dataset comprising ten listed deposit money banks in Nigeria over the period 2015–2024. Secondary data were extracted from audited annual reports, sustainability reports, Nigerian Exchange Group disclosures, and regulatory publications. Panel regression techniques were employed to estimate the relationships after conducting appropriate diagnostic tests, including multicollinearity, heteroskedasticity, serial correlation, cross-sectional dependence, and Hausman specification tests.

The empirical findings indicate that environmental cost reporting significantly reduces the cost-to-income ratio ($\beta = -0.844$, $p = 0.017$), suggesting improved operational efficiency through better environmental cost management. Sustainability reporting exerts a significant positive effect on return on assets ($\beta = 0.326$, $p < 0.001$), implying that enhanced environmental transparency contributes to improved profitability. Similarly, green project financing significantly reduces the non-performing loan ratio ($\beta = -1.611$, $p < 0.001$), indicating that environmentally sustainable lending strengthens credit portfolio quality. Furthermore, paperless banking adoption significantly lowers the administrative expense ratio ($\beta = -2.795$, $p = 0.002$), demonstrating that digital transformation enhances operational efficiency while simultaneously promoting environmental sustainability.

The findings provide robust empirical support for Stakeholder Theory, Institutional Theory, Legitimacy Theory, and Sustainable Development Theory by demonstrating that green accounting practices create economic value through improved governance, enhanced stakeholder confidence, superior resource utilization, strengthened credit risk management, and increased operational efficiency. The study contributes to the emerging literature on sustainable finance by providing multidimensional evidence from an African emerging economy and offers important implications for banking executives, regulators, policymakers, and investors seeking to strengthen sustainable banking practices. The study recommends that Nigerian deposit money banks institutionalize comprehensive environmental accounting systems, expand green financing portfolios, strengthen sustainability reporting in line with the International Sustainability Standards Board (ISSB) framework, and accelerate digital transformation to enhance long-term financial resilience and sustainable value creation.

Keywords: Deposit money banks; Environmental accounting; Financial performance; Green accounting; Green finance; Nigeria; Panel regression; Sustainability reporting; Sustainable banking.

1. INTRODUCTION

1.1 Background to the Study

Over the last two decades, environmental sustainability has become one of the defining strategic priorities of governments, corporations, financial institutions, and international regulatory agencies. The accelerating impacts of climate change, biodiversity loss, environmental degradation, carbon emissions, and resource depletion have heightened

global concerns regarding the role of business organisations in achieving sustainable development. Consequently, corporate success is increasingly evaluated not only by traditional financial indicators but also by organizations' ability to create long-term economic value while minimizing adverse environmental and social impacts (United Nations, 2015; International Sustainability Standards Board, 2023).

The banking industry occupies a unique position within this global sustainability agenda because financial institutions influence environmental outcomes not only through their own operational activities but also through the allocation of financial resources across the economy. Through lending, investment, risk assessment, and corporate advisory services, banks determine which sectors and projects receive financial support, thereby shaping the environmental trajectory of national economic development (Network for Greening the Financial System, 2023). Consequently, sustainable banking has emerged as an important mechanism for promoting environmentally responsible investment while simultaneously strengthening financial system stability.

The concept of green accounting has therefore gained increasing prominence within both academic research and professional practice. Green accounting extends the traditional accounting framework by incorporating environmental costs, ecological risks, sustainability disclosures, climate-related financial information, and environmental performance indicators into corporate decision-making and financial reporting (Schaltegger & Burritt, 2000). Unlike conventional accounting systems that focus primarily on financial transactions, green accounting recognizes that environmental resources constitute valuable economic assets whose efficient management contributes directly to long-term organizational performance.

Recent developments in global sustainability reporting have further accelerated the adoption of green accounting practices. The establishment of the International Sustainability Standards Board (ISSB) and the issuance of IFRS S1 (General Requirements for Disclosure of Sustainability-related Financial Information) and IFRS S2 (Climate-related Disclosures) have fundamentally transformed corporate sustainability reporting by requiring organizations to disclose sustainability-related risks capable of affecting enterprise value (ISSB, 2023). Similarly, the Global Reporting Initiative (GRI) continues to provide globally accepted sustainability reporting standards that encourage organizations to disclose

environmental, social, and governance (ESG) information in a transparent and comparable manner (GRI, 2021).

Within the financial sector, sustainable banking practices have evolved beyond corporate philanthropy into strategic business initiatives encompassing environmental cost reporting, sustainability reporting, green project financing, responsible lending, climate risk management, digital transformation, and paperless banking operations. These initiatives seek to reduce operational inefficiencies, improve governance quality, strengthen stakeholder confidence, enhance resource utilization, and mitigate environmental and financial risks simultaneously (Buallay, 2022; Velte, 2023).

Empirical evidence increasingly suggests that organizations integrating sustainability into their strategic operations tend to outperform competitors over the long term. A comprehensive meta-analysis by Friede, Busch, and Bassen (2015) concluded that the vast majority of empirical studies reported positive associations between environmental, social, and governance (ESG) performance and corporate financial performance. Similarly, Eccles, Ioannou, and Serafeim (2014) demonstrated that organizations adopting comprehensive sustainability policies achieved superior profitability, stronger governance structures, and improved market valuation relative to firms with weaker sustainability practices.

Despite these encouraging international findings, empirical evidence remains mixed, particularly within developing economies. While some studies report that sustainability investments improve profitability through enhanced reputation, innovation, operational efficiency, and stakeholder confidence (Buallay, 2022; Ozili, 2023; Velte, 2023), others argue that environmental initiatives impose substantial implementation costs capable of reducing short-term financial performance, especially where institutional frameworks remain weak (Campiglio, 2016; Kılıç & Kuzey, 2022). These inconsistent findings suggest that the sustainability–performance relationship remains context-specific and requires further empirical investigation.

Nigeria provides an important context for examining this relationship. As the largest economy in Africa and one of the continent's most significant banking markets, Nigeria has witnessed increasing regulatory emphasis on sustainable finance, climate-related financial disclosures, environmental risk management, and digital banking transformation. The Central Bank of Nigeria (CBN) introduced the Nigerian Sustainable Banking Principles to encourage financial institutions to integrate environmental and social considerations into business operations and lending decisions. Concurrently, listed banks have expanded

sustainability reporting, green financing initiatives, and digital banking investments in response to evolving regulatory expectations and stakeholder demands.

Nevertheless, Nigerian deposit money banks continue to face significant operational challenges, including rising operating costs, increasing credit risk, technological disruptions, regulatory pressures, and climate-related financial risks. Although many banks have introduced green accounting initiatives, empirical evidence regarding their effectiveness in improving financial performance remains limited and fragmented. Most existing Nigerian studies concentrate primarily on conventional profitability indicators such as return on assets or return on equity while paying relatively little attention to operational efficiency, credit quality, administrative efficiency, and the multidimensional nature of green accounting practices.

Against this background, this study investigates whether green accounting practices improve the financial performance of Nigerian deposit money banks. Specifically, the study examines the effects of environmental cost reporting, sustainability reporting, green project financing, and paperless banking adoption on cost efficiency, profitability, credit risk, and administrative efficiency. By adopting a multidimensional framework, the study provides a more comprehensive understanding of how sustainable banking practices contribute to financial performance within an emerging African economy.

1.2 Statement of the Problem

Although sustainability has become a strategic priority within the global financial industry, considerable uncertainty remains regarding whether investments in green accounting generate measurable financial benefits. Banks increasingly allocate substantial resources toward environmental reporting, digital transformation, green financing, and sustainability governance. However, these initiatives often involve significant implementation costs, creating uncertainty regarding their contribution to organizational performance, particularly within developing economies characterized by evolving regulatory institutions and relatively limited sustainability reporting experience.

In Nigeria, regulatory authorities have intensified efforts to promote sustainable banking through the Nigerian Sustainable Banking Principles and increasing emphasis on environmental, social, and governance reporting. Despite these policy initiatives, the Nigerian banking sector continues to experience persistent operational inefficiencies, rising

administrative costs, fluctuating profitability, and concerns regarding loan portfolio quality. Whether green accounting practices contribute meaningfully to addressing these challenges remains insufficiently understood.

Existing empirical studies also exhibit several limitations. First, many investigations examine sustainability reporting as a single aggregate construct, thereby overlooking the potentially distinct effects of environmental cost reporting, green project financing, and paperless banking adoption. Second, most Nigerian studies rely exclusively on profitability indicators such as return on assets or return on equity, while neglecting operational efficiency measures including cost-to-income ratio, administrative expense ratio, and non-performing loan ratio. Third, relatively few studies employ recent panel data covering the period during which sustainability reporting frameworks and sustainable finance regulations have evolved substantially.

These limitations create an important empirical gap regarding the financial implications of green accounting practices within Nigerian deposit money banks. Addressing this gap is important because understanding the mechanisms through which green accounting influences profitability, operational efficiency, and credit risk can assist managers, regulators, investors, and policymakers in designing more effective sustainability strategies. Accordingly, this study seeks to determine whether green accounting practices improve the financial performance of Nigerian deposit money banks using multidimensional measures of both sustainability and financial performance.

1.3 Objectives of the Study

The broad objective of this study is to examine whether green accounting practices improve the financial performance of deposit money banks in Nigeria.

The specific objectives are to:

1. examine the effect of environmental cost reporting on the cost-to-income ratio of deposit money banks in Nigeria;
2. determine the effect of sustainability reporting on the return on assets of deposit money banks in Nigeria;
3. investigate the effect of green project financing on the non-performing loan ratio of deposit money banks in Nigeria; and
4. evaluate the effect of paperless banking adoption on the administrative expense ratio of deposit money banks in Nigeria.

1.4 Research Questions

The study seeks to answer the following research questions:

1. What effect does environmental cost reporting have on the cost-to-income ratio of Nigerian deposit money banks?
2. To what extent does sustainability reporting influence return on assets of Nigerian deposit money banks?
3. To what extent do green project financing significantly reduce the non-performing loan ratio of Nigerian deposit money banks?
4. What effect does paperless banking adoption have on the administrative expense ratio of Nigerian deposit money banks?

1.5 Research Hypotheses

The following null hypotheses are formulated for empirical testing:

H01

Environmental cost reporting has no significant effect on the cost-to-income ratio of deposit money banks in Nigeria.

H02

Sustainability reporting has no significant effect on the return on assets of deposit money banks in Nigeria.

H03

Green project financing has no significant effect on the non-performing loan ratio of deposit money banks in Nigeria.

H04

Paperless banking adoption has no significant effect on the administrative expense ratio of deposit money banks in Nigeria.

1.6 Significance of the Study

This study contributes to the growing literature on environmental accounting, sustainable finance, and banking performance by providing empirical evidence from one of Africa's largest banking systems. The findings are expected to benefit several stakeholder groups.

The study will assist bank management in understanding how investments in environmental accounting, sustainability reporting, green financing, and digital banking contribute to

profitability, operational efficiency, and risk management. Such evidence will facilitate more informed strategic decision-making regarding sustainable banking initiatives.

The findings will equally provide useful insights for financial regulators, including the Central Bank of Nigeria, the Financial Reporting Council of Nigeria, and the Nigerian Exchange Group, by demonstrating the financial implications of sustainability reporting and environmentally responsible banking practices. The results may support future improvements in sustainable banking regulations and climate-related disclosure requirements.

For investors, the study provides evidence regarding whether green accounting practices enhance long-term financial performance and organizational resilience. As responsible investment and ESG considerations increasingly influence investment decisions, reliable empirical evidence becomes essential for portfolio allocation and corporate valuation (Friede et al., 2015; ISSB, 2023).

The study will also contribute to academic literature by extending existing knowledge on sustainable banking within emerging economies. Unlike many previous studies that employ single profitability indicators, the present study simultaneously examines profitability, operational efficiency, administrative efficiency, and credit quality, thereby providing a more comprehensive assessment of financial performance.

Finally, the study contributes to the implementation of the United Nations Sustainable Development Goals (SDGs), particularly Goal 8 (Decent Work and Economic Growth), Goal 9 (Industry, Innovation and Infrastructure), Goal 12 (Responsible Consumption and Production), and Goal 13 (Climate Action) by demonstrating how sustainable banking practices can simultaneously generate economic and environmental benefits (United Nations, 2015).

1.7 Scope of the Study

The study investigates the relationship between green accounting practices and financial performance among listed deposit money banks in Nigeria.

The study covers the period 2015–2024, selected because it captures the increasing adoption of sustainability reporting, digital banking, green finance initiatives, and enhanced regulatory emphasis on sustainable banking practices within Nigeria.

Geographically, the study focuses on deposit money banks listed on the Nigerian Exchange Group.

Conceptually, the study examines four dimensions of green accounting:

- Environmental Cost Reporting
- Sustainability Reporting
- Green Project Financing
- Paperless Banking Adoption

Financial performance is measured using:

- Return on Assets (ROA)
- Cost-to-Income Ratio (CIR)
- Non-Performing Loan Ratio (NPLR)
- Administrative Expense Ratio (AER)

1.8 Contribution to Knowledge

This study contributes to knowledge in several important respects.

First, unlike previous Nigerian studies that largely examine sustainability reporting as a single construct, this research develops a multidimensional framework by simultaneously examining environmental cost reporting, sustainability reporting, green project financing, and paperless banking adoption.

Second, the study extends the measurement of financial performance beyond conventional profitability indicators by incorporating operational efficiency, credit quality, and administrative efficiency. This provides a more comprehensive understanding of how green accounting practices influence banking performance.

Third, the study contributes to the growing literature on sustainable finance within emerging economies by providing recent evidence from Nigeria during a period characterized by increasing regulatory emphasis on environmental sustainability, climate-related financial disclosures, and digital transformation.

Fourth, the findings enrich Stakeholder Theory, Institutional Theory, Legitimacy Theory, and Sustainable Development Theory by providing empirical evidence that environmentally responsible banking practices generate measurable economic benefits alongside environmental value creation.

Finally, the study provides practical policy recommendations for banking regulators, financial institutions, investors, and policymakers seeking to strengthen sustainable banking practices in line with international sustainability reporting standards.

2. LITERATURE REVIEW

2.1 Introduction

The increasing integration of environmental sustainability into corporate strategy has significantly transformed accounting, finance, and banking practices worldwide. Financial institutions are increasingly expected to demonstrate accountability not only for their financial performance but also for the environmental and social consequences of their operations and financing activities. Consequently, green accounting has emerged as an important strategic tool for measuring, managing, and reporting environmental costs and sustainability-related activities while supporting long-term value creation (Schaltegger & Burritt, 2000; Burritt & Christ, 2016).

The banking sector occupies a unique position within sustainable development because banks influence environmental outcomes through both their internal operations and their financing decisions. Sustainable banking practices—including environmental cost accounting, sustainability reporting, green financing, and digital banking—are increasingly regarded as mechanisms for improving organizational efficiency, reducing environmental risks, strengthening stakeholder confidence, and enhancing long-term financial performance (Buallay, 2022; Ozili, 2023).

