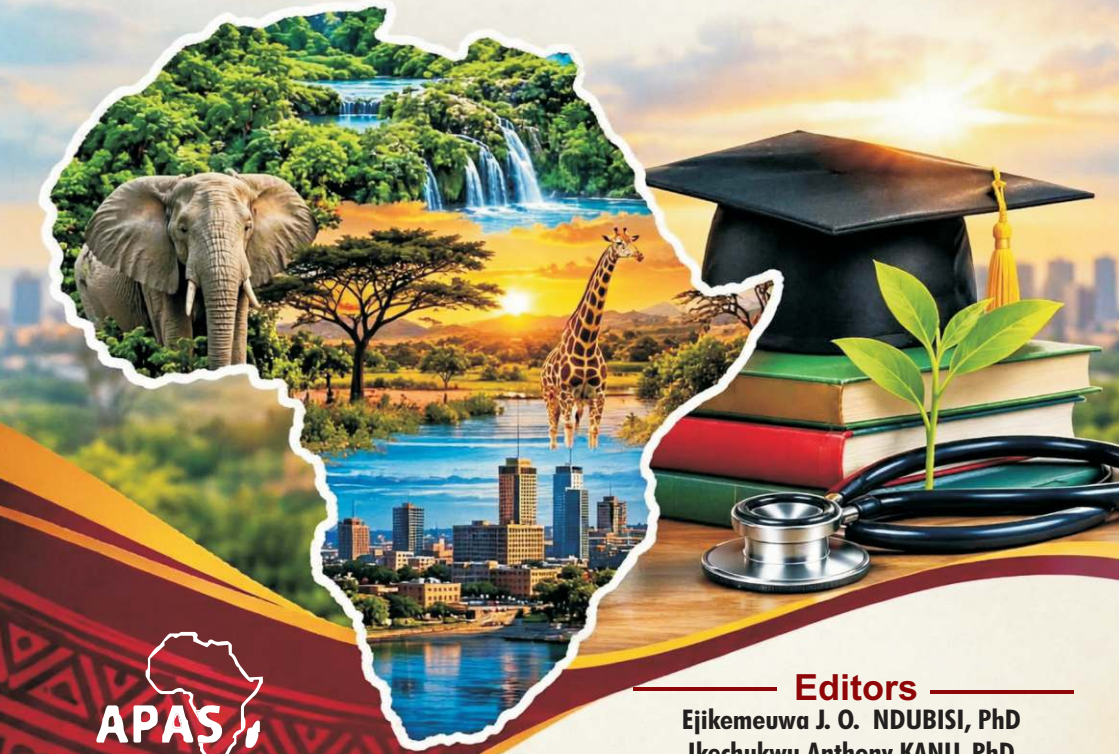
GOVERNANCE, EDUCATION AND SUSTAINABLE DEVELOPMENT IN AFRICA:

POLICY AND INSTITUTIONAL PATHWAYS FOR BIODIVERSITY CONSERVATION AND PUBLIC HEALTH

Proceedings of the 2026 International Conference of the Association for the Promotion of African Studies (APAS)



APAS

Editors

Ejikemeuwa J. O. NDUBISI, PhD
Ikechukwu Anthony KANU, PhD
Mary Winfred ECHE, PhD
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Proceedings of the 2026 International Conference of the Association for the Promotion of African Studies (APAS) held at the Veritas University, Abuja, Nigeria, 26 - 29 May 2026

First Published in 2026

A Publication of the Association for the Promotion of African Studies
COYWRIGHT @ 2026 by The Association for the Promotion of African Studies

ISBN: 978-2981-35-15

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DEDICATION

To

The Loving Memory of Late Sr. Dr. Chika Eze, SHCJ, for her contribution towards the success of the 2026 APAS Conference as the LOC Chairperson

TABLE OF CONTENTS

1.	Dedication	iii
2.	Table Of Content	iv-v
3.	Preface	vi-xiii
4.	Akara And Pap Democracy: Socio-religious Implications For Sustainable Development Practice In Nigeria *Onyinyechi Fidelia Maduagwu*	1-19
5.	Corporate Social Responsibility And National Development In Nigeria: The Role Of The Private Sector *Solomon Kumapayi, PhD*	20-36
6.	Curriculum Innovation For Sustainable Development In Africa *Sunday B. Idakwoji, PhD & Francis R. Ojo, PhD*	37-55
7.	Domestic Investment In Large-scale Agriculture: A Catalyst For Productive Employment And Sustainable Development In Nigeria *Ngbonyejugbo, Benedict & EGBULE, Philip Onyekachukwu*	56-71
8.	Ecological Literacy And Curriculum Innovation For Environmental Sustainability Among School Leaders In Shcj Schools In Africa *Antoinette Nneka Opara, PhD*	72-89
9.	Identifying The Utility Gap: A Qualitative Curriculum Audit Of The National Universities Commission Core Curriculum And Minimum Academic Standards (CCMAS) And The Self-Employment Readiness Of Education Economics Graduates *Inegbu Miriamterese Chigozie*	90-109
10.	Innovative Pedagogical Strategies For Teaching Environmental Literacy In African Classrooms *Sunday Bene Idakwoji, PhD & Francis R. Ojo, PhD*	110-123
11.	Leadership For Climate Action, Environmental Sustainability, And Green Governance *Okuji Obinna Oreh, PhD; Victor Chidera Oguh & Mogu, Simon Ijing*	124-139
12.	Natural Capital Risk And Corporate Strategy: Integrating Biodiversity Into Business Decision-making *Okuji Obinna Oreh, PhD & Victor Chidera Oguh*	140-157