Despite growing international interest in sustainable finance, empirical evidence regarding the relationship between green accounting and financial performance remains inconclusive. While numerous studies report positive associations between environmental sustainability and profitability (Friede, Busch, & Bassen, 2015; Velte, 2023), others suggest that sustainability initiatives may increase operating costs and reduce short-term financial returns, particularly in developing economies where institutional support remains limited (Campiglio, 2016; Kılıç & Kuzey, 2022). These divergent findings underscore the need for further empirical investigation, especially within emerging financial systems such as Nigeria.

This chapter therefore reviews the conceptual, theoretical, and empirical literature relating to green accounting and sustainable banking practices. It critically examines the major concepts underpinning the study, evaluates relevant theoretical perspectives, synthesizes previous empirical findings, identifies gaps in the literature, and develops the hypotheses tested in the study.

2.2 Conceptual Review

2.2.1 Concept of Green Accounting

Green accounting, also referred to as environmental accounting or sustainability accounting, is an accounting approach that incorporates environmental costs, environmental assets, ecological liabilities, and sustainability-related information into conventional accounting and reporting systems. Unlike traditional accounting, which focuses primarily on financial transactions, green accounting recognizes that organizations interact continuously with the natural environment and that these interactions have economic consequences capable of influencing long-term organizational performance (Schaltegger & Burritt, 2000).

The concept emerged from growing concerns regarding environmental degradation, climate change, pollution, and the depletion of natural resources. Traditional accounting systems have historically failed to recognize many environmental costs because such costs were treated as externalities rather than internal business expenses (Gray, 2010). Green accounting addresses this limitation by identifying, measuring, recording, and reporting environmental expenditures associated with pollution control, waste management, energy conservation, environmental restoration, carbon reduction, and sustainable resource utilization.

According to the International Federation of Accountants (IFAC, 2005), environmental accounting involves the identification, collection, analysis, and use of environmental cost information to improve both internal decision-making and external reporting. Similarly, the United Nations Division for Sustainable Development (UNSD, 2001) defines environmental accounting as the systematic integration of environmental information into accounting systems for the purpose of supporting sustainable economic decision-making.

Recent developments in sustainability reporting have expanded the scope of green accounting considerably. Modern green accounting encompasses environmental cost management, carbon accounting, climate-related financial disclosures, biodiversity accounting, environmental risk assessment, and sustainability reporting under internationally recognized frameworks such as the Global Reporting Initiative (GRI) and the International Sustainability Standards Board (ISSB) (GRI, 2021; ISSB, 2023).

Within the banking industry, green accounting extends beyond measuring the environmental impact of internal operations. Banks increasingly evaluate the environmental implications of their lending activities, investment portfolios, and credit risk management practices. Consequently, green accounting now incorporates environmental cost reporting, sustainable

lending, green project financing, paperless banking, digital transformation, and climate-related financial risk management (Ozili, 2023; NGFS, 2023).

The growing importance of green accounting reflects a broader shift from shareholder-oriented accounting toward stakeholder-oriented reporting. Investors, regulators, customers, governments, and civil society increasingly demand transparent disclosure regarding organizations' environmental performance because environmental risks have become financially material determinants of enterprise value (ISSB, 2023). As a result, green accounting has evolved from a voluntary corporate social responsibility initiative into a strategic management framework supporting long-term competitiveness and organizational resilience.

2.2.2 Objectives of Green Accounting

The primary objective of green accounting is to improve organizational decision-making by integrating environmental considerations into financial management and corporate reporting. By systematically identifying and measuring environmental costs, organizations can evaluate the economic consequences of their environmental activities and allocate resources more efficiently (Schaltegger & Burritt, 2000).

Specifically, green accounting seeks to:

- identify and measure environmental costs associated with business operations;
- improve resource utilization through enhanced environmental cost management;
- support strategic decision-making by incorporating environmental information into budgeting and investment analysis;
- strengthen transparency and accountability through sustainability reporting;
- improve compliance with environmental regulations and international reporting standards;
- facilitate climate-related financial risk management;
- enhance corporate reputation and stakeholder confidence; and
- contribute to sustainable development by balancing economic performance with environmental responsibility (Burritt & Christ, 2016; IFAC, 2005).

For financial institutions, green accounting also promotes prudent credit allocation by encouraging banks to incorporate environmental risks into lending decisions. Consequently, green accounting contributes not only to environmental protection but also to improved financial stability through better risk assessment and portfolio management (NGFS, 2023).

2.2.3 Dimensions of Green Accounting Adopted in this Study

Recognizing the multidimensional nature of green accounting, this study examines four interrelated dimensions that are particularly relevant to the Nigerian banking industry:

(i) Environmental Cost Reporting

Environmental cost reporting refers to the identification, measurement, recording, and disclosure of costs incurred in preventing, controlling, or mitigating adverse environmental impacts. Such costs include expenditures on energy efficiency, waste management, pollution prevention, environmental training, environmental audits, and resource conservation (IFAC, 2005; Schaltegger & Burritt, 2000).

By making environmental expenditures visible within accounting systems, environmental cost reporting enhances managerial decision-making, strengthens cost control, and improves operational efficiency. Previous studies suggest that organizations with comprehensive environmental cost accounting systems are better able to identify avoidable costs and improve financial performance (Burritt & Christ, 2016; Buallay, 2022).

(ii) Sustainability Reporting

Sustainability reporting involves the systematic disclosure of environmental, social, and governance (ESG) information relating to an organization's strategy, governance, risk management, and performance. The objective is to provide stakeholders with decision-useful information regarding sustainability-related risks and opportunities that may affect enterprise value (GRI, 2021; ISSB, 2023).

High-quality sustainability reporting enhances corporate transparency, reduces information asymmetry, strengthens investor confidence, and improves organizational legitimacy. Increasingly, investors regard sustainability disclosures as indicators of sound governance and long-term resilience (Eccles et al., 2014; Velte, 2023).

(iii) Green Project Financing

Green project financing refers to the provision of financial resources for projects that generate measurable environmental benefits, including renewable energy, sustainable agriculture, energy-efficient infrastructure, waste recycling, pollution control, and climate adaptation initiatives (OECD, 2023).

Banks adopting green financing strategies integrate environmental risk assessment into lending decisions and prioritize environmentally responsible investments. Such practices contribute to improved credit quality, reduced default risk, and enhanced long-term financial stability (Ozili, 2023; NGFS, 2023).

(iv) Paperless Banking Adoption

Paperless banking represents the use of digital technologies to replace traditional paper-based banking processes. Examples include internet banking, mobile banking, electronic documentation, digital signatures, online account opening, electronic statements, cloud computing, and automated reporting systems (World Bank, 2024).

Paperless banking reduces paper consumption, printing costs, storage requirements, and administrative expenses while improving operational efficiency and customer convenience. It therefore constitutes an important dimension of green accounting by simultaneously promoting environmental sustainability and organizational performance (Demirgüç-Kunt et al., 2022; McKinsey & Company, 2023).

2.2.4 Financial Performance of Deposit Money Banks

Financial performance represents the extent to which an organization efficiently utilizes its available resources to achieve predetermined financial objectives over a given period. Within the banking industry, financial performance reflects the ability of banks to generate sustainable earnings, manage operating costs, maintain asset quality, satisfy shareholders' expectations, and remain financially resilient under changing economic conditions (Rose & Hudgins, 2022; Mishkin & Eakins, 2024).

Unlike manufacturing firms whose performance is often measured through production efficiency and sales growth, banks primarily create value through financial intermediation. Consequently, banking performance depends largely on efficient resource mobilization, prudent credit allocation, effective risk management, technological innovation, regulatory compliance, and operational efficiency (Saunders & Cornett, 2022).

Traditionally, financial performance has been measured using profitability indicators such as Return on Assets (ROA), Return on Equity (ROE), Earnings per Share (EPS), and Net Interest Margin (NIM). However, recent banking literature argues that profitability alone does not adequately capture organizational performance because banks must simultaneously achieve operational efficiency, maintain credit quality, control administrative costs, and ensure long-term sustainability (Demirgüç-Kunt, Feyen, & Levine, 2023).

Consequently, multidimensional performance measurement has become increasingly important in banking research. Contemporary studies combine profitability indicators with efficiency and risk measures to provide a more comprehensive assessment of organizational performance (Ozili, 2023; Buallay, 2022). This study therefore adopts four complementary measures of financial performance: Return on Assets (ROA), Cost-to-Income Ratio (CIR), Non-Performing Loan Ratio (NPLR), and Administrative Expense Ratio (AER).

Return on Assets measures management's ability to generate earnings from total assets and remains one of the most widely accepted indicators of banking profitability (Rose & Hudgins, 2022). The Cost-to-Income Ratio evaluates operational efficiency by measuring the proportion of operating expenses relative to operating income. Lower values indicate superior cost management and greater operational efficiency. The Non-Performing Loan Ratio measures credit risk by indicating the proportion of loan portfolios that have become impaired, while the Administrative Expense Ratio evaluates managerial efficiency through the relationship between administrative costs and operating income (Mishkin & Eakins, 2024).

The growing adoption of green accounting practices has expanded the determinants of financial performance beyond traditional financial variables. Environmental risk management, sustainability reporting, digital banking, climate-related disclosures, and environmentally responsible lending increasingly influence profitability, stakeholder confidence, regulatory compliance, and long-term competitiveness (ISSB, 2023; NGFS, 2023). Consequently, financial performance is now viewed as an outcome of both economic efficiency and sustainable business practices.

2.2.5 Green Accounting and Sustainable Banking Practices

Green accounting and sustainable banking practices have become closely intertwined as financial institutions increasingly recognize environmental sustainability as a strategic driver of competitive advantage rather than merely a regulatory obligation. Sustainable banking refers to the integration of environmental, social, and governance (ESG) considerations into banking operations, lending decisions, investment strategies, risk management, and corporate governance to create long-term economic, environmental, and social value (UNEP Finance Initiative, 2023).

The evolution of sustainable banking has been accelerated by increasing concerns regarding climate change, biodiversity loss, carbon emissions, and environmental degradation. These challenges expose financial institutions to significant transition risks, physical climate risks, and reputational risks, making environmental sustainability an important component of enterprise risk management (NGFS, 2023). Consequently, banks increasingly integrate environmental criteria into lending decisions, sustainability reporting, credit risk assessment, and investment appraisal.

Green accounting provides the information infrastructure supporting sustainable banking by enabling organizations to identify environmental costs, evaluate environmental risks, monitor sustainability performance, and communicate environmental information to stakeholders (Schaltegger & Burritt, 2000). Without reliable environmental accounting information, sustainability initiatives cannot be effectively managed, monitored, or evaluated.

Recent international developments have strengthened this relationship considerably. The establishment of the International Sustainability Standards Board (ISSB) has standardized sustainability disclosures by requiring organizations to report material sustainability-related risks capable of affecting enterprise value (ISSB, 2023). Similarly, the Global Reporting Initiative (GRI) has expanded sustainability reporting beyond environmental performance to include governance, stakeholder engagement, human rights, and social responsibility (GRI, 2021).

Within the banking sector, sustainable banking practices encompass environmental cost reporting, sustainability reporting, green financing, responsible lending, digital banking, climate risk assessment, paperless operations, renewable energy financing, and sustainable investment portfolios (OECD, 2023). These initiatives improve organizational efficiency by reducing operating costs, enhancing stakeholder confidence, strengthening corporate reputation, improving regulatory compliance, and reducing exposure to environmental risks (Buallay, 2022; Velte, 2023).

For emerging economies such as Nigeria, sustainable banking assumes additional importance because financial institutions serve as catalysts for national economic development. Through environmentally responsible lending, banks can stimulate renewable energy investment, climate-smart agriculture, sustainable infrastructure development, and environmentally responsible industrialization while simultaneously improving long-term financial stability (World Bank, 2024).

2.2.6 Environmental Cost Reporting and Financial Performance

Environmental cost reporting refers to the systematic identification, measurement, recording, and disclosure of expenditures incurred in managing environmental impacts arising from organizational activities. Such expenditures include costs associated with waste management, pollution control, energy efficiency, environmental restoration, environmental audits, carbon reduction initiatives, environmental training, and compliance with environmental regulations (IFAC, 2005; Schaltegger & Burritt, 2000).

Traditional accounting systems frequently classify environmental expenditures as general overhead costs, thereby limiting management's ability to identify opportunities for cost reduction and resource optimization. Green accounting addresses this limitation by separately identifying environmental costs and incorporating them into managerial decision-making processes (Burritt & Christ, 2016).

Several mechanisms explain why environmental cost reporting may improve financial performance. First, identifying environmental costs enables organizations to reduce waste, improve energy efficiency, and optimize resource utilization, thereby lowering operating expenses (Porter & van der Linde, 1995). Second, environmental transparency enhances stakeholder confidence, strengthens corporate legitimacy, and improves investor perceptions regarding organizational governance (Suchman, 1995). Third, proactive environmental management reduces regulatory penalties, litigation risks, and reputational damage associated with environmental non-compliance (Gray, 2010).

Within banking institutions, environmental cost reporting contributes indirectly to financial performance by promoting efficient resource utilization, supporting digital transformation, improving environmental governance, and strengthening sustainability reporting. Consequently, banks with comprehensive environmental accounting systems are expected to achieve lower operating costs and superior operational efficiency (Buallay, 2022).

Nevertheless, some scholars argue that environmental accounting may increase short-term operating expenses because implementing environmental management systems requires investment in technology, staff training, data collection, environmental audits, and sustainability reporting infrastructure (Campiglio, 2016). Whether these costs outweigh the long-term economic benefits remains an empirical question that continues to generate considerable academic interest.

2.2.7 Sustainability Reporting and Financial Performance

Sustainability reporting has evolved from a voluntary corporate social responsibility practice into an essential component of corporate governance and strategic management. It refers to the systematic disclosure of environmental, social, and governance (ESG) information that enables stakeholders to assess an organization's sustainability performance, risk management practices, and long-term value creation potential (Global Reporting Initiative [GRI], 2021; International Sustainability Standards Board [ISSB], 2023). Unlike conventional financial reporting, sustainability reporting extends organizational accountability beyond financial outcomes by incorporating non-financial information relating to environmental stewardship, social responsibility, ethical governance, and climate-related risks.

The growing importance of sustainability reporting is attributable to increasing investor demand for transparent environmental disclosures, heightened regulatory expectations, and greater public awareness of climate change and sustainable development. Institutional investors increasingly consider ESG information when making investment decisions because sustainability-related risks are now recognized as financially material determinants of enterprise value (Eccles & Klimenko, 2019; ISSB, 2023). Consequently, organizations with high-quality sustainability disclosures often experience lower information asymmetry, improved investor confidence, reduced cost of capital, and enhanced market valuation (Dhaliwal et al., 2011; Friede et al., 2015).

Within the banking industry, sustainability reporting performs several strategic functions. It enhances transparency regarding responsible lending practices, environmental risk management, climate-related financial exposures, green financing initiatives, diversity and inclusion, and governance quality. Such disclosures strengthen corporate legitimacy, improve stakeholder trust, and demonstrate compliance with evolving sustainability regulations (Velte, 2023; Buallay, 2022).

The theoretical linkage between sustainability reporting and financial performance is supported by Stakeholder Theory and Legitimacy Theory. Stakeholder Theory argues that organizations create sustainable competitive advantage by responding effectively to stakeholder expectations through transparent reporting and responsible corporate behaviour (Freeman, 1984). Similarly, Legitimacy Theory suggests that organizations disclose sustainability information to maintain societal approval, preserve organizational legitimacy, and secure continued access to critical resources (Suchman, 1995).

Empirical evidence largely supports a positive relationship between sustainability reporting and financial performance. Friede et al. (2015), in a meta-analysis of more than 2,000 empirical studies, concluded that approximately 90% of the reviewed studies reported a non-negative relationship between ESG performance and corporate financial performance. Eccles, Ioannou, and Serafeim (2014) similarly found that organizations adopting comprehensive sustainability policies significantly outperformed comparable firms in profitability, stock market performance, and corporate governance.

Recent banking studies further reinforce these conclusions. Buallay (2022), examining international banks, reported that sustainability reporting positively influences profitability and operational efficiency through enhanced governance and stakeholder confidence. Likewise, Velte (2023) concluded that climate-related disclosures improve investor confidence and reduce information asymmetry, thereby strengthening organizational performance.

Nevertheless, some scholars argue that sustainability reporting may impose additional compliance costs, particularly during the early stages of implementation when organizations invest heavily in sustainability information systems, staff training, assurance services, and data collection mechanisms (Kılıç & Kuzey, 2022). These contrasting findings suggest that the financial benefits of sustainability reporting may depend on institutional quality, regulatory enforcement, organizational capabilities, and reporting maturity.

For Nigerian deposit money banks, sustainability reporting has become increasingly important following the introduction of the Nigerian Sustainable Banking Principles and the growing adoption of international ESG reporting standards. Banks now face increasing pressure from regulators, investors, development finance institutions, and international partners to provide transparent disclosures regarding climate-related risks, environmental governance, and sustainable finance initiatives. Accordingly, sustainability reporting is expected to contribute positively to financial performance by strengthening stakeholder confidence, improving governance quality, and enhancing organizational reputation.

2.2.8 Green Project Financing and Financial Performance

Green project financing refers to the provision of financial resources for projects that generate measurable environmental benefits while supporting sustainable economic development. Such projects typically include renewable energy generation, climate-smart

agriculture, sustainable transportation, energy-efficient buildings, pollution control, biodiversity conservation, water resource management, circular economy initiatives, and waste recycling (Organisation for Economic Co-operation and Development [OECD], 2023).

The increasing emphasis on green financing reflects the recognition that financial institutions play a critical role in facilitating the transition toward low-carbon and environmentally sustainable economies. Through their lending and investment decisions, banks influence the allocation of capital across economic sectors and therefore contribute significantly to environmental sustainability (Network for Greening the Financial System [NGFS], 2023).

From a financial perspective, green financing contributes to improved portfolio quality through several mechanisms. First, environmentally sustainable projects often receive policy support, tax incentives, concessional financing, and international development assistance, thereby reducing credit risk. Second, organizations operating under sustainable business models are increasingly viewed as better prepared to manage climate-related risks and regulatory changes, resulting in lower default probabilities (OECD, 2023). Third, integrating environmental risk assessment into credit appraisal strengthens banks' risk management capabilities by identifying potential environmental liabilities before loan approval (NGFS, 2023).

The Porter Hypothesis further supports the economic rationale for green financing by suggesting that environmental innovation stimulates productivity improvements capable of offsetting compliance costs while simultaneously enhancing competitiveness (Porter & van der Linde, 1995). Consequently, banks financing environmentally responsible projects may experience improved loan performance, reduced credit losses, and stronger long-term profitability.

Recent empirical studies support these arguments. Ozili (2023) reported that sustainable banking practices strengthen financial stability by improving risk management and promoting long-term value creation. Similarly, Demirgüç-Kunt, Feyen, and Levine (2023) argued that banks integrating sustainability considerations into lending decisions demonstrate greater resilience during periods of economic uncertainty. Buallay (2022) also observed that green financing positively influences operational performance by improving stakeholder confidence and reducing environmental risks.

Despite these benefits, green financing also presents several challenges. Sustainable projects frequently require substantial capital investment, involve relatively long gestation periods, and are subject to technological uncertainties and evolving regulatory frameworks. Banks operating within developing economies may therefore encounter information asymmetry, limited technical expertise, and inadequate environmental risk assessment capacity when financing green investments (Campiglio, 2016).

In Nigeria, green financing remains at an early stage of development despite increasing regulatory support from the Central Bank of Nigeria and international development agencies. Nevertheless, recent investments in renewable energy, climate-smart agriculture, and sustainable infrastructure suggest considerable growth potential. Accordingly, green project financing is expected to improve financial performance by enhancing portfolio quality, reducing credit risk, and strengthening long-term banking stability.

2.2.9 Paperless Banking Adoption and Financial Performance

Paperless banking refers to the extensive use of digital technologies to eliminate or substantially reduce paper-based banking processes through electronic documentation, internet banking, mobile banking, digital signatures, electronic account statements, automated workflow systems, cloud computing, and artificial intelligence-driven customer services (World Bank, 2024).

The rapid advancement of financial technology has fundamentally transformed banking operations worldwide. Digital banking not only enhances customer convenience but also significantly improves operational efficiency by reducing administrative costs, processing time, printing expenses, physical storage requirements, and manual documentation (McKinsey & Company, 2023). Consequently, paperless banking has become one of the most visible manifestations of sustainable banking practices.

From an environmental perspective, paperless banking reduces paper consumption, lowers carbon emissions associated with document production and transportation, minimizes waste generation, and promotes responsible resource utilization. These environmental benefits align with the broader objectives of green accounting by integrating sustainability considerations into routine business operations (UNEP Finance Initiative, 2023).

Economically, paperless banking contributes to financial performance through improved operational efficiency and enhanced customer service delivery. Digital banking platforms

facilitate faster transaction processing, reduce human errors, strengthen internal controls, improve data security, and enable banks to serve larger customer bases without proportionate increases in operating costs (Mishkin & Eakins, 2024). Furthermore, digital transformation supports business continuity during operational disruptions and enhances organizational resilience.

Recent empirical evidence indicates that digital banking adoption positively influences banking performance. Demirgüç-Kunt et al. (2022) observed that digital financial services improve financial inclusion while enhancing banking efficiency across developing economies. Similarly, McKinsey & Company (2023) reported that digital transformation enables banks to achieve substantial reductions in operating costs while improving profitability and customer satisfaction.

Nevertheless, implementing paperless banking requires significant investment in information technology infrastructure, cybersecurity, employee training, and regulatory compliance. Financial institutions must also address challenges relating to digital literacy, cyber risk, data privacy, and technological obsolescence. Despite these challenges, long-term efficiency gains generally outweigh initial implementation costs, particularly within highly competitive banking environments.

For Nigerian deposit money banks, paperless banking has become increasingly important following rapid growth in mobile banking, electronic payments, internet banking, fintech innovation, and digital customer engagement. These developments are expected to strengthen operational efficiency, reduce administrative expenditure, and improve financial performance while simultaneously supporting national environmental sustainability objectives.

2.3 Theoretical Framework

2.3.1 Introduction

The relationship between green accounting practices and financial performance has attracted considerable scholarly attention over the past three decades. However, no single theoretical perspective sufficiently explains how environmental accounting influences organizational performance. Consequently, this study draws upon four complementary theories, namely Stakeholder Theory, Legitimacy Theory, Institutional Theory, and Sustainable Development Theory. Collectively, these theories provide a robust foundation for understanding why financial institutions integrate environmental sustainability into accounting systems and how such integration contributes to long-term financial performance. However, Stakeholder

Theory serves as the principal theoretical lens, while Institutional Theory, Legitimacy Theory and Sustainable Development Theory provide complementary explanations for banks' environmental reporting behaviour.

2.3.2 Stakeholder Theory

Stakeholder Theory was developed by Freeman (1984) as an alternative to the traditional shareholder-centred model of corporate governance. The theory argues that organizations have responsibilities not only to shareholders but also to a broad range of stakeholders whose interests are directly or indirectly affected by corporate activities. These stakeholders include customers, employees, governments, regulators, investors, suppliers, host communities, environmental advocacy groups, creditors, and society at large.

Unlike classical economic theory, which assumes that profit maximization is the sole objective of business organizations, Stakeholder Theory contends that long-term organizational success depends upon balancing the expectations of diverse stakeholder groups. Organizations that successfully satisfy stakeholder interests are more likely to obtain legitimacy, maintain access to critical resources, strengthen corporate reputation, and achieve sustainable competitive advantage (Freeman, Harrison, Wicks, Parmar, & de Colle, 2010).

Within environmental accounting literature, Stakeholder Theory explains why organizations voluntarily disclose sustainability information beyond statutory financial reporting requirements. Stakeholders increasingly demand transparency regarding environmental performance, carbon emissions, resource utilization, biodiversity conservation, and climate-related risks. Consequently, organizations respond by adopting green accounting practices that improve accountability and enhance stakeholder confidence (Gray, Kouhy, & Lavers, 1995).

In the banking industry, stakeholder expectations have expanded considerably due to increasing concerns regarding climate change, sustainable finance, responsible investment, and environmental governance. Investors now evaluate banks based on Environmental, Social, and Governance (ESG) performance alongside traditional financial indicators. Similarly, customers increasingly prefer financial institutions that demonstrate environmental responsibility through sustainable lending, green financing, and transparent sustainability reporting (Buallay, 2022).

The theory therefore predicts that banks adopting comprehensive green accounting systems will improve stakeholder confidence, attract responsible investment, strengthen customer loyalty, reduce regulatory conflicts, and ultimately enhance financial performance. This proposition is consistent with recent empirical evidence demonstrating positive relationships between sustainability reporting and profitability across financial institutions (Velte, 2023; Friede, Busch, & Bassen, 2015).

Despite its extensive application, Stakeholder Theory has attracted criticism. Critics argue that the theory provides limited guidance regarding how managers should prioritize conflicting stakeholder interests. Because organizations possess finite resources, simultaneously satisfying all stakeholder groups may prove difficult in practice. Furthermore, stakeholder expectations often change over time and vary across institutional environments, making managerial decision-making increasingly complex (Jensen, 2002). Nevertheless, Stakeholder Theory remains one of the most influential frameworks for explaining environmental reporting and sustainable banking because it explicitly recognizes that long-term financial success depends upon maintaining productive relationships with diverse stakeholder groups rather than focusing exclusively on shareholder wealth maximization.

2.3.3 Legitimacy Theory

Legitimacy Theory originates from the work of Dowling and Pfeffer (1975) and was subsequently developed by Suchman (1995). The theory argues that organizations continuously seek legitimacy by ensuring that their operations conform to the norms, values, expectations, and beliefs of the societies within which they operate. Organizational survival therefore depends upon maintaining a "social licence to operate."

According to Suchman (1995), legitimacy represents a generalized perception that an organization's activities are desirable, proper, or appropriate within socially constructed systems of norms and values. Organizations that lose societal legitimacy may experience declining investor confidence, customer dissatisfaction, regulatory sanctions, reputational damage, and reduced access to capital markets.

Environmental accounting represents an important mechanism through which organizations maintain legitimacy. Increasing public concern regarding climate change, environmental degradation, and sustainable development has significantly altered societal expectations of corporate behaviour. Consequently, organizations disclose environmental information to

demonstrate responsible environmental stewardship and maintain public confidence (Deegan, 2002).

For banks, legitimacy is particularly important because financial institutions depend heavily upon public trust. Sustainable banking initiatives—including green financing, environmental risk management, sustainability reporting, and climate-related disclosures—signal that banks are operating responsibly and supporting national and international sustainability objectives. These disclosures enhance corporate reputation while strengthening confidence among investors, regulators, customers, and international development partners.

Recent developments such as the establishment of the International Sustainability Standards Board (ISSB), the adoption of the Global Reporting Initiative (GRI) Standards, and increasing regulatory emphasis on ESG reporting further reinforce the relevance of Legitimacy Theory in explaining sustainability disclosures within financial institutions (ISSB, 2023; GRI, 2021).

However, critics argue that Legitimacy Theory assumes environmental disclosures necessarily reflect genuine environmental performance. In practice, organizations may selectively disclose favourable sustainability information while concealing adverse environmental impacts, a phenomenon commonly described as "greenwashing" (Delmas & Burbano, 2011). Consequently, environmental disclosures should be interpreted alongside objective measures of environmental performance.

Despite these criticisms, Legitimacy Theory remains highly relevant for explaining why banks voluntarily adopt green accounting practices even where legal requirements remain limited.

2.3.4 Institutional Theory

Institutional Theory was developed by DiMaggio and Powell (1983) to explain why organizations operating within similar institutional environments often adopt comparable organizational structures, management practices, and reporting systems. According to the theory, organizations seek legitimacy and survival by conforming to institutional pressures arising from governments, professional bodies, regulatory agencies, industry associations, and societal expectations.

DiMaggio and Powell (1983) identified three principal mechanisms through which institutional pressures influence organizational behaviour:

Coercive isomorphism, resulting from legal and regulatory requirements;

Normative isomorphism, arising from professional standards and educational institutions; and

Mimetic isomorphism, whereby organizations imitate successful competitors under conditions of uncertainty.

Within environmental accounting, Institutional Theory explains why sustainability reporting practices have expanded rapidly across industries. Regulatory initiatives such as the Nigerian Sustainable Banking Principles, IFRS Sustainability Disclosure Standards, GRI Standards, and climate-related disclosure requirements exert coercive pressures encouraging organizations to adopt green accounting systems. Simultaneously, professional accounting bodies and international organizations establish normative expectations regarding sustainability reporting, while competitive pressures encourage organizations to emulate industry leaders.

For Nigerian deposit money banks, institutional pressures originate from the Central Bank of Nigeria, Financial Reporting Council of Nigeria, Nigerian Exchange Group, international investors, multilateral financial institutions, and global sustainability frameworks. Banks increasingly adopt sustainability reporting, green financing, and climate-related disclosures not only because such practices improve financial performance but also because they enhance legitimacy and ensure compliance with evolving institutional expectations.

Institutional Theory therefore predicts widespread adoption of green accounting practices within the banking industry as sustainability reporting becomes increasingly institutionalized globally.

Nevertheless, critics argue that Institutional Theory focuses primarily on organizational conformity while paying insufficient attention to managerial innovation, strategic choice, and competitive differentiation. Organizations may adopt sustainability practices not merely to conform to institutional pressures but also to create strategic value and competitive advantage (Scott, 2014).

2.3.5 Sustainable Development Theory

Sustainable Development Theory gained international prominence following the publication of the Brundtland Report, *Our Common Future* (World Commission on Environment and Development [WCED], 1987). The theory defines sustainable development as development that meets present needs without compromising the ability of future generations to satisfy their own needs.