12. Green Innovation As A Mediator Between CSR And Sustainable Competitive Advantage 158-184
Victor Chidera Oguh & Okuji Obinna Oreh, PhD

13. Nature-positive Business Models And Corporate Sustainability: Evidence From Global Value Chains 185-209
Victor Chidera Oguh & Okuji Obinna Oreh, PhD

14. Policy, Governance And Environmental Legislation In Africa 210-230
Okewu Michael Peter, PhD & Ukata Emmanuel Egbe, PhD

15 Stewardship Theology And Indigenous Ecological Knowledge As Pathways For Biodiversity Conservation In The African Diaspora 231-253
Kanu, Anthony Ikechukwu, PhD; Pilani, Michael Paul, PhD; Bazza. Mike Boni PhD & Michael Sunday Sasa, PhD

16. Prospect And Challenges Of Biodiversity Conservation And Public Health In Africa: A Public Administration And Education Perspectives 254-270
Omojola Immaculata Olu, PhD; Chukwuwinke Smart Mokuye & Madueke, Mary Judith

17. Sustainable Entrepreneurial Intention And Climate Awareness: Testing The Theory Of Planned Behaviour 271-297
Victor Chidera Oguh; Okuji Obinna Oreh, PhD & Mogu, Simon Ijing

18. Transforming Education In Africa: A Critical Consciousnessapproach To Curriculum Innovation And Ecological Literacy Inspired By Paulo Freire 298-307
Obinna C. Ofozoba, Ph.D

19. Technological Progress And Environmental Stewardship: Insights From African Philosophy 308-334
Ikechukwu Anthony Kanu, PhD; Adaora Ngozi Ogbonnaya & Michael Sunday Sasa, PhD

20 The Politics Of Biodiversity And Public Health In Africa: A Philosophical Inquiry Into The Nature Of Policies And Their Implications 135-152
Vincent Gerald Onwudinjo & Kelechi Onyeka Ezeani, PhD

PREFACE

It is with great pleasure and a profound sense of scholarly commitment that I present this third volume of the proceedings of the 10th International Conference of the Association for the Promotion of African Studies (APAS), titled *Governance, Education and Sustainable Development in Africa: Policy and Institutional Pathways for Biodiversity Conservation and Public Health*. The volume is part of a three-volume scholarly publication from the APAS international conference held at Veritas University, Abuja, from Tuesday, 26 May to Friday, 29 May 2026, on the theme, "Biodiversity, Conservation and Public Health in Africa: Challenges and Prospects."

The publication of these three volumes represents a significant intellectual outcome of the 2026 APAS International Conference. Taken together, they reflect the breadth of the conference theme and the interdisciplinary character of the Association for the Promotion of African Studies. While the first volume, *African Ecologies, Philosophy and Religious Worldviews: Rethinking Human–Nature Relations, Biodiversity and Environmental Responsibility*, examines the philosophical, religious, ethical and indigenous foundations of humanity's relationship with the natural world, and the second volume, *Biodiversity, Climate Change and Environmental Sustainability in Africa: Challenges, Consequences and Ecological Responses*, focuses on ecological challenges and their consequences, this third volume turns attention to the institutional, educational, policy and developmental pathways through which African societies can respond to these challenges. The central concern of this volume is therefore not merely what Africa knows about biodiversity, environmental degradation and public health, but what Africa does with that knowledge. Knowledge must ultimately find expression in policies, institutions, educational systems, leadership practices, economic decisions, legislation and responsible civic action. Without

appropriate institutional structures and effective implementation mechanisms, even the most compelling environmental ideals may remain largely aspirational.

The challenges confronting Africa's biodiversity and public-health systems are multidimensional. They are connected to patterns of economic development, agricultural production, urbanisation, governance, education, industrial activity, environmental legislation, corporate behaviour and public consciousness. Consequently, the pursuit of sustainable development requires an integrated approach in which environmental considerations are incorporated into public administration, education, business, legislation and other dimensions of social organisation. One of the important contributions of this volume is its attention to governance and leadership. Environmental sustainability is not achieved by declarations alone. It requires institutions capable of translating policies into practice, leaders willing to make difficult but necessary decisions, regulatory systems that are functional, and citizens and organisations that accept responsibility for the consequences of their actions. The contributions on leadership for climate action, green governance, environmental legislation and the politics of biodiversity and public health therefore raise fundamental questions about institutional responsibility and the quality of governance required for sustainable development in Africa. The relationship between governance and environmental sustainability is particularly important because environmental resources are frequently subject to competing interests. Forests, agricultural lands, waterways, mineral resources and other ecological assets have economic, social, cultural and political significance. Decisions concerning their use inevitably involve questions of power, justice, ownership, regulation and public interest. Effective governance must therefore seek a balance between development imperatives and the long-term protection of the ecological systems upon which societies depend.