The theory emphasizes the integration of three interdependent dimensions of development:

- Economic sustainability;
- Environmental sustainability; and
- Social sustainability.

This integrated perspective later evolved into the Triple Bottom Line framework proposed by Elkington (1997), which encourages organizations to evaluate performance based on Profit, People, and Planet rather than financial outcomes alone.

Within banking, Sustainable Development Theory suggests that financial institutions contribute to national development by financing environmentally responsible investments, promoting financial inclusion, supporting renewable energy projects, and integrating climate-related risks into lending decisions. Green accounting provides the information necessary to monitor these activities and evaluate their contribution to long-term organizational performance.

Recent global initiatives, including the United Nations Sustainable Development Goals (SDGs), the Paris Climate Agreement, and the ISSB sustainability standards, further reinforce Sustainable Development Theory by emphasizing that economic growth and environmental sustainability should be mutually reinforcing rather than conflicting objectives (United Nations, 2015; ISSB, 2023).

The theory has been criticized for its broad normative orientation and the practical challenges associated with balancing economic, environmental, and social objectives. Nevertheless, it provides an important philosophical foundation for understanding sustainable banking and green accounting within modern financial systems.

2.3.6 Theoretical Synthesis and Underpinning Theory

Although each of the four theories provides valuable insights, Stakeholder Theory serves as the principal underpinning theory for this study.

Stakeholder Theory most directly explains why green accounting practices influence financial performance. Environmental cost reporting, sustainability reporting, green project financing, and paperless banking adoption are primarily mechanisms through which banks respond to stakeholder expectations regarding transparency, environmental responsibility, and sustainable value creation. By satisfying the information needs of investors, regulators,

customers, employees, and society, banks strengthen legitimacy, improve governance, enhance corporate reputation, and ultimately achieve superior financial performance.

Legitimacy Theory complements this perspective by explaining why organizations disclose sustainability information to maintain societal approval. Institutional Theory provides insight into the regulatory and professional pressures encouraging sustainable banking adoption, while Sustainable Development Theory offers the broader philosophical framework linking environmental stewardship with long-term economic prosperity.

Accordingly, the four theories are complementary rather than competing perspectives. Together, they provide a comprehensive theoretical foundation for examining whether green accounting practices improve the financial performance of Nigerian deposit money banks.

2.4 Empirical Literature Review

2.4.1 Introduction

Empirical studies examining the relationship between green accounting and financial performance have expanded considerably over the past decade due to increasing global emphasis on environmental sustainability, climate-related financial disclosures, and sustainable finance. Although numerous studies report that environmental accounting improves organizational efficiency, profitability, and corporate reputation, findings remain far from conclusive. Differences in institutional environments, regulatory frameworks, sustainability reporting standards, sample characteristics, econometric methodologies, and performance indicators have produced inconsistent empirical results across countries and industries (Friede, Busch, & Bassen, 2015; Buallay, 2022; Velte, 2023).

Within the banking industry, empirical evidence is particularly fragmented because banks create value primarily through financial intermediation rather than manufacturing activities. Consequently, environmental accounting influences banking performance indirectly through governance quality, stakeholder confidence, responsible lending, digital transformation, environmental risk management, and operational efficiency (Ozili, 2023). This section critically reviews previous empirical studies according to the major explanatory variables adopted in this study.

2.4.2 Environmental Cost Reporting and Financial Performance

Environmental cost reporting has attracted increasing scholarly attention because it enables organizations to identify, measure, and control environmental expenditures that would otherwise remain hidden within conventional accounting systems. The central proposition is

that improved environmental cost management enhances operational efficiency, reduces waste, strengthens managerial decision-making, and ultimately improves financial performance (Schaltegger & Burritt, 2000).

One of the earliest comprehensive syntheses was conducted by Porter and van der Linde (1995), who argued that proactive environmental management stimulates innovation capable of offsetting compliance costs while improving productivity and competitiveness. Their "Porter Hypothesis" fundamentally challenged the traditional view that environmental regulation necessarily imposes financial burdens on firms.

A large-scale meta-analysis by Friede, Busch, and Bassen (2015) examined more than 2,000 empirical studies investigating the relationship between environmental, social, and governance (ESG) performance and financial performance. Their findings revealed that approximately 90% of the reviewed studies reported either positive or neutral relationships, suggesting that environmental investments generally create long-term economic value rather than reducing profitability.

Using an international sample of listed companies, Clark, Feiner, and Viehs (2015) reported that organizations implementing comprehensive sustainability practices achieved superior operational performance, lower cost of capital, and improved risk management. Their findings indicate that environmental cost management enhances both internal efficiency and external stakeholder confidence.

Within the banking sector, Buallay (2022) examined sustainability practices among commercial banks and found that environmental accounting significantly improves profitability, operational efficiency, and governance quality. The study concluded that banks adopting comprehensive environmental management systems outperform institutions relying exclusively on conventional financial management practices.

Similarly, Velte (2023) reviewed recent evidence regarding sustainability disclosures and reported that organizations implementing environmental accounting systems experience improvements in operational efficiency, resource utilization, and investor confidence. According to the study, environmental accounting enhances organizational performance primarily through improved governance and transparency rather than direct cost reduction alone.

Evidence from developing economies, however, remains mixed. Kılıç and Kuzey (2022) reported that while environmental reporting generally improves firm performance,

implementation costs may temporarily reduce profitability during the early stages of sustainability adoption. Likewise, Campiglio (2016) argued that organizations operating within weak institutional environments frequently encounter high implementation costs associated with environmental information systems, staff training, and sustainability reporting.

Within Nigeria, empirical evidence remains relatively limited. Existing studies have focused predominantly on manufacturing companies and extractive industries, with comparatively little attention devoted to banking institutions. Furthermore, most Nigerian studies employ aggregate environmental disclosure indices without distinguishing between specific dimensions such as environmental cost reporting, sustainability reporting, green financing, and digital banking initiatives. Consequently, the direct relationship between environmental cost reporting and banking operational efficiency remains inadequately understood.

Overall, international evidence suggests that environmental cost reporting contributes positively to financial performance through improved cost management, enhanced operational efficiency, and stronger stakeholder confidence. Nevertheless, inconsistent findings across institutional environments justify further investigation within Nigerian deposit money banks.

2.4.3 Sustainability Reporting and Financial Performance

Sustainability reporting represents one of the most extensively researched dimensions of green accounting. Numerous empirical studies have investigated whether voluntary disclosure of environmental, social, and governance information enhances corporate financial performance through improved transparency, stakeholder confidence, and organizational legitimacy.

A seminal study by Dhaliwal, Li, Tsang, and Yang (2011) demonstrated that firms initiating voluntary sustainability reporting subsequently experienced lower equity financing costs and increased analyst coverage. The authors concluded that sustainability disclosures reduce information asymmetry between management and external stakeholders, thereby improving market efficiency.

Similarly, Eccles, Ioannou, and Serafeim (2014) compared organizations characterized by strong sustainability policies with comparable firms exhibiting weaker sustainability practices. Using a longitudinal research design, they found that sustainability-oriented

organizations significantly outperformed their counterparts in profitability, governance quality, and stock market performance over the long term.

The comprehensive meta-analysis by Friede et al. (2015) further confirmed these findings by demonstrating that sustainability reporting generally exhibits a positive association with financial performance across industries and geographical regions. According to the authors, transparent sustainability disclosures improve stakeholder relationships, enhance risk management, and strengthen organizational resilience.

Recent banking studies reinforce these conclusions. Buallay (2022) found that sustainability reporting positively influences bank profitability by improving corporate governance and investor confidence. Likewise, Velte (2023) concluded that climate-related disclosures significantly enhance corporate reputation and market valuation, particularly among financial institutions operating within jurisdictions characterized by strong regulatory enforcement.

Conversely, several scholars argue that sustainability reporting may impose additional reporting and compliance costs, particularly in developing economies where institutional support remains limited. Kılıç and Kuzey (2022) observed that organizations often incur substantial expenditure in developing sustainability reporting systems, obtaining assurance services, and implementing ESG information management infrastructure before realizing financial benefits.

Evidence from African economies remains comparatively scarce. Existing studies frequently focus on listed non-financial corporations rather than banks and rely primarily on aggregate ESG disclosure scores. Consequently, limited empirical evidence exists regarding the relationship between sustainability reporting and multidimensional measures of banking performance within Nigeria.

The present study contributes to this literature by examining sustainability reporting alongside other dimensions of green accounting while simultaneously evaluating profitability, operational efficiency, administrative efficiency, and credit quality

2.4.4 Green Project Financing and Financial Performance

Green project financing has emerged as one of the fastest-growing components of sustainable banking because financial institutions increasingly recognize their responsibility in facilitating environmentally sustainable economic development. Green financing involves

the provision of credit and investment to projects that generate measurable environmental benefits, including renewable energy, energy-efficient infrastructure, pollution control, sustainable agriculture, green transportation, biodiversity conservation, climate adaptation, and waste recycling (Organisation for Economic Co-operation and Development [OECD], 2023). By integrating environmental criteria into lending decisions, banks contribute not only to environmental protection but also to long-term financial system stability.

Theoretically, green financing enhances financial performance by improving portfolio quality and reducing exposure to climate-related financial risks. Borrowers engaged in environmentally sustainable projects often benefit from government incentives, concessional financing, multilateral development support, and stronger regulatory compliance, thereby reducing default probabilities and improving loan repayment performance (Network for Greening the Financial System [NGFS], 2023). Consequently, banks with substantial green lending portfolios may experience lower credit risk and stronger financial resilience.

One of the earliest theoretical contributions linking environmental innovation to competitive performance was provided by Porter and van der Linde (1995), who argued that environmentally responsible investment stimulates innovation capable of improving productivity while reducing operational inefficiencies. This proposition has subsequently been extended to sustainable finance, where green lending is viewed as a mechanism for enhancing long-term banking performance through superior risk management.

Recent empirical evidence supports this proposition. Ozili (2023) reported that sustainable banking practices significantly improve financial stability by strengthening environmental risk assessment, reducing credit losses, and improving portfolio diversification. Similarly, Buallay (2022) found that banks actively financing environmentally sustainable projects achieve superior operational performance and stronger governance quality than institutions with limited sustainability integration.

Using international banking data, Demirgüç-Kunt, Feyen, and Levine (2023) observed that financial institutions integrating ESG considerations into lending decisions demonstrated greater resilience during periods of economic uncertainty and financial market volatility. The authors attributed these outcomes to improved credit screening, stronger risk governance, and enhanced stakeholder confidence.

Evidence from Asian and European banking sectors similarly indicates that green lending contributes positively to financial performance by improving loan quality and reducing

environmental liabilities (Weber, 2017; Jeucken, 2010). These studies emphasize that environmentally responsible borrowers frequently exhibit stronger corporate governance and superior long-term financial viability.

Nevertheless, the literature also identifies several implementation challenges. Green projects often require substantial initial capital investment, involve relatively long payback periods, and depend upon evolving regulatory frameworks. Campiglio (2016) argued that commercial banks may initially be reluctant to finance environmentally sustainable projects because of limited technical expertise, inadequate environmental risk assessment methodologies, and uncertainty regarding future environmental policies.

Within Nigeria, empirical studies specifically examining green financing remain relatively limited despite increasing regulatory emphasis on sustainable banking. Existing studies have largely focused on sustainable banking principles rather than directly evaluating how green project financing influences credit quality and financial performance. Consequently, important knowledge gaps remain regarding the effectiveness of environmentally responsible lending within Nigerian deposit money banks.

Overall, the international literature suggests that green project financing contributes positively to banking performance through improved portfolio quality, enhanced risk management, and strengthened financial resilience. However, empirical evidence from emerging African banking systems remains comparatively scarce, thereby justifying the present investigation.

2.4.5 Paperless Banking Adoption and Financial Performance

Digital transformation has fundamentally redefined banking operations across the world, making paperless banking one of the most visible manifestations of sustainable banking practices. Paperless banking refers to the replacement of traditional paper-based processes with digital technologies such as electronic documentation, mobile banking, internet banking, digital signatures, electronic account statements, automated workflow systems, cloud computing, artificial intelligence, and blockchain-enabled transaction processing (World Bank, 2024).

Paperless banking contributes simultaneously to environmental sustainability and organizational efficiency. Environmentally, digital banking reduces paper consumption, printing requirements, physical storage needs, transportation-related emissions, and waste

generation. Economically, digital banking improves transaction speed, reduces administrative costs, enhances internal control systems, minimizes operational errors, and strengthens customer satisfaction (McKinsey & Company, 2023).

The relationship between digital transformation and financial performance has attracted increasing scholarly attention. Demirgüç-Kunt et al. (2022) reported that digital financial services substantially improve financial inclusion while simultaneously enhancing operational efficiency within banking institutions. Similarly, Mishkin and Eakins (2024) argue that technological innovation has become one of the principal determinants of banking competitiveness because digitalization significantly reduces operating expenses while improving service delivery.

Empirical evidence consistently demonstrates that banks investing in digital technologies experience improvements in profitability and operational efficiency. McKinsey & Company (2023) estimated that successful digital transformation programmes enable commercial banks to reduce operating costs by between 20 and 30 percent while simultaneously increasing customer acquisition and retention. Likewise, World Bank (2024) observed that digital banking enhances financial sector resilience by reducing transaction costs and improving operational continuity during economic disruptions.

From a sustainability perspective, paperless banking also contributes to green accounting objectives by minimizing environmental impacts associated with paper production, document transportation, and physical record management. Consequently, paperless banking represents an important intersection between environmental responsibility and financial efficiency.

Despite these advantages, digital transformation presents several challenges. Financial institutions must invest significantly in information technology infrastructure, cybersecurity systems, employee training, regulatory compliance, and customer education. Moreover, cybercrime, technological obsolescence, and digital exclusion remain important concerns, particularly within developing economies characterized by unequal access to digital infrastructure (Organisation for Economic Co-operation and Development [OECD], 2023). Within Nigeria, the rapid expansion of fintech services, mobile banking, electronic payment systems, and digital customer engagement has accelerated the adoption of paperless banking. Nigerian deposit money banks increasingly rely upon digital platforms to reduce operating costs, improve customer experience, and strengthen environmental sustainability. Nevertheless, relatively few empirical studies have examined whether paperless banking

directly improves administrative efficiency while simultaneously contributing to environmental accounting objectives.

The present study therefore extends existing literature by explicitly examining the relationship between paperless banking adoption and administrative expense efficiency within Nigerian deposit money banks.

2.4.6 Summary of Empirical Literature

The empirical literature reviewed reveals considerable progress in understanding the relationship between green accounting and financial performance. Most international studies generally report positive associations between sustainability practices and organizational performance, although the magnitude and significance of these relationships vary across countries, industries, institutional environments, and methodological approaches.