The contribution on policy, governance and environmental legislation in Africa is especially relevant in this regard. Environmental sustainability requires appropriate legal frameworks, but legislation alone is insufficient. Laws must be properly designed, adequately communicated, fairly implemented and effectively enforced. The presence of environmental legislation without corresponding institutional capacity and political commitment can create a gap between policy intention and social reality. This volume therefore invites sustained reflection on the relationship between environmental policy and its practical implementation. The inclusion of a study on problems of enforcement in the administration of criminal justice in Nigeria further broadens the institutional conversation. Although not exclusively environmental in its immediate focus, the question of enforcement is central to the effectiveness of any regulatory framework. Sustainable development requires institutions in which rules are not merely formulated but are capable of being responsibly administered and enforced. The rule of law, institutional accountability and effective administration are therefore important components of the wider sustainability agenda.

A second major concern of this volume is education. If sustainable development is to become more than a policy aspiration, ecological consciousness must be cultivated across generations. Schools, universities and other educational institutions have a significant role in shaping how individuals understand their relationship with nature, society and development. Environmental literacy must consequently become an important component of education in Africa. The contributions on curriculum innovation, ecological literacy, environmental education, innovative pedagogical strategies and critical consciousness demonstrate the importance of transforming educational approaches to respond to contemporary ecological realities. Education should not merely transmit information about environmental problems; it should develop the knowledge, values, critical capacities and practical dispositions necessary for responsible

environmental citizenship. The engagement with Paulo Freire's critical consciousness approach is particularly significant. Environmental challenges are often embedded within broader structures of power, inequality, consumption and development. Education that encourages critical reflection can help learners move beyond passive awareness towards active participation in addressing social and ecological problems. In this sense, environmental education is also education for responsible citizenship and sustainable social transformation. The discussion of curriculum innovation likewise raises a fundamental question: What kind of education does Africa need for the future it desires? A curriculum that prepares learners exclusively for conventional economic participation without developing ecological consciousness may inadequately prepare them for a world experiencing climate change, biodiversity loss, resource pressures and environmental uncertainty. Sustainable development therefore calls for curricula capable of integrating disciplinary knowledge with environmental responsibility, creativity, critical thinking and practical problem-solving.

The volume also examines the relationship between education, employability and development. The study of the National Universities Commission's Core Curriculum and Minimum Academic Standards (CCMAS) and the self-employment readiness of Education Economics graduates illustrates the importance of ensuring that educational systems remain responsive to the changing needs of society and the economy. Sustainable development requires not only environmentally conscious citizens but also graduates capable of generating innovative and productive responses to Africa's developmental challenges.

Another important dimension of the volume is the role of the private sector and responsible business practice. The relationship between economic activity and environmental sustainability is unavoidable. Businesses depend on natural resources and ecological systems, while their production and consumption practices can also affect

those same systems. The papers on corporate social responsibility, natural capital risk, green innovation and nature-positive business models therefore contribute to an important conversation about how economic institutions can become partners in sustainable development. The concept of natural capital is particularly useful because it challenges businesses and policy-makers to recognise biodiversity and ecosystems as possessing value that should be incorporated into decision-making. If ecological resources are treated as costless or inexhaustible, economic decisions may encourage practices that generate short-term benefits while imposing long-term environmental costs. Integrating biodiversity considerations into corporate strategy can therefore contribute to a more responsible conception of competitiveness and economic success. The discussion of green innovation similarly demonstrates that environmental responsibility need not necessarily be viewed as antithetical to economic development. Innovation can create opportunities for enterprises to reduce environmental harm while improving efficiency, competitiveness and long-term sustainability. Likewise, nature-positive business models point towards economic approaches in which commercial activity can be aligned more closely with the protection and restoration of ecological systems.

Agriculture is another important area in which development, employment and sustainability intersect. The contribution on domestic investment in large-scale agriculture highlights the economic potential of agriculture for productive employment and sustainable development in Nigeria. The challenge, however, is to ensure that agricultural development is pursued in ways that protect ecological systems and support the long-term productivity of the land.

The volume also contains contributions that illuminate the relationship between **culture, society and sustainable development**. The examination of *Akara and Pap Democracy*

demonstrates that sustainable development cannot be understood solely in technical or bureaucratic terms. Social practices, religious meanings, cultural experiences and everyday forms of political participation can influence how development is understood and practised. Sustainable development must therefore remain attentive to the cultural contexts within which policies and institutions operate.

Similarly, the inclusion of a study of e-counselling and perceptions surrounding the use of Telegram demonstrates the expanding relevance of digital technologies to contemporary African institutions and educational environments. Although the immediate subject differs from biodiversity conservation, it contributes to the broader question of how African institutions can responsibly harness technological innovation to address emerging social needs. The digital transformation of African societies creates both opportunities and responsibilities for education, counselling, governance and public engagement.

This interdisciplinary breadth is consistent with the mission of APAS. Africa's developmental and environmental challenges cannot be adequately addressed through disciplinary isolation. Policy-makers need the insights of philosophers and ethicists; educators require an understanding of environmental realities; businesses need sustainability frameworks; environmental practitioners require effective governance; and communities need meaningful participation in decisions affecting their ecological and social environments. The papers in this volume therefore invite us to reconsider sustainable development as an institutional project. It is not enough to ask whether Africa possesses natural resources, environmental policies or educational institutions. We must also ask whether these institutions are capable of functioning effectively; whether policies are implemented; whether leaders are accountable; whether citizens are adequately informed; whether businesses recognise their ecological responsibilities; and whether educational systems equip younger generations to confront the challenges ahead.