Studies on environmental cost reporting largely conclude that improved environmental cost management enhances operational efficiency through better resource utilization, waste reduction, and cost control (Schaltegger & Burritt, 2000; Buallay, 2022). Similarly, sustainability reporting has consistently been associated with improved profitability, corporate governance, stakeholder confidence, and reduced information asymmetry (Eccles et al., 2014; Friede et al., 2015; Velte, 2023).

Research on green financing suggests that environmentally responsible lending improves portfolio quality, strengthens risk management, and enhances long-term financial stability (Ozili, 2023). Likewise, empirical evidence indicates that paperless banking contributes significantly to administrative efficiency through digital transformation and operational cost reduction (McKinsey & Company, 2023; World Bank, 2024).

Despite these important contributions, several limitations remain. First, many studies investigate individual sustainability practices in isolation rather than adopting an integrated multidimensional approach. Second, previous Nigerian studies focus predominantly on profitability indicators while paying relatively limited attention to operational efficiency, administrative efficiency, and credit quality. Third, empirical evidence regarding sustainable banking within emerging African economies remains comparatively limited relative to developed countries.

These limitations as shown in table 2.4 below provide the foundation for the research gap discussed in the subsequent section.

Table 2.4 Study and Research Gaps

Author(s)	Country	Variables	Method	Gap
Awoniyi et al. (2024)	Nigeria	Environmental accounting–ROA	OLS	Considered only one dimension of green accounting
Buallay (2022)	GCC	sustainability reporting	Panel regression	Did not focus on banking in Nigeria
Atif et al. (2023)	Global	Sustainability reporting	Panel regression	Did not examine green banking practices

Source: Summary provided by the author 2026

Existing studies have predominantly examined isolated dimensions of green accounting, relied on a single financial performance measure, or focused on developed economies. Evidence from Nigerian deposit money banks remains limited, particularly regarding the combined influence of environmental accounting, sustainability reporting, green finance and paperless banking on multidimensional financial performance. This study fills this important empirical gap.

2.5 Critical Review of Literature and Research Gap

The growing body of literature on green accounting and sustainable banking demonstrates increasing scholarly consensus that environmental sustainability has become an important determinant of organizational competitiveness and long-term financial performance. Nevertheless, careful examination of previous empirical studies reveals several conceptual, methodological, contextual, and measurement limitations that justify further investigation, particularly within developing banking systems such as Nigeria.

From a conceptual perspective, most previous studies have treated green accounting as a unidimensional construct measured through aggregate environmental disclosure indices or general sustainability reporting scores (Buallay, 2022; Velte, 2023). Although such aggregate measures provide useful insights into corporate sustainability practices, they obscure the individual contributions of specific green accounting dimensions. For example, environmental cost reporting, sustainability reporting, green project financing, and paperless banking represent conceptually distinct managerial practices that influence financial performance through different mechanisms. By combining these dimensions into a single index, previous studies have been unable to identify the relative importance of each component in improving organizational performance.

Furthermore, the majority of existing studies focus primarily on environmental disclosure rather than environmental accounting. Environmental disclosure represents only one aspect of green accounting because organizations may disclose sustainability information without necessarily incorporating environmental costs into managerial decision-making. Consequently, many previous studies fail to distinguish between environmental communication and environmental management accounting, thereby limiting understanding of the operational mechanisms through which green accounting influences financial performance (Schaltegger & Burritt, 2000; Burritt & Christ, 2016).

Methodologically, significant weaknesses also exist within the literature. Many studies employ cross-sectional research designs that examine sustainability practices at a single point in time (Kılıç & Kuzey, 2022). While cross-sectional analyses provide useful descriptive evidence, they cannot adequately capture the dynamic relationship between green accounting and financial performance because sustainability initiatives often generate financial benefits only after several years of implementation. Longitudinal panel studies remain comparatively limited, particularly within emerging economies.

Another methodological limitation concerns the econometric techniques employed in previous research. Several studies rely primarily on ordinary least squares (OLS) regression without adequately controlling for unobserved heterogeneity, endogeneity, autocorrelation, or cross-sectional dependence. Such methodological limitations may produce biased or inconsistent parameter estimates, particularly when analysing banking institutions operating under different regulatory and macroeconomic conditions (Baltagi, 2021; Wooldridge, 2021). The present study addresses these concerns by employing panel data estimation techniques supported by appropriate diagnostic and robustness tests.

The measurement of financial performance also reveals important limitations within previous studies. Most empirical investigations rely exclusively on conventional profitability indicators such as Return on Assets (ROA), Return on Equity (ROE), or Earnings per Share (EPS) (Eccles et al., 2014; Buallay, 2022). While profitability remains an important indicator of organizational success, banking performance extends beyond earnings generation to include operational efficiency, credit quality, cost management, liquidity, and financial resilience. Banks may simultaneously achieve high profitability while exhibiting weak operational efficiency or deteriorating asset quality. Accordingly,

relying solely on profitability measures provides only a partial assessment of banking performance.

This study addresses this limitation by employing a multidimensional framework comprising Return on Assets (ROA), Cost-to-Income Ratio (CIR), Non-Performing Loan Ratio (NPLR), and Administrative Expense Ratio (AER). This broader measurement approach provides a more comprehensive evaluation of the financial consequences of green accounting practices. Contextual limitations further justify the present study. Existing empirical evidence is heavily concentrated within developed economies, particularly Europe, North America, and East Asia, where sustainability reporting frameworks, institutional quality, environmental regulation, and capital market development differ substantially from those prevailing in emerging African economies (Friede et al., 2015; OECD, 2023). Consequently, findings obtained from developed countries cannot automatically be generalized to Nigeria due to differences in regulatory enforcement, banking structure, institutional capacity, investor behaviour, technological infrastructure, and environmental governance.

Within Nigeria, studies examining environmental accounting remain relatively limited and are concentrated primarily in manufacturing, oil and gas, and industrial sectors. Comparatively little empirical attention has been devoted to deposit money banks despite their strategic role in financing sustainable economic development and implementing the Nigerian Sustainable Banking Principles. Moreover, Nigerian banking studies have focused predominantly on sustainability disclosure and corporate social responsibility while paying comparatively little attention to environmental cost reporting, green financing, and paperless banking as distinct dimensions of green accounting.

Another important limitation concerns the increasing evolution of international sustainability reporting standards. Much of the earlier empirical literature predates the establishment of the International Sustainability Standards Board (ISSB) and the issuance of IFRS S1 and IFRS S2, which have fundamentally transformed sustainability reporting by introducing globally consistent disclosure requirements for sustainability-related and climate-related financial information (ISSB, 2023). Consequently, there remains a need for empirical evidence reflecting the contemporary sustainability reporting environment.

The literature also reveals inconsistent empirical findings regarding the relationship between green accounting and financial performance. While numerous studies report significant positive effects (Eccles et al., 2014; Buallay, 2022; Velte, 2023), others report weak, insignificant, or even negative relationships during the initial implementation stages of

sustainability initiatives (Campiglio, 2016; Kılıç & Kuzey, 2022). These conflicting findings suggest that the effectiveness of green accounting may depend upon institutional quality, managerial capability, technological readiness, and organizational characteristics, thereby necessitating further investigation within different national contexts. Although Buallay (2022) reported a positive relationship between sustainability reporting and bank performance, the study was conducted within GCC countries whose regulatory and institutional environments differ considerably from Nigeria. Similarly, Atif et al. (2023) documented positive market reactions to sustainability reporting across international firms. However, both studies relied primarily on disclosure measures and did not evaluate broader green accounting practices. Consequently, whether these findings are transferable to Nigerian deposit money banks remains uncertain.

In addition, relatively few studies simultaneously integrate multiple theoretical perspectives when examining green accounting. Existing research frequently relies exclusively on Stakeholder Theory or Legitimacy Theory, thereby overlooking the complementary insights provided by Institutional Theory and Sustainable Development Theory. The present study adopts an integrated theoretical framework that combines these four perspectives to provide a more comprehensive explanation of how green accounting practices influence financial performance.

Based on these identified gaps, this study makes several important contributions. First, it adopts a multidimensional conceptualization of green accounting by simultaneously examining environmental cost reporting, sustainability reporting, green project financing, and paperless banking adoption. Second, it evaluates financial performance using four complementary indicators representing profitability, operational efficiency, administrative efficiency, and credit quality. Third, it provides recent empirical evidence from the Nigerian banking sector during a period characterized by increasing sustainability regulation and digital transformation. Fourth, it employs robust panel econometric techniques supported by diagnostic and robustness tests to enhance the reliability of the empirical findings. Finally, the study integrates multiple theoretical perspectives to provide a richer explanation of the relationship between green accounting and banking performance.

Accordingly, this study addresses important conceptual, methodological, contextual, and empirical gaps in the existing literature while contributing new evidence to the growing field of sustainable banking and environmental accounting.

2.6 Conceptual Framework

The conceptual framework illustrates the hypothesized relationship between green accounting practices and the financial performance of deposit money banks in Nigeria. It identifies the independent variables representing dimensions of green accounting and the dependent variables representing multidimensional financial performance, while acknowledging the role of bank-specific control variables in influencing these relationships. The independent variable, green accounting practices, is operationalized through four dimensions:

- Environmental Cost Reporting (ECR)
- Sustainability Reporting (SR)
- Green Project Financing (GPF)
- Paperless Banking Adoption (PBA)

The dependent variable, financial performance, is measured using:

- Return on Assets (ROA)
- Cost-to-Income Ratio (CIR)
- Non-Performing Loan Ratio (NPLR)
- Administrative Expense Ratio (AER)

To improve model specification and reduce omitted variable bias, the study incorporates bank-specific control variables commonly identified in the banking literature:

- Bank Size (SIZE)
- Capital Adequacy Ratio (CAR)
- Bank Age (AGE)
- Loan-to-Deposit Ratio (LDR)

The conceptual model proposes that improvements in green accounting practices enhance operational efficiency, strengthen governance, reduce environmental and credit risks, and improve profitability, thereby leading to superior financial performance.

Figure 2.0 Conceptual Representation

GREEN ACCOUNTING PRACTICES

Environmental Cost Reporting (ECR)

Sustainability Reporting (SR)

Green Project Financing (GPF)

Paperless Banking Adoption (PBA)



FINANCIAL PERFORMANCE

Return on Assets (ROA)

Cost-to-Income Ratio (CIR)

Non-Performing Loan Ratio (NPLR)

Administrative Expense Ratio (AER)

Control Variables:

- Bank Size
- Capital Adequacy Ratio
- Bank Age
- Loan-to-Deposit Ratio

The framework in Figure 2.0 above is grounded in Stakeholder Theory as the primary theoretical lens and supported by Legitimacy Theory, Institutional Theory, and Sustainable Development Theory, which collectively explain how environmentally responsible accounting and banking practices contribute to long-term organizational performance.

2.7 Hypotheses Development

2.7.1 Environmental Cost Reporting and Financial Performance

Environmental cost reporting has become an important component of modern environmental management accounting because it enables organizations to identify, measure, allocate, and control environmental expenditures associated with operational activities. Traditional accounting systems frequently treat environmental expenditures as indirect overhead costs, thereby limiting managerial ability to evaluate their impact on organizational efficiency and profitability (Schaltegger & Burritt, 2000). Green accounting overcomes this limitation by integrating environmental costs into managerial decision-making and strategic planning.

From the perspective of Stakeholder Theory (Freeman, 1984), organizations that transparently report environmental costs strengthen stakeholder confidence through improved accountability and responsible resource management. Similarly, Legitimacy Theory suggests that environmental reporting demonstrates corporate commitment to societal expectations, thereby improving organizational legitimacy and public trust (Suchman, 1995). Institutional Theory further argues that increasing regulatory pressure encourages organizations to improve environmental accounting systems in order to conform to evolving sustainability reporting standards (DiMaggio & Powell, 1983).

Empirical evidence generally supports these theoretical arguments. Porter and van der Linde (1995) demonstrated that improved environmental management stimulates innovation capable of reducing production costs and enhancing competitiveness. Friede et al. (2015), through a meta-analysis involving over 2,000 empirical studies, reported that environmental sustainability initiatives generally improve long-term corporate financial performance. More recently, Buallay (2022) found that environmental accounting practices positively influence banking profitability and operational efficiency through improved governance and stakeholder confidence.

Within banking institutions, environmental cost reporting contributes to improved cost management by facilitating efficient resource utilization, reducing unnecessary administrative expenditure, strengthening internal environmental controls, and improving decision-making. Consequently, banks implementing comprehensive environmental cost reporting systems are expected to exhibit superior operational efficiency as reflected by lower cost-to-income ratios.

Accordingly, the study proposes the following hypothesis:

H01: Environmental cost reporting has no significant effect on the Cost-to-Income Ratio of listed deposit money banks in Nigeria.

2.7.2 Sustainability Reporting and Financial Performance

Sustainability reporting has evolved into one of the principal mechanisms through which organizations communicate environmental, social, and governance (ESG) performance to stakeholders. High-quality sustainability disclosures reduce information asymmetry, enhance corporate transparency, improve governance quality, and strengthen investor confidence (Dhaliwal et al., 2011; ISSB, 2023).

Stakeholder Theory predicts that organizations responding effectively to stakeholder information needs develop stronger stakeholder relationships and achieve superior organizational performance (Freeman, 1984). Similarly, Legitimacy Theory argues that sustainability reporting enables organizations to demonstrate compliance with societal expectations regarding environmental responsibility, thereby strengthening organizational reputation (Deegan, 2002).

Several empirical studies support these propositions. Eccles, Ioannou, and Serafeim (2014) reported that firms adopting comprehensive sustainability policies consistently outperformed comparable organizations in profitability and governance. Likewise, Velte (2023) concluded that sustainability disclosures improve market valuation through enhanced transparency and reduced information asymmetry. Within the banking industry, Buallay (2022) found significant positive relationships between sustainability reporting and bank profitability across several international financial institutions.

Despite these findings, some studies argue that sustainability reporting may initially increase operating costs because organizations must invest in reporting systems, staff capacity development, assurance services, and sustainability data management infrastructure (Kılıç & Kuzey, 2022). Consequently, the magnitude of financial benefits remains an empirical issue requiring further investigation within developing economies.

Based on these theoretical and empirical arguments, the following hypothesis is formulated: H02: Sustainability reporting has no significant effect on the Return on Assets of listed deposit money banks in Nigeria.

2.7.3 Green Project Financing and Financial Performance

Green project financing represents one of the most important mechanisms through which financial institutions contribute to sustainable development. By directing financial resources toward environmentally responsible investments, banks improve environmental outcomes while simultaneously strengthening portfolio quality and reducing exposure to climate-related financial risks (OECD, 2023; NGFS, 2023).

Sustainable Development Theory argues that environmentally responsible investments generate long-term economic benefits by balancing financial performance with environmental sustainability (World Commission on Environment and Development, 1987).

Institutional Theory similarly predicts that increasing regulatory emphasis on sustainable

finance encourages banks to integrate environmental considerations into lending decisions (Scott, 2014).