This is particularly important in relation to biodiversity conservation and public health. Biodiversity protection requires institutions capable of coordinating conservation efforts, regulating resource use and supporting local communities. Public health likewise depends on environmental conditions, institutional capacity, education, infrastructure and responsible governance. The two concerns are therefore deeply interconnected.

The paper on the prospects and challenges of biodiversity conservation and public health from public administration and education perspectives appropriately reflects this intersection. It reinforces the idea that environmental and health challenges must be addressed through coordinated institutional responses rather than isolated interventions. The future of biodiversity conservation in Africa will depend not only on scientific knowledge but also on administrative competence, educational consciousness, political commitment and public participation.

The politics of biodiversity and public health, as explored in this volume, also reminds us that environmental questions are never completely politically neutral. Decisions concerning which ecosystems receive protection, whose interests receive priority, how resources are distributed, and whose voices are heard involve political and ethical considerations. A genuinely sustainable policy framework must therefore take seriously questions of equity, inclusion, accountability and justice.

As President of the Association for the Promotion of African Studies, I wish to express my profound appreciation to the members of APAS for their constant scholarship, intellectual commitment and remarkable zeal towards the promotion and sustenance of African heritage. The contributions represented in this volume are a testimony to the Association's continuing commitment to scholarship that is both intellectually rigorous and responsive to the needs of African societies. I particularly commend the contributors to this volume for bringing together perspectives from public

administration, education, philosophy, environmental studies, economics, business, law, religious studies and related disciplines. Their work demonstrates that the promotion of African scholarship must include both the critical study of existing realities and the search for creative pathways towards a better future.

I also acknowledge with gratitude the conference organising committee, the editors, reviewers, rapporteurs, and all those who contributed to the successful organisation of the 2026 APAS International Conference. Our appreciation goes especially to Veritas University, Abuja, for hosting the conference and providing a conducive environment for intellectual engagement and scholarly exchange. The 10th International Conference was an important milestone in the history of APAS. The publication of these three volumes provides a lasting scholarly record of the intellectual conversations generated by the conference and demonstrates the capacity of African scholars to engage critically with questions of profound local and global significance.

As the third volume of the proceedings, this book completes an important intellectual movement across the conference publications. The three volumes may be read as complementary dimensions of a single question: How can Africa build a future in which human development, environmental integrity, cultural identity and public well-being mutually reinforce one another? The first volume addresses the philosophical, religious and worldview foundations of that question; the second examines the ecological challenges and consequences; while this third volume considers the policies, institutions, educational systems and developmental strategies through which meaningful responses may be constructed. The task ahead is considerable. Africa requires institutions that can translate knowledge into action, educational systems that cultivate ecological consciousness, policies that are responsive to local realities, businesses that recognise their social and environmental responsibilities, and leaders capable of thinking beyond immediate

political and economic interests. It also requires citizens who understand that sustainable development is a shared responsibility. The contributions in this volume do not pretend to provide exhaustive solutions to these complex problems. Rather, they provide intellectual resources for continued reflection, debate and action. They challenge scholars and practitioners to move beyond diagnosis towards implementation, and beyond policy formulation towards institutional transformation.

The future of biodiversity conservation and public health in Africa will ultimately depend on the quality of the choices made today. Those choices must be informed by knowledge, guided by ethical responsibility, supported by effective institutions and sustained by an educated and environmentally conscious citizenry. It is my hope that this volume will contribute to that process. May it stimulate further scholarship, encourage policy innovation, strengthen institutional responsibility and inspire educational transformation across Africa. May it also contribute to the emergence of a developmental vision in which economic advancement does not undermine ecological integrity, and in which the protection of biodiversity is recognised as fundamental to the health, dignity and prosperity of present and future generations.

I commend *this book* to the scholarly community, policy-makers, educators, institutional leaders, development practitioners, business leaders, students and all who are committed to building a sustainable and flourishing Africa. May the scholarship contained in this volume move us from knowledge to consciousness, from consciousness to responsibility, and from responsibility to transformative action.

Prof. Ejikemeuwa J. O. NDUBISI, PhD

President, Association for the Promotion of African Studies
15 September, 2026

PAPER 1

AKARA AND PAP DEMOCRACY: SOCIO-RELIGIOUS IMPLICATIONS FOR SUSTAINABLE DEVELOPMENT PRACTICE IN NIGERIA

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Abstract

Democracy in Nigeria and its religious landscape are growing fast, with so many challenges of social divisions, doubt, and political breaks. This study examines the socio-religious implications of political disunity in Nigeria using "akara and pap democracy" as a homegrown food metaphor to examine the effective realities of democratic practice. From history, akara (fried bean cake) and pap (corn cereal) are consumed together as a matching pair, one is structurally and textually incomplete without the other. This study argued that sustainable development remains unachievable so long as sectional identities displayed in ethnic, religious, and political spheres continue to displace unified national identity, thereby weakening collective resistance against poor governance and permitting extractive leadership patterns to persist. Although many citizens desire political change and social transformation, the absence of national unity weakens collective resistance against poor governance and allows ineffective leadership patterns to persist. Adopting a qualitative, descriptive research design, the study examines peer-reviewed literature, policy reports, media documentation, and contemporary socio-political developments in Nigeria. The study is grounded in Social Cohesion Theory,

emphasizing shared identity, social trust, mutual obligation, and civic solidarity as vital basics for institutional stability. Findings show that while the general public greatly desires economic transformation and accountability, religion which ought to serve as a driver for peacebuilding, social justice, and national integration is usually misused as a tool for democratic positioning and sectional division. The study concludes that sustainable democratic practice and development, requires a change from transactional individuality politics to a cooperative governance model which is determined by intentional interreligious dialogue, ethical leadership, and well-organized civic orientation. The study recommends a conscious unity, cooperation, ethical leadership, religious tolerance, and value orientation, interreligious dialogue as required pathways to achieve sustainable democratic practice in Nigeria. The study concludes that sustainable development in Nigeria can only be achieved only through unity, collective social responsibility, and national interest not fronted in the practice of true democracy.