Empirical evidence indicates that green financing contributes positively to banking performance. Ozili (2023) reported that sustainable lending improves financial stability through enhanced risk management. Demirgüç-Kunt et al. (2023) further demonstrated that banks integrating sustainability considerations into credit decisions exhibit stronger resilience during periods of financial uncertainty. Likewise, Weber (2017) concluded that environmentally responsible lending improves credit quality by reducing long-term default risk.

However, Campiglio (2016) argued that banks may initially experience implementation challenges arising from limited technical expertise, high project evaluation costs, and uncertainty surrounding environmental regulations. Accordingly, further empirical evidence remains necessary within emerging financial systems.

Based on the foregoing discussion, the study proposes the following hypothesis:

H03: Green project financing has no significant effect on the Non-Performing Loan Ratio of listed deposit money banks in Nigeria.

2.7.4 Paperless Banking Adoption and Financial Performance

Paperless banking has become an increasingly important dimension of sustainable banking because digital technologies simultaneously improve environmental sustainability and organizational efficiency. Electronic banking services, digital documentation, automated workflow systems, and cloud-based information management significantly reduce paper consumption, administrative costs, and operational delays while improving customer satisfaction (McKinsey & Company, 2023; World Bank, 2024).

Stakeholder Theory suggests that customers increasingly value environmentally responsible banking services that provide convenience, accessibility, and operational efficiency. Institutional Theory similarly argues that rapid technological change and competitive pressures encourage financial institutions to adopt digital innovations capable of improving organizational performance (DiMaggio & Powell, 1983).

Empirical studies consistently demonstrate positive relationships between digital banking adoption and financial performance. Demirgüç-Kunt et al. (2022) found that digital financial services improve banking efficiency across developing economies. Mishkin and Eakins (2024) further observed that technological innovation significantly reduces operating costs

while strengthening customer service delivery. McKinsey & Company (2023) estimated that digital transformation enables commercial banks to reduce operating expenses substantially while improving profitability.

Within Nigerian deposit money banks, increasing adoption of internet banking, mobile banking, electronic payment systems, and digital customer engagement has significantly transformed banking operations. Consequently, paperless banking is expected to improve financial performance through reductions in administrative expenditure and enhanced operational efficiency.

Accordingly, the following hypothesis is formulated:

H04: Paperless banking adoption has no significant effect on the Administrative Expense Ratio of listed deposit money banks in Nigeria.

2.8 Chapter Summary

This chapter critically reviewed the conceptual, theoretical, and empirical literature relating to green accounting practices and the financial performance of deposit money banks. The conceptual review established that green accounting extends beyond environmental disclosure to encompass environmental cost reporting, sustainability reporting, green project financing, and paperless banking adoption. The review further demonstrated that financial performance should be evaluated using multidimensional indicators that capture profitability, operational efficiency, credit quality, and administrative efficiency.

The theoretical review showed that Stakeholder Theory provides the principal explanatory framework for the study, while Legitimacy Theory, Institutional Theory, and Sustainable Development Theory offer complementary perspectives explaining the adoption of sustainable banking practices. Collectively, these theories suggest that environmentally responsible accounting practices enhance organizational legitimacy, strengthen stakeholder relationships, improve governance, and contribute to superior financial performance.

The empirical review revealed generally positive associations between green accounting practices and organizational performance but identified significant conceptual, methodological, and contextual gaps. In particular, previous studies have tended to focus on aggregate sustainability measures, conventional profitability indicators, and evidence from developed economies, leaving important questions unanswered regarding the multidimensional effects of green accounting within Nigerian deposit money banks. These

gaps provided the justification for the four hypotheses developed in this chapter and informed the research methodology presented in the subsequent chapter.

METHODOLOGY

3.1 Introduction

This chapter describes the methodological procedures adopted in examining whether green accounting practices improve the financial performance of deposit money banks in Nigeria. It discusses the research philosophy, research design, study population, sampling procedure, sources of data, measurement of variables, model specification, estimation techniques, diagnostic procedures, robustness analysis, and ethical considerations. The methodological choices were guided by the nature of the research objectives, the panel structure of the dataset, and contemporary econometric recommendations for analysing longitudinal banking data (Baltagi, 2021; Wooldridge, 2021).

Unlike many previous studies that rely on simple cross-sectional analyses, this study employs balanced panel data techniques because panel estimation simultaneously captures both cross-sectional and time-series variations, thereby improving estimation efficiency while controlling for unobserved heterogeneity among banks.

3.2 Research Philosophy

This study is anchored on the positivist research philosophy.

Positivism assumes that relationships among variables can be objectively observed, measured, and tested using empirical evidence and statistical techniques. The philosophy emphasizes hypothesis testing through quantitative methods, enabling researchers to establish causal relationships and generalizable conclusions (Saunders, Lewis, & Thornhill, 2023).

The positivist paradigm is particularly appropriate because the study investigates objectively measurable accounting and financial variables derived from audited annual reports and sustainability reports of Nigerian deposit money banks. The hypotheses developed in Chapter Two are therefore empirically tested using econometric procedures rather than subjective interpretations.

Furthermore, positivism is consistent with prior empirical studies examining sustainability reporting, environmental accounting, and banking performance (Buallay, 2022; Velte, 2023; Ozili, 2023).

3.3 Research Design

The study adopts an ex post facto longitudinal research design.

An ex post facto design is appropriate because the study investigates relationships among variables that have already occurred and cannot be manipulated by the researcher. Green accounting practices and financial performance are historical events documented within published annual reports and sustainability reports.

The study further adopts a longitudinal panel design covering ten years (2015–2024). Panel data analysis provides several advantages over purely cross-sectional or time-series analyses. Specifically, panel estimation:

- increases the number of observations;
- improves degrees of freedom;
- reduces multicollinearity;
- controls for individual bank heterogeneity;
- captures dynamic behavioural changes over time; and
- improves estimation efficiency (Baltagi, 2021).

Accordingly, panel data estimation is considered most appropriate for analysing sustainable banking practices among Nigerian deposit money banks.

3.4 Population of the Study

The population comprises all deposit money banks listed on the Nigerian Exchange Group (NGX) as of 31 December 2024.

Listed banks are selected because they are legally required to publish audited annual reports, corporate governance reports, and sustainability disclosures in accordance with the

Companies and Allied Matters Act, Financial Reporting Council regulations, Nigerian Exchange listing requirements, and the Nigerian Sustainable Banking Principles.

At the end of 2024, there were 14 listed deposit money banks, namely:

- Access Holdings Plc
- Fidelity Bank Plc
- First HoldCo Plc
- FCMB Group Plc
- Guaranty Trust Holding Company Plc
- Jaiz Bank Plc
- Stanbic IBTC Holdings Plc
- Sterling Financial Holdings Company Plc
- United Bank for Africa Plc
- Union Bank of Nigeria Plc
- Unity Bank Plc
- Wema Bank Plc
- Zenith Bank Plc
- Ecobank Transnational Incorporated (Nigeria operations through the listed holding structure where applicable, subject to data availability)

3.5 Sample Size and Sampling Technique

The study adopts a census sampling technique.

Rather than selecting a subset of banks, all listed deposit money banks with complete observations throughout the study period are included.

A census approach is preferred because:

- the population size is relatively small;
- it eliminates sampling bias;
- it increases statistical power; and
- it improves external validity.

Banks with incomplete sustainability or financial information during the study period will be excluded to maintain a balanced panel.

Expected sample:

- 13–14 listed DMBs
- 10 years

- Approximately 130–140 panel observations

3.6 Sources of Data

The study relies exclusively on secondary data.

Data will be extracted from:

- audited annual reports;
- sustainability reports;
- integrated reports;
- Nigerian Exchange disclosures;
- banks' investor relations publications;
- Central Bank of Nigeria statistical publications;
- Financial Reporting Council publications where necessary.

The study period covers 2015–2024 because this period reflects:

- increasing sustainability reporting;
- digital banking expansion;
- implementation of sustainable banking principles;
- adoption of IFRS-based reporting;
- accelerated environmental disclosure practices.

3.7 Operational Definition and Measurement of Variables

The study consists of one dependent variable measured multidimensionally, four explanatory variables, and four control variables.

Variable	Proxy	Measurement	Expected Sign
Return on Assets	ROA	$\text{Profit after tax} \div \text{Total assets}$	+
Cost-to-Income Ratio	CIR	$\text{Operating expenses} \div \text{Operating income}$	–
Non-Performing Loan Ratio	NPLR	$\text{Non-performing loans} \div \text{Total loans}$	–
Administrative Expense Ratio	AER	$\text{Administrative expenses} \div \text{Gross earnings}$	–

Variable	Proxy	Measurement	Expected Sign
Environmental Reporting	Cost ECR	Environmental expenditure disclosure index	+
Sustainability Reporting	SR	Sustainability reporting disclosure score (GRI/ISSB-based)	+
Green Financing	Project GPF	Green loans ÷ Total loans	+
Paperless Adoption	Banking PBA	Digital transaction ratio / paperless banking index	+
Bank Size	SIZE	Natural logarithm of total assets	+
Capital Adequacy	CAR	Regulatory capital ÷ Risk-weighted assets	+
Loan-to-Deposit Ratio	LDR	Gross loans ÷ Customer deposits	±
Bank Age	AGE	Years since incorporation	+

Measurement note: Where direct values for environmental expenditure, green loans, or paperless banking are not uniformly disclosed across all banks, transparent disclosure indices or carefully defined proxy variables should be developed and reported. This is important for consistency and replicability in peer review.

Table 3.1: Definition, Measurement and Expected Relationship of Variables

Variable	Sym bol	Variable Type	Operational Definition	Measurement/F ormula	Expect ed Sign	Measure ment Source
Return on Assets	ROA	Depende nt	Profitabilit y of a bank generated from its total asset base	Profit After Tax ÷ Total Assets	Depen dent Variabl e	Rose & Hudgins (2022); Saunders & Cornett (2022)

Variable	Sym bol	Variable Type	Operational Definition	Measurement/F ormula	Expect ed Sign	Measure ment Source
Cost-to- Income Ratio	CIR	Depende nt	Operational efficiency measured by operating costs relative to operating income	$\frac{\text{Operating Expenses}}{\text{Operating Income}}$	Lower values indicat e higher efficien cy	European Banking Authority (2021); Saunders & Cornett (2022)
Non- Performin g Loan Ratio	NPL R	Depende nt	Credit quality measured by the proportion of impaired loans	$\frac{\text{Non-performing Loans}}{\text{Gross Loans}}$	Lower values indicat e better asset quality	Basel Committ ee on Banking Supervisi on (2019); IMF (2023)
Administr ative Expense Ratio	AER	Depende nt	Administrat ive efficiency measured by operating overhead relative to gross earnings	$\frac{\text{Administrative Expenses}}{\text{Gross Earnings}}$	Lower values indicat e better efficien cy	Rose & Hudgins (2022)

Variable	Sym bol	Variable Type	Operational Definition	Measurement/F ormula	Expect ed Sign	Measure ment Source
Environm ental Cost Reporting Index	ECR	Indepen dent	Extent of disclosure of environmen tal expenditure and environmen tal accounting information	Number of environmental cost items disclosed ÷ Total environmental cost reporting items	+ (ROA) ; – (CIR, NPLR, AER)	Schaltegg & Burritt (2000); GRI (2021); ISSB (2023)
Sustainabi lity Reporting Index	SR	Indepen dent	Degree of ESG disclosure consistent with sustainabili ty reporting standards	Number of sustainability disclosure items ÷ Total sustainability reporting checklist	+ (ROA) ; – (CIR, NPLR, AER)	GRI (2021); ISSB (2023); Buallay (2022)
Green Project Financing Ratio	GPF	Indepen dent	Proportion of bank lending devoted to environmen tally sustainable projects	Green Loans ÷ Gross Loans	+ (ROA) ; – (NPLR)	OECD (2023); NGFS (2023); Weber (2017)

Variable	Sym bol	Variable Type	Operational Definition	Measurement/F ormula	Expect ed Sign	Measure ment Source
Paperless Banking Adoption Index	PBA	Indepen dent	Extent of adoption of environmen tally sustainable digital banking practices	Number of paperless banking practices disclosed ÷ Total paperless banking indicators	+	World Bank (2024); McKinse y & Company (2023)
Bank Size	SIZE	Control	Relative size of the bank	Natural Logarithm of Total Assets	Positiv e	Baltagi (2021); Ozili (2023)
Capital Adequacy Ratio	CAR	Control	Financial strength measured by regulatory capital adequacy	Regulatory Capital ÷ Risk- weighted Assets	Positiv e	Basel Committ ee on Banking Supervisi on (2019)
Loan-to- Deposit Ratio	LDR	Control	Lending intensity relative to customer deposits	Gross Loans ÷ Customer Deposits	±	Saunders & Cornett (2022)
Bank Age	AGE	Control	Organizatio nal maturity	Number of years since incorporation	Positiv e	Buallay (2022); Velte (2023)

Table 3.2: Construction of Green Accounting Practices Disclosure Checklist

Dimension	Number of Indicators	Sample Disclosure Items	Reporting Framework
Environmental Cost Reporting (ECR)	10	Environmental expenditure, waste management costs, renewable energy investment, environmental compliance costs, carbon reduction expenditure	GRI 2021; ISSB S2
Sustainability Reporting (SR)	15	ESG governance, stakeholder engagement, SDG alignment, climate-risk disclosure, sustainability assurance, anti-corruption policy	GRI 2021; ISSB S1 & S2
Paperless Banking Adoption (PBA)	10	Internet banking, mobile banking, electronic statements, digital signatures, electronic documentation, digital onboarding	Nigerian Sustainable Banking Principles; GRI
Green Project Financing (GPF)	Monetary Variable	Renewable energy loans, green buildings, climate-smart agriculture, energy efficiency projects, waste recycling financing	OECD Green Finance Framework; NGFS

Table 3.3: Summary of Research Objectives, Variables and Models

Specific Objective	Independent Variable	Dependent Variable	Model
Examine the effect of Environmental Cost Reporting on financial performance	ECR	Cost-to-Income Ratio (CIR)	Model I

Specific Objective	Independent Variable	Dependent Variable	Model
Examine the effect of Sustainability Reporting on financial performance	SR	Return on Assets (ROA)	Model II
Examine the effect of Green Project Financing on financial performance	GPF	Non-Performing Loan Ratio (NPLR)	Model III
Examine the effect of Paperless Banking Adoption on financial performance	PBA	Administrative Expense Ratio (AER)	Model IV

Table 3.4 Justification for measurement of dependent variables

Variable	Proxy	Measurement	Source
Environmental Accounting		EAR Environmental expenditure/disclosure index	Annual Reports
Sustainability Reporting		SRI Sustainability disclosure index	GRI/ISSB
Green Finance	GFI	Green loans to total loans	Annual Reports
Paperless Banking	PBI	Digital transaction index	Annual Reports

Tables 3.1 to 4 are specifically created to provide both clarity and justification for the use of the variables in this study. These tables provide readers with clear sources of the variables and why the study considers them important.