Keywords: democracy, socio-religious relations, political unity, sustainable development,
Nigeria.

Introduction

Nigeria is blessed richly with human and natural resources, yet the nation continues to struggle with underdevelopment, poverty, insecurity, and political instability. One major factor responsible for this situation is the absence of national unity among citizens. Democracy is expected to promote equality, participation, justice, accountability, and development. However, in Nigeria, democracy has often produced division rather than unity. Democracy and development are global phenomenon. Since gaining independence in 1960, Nigeria's political trajectory has been defined by leadership deficits, institutionalized corruption, ethno-religious rivalry, and violent instability (Achebe, 1983; Ake, 1996). Despite successive transitions between military rule and civilian governance, the promised dividends of democracy remain elusive for the majority of

the population. The Nigeria's democratic experience has remained one of the most discussed issues in contemporary African political and religious discourse. Since independence in 1960, the nation has struggled with challenges of leadership, corruption, ethnic rivalry, religious intolerance, political instability, insecurity, and economic hardship. Despite numerous democratic transitions and political reforms, the expected dividends of democracy have remained largely inaccessible to many citizens. Poverty, unemployment, social unrest, and infrastructural decay continue to characterize the socio-political landscape of the country. The problem this paper addresses is the division among citizens, which is a major barrier to development. The metaphor of *"akara and pap democracy"* offers an original, investigative lens to examine this structural disconnect. In Nigerian cooking backgrounds or traditions, *akara* (fried bean cake) and *pap*(fermented corn cereal), form a complementary meal. To say that one relies on the other to achieve balance, sustenance, and completeness. Reordered into political concept, this metaphor reveals the structural interdependence required between political leadership (*akara*) and the population (*pap*), as well as the necessity of social cohesion across various ethno-religious groups. Governance, like *akara* and *pap*, fails to nourish the body politic when its primary components are artificially severed or placed in opposition to one another. According to the United Nations (2015) Sustainable Development Framework, sustainable development cannot happen in an atmosphere characterized by social division, institutional distrust, and religious hostility.

Religion occupies a significant position in Nigerian society. It shapes moral values, social interactions, political behavior, and communal identity. Nigeria is largely divided among Christianity, Islam, and African Traditional Religion. While religion has the potential to promote peace, social justice, and national development, it has also been manipulated by political actors for selfish interests. Religious sentiments have influenced elections, governance, policy decisions, and even violent conflicts. Similarly,

ethnicity continues to define political loyalty in Nigeria. Citizens often prioritize ethnic and religious identities above national identity. Political appointments, voting patterns, and access to public resources are frequently influenced by tribal and religious considerations rather than competence and merit. The problem this paper addresses is not simply just religious sentiments and ethnic differences, the problem is that unity and cooperation is yet to be achieved. This state of affairs has weakened national unity and hindered sustainable development. Sustainable development involves meeting the needs of the present generation without compromising the ability of future generations to meet their own needs. It encompasses economic growth, social inclusion, political stability, environmental protection, and human development. According to the United Nations, sustainable development cannot thrive in an atmosphere of social division, political instability, and religious intolerance. A lot of persons are yearning for change in terms of unity but, the Nigeria experience presents a contradiction. A situation where the populace mostly complains about wellbeing. The socio-religious implications of political disunity in Nigeria through the lens of "*akara and pap democracy,* evaluates the story of eighty people, who disliked eating akara and pap every morning, while only twenty of them enjoyed it. Consequently, the eighty in their food preferences were always divided, whereas, the united twenty won the votes. This suggests how ethnic and religious divisions weaken democratic governance and frustrate sustainable development practices in Nigeria. Nigeria is richly blessed with human and natural resources, yet the nation continues to struggle with underdevelopment, poverty, insecurity, and political instability Democracy should promote equality, participation, justice, accountability, and development. Howbeit, the analogy displays Nigerian democracy which has often produced division rather than unity. Religious institutions that should promote peace and moral discipline are sometimes drawn into partisan politics. Some religious leaders openly endorse political candidates and

encourage followers to vote based on religious identity instead of competence and integrity. As a result, political decisions are increasingly influenced by emotional and sectional interests rather than national development goals.

The inability of citizens to unite against corruption, poor governance, injustice, and economic hardship has further weakened democratic accountability. Many Nigerians complain about bad leadership, yet ethnic and religious loyalties often prevent objective political judgment. This situation has contributed to the persistence of poor leadership and underdevelopment. The problem therefore lies in the disconnect between democracy, religion, and national development in Nigeria. Without social cohesion, religious tolerance, and collective responsibility, sustainable development may remain difficult to achieve. The major objective of this study is to examine the socio-religious implications of political disunity on sustainable development practice in Nigeria.

Conceptual Clarification

The Concept of "Democracy"

Democracy is conceptually defined as a system of governance wherein sovereign power is vested in the people, exercised either through direct participation or elected representatives. Diamond (2008) emphasizes that true democracy requires meaningful competition for office, inclusive civic participation, and robust protection of civil liberties. In Nigeria, while democratic structures were formally restored in 1999, democratic practice remains compromised by electoral malpractice, political godfatherism, weak judicial independence, and systemic voter suppression (Ojo, 2007). Democracy simply put, is a system of government in which

power belongs to the people either directly or through elected representatives. Abraham Lincoln famously defined democracy as "government of the people, by the people and for the people." Democracy encourages citizen participation, freedom of expression, accountability, equality, justice, and rule of law. According to Larry Diamond, democracy involves meaningful competition for political office, broad political participation, and protection of civil liberties (Diamond, 2008). In Nigeria, democracy officially returned in 1999 after several years of military rule. However, democratic practice in the country continues to face challenges such as corruption, electoral violence, political godfatherism, insecurity, and weak institutions.

The Concept of "Socio-Religious Relations"

Socio-religious relations describe the multi-dimensional interactions between religious systems and societal institutions. In the Nigerian context, religion functions as a dual-edged force: it offers moral frameworks, extensive social welfare networks, and community safety nets, while simultaneously serving as a primary fault line for elite manipulation (Nwachukwu, 2015). When socio-religious relations are governed by tolerance, they foster civic integration; when exploited for partisan gain, they generate polarization (Huntington, 1991; Weber, 1905/2002).

The Concept of "Sustainable Development"

Sustainable development refers to development that meets present socio-economic requirements without compromising the capacity of future generations to satisfy their own needs (Brundtland Commission, 1987). As outlined in the United Nations (2015) Sustainable Development Goals (SDGs)—particularly Goal 16—sustainable development requires peace, institutional justice, reduced inequality, and transparent governance. Political instability and ethno-religious conflict directly impede the realization of these objectives (Okoye, 2018). Moreover,

Sustainable development simply put, is the development that meets present needs without destroying the opportunities of future generations. The concept gained global recognition through the Brundtland Report of 1987. Sustainable development involves economic growth, environmental protection, social inclusion, good governance, education, peace, and human wellbeing. The United Nations Sustainable Development Goals (SDGs) emphasize peace, justice, strong institutions, quality education, poverty reduction, and partnerships as necessary conditions for sustainable development. Political instability, corruption, and social conflict therefore constitute major obstacles to sustainable national growth.

The Concept of "Political Unity"

Political Unity: Political unity refers to collective agreement and cooperation among citizens toward national goals despite differences in ethnicity, religion, language, or political affiliation. Political unity strengthens democracy because it encourages cooperation, accountability, social trust, and national integration. In the Nigerian context, political unity remains weak due to ethnic rivalry, religious intolerance, regionalism, and competition for political power. This has contributed to instability and weakened national development.

Theoretical Framework

Social Cohesion Theory

This study adopts Social Cohesion Theory as its foundational framework. Originating in the sociological scholarship of Durkheim (1893/1933), social cohesion denotes the degree of trust, solidarity, and mutual connectedness within a social system. Durkheim posited that societal stability relies on collective consciousness and social solidarity. When social bonds weaken, societies enter a state of isolation characterized by institutional breakdown, moral division, and rampant conflict. Social cohesion states that there should be level of trust, cooperation, solidarity, and unity existing among members of a society. emphasizing shared identity, social inclusion, collective responsibility, and mutual respect as important conditions

for peaceful coexistence and national development. Social Cohesion Theory directly illuminates the challenges facing Nigerian democracy. Nigeria's structural fragility is not an inevitable consequence of its multi-ethnic and multi-religious composition, but rather a reflection of decayed social cohesion. When citizens prioritize primordial attachments over national citizenship, political institutions lose public legitimacy. Corrupt leadership persists because elite actors intentionally fracture social trust, preventing the emergence of unified civic coalitions capable of demanding accountability. The theory is relevant to this study because Nigeria's democratic challenges are closely connected to weak social cohesion. Ethnic distrust, religious intolerance, political opposition, and corruption. This has resulted to a weakened sense of collective national identity among citizens. Social cohesion theory therefore, explains why sustainable development becomes difficult in a divided society. Development thrives where there is trust, cooperation, inclusion, and shared responsibility. Where division, hatred, and suspicion dominate, democratic governance and national growth suffer. The "*akara and pap democracy*" metaphor aligns with the expectations of social cohesion theory. Just as akara and pap complement each other to create satisfaction, democracy requires unity and cooperation among citizens for national progress.

The "*akara* and *pap*" Metaphor

The native combination of *akara(*fried bean cake) and *pap(*fermented corn cereal*)* provides a rich conceptual framework for evaluating state-citizen relations in Nigeria. In local cooking practice, *akara* provides basic firmness and protein, while *pap* offers fluid, nourishing temperature control. The failure of Nigerian democracy is fundamentally a failure of governance support. Democratic governance requires an active, harmonizing placement between the state or leadership (*akara*) and the populace (*pap*). To capture this dysfunction, the study employs "akara and pap democracy" as an indigenous culinary metaphor. Culturally, *akara* (fried bean cake) and *pap* (fermented corn cereal) are consumed as an organic,

complementary pair where each balances the texturally incomplete nature of the other. In Nigerian political practice, however, this complementary pairing is artificially severed as Political actors manipulate religious and ethnic fault lines during electoral cycles, forcing citizens to defend elite interests under the guise of protecting their faith or tribe (Ibrahim, 2007; Obasanjo, 1999). Consequently, the electorate becomes structurally divided, demanding democratic dividends in principle, yet validating corrupt leadership in practice based on primordial loyalties.