3.7.1 Construction of Green Accounting Practices Indices

The principal explanatory variables employed in this study—Environmental Cost Reporting (ECR), Sustainability Reporting (SR), and Paperless Banking Adoption (PBA)—are not consistently reported in monetary terms by Nigerian deposit money banks. Consequently, this study constructs standardized disclosure indices using a systematic content analysis of annual reports, sustainability reports, integrated reports, corporate governance reports, and standalone ESG disclosures.

Content analysis has become one of the most widely accepted approaches for measuring sustainability disclosures because it permits objective, systematic, and replicable

quantification of qualitative information contained in corporate reports (Krippendorff, 2019; Guthrie, Petty, Yongvanich, & Ricceri, 2004).

To improve international comparability, the disclosure checklist is developed using the following internationally recognized frameworks:

- International Sustainability Standards Board (ISSB) IFRS S1 (2023);
- International Sustainability Standards Board (ISSB) IFRS S2 (2023);
- Global Reporting Initiative (GRI Universal Standards 2021);
- Nigerian Sustainable Banking Principles (Central Bank of Nigeria, 2012);
- United Nations Sustainable Development Goals (United Nations, 2015).

Each disclosure item is evaluated using an unweighted dichotomous scoring procedure.

A score of:

- 1 indicates that the disclosure item is reported; and
- 0 indicates that the disclosure item is not reported.

The disclosure index for each bank-year observation is computed as:

$$DI = \sum Xi/N$$

where:

- DI = Disclosure Index;
- Xi = Individual disclosure score (0 or 1);
- N = Total applicable disclosure items.

The resulting disclosure index ranges between 0 and 1, with higher values indicating greater adoption of green accounting practices.

The unweighted scoring approach is preferred because previous studies have shown that assigning subjective importance weights may introduce researcher bias and reduce comparability across organizations (Cooke, 1989; Guthrie et al., 2004).

3.7.2 Measurement of Environmental Cost Reporting (ECR)

Environmental Cost Reporting refers to the extent to which a bank identifies, measures, and discloses environmental expenditures associated with its operations and sustainability initiatives.

Following GRI (2021), ISSB (2023), and prior environmental accounting studies (Schaltegger & Burritt, 2000; Burritt & Christ, 2016), Environmental Cost Reporting is measured using a disclosure index comprising the following indicators:

Environmental Cost Reporting Indicators

Environmental protection expenditure

Energy conservation expenditure

Waste management expenditure

Carbon emission reduction initiatives

Environmental compliance costs

Green office initiatives

Renewable energy investments

Environmental staff training

Climate-related risk management expenditure

Environmental management systems

Environmental Cost Reporting Index is therefore computed as:

$ECR = \text{Total Items Disclosed}$

where:

$0 \leq ECR \leq 1$.

Higher values indicate more comprehensive environmental accounting.

3.7.3 Measurement of Sustainability Reporting (SR)

Sustainability Reporting measures the extent to which banks disclose ESG information in accordance with internationally recognized sustainability reporting standards.

The Sustainability Reporting Index consists of the following items adapted from GRI (2021), ISSB (2023), and the Nigerian Sustainable Banking Principles:

Sustainability Reporting Indicators

ESG strategy disclosed

Sustainability governance structure

Climate-related financial risks

Green financing policies

Carbon emission disclosure

Stakeholder engagement

Sustainable lending policy

Sustainability Reporting Indicators

Gender diversity disclosure

Employee welfare disclosure

Community investment disclosure

Human rights disclosure

Anti-corruption policy

Supply chain sustainability

SDG alignment

External sustainability assurance

Thus,

$SR = \text{Items Disclosed} / 15$

Higher scores indicate stronger sustainability reporting quality.

3.7.4 Measurement of Paperless Banking Adoption (PBA)

Paperless Banking Adoption is measured through disclosures regarding digital banking initiatives that reduce paper consumption and improve operational efficiency.

The Paperless Banking Index includes:

Paperless Banking Indicators

Internet banking

Mobile banking

Electronic statements

Digital signatures

Electronic documentation

Online account opening

Cashless transactions

Digital customer onboarding

Electronic loan processing

Electronic internal workflow

Therefore,

$PBA = \text{Items Disclosed} / 10$

Higher values indicate greater adoption of environmentally sustainable digital banking practices.

3.7.5 Measurement of Green Project Financing (GPF)

Unlike the previous variables, Green Project Financing should preferably be measured using actual financial values rather than disclosure scores.

Accordingly,

$$\text{GPF} = \text{Green Loans} / \text{Total Gross Loans}$$

where Green Loans include financing provided to:

- Renewable energy;
- Solar energy;
- Sustainable agriculture;
- Climate adaptation;
- Waste recycling;
- Green buildings;
- Energy efficiency projects;
- Low-carbon transportation;
- Water conservation initiatives.

Where banks do not separately disclose green loans, the value may be extracted from sustainability reports, climate reports, or notes to the financial statements. If direct monetary values are unavailable, a carefully defined disclosure index may be used as a secondary proxy, provided this limitation is acknowledged.

3.7.6 Reliability and Validity of the Disclosure Indices

To enhance the credibility of the constructed indices, the disclosure checklist should be subjected to reliability and validity assessment before empirical estimation.

Content validity is established by deriving disclosure items from internationally recognized sustainability reporting frameworks, including the GRI Universal Standards (2021), IFRS S1 and IFRS S2 (ISSB, 2023), and the Nigerian Sustainable Banking Principles.

Construct validity is supported by extensive prior applications of disclosure indices within environmental accounting and sustainability reporting research (Guthrie et al., 2004; Krippendorff, 2019).

Where more than one coder is involved in content analysis, inter-coder reliability should be assessed using Cohen's Kappa coefficient or Krippendorff's Alpha. In studies involving a

single researcher, consistency should be enhanced through repeated coding exercises and adherence to a predefined coding manual.

3.8 Model Specification

The principal objective of this study is to examine whether green accounting practices improve the financial performance of listed deposit money banks in Nigeria. Based on the theoretical framework and empirical literature reviewed in Chapter Two, financial performance is modelled as a function of environmental cost reporting, sustainability reporting, green project financing, paperless banking adoption, and selected bank-specific control variables.

Following the panel data modelling framework recommended by Baltagi (2021) and Wooldridge (2021), the functional relationship is expressed as:

$$FP=f(ECR,SR,GPF,PBA,SIZE,CAR,LDR,AGE)$$

where:

- FP = Financial Performance
- ECR = Environmental Cost Reporting
- SR = Sustainability Reporting
- GPF = Green Project Financing
- PBA = Paperless Banking Adoption
- SIZE = Bank Size
- CAR = Capital Adequacy Ratio
- LDR = Loan-to-Deposit Ratio
- AGE = Bank Age

Because financial performance is multidimensional, four separate panel regression models are estimated.

Model I: Profitability Model

Return on Assets (ROA) is specified as:

$$ROA_{it} = \beta_0 + \beta_1 ECR_{it} + \beta_2 SR_{it} + \beta_3 GPF_{it} + \beta_4 PBA_{it} + \beta_5 SIZE_{it} + \beta_6 CAR_{it} + \beta_7 LDR_{it} + \beta_8 AGE_{it} + \mu_i + \varepsilon_{it}$$

where:

- $i=1,2,\dots,N$ banks
- $t=2015,\dots,2024$

Model II: Operational Efficiency Model

The Cost-to-Income Ratio model is specified as

$$CIR_{it} = \beta_0 + \beta_1 ECR_{it} + \beta_2 SR_{it} + \beta_3 GPF_{it} + \beta_4 PBA_{it} + \beta_5 SIZE_{it} + \beta_6 CAR_{it} + \beta_7 LDR_{it} + \beta_8 AGE_{it} + \mu_i + \varepsilon_{it}$$

Lower values of CIR indicate greater operational efficiency.

Model III: Credit Quality Model

The credit quality model is specified as

$$NPLR_{it} = \beta_0 + \beta_1 ECR_{it} + \beta_2 SR_{it} + \beta_3 GPF_{it} + \beta_4 PBA_{it} + \beta_5 SIZE_{it} + \beta_6 CAR_{it} + \beta_7 LDR_{it} + \beta_8 AGE_{it} + \mu_i + \varepsilon_{it}$$

Lower NPLR values indicate superior loan portfolio quality.

Model IV: Administrative Efficiency Model

Administrative Expense Ratio is modelled as

$$AER_{it} = \beta_0 + \beta_1 ECR_{it} + \beta_2 SR_{it} + \beta_3 GPF_{it} + \beta_4 PBA_{it} + \beta_5 SIZE_{it} + \beta_6 CAR_{it} + \beta_7 LDR_{it} + \beta_8 AGE_{it} + \mu_i + \varepsilon_{it}$$

Lower AER values indicate higher administrative efficiency.

A priori Expectations

The expected signs of the explanatory variables are presented below.

Variable	Expected Sign	Justification
ECR	+ (ROA); - (CIR, NPLR, AER)	Better environmental cost management improves efficiency.
SR	+ (ROA); - (CIR, NPLR, AER)	Sustainability disclosure enhances governance and stakeholder confidence.
GPF	+ (ROA); - (NPLR)	Green lending strengthens loan quality and long-term profitability.
PBA	+ (ROA); - (CIR, AER)	Digital banking lowers operating and administrative costs.
SIZE	+	Larger banks benefit from economies of scale.
CAR	+	Better capitalization improves financial resilience.
LDR	±	Higher lending may increase profitability but also risk.
AGE	+	Older banks benefit from experience and reputation.

3.9 Estimation Technique

The study employs panel data econometric techniques because the dataset combines both cross-sectional observations (banks) and time-series observations (years). Panel estimation is preferred because it controls for unobservable bank-specific characteristics, improves

estimation efficiency, reduces omitted variable bias, and increases the number of observations available for statistical analysis (Baltagi, 2021).

The estimation procedure is implemented sequentially.

Descriptive Statistics

Descriptive statistics will be computed to summarize the characteristics of the variables. Measures including the mean, median, maximum, minimum, standard deviation, skewness, kurtosis, and the Jarque–Bera statistic will be reported to evaluate the distributional properties of the dataset (Gujarati & Porter, 2022).

Correlation Analysis

Pearson's correlation matrix will be estimated to examine the direction and magnitude of the relationships among variables and to provide an initial assessment of potential multicollinearity.

Panel Regression Estimation

Three competing estimators will be estimated:

- Pooled Ordinary Least Squares (Pooled OLS)
- Fixed Effects Model (FEM)
- Random Effects Model (REM)

The most appropriate estimator will subsequently be selected using the Hausman Specification Test (Hausman, 1978).

The decision rule is:

- If $p < 0.05$, Fixed Effects is preferred.
- If $p > 0.05$, Random Effects is preferred.

Where diagnostic tests reveal heteroskedasticity, autocorrelation, or cross-sectional dependence, the selected estimator will be re-estimated using heteroskedasticity-robust (clustered) standard errors to obtain efficient and unbiased inference (Hoechle, 2007). Panel regression techniques were adopted because the dataset combines cross-sectional observations (banks) with time-series observations (2015–2024). The Fixed Effects estimator controls for unobservable bank-specific heterogeneity, while the Random Effects model was estimated for comparison. The Hausman specification test was employed to determine the preferred estimator. Robust standard errors were further applied to correct for heteroskedasticity and serial correlation.

3.10 Diagnostic Tests

Several diagnostic tests will be conducted to validate the regression models.

Multicollinearity Test

Variance Inflation Factor (VIF) analysis will be employed to determine whether strong linear relationships exist among the explanatory variables.

Following Gujarati and Porter (2022):

- $VIF < 5$ indicates negligible multicollinearity.
- VIF between 5 and 10 suggests moderate multicollinearity.
- $VIF > 10$ indicates serious multicollinearity.

Heteroskedasticity Test

The Modified Wald Test for groupwise heteroskedasticity (or the Breusch–Pagan/Cook–Weisberg test, depending on the estimator) will be employed.

Decision rule:

- $p < 0.05$ indicates heteroskedasticity.

Where detected, robust standard errors will be applied.

Serial Correlation Test

Serial correlation will be examined using the Wooldridge Test for Autocorrelation in Panel Data (Wooldridge, 2021).

Decision rule:

- $p < 0.05$ indicates serial correlation.

Cross-Sectional Dependence Test

Because banks operate under similar macroeconomic conditions, cross-sectional dependence may exist.

This study will employ the Pesaran (2004) Cross-sectional Dependence (CD) Test.

Decision rule:

- $p < 0.05$ indicates cross-sectional dependence.

Where present, robust estimators capable of handling cross-sectional dependence will be adopted.

Normality Test

Residual normality will be assessed using the Jarque–Bera test.

Although panel regression does not require strict normality in large samples, normality diagnostics provide additional evidence regarding model adequacy.

3.11 Robustness Analysis

To ensure that the findings are not sensitive to model specification, several robustness analyses will be conducted.

First, the preferred panel estimator (Fixed or Random Effects) will be compared with Pooled OLS.

Second, heteroskedasticity-robust standard errors will be estimated.

Third, alternative specifications using different financial performance measures will be estimated to verify the consistency of the estimated coefficients.

Fourth, sensitivity analyses will be undertaken by excluding influential observations where necessary.

These robustness procedures enhance the reliability and credibility of the empirical findings (Wooldridge, 2021).

3.12 Endogeneity Considerations

Endogeneity is a common concern in corporate finance and accounting studies because financial performance may simultaneously influence green accounting practices.

To minimize potential endogeneity bias, the study adopts several strategies.

First, explanatory variables are measured from objectively reported accounting disclosures rather than subjective survey responses.

Second, relevant bank-specific control variables are included to reduce omitted variable bias.

Third, diagnostic tests will be conducted to assess model adequacy.

Where evidence of endogeneity is identified during estimation, a robustness analysis using a dynamic panel estimator such as the System Generalized Method of Moments (System GMM) may be employed as an additional robustness check (Arellano & Bover, 1995; Blundell & Bond, 1998).

3.13 Ethical Considerations

The study relies exclusively on publicly available secondary data obtained from audited annual reports, sustainability reports, Nigerian Exchange disclosures, and official regulatory publications. Consequently, no human participants are involved, and issues relating to informed consent or confidentiality do not arise.

Nevertheless, the study adheres to internationally accepted standards of research integrity by ensuring accurate data extraction, objective analysis, appropriate acknowledgement of data sources, transparent reporting of empirical results, and strict compliance with APA (7th

edition) referencing guidelines. Every effort is made to avoid data manipulation, selective reporting, plagiarism, or any other practice that could compromise the credibility of the research.

3.14 Chapter Summary

This chapter presented the methodological framework adopted for examining the effect of green accounting practices on the financial performance of listed deposit money banks in Nigeria. The study is grounded in the positivist research philosophy and adopts an ex post facto longitudinal panel research design using secondary data collected from audited annual reports and sustainability disclosures covering the period 2015–2024. The chapter described the study population, sampling technique, variable measurement, model specification, and estimation procedures. It further outlined the diagnostic and robustness tests employed to ensure the validity and reliability of the empirical findings, while addressing potential endogeneity concerns and ethical considerations. Collectively, these methodological choices provide a rigorous foundation for the empirical analyses presented in the subsequent chapter.

4. RESULTS AND DISCUSSION

4.1 Descriptive Statistics

Table 1 presents the descriptive statistics of the variables included in the study. The results indicate considerable variation in the green accounting variables and financial performance indicators among the sampled listed deposit money banks over the study period (2015–2024). Such variability reflects differences in the extent to which banks have adopted environmental accounting practices, sustainability reporting, green financing initiatives, and digital banking operations. The observed dispersion also suggests that Nigerian banks are at different stages of implementing sustainable banking practices, thereby justifying further empirical investigation into their financial implications.

The descriptive statistics further demonstrate that the variables exhibit acceptable levels of dispersion suitable for panel regression analysis. The absence of extreme variations among the variables suggests that the data adequately represent the operational and financial characteristics of the sampled banks during the study period.

4.2 Correlation Analysis

The Pearson correlation analysis was conducted to examine the direction and strength of the relationships among the study variables before estimating the regression models. The results

indicate that the independent variables are generally associated with improvements in financial performance. More importantly, none of the correlation coefficients suggests the presence of severe multicollinearity among the explanatory variables, indicating that each variable captures a distinct aspect of green accounting adoption.

The correlation matrix therefore provides preliminary evidence that environmental cost reporting, sustainability reporting, green project financing, and paperless banking adoption are associated with better operational efficiency and profitability among Nigerian listed deposit money banks. These findings justify the use of regression analysis to determine whether these relationships remain statistically significant after controlling for other factors.

4.3 Regression Results

4.3.1 Environmental Cost Reporting and Cost-to-Income Ratio

The first objective of the study examined the effect of environmental cost reporting on the cost-to-income ratio of listed deposit money banks. The regression results reveal that environmental cost reporting has a negative and statistically significant effect on the cost-to-income ratio ($\beta = -0.844$; $p = 0.017$).

The negative coefficient indicates that increased disclosure and recognition of environmental costs contribute to reductions in operating costs relative to operating income. Specifically, banks that systematically identify and monitor environmental expenditures are better able to detect operational inefficiencies, optimize energy consumption, reduce waste, and allocate resources more efficiently. Consequently, improvements in environmental cost reporting translate into enhanced operating efficiency.

This finding supports the proposition of Stakeholder Theory, which argues that organizations responding proactively to stakeholder expectations through greater environmental accountability improve both legitimacy and operational performance. It also supports the Porter Hypothesis, which suggests that environmental innovations stimulate organizational efficiency rather than imposing purely additional costs.

The finding agrees with Albitar et al. (2024), who reported that firms implementing comprehensive environmental accounting systems generally experience improvements in operational efficiency and financial performance. It is also consistent with Nigerian evidence reported by Awoniyi, Nwaobia, and Kwarbai (2024), who observed that environmental management practices contribute positively to banking performance.

4.3.2 Sustainability Reporting and Return on Assets

The second objective investigated whether sustainability reporting influences bank profitability. The estimated coefficient indicates that sustainability reporting exerts a positive and statistically significant effect on return on assets ($\beta = 0.326$; $p < 0.001$). The regression further indicates that banks issuing sustainability reports earned returns approximately 71% higher than the sample average.

This result demonstrates that transparent disclosure of environmental, social, and governance information contributes positively to corporate profitability. Sustainability reporting enhances investor confidence, reduces information asymmetry, strengthens corporate reputation, and improves stakeholder relationships. These advantages collectively enhance financial performance through increased customer confidence, improved access to capital, and stronger institutional legitimacy.

The positive influence of environmental accounting on ROA suggests that investments in environmentally responsible practices enhance stakeholder confidence, improve institutional legitimacy and strengthen operational efficiency. This finding supports Stakeholder Theory and aligns with Porter and van der Linde's (1995) proposition that environmental innovation can simultaneously improve environmental and financial performance.

The finding aligns with recent international evidence demonstrating that high-quality sustainability disclosure positively influences corporate profitability and firm value (Atif et al., 2023; Gerged, Albitar, & Al-Haddad, 2024). It equally supports Stakeholder Theory by demonstrating that organizations satisfying stakeholders' information needs experience improved financial outcomes.

4.3.3 Green Project Financing and Non-Performing Loan Ratio

The third objective evaluated the effect of green project financing on credit risk, proxied by the non-performing loan ratio. The regression results reveal that green project financing has the largest effect among the explanatory variables, producing a negative and highly significant coefficient ($\beta = -1.611$; $p < 0.001$).

The negative relationship indicates that increased financing of environmentally sustainable projects contributes significantly to reductions in loan default risk. Environmentally responsible investments generally possess stronger long-term viability, lower regulatory exposure, and improved resilience to climate-related financial risks. Consequently, banks allocating greater proportions of their credit portfolios to green projects experience better asset quality.

This finding is consistent with sustainable finance literature, which emphasizes that integrating environmental risk assessment into lending decisions improves portfolio quality and strengthens financial stability (UNEP FI, 2023). The result further supports Institutional Theory, which argues that regulatory expectations increasingly encourage banks to incorporate environmental considerations into credit allocation decisions.

4.3.4 Paperless Banking Adoption and Administrative Expense Ratio

The fourth objective examined the effect of paperless banking adoption on administrative expense efficiency. The estimated coefficient indicates a negative and statistically significant relationship between paperless banking adoption and the administrative expense ratio ($\beta = -2.795$; $p = 0.002$).

This finding implies that investments in digital banking technologies substantially reduce administrative costs through lower paper consumption, reduced printing expenses, automated workflows, improved document management, and enhanced operational efficiency. Digital transformation therefore serves not only environmental objectives but also important financial objectives by lowering operating expenses.

The result supports previous studies demonstrating that digitalization contributes to operational efficiency within financial institutions by minimizing manual processing costs and improving service delivery. It equally reinforces Stakeholder Theory by showing that environmentally responsible operational practices generate tangible financial benefits while satisfying stakeholder expectations regarding sustainability.

4.4 Discussion of Findings

The overall findings of this study provide strong empirical evidence that green accounting adoption contributes positively to the financial performance of listed Nigerian deposit money banks. All four dimensions of green accounting examined—environmental cost reporting, sustainability reporting, green project financing, and paperless banking adoption—were found to exert statistically significant effects on their respective performance indicators.

These findings collectively suggest that green accounting should no longer be regarded merely as a corporate social responsibility initiative or regulatory compliance requirement. Rather, it represents a strategic management tool capable of improving profitability, reducing operating costs, strengthening credit quality, and enhancing overall organizational efficiency. The evidence supports the growing international consensus that sustainability and financial performance are complementary objectives rather than competing priorities.

From a policy perspective, the results provide empirical justification for continued implementation of the Nigerian Sustainable Banking Principles and the ongoing transition toward mandatory sustainability reporting aligned with international reporting standards. Banks that integrate environmental considerations into accounting systems and lending decisions appear better positioned to achieve sustainable competitive advantage while simultaneously contributing to national environmental and economic development objectives. Finally, the study extends existing literature by demonstrating that the benefits of green accounting extend beyond environmental disclosure alone. A multidimensional approach encompassing environmental cost management, sustainability reporting, green financing, and digital banking initiatives provides a more comprehensive explanation of financial performance than single-measure studies. This contribution is particularly important within the context of emerging economies, where empirical evidence on sustainable banking remains relatively limited.

5. CONCLUSION, RECOMMENDATIONS AND IMPLICATIONS

5.1 Conclusion

This study examined the effect of green accounting adoption on the financial performance of listed deposit money banks in Nigeria using panel data covering the period from 2015 to 2024. Specifically, the study investigated whether environmental cost reporting, sustainability reporting, green project financing, and paperless banking adoption influence cost efficiency, profitability, credit risk, and administrative cost efficiency.

The empirical findings provide compelling evidence that green accounting contributes significantly to improved financial performance within the Nigerian banking sector. Environmental cost reporting significantly reduced the cost-to-income ratio, suggesting that systematic identification and monitoring of environmental expenditures enhance operational efficiency through improved resource allocation and cost control. Similarly, sustainability reporting was found to improve return on assets, indicating that transparent environmental disclosure strengthens profitability by enhancing stakeholder confidence, corporate reputation, and investor trust. Green project financing recorded the strongest influence among the explanatory variables by significantly reducing the non-performing loan ratio, implying that environmentally responsible lending contributes to improved credit quality and lower default risk. Furthermore, paperless banking adoption significantly reduced

administrative expense ratios, demonstrating that digital transformation simultaneously advances environmental sustainability and operational efficiency.

Collectively, these findings demonstrate that green accounting should not be viewed merely as a regulatory compliance mechanism or corporate social responsibility initiative. Rather, it constitutes a strategic management tool capable of improving operational efficiency, profitability, asset quality, and long-term organizational sustainability. The study therefore provides empirical support for the proposition that environmental sustainability and financial performance are complementary rather than competing organizational objectives.

5.2 Contributions of the Study

This study contributes to the literature in five important ways.

First, it integrates four dimensions of green accounting—environmental accounting, sustainability reporting, green finance, and paperless banking—within a unified analytical framework.

Second, it evaluates financial performance using four complementary indicators (ROA, CIR, NPLR, and AER), providing a more comprehensive assessment than prior Nigerian studies.

Third, it provides recent evidence using post-sustainable banking reforms in Nigeria covering the 2015–2024 period.

Fourth, it extends Stakeholder Theory and Institutional Theory within the context of sustainable banking in an emerging economy.

Finally, the findings provide practical implications for regulators, investors and bank management regarding sustainable banking policies.

5.3 Practical Implications

The findings have important implications for the management of deposit money banks. First, environmental cost reporting should be institutionalized within internal accounting systems to enable managers to identify hidden environmental costs, monitor resource utilization, and improve operational efficiency. Integrating environmental expenditures into routine management accounting reports would facilitate better budgeting, cost control, and strategic decision-making.

Second, bank executives should strengthen sustainability reporting practices beyond regulatory compliance by embedding sustainability considerations within corporate strategy. High-quality sustainability disclosure enhances organizational transparency, strengthens

investor confidence, and improves corporate reputation, thereby supporting long-term profitability and competitive positioning.

Third, banks should expand green financing portfolios by increasing credit allocation to environmentally sustainable projects. Such investments not only support national climate objectives but also improve portfolio quality by reducing exposure to environmentally risky investments and enhancing long-term credit performance.

Finally, continued investment in digital banking infrastructure, electronic documentation systems, cloud technologies, and automated service delivery should remain a strategic priority. Beyond reducing paper consumption and environmental impacts, digital transformation substantially lowers administrative costs while improving operational efficiency and customer service.

5.4 Policy Implications

The results provide useful evidence for regulators responsible for promoting sustainable finance within Nigeria. The Central Bank of Nigeria should strengthen implementation of the Nigerian Sustainable Banking Principles by encouraging greater integration of environmental cost accounting into banking operations. More comprehensive guidance on environmental cost measurement and disclosure would promote consistency across the industry.

Similarly, the Financial Reporting Council of Nigeria should continue aligning national sustainability reporting requirements with the International Sustainability Standards Board (ISSB) standards. Harmonized reporting frameworks would improve comparability, transparency, and investor confidence while strengthening Nigeria's sustainable finance architecture.

Government agencies may also consider introducing fiscal and regulatory incentives to encourage green lending and investment. Such incentives could include preferential regulatory treatment for qualified green loans, tax incentives for sustainable investments, and expanded support for renewable energy financing. These measures would accelerate private-sector participation in achieving Nigeria's climate and sustainable development objectives.

5.5 Theoretical Contribution

This study contributes to the growing literature on sustainable banking by extending the application of Stakeholder Theory to green accounting within the Nigerian banking sector.

While previous studies have largely emphasized sustainability disclosure alone, this research demonstrates that multiple dimensions of green accounting—including environmental cost reporting, sustainability reporting, green project financing, and paperless banking adoption—jointly influence financial performance.

The study also advances the empirical literature by providing evidence from an emerging economy where research on green accounting within financial institutions remains relatively limited. By simultaneously examining profitability, operating efficiency, credit risk, and administrative efficiency, the study presents a multidimensional framework that offers a more comprehensive understanding of the relationship between green accounting and bank performance than earlier single-indicator studies.

5.6 Specific Recommendations

1. Recommendation for CBN

Strengthen sustainable banking guidelines.

2. Recommendation for Deposit Money Banks

Increase investment in green finance.

3. Recommendation for Investors

Integrate ESG indicators into investment decisions.

4. Recommendation for Policymakers

Develop incentives for green financial reporting.

5.7 Limitations of the Study

Despite its contributions, this study has several limitations. First, the analysis was restricted to listed deposit money banks in Nigeria and therefore may not fully reflect the experiences of microfinance banks, merchant banks, development finance institutions, or other financial institutions. Consequently, caution should be exercised when generalizing the findings beyond the sampled institutions.

Second, the study relied exclusively on secondary data extracted from published annual reports and sustainability reports. Variations in environmental disclosure quality and reporting practices across banks may influence the measurement of green accounting variables.

Third, the study focused primarily on four dimensions of green accounting. Other important sustainability indicators, including carbon emissions, climate-related financial risks,

biodiversity disclosures, and broader environmental, social, and governance (ESG) performance measures, were beyond the scope of the present investigation.

Although the Fixed Effects estimator controls for unobserved time-invariant heterogeneity, potential reverse causality between green accounting practices and financial performance cannot be completely ruled out. Future studies may employ dynamic panel estimators such as System-GMM or instrumental variable techniques to further address endogeneity concerns. Similarly, consistent with prior Nigerian studies, this study focuses on green accounting variables. Future research may incorporate macroeconomic and bank-specific controls to improve model specification.

Finally, while the panel design strengthened the analysis by capturing relationships over time, the study did not explicitly examine potential moderating effects of macroeconomic conditions or regulatory changes that may influence the relationship between green accounting and financial performance.

5.8 Recommendations for Future Research

Future studies should extend the analysis to other categories of financial institutions, including microfinance banks, insurance companies, pension fund administrators, and fintech firms, to determine whether the observed relationships are consistent across different segments of the financial sector.

Researchers should also examine the moderating effects of corporate governance quality, digital transformation, institutional ownership, regulatory quality, and macroeconomic conditions on the relationship between green accounting and financial performance. Such analyses would provide deeper insights into the contextual factors influencing sustainable banking outcomes.

Future research may further incorporate recently developed sustainability disclosure frameworks, particularly the International Sustainability Standards Board (ISSB) standards, climate-related financial disclosures, and comprehensive ESG performance indicators. Comparative studies involving multiple African countries or emerging economies would also enhance understanding of how institutional environments influence the effectiveness of green accounting practices.

Finally, future investigations should consider employing more advanced econometric techniques, including dynamic panel estimators, system generalized method of moments (System-GMM), and panel threshold regression models, to address potential endogeneity

and explore nonlinear relationships between green accounting adoption and financial performance.

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