Socio-Religious Implications of Political Disunity

Ethnic and Religious Division in Contemporary Elections

Political disunity worsens ethno-religious division. Electoral campaigns in Nigeria frequently decentralize into identity mobilization, where political actors utilize hate speech and sectarian propaganda to consolidate voter bases (Kukah, 2011; Richardson, 2004). Religion becomes a mechanism for political exclusion rather than a bridge for moral reconciliation. Recent empirical work on the 2023 presidential election cycles shows how identity opposition continues to shape democratic behavior. Evaluating post-independence voting patterns, Odogwu (2023) reveals that candidate selection and voter turnout remain heavily constrained by regional and religious identity politics. Extending this analysis, Bako and Goma (2026) reveal that ethno-religious division during elections creates a two-fold "we versus them" civic mindset. This psychological division fractures social trust and creates a political development. Nigeria's democracy looks like a table where all groups must contribute for national stability.

The "*akara and pap* Democracy" metaphor further illustrates the irony of Nigerian politics. Many Nigerians desire change and complain about poor leadership, corruption, and economic hardship. Yet during elections, citizens are often divided by ethnic

and religious sentiments. One major implication of political disunity in Nigeria is ethnic and religious division. Political competition often increases tension among ethnic and religious groups. Politicians frequently manipulate identity differences to secure support. For example, election campaigns sometimes involve hate speech and propaganda targeting specific ethnic or religious communities. This creates suspicion, hostility, and division among citizens. According to Kukah (2011), religion in Nigeria has become heavily politicized, thereby contributing to social instability. Instead of voting based on competence, integrity, and national interest, political loyalty is frequently shaped by tribe, religion, and personal gain. This situation weakens collective political resistance against bad governance. The same political actors continue to recycle themselves in power because citizens lack unity. The metaphor therefore, exposes the contradiction between public dissatisfaction and political behavior. Socio-Religious Implications of Political Disunity in Nigeria Ethnic and Religious Polarization: One major implication of political disunity in Nigeria is ethnic and religious polarization. Political competition often increases tension among ethnic and religious groups. Politicians frequently manipulate identity differences to secure support. For example, election campaigns sometimes involve hate speech and propaganda targeting specific ethnic or religious communities. This creates suspicion, hostility, and division among citizens. According to Kukah (2011), religion in Nigeria has become heavily politicized, thereby contributing to social instability.

The consequence is reduced national trust and weakened social cohesion. Citizens become more
loyal to ethnic or religious identities than national identity, or get confused what they actually desire. Weak Democratic Institutions: Political disunity also weakens democratic institutions in Nigeria. When citizens are divided, accountability becomes difficult.

Corrupt political leaders exploit social divisions to avoid criticism and maintain political control. Electoral malpractice, vote buying, political violence, and judicial manipulation continue partly because citizens lack collective resistance. Ethnic and religious sentiments often prevent objective political judgment. Weak democratic institutions negatively affect governance, economic growth, and social development. Insecurity and Violence: Religious and ethnic conflicts have contributed significantly to insecurity in Nigeria. Violent clashes between communities, insurgency, banditry, kidnapping, and terrorism have threatened national stability. Religion and ethnicity occupy central positions in Nigerian public life, exerting a profound influence on moral values, social interactions, political behavior, and communal identity (Falola, 1998; Nnoli, 1980).

Groups such as Boko Haram have used religious extremism to justify violence. Farmer-herder conflicts, communal clashes, and separatist agitations further establish the dangers of political disunity. Insecurity discourages investment, destroys infrastructure, increases poverty, and disrupts education and healthcare systems. Poverty and Underdevelopment: Political instability and social division have serious economic implications. Resources that should be used for development are often diverted toward security management and conflict resolution. Corruption and bad governance also contribute to poverty and unemployment. Many Nigerians lack access to quality healthcare, education, electricity, clean water, and infrastructure despite the nation's enormous resources.

The Role of Religion in Promoting Sustainable Development

While religious organizations in Nigeria maintain huge social reach, their moral authority is often compromised by political co-option. In terms of grassroots socio-economic development, faith-based institutions frequently step in to address institutional deficits

in public service delivery. As stressed by Iyayi and Obani (2021), local church structures significantly drive community awareness and capacity building around the SDGs. This critical contribution is further highlighted by Emeaku (2023), who evaluates the general role of religious leadership in promoting or, on the other hand hindering the successful realization of developmental targets in Nigeria. Nevertheless, Religion remains one of the most influential institutions in Nigeria. Churches, mosques, and traditional religious institutions reach millions of people daily. Therefore, religion possesses enormous potential for promoting sustainable development viz:

Religion as a Tool for Peacebuilding: Religious teachings generally promote peace, love, justice, forgiveness, and human dignity. Religious institutions can therefore serve as platforms for conflict resolution and national reconciliation. Interfaith dialogue between Christians, Muslims, and traditional worshippers can strengthen social trust and reduce religious hostility. Religion and Moral Development: Religion contributes to moral discipline by encouraging honesty, accountability, compassion, and social responsibility. Ethical leadership can emerge when religious values are properly applied. A morally conscious society is more likely to resist corruption, injustice, and exploitation. Religion and Social Welfare: Many religious organizations in Nigeria contribute to healthcare, education, poverty alleviation, and humanitarian services. Churches and Islamic organizations operate schools, hospitals, orphanages, and charity programs. These contributions support national development and improve social wellbeing.

Religion and Civic Responsibility: Religious leaders can educate citizens about responsible voting, peaceful coexistence, and democratic participation. Instead of encouraging blind loyalty to political actors, religious institutions should promote justice,

integrity, and accountability.

Democracy and Sustainable Development in Nigeria

Democracy and sustainable development are closely associated. Good governance creates opportunities for economic growth, social inclusion, and political stability. Nevertheless, sustainable development requires more than elections. It depends on transparent leadership, functional institutions, accountability, social justice, and citizen participation In Nigeria, sustainable development remains unattainable by corruption, insecurity, poor leadership, unemployment, and political instability. The Sustainable Development Goals (SDGs) emphasizes peace, justice, strong institutions, and partnerships as important foundations for development. Without social cohesion and national unity, achieving these goals becomes difficult. The Nigerian government, religious institutions, civil society organizations, and citizens consequently, share a collective responsibility for national development. Challenges to Social Cohesion in Nigeria can be summarized as follows: Corruption, Unemployment: Youth empowerment through education, entrepreneurship, and job creation, Religious extremism, Lack of Civic Consciousness etc.

Recommendations

Institutionalizing Non-Partisan Civic Education: The Federal Ministry of Education, in coordination with civil society organizations, should revise national civic curricula. Civic education must focus on democratic rights, institutional oversight, cross-cultural literacy, and the dangers of electoral identity manipulation.

Targeted Socio-Economic Empowerment for Youth: To reduce the pool of vulnerable youth recruited for political violence, the state must prioritize vocational technology hubs, agricultural enterprise grants, and accessible credit schemes across all

geopolitical zones.

Promotion of National Unity:
Government, religious institutions, schools, and civil society organizations should promote national unity above ethnic and religious divisions. Citizens should be encouraged to see themselves first as Nigerians.

Institutionalizing Non-Partisan Civic Education: The Federal Ministry of Education, in coordination with civil society organizations, should revise national civic curricula. Civic education must focus on democratic rights, institutional oversight, cross-cultural literacy, and the dangers of electoral identity manipulation.

Civic Education and Political Awareness: Citizens should be educated on democratic values, responsible voting, and accountability. Political decisions should be based on competence, integrity, and national interest rather than ethnic or religious sentiments.

Ethical Leadership: Nigeria needs leaders with integrity, accountability, and commitment to public service. Religious institutions should emphasize moral leadership and social justice.

Citizens Empowerment: Government should invest in education, vocational training, entrepreneurship, and employment opportunities for citizens. Empowered youths are less vulnerable to political manipulation and violence.

Strengthening Democratic Institutions: Independent electoral bodies, judiciary, anti-corruption agencies, and security institutions should be strengthened to ensure justice,

accountability, and transparency.

Religious Responsibility: Religious leaders should avoid partisan politics capable of dividing citizens. Religion should promote peace, tolerance, and social responsibility**:** Key socio-religious organizations—including the Christian Association of Nigeria (CAN) and the Nigerian Supreme Council for Islamic Affairs (NSCIA)—should establish joint civil oversight committees. Rather than endorsing political candidates, these bodies should monitor budget performance, public service delivery, and human rights compliance.

Conclusion

The metaphor of "akara and pap democracy" demonstrates that democratic stability in Nigeria cannot be sustained on a foundation of socio-religious division. Just as *akara* and *pap* require complementary union to provide sustenance, effective democratic governance requires structural integration between political leadership and a unified populace.

Overcoming Nigeria's socio-political crisis requires deliberate action: transitioning from identity-driven politics toward shared civic responsibility, institutional integrity, and national solidarity. Sustainable development will remain unattainable so long as sectional loyalties eclipse the public good. Nigeria can only achieve enduring democratic consolidation when justice, mutual trust, and a unified national vision define its political practice.

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CORPORATE SOCIAL RESPONSIBILITY AND NATIONAL DEVELOPMENT IN NIGERIA: THE ROLE OF THE PRIVATE SECTOR

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Abstract

Corporate Social Responsibility (CSR) has become an important instrument through which the private sector contributes to national development, particularly in developing countries such as Nigeria. This study examines the role of CSR initiatives in promoting sustainable economic growth, social welfare, and environmental sustainability. In a context where government resources are often limited, private sector involvement in development efforts plays a complementary and increasingly significant role. The paper explores the concept and evolution of CSR within Nigeria, focusing on how organizations integrate social and environmental considerations into their business operations. The study adopts a descriptive research approach based on a review of relevant literature, government publications, and empirical studies on CSR in Nigeria. It highlights key sectors including oil and gas, telecommunications, banking, and manufacturing where CSR activities have contributed to infrastructure development, education, healthcare services, and poverty alleviation. The study also evaluates the motivations behind CSR practices, such as corporate image building, regulatory compliance, ethical responsibility, and the need to maintain community support. In addition, the research identifies challenges that hinder the effectiveness of CSR in Nigeria, including weak regulatory enforcement, lack of transparency, insufficient stakeholder engagement, and the tendency for CSR initiatives to serve as public relations tools rather than genuine development strategies. Despite these challenges, CSR remains a viable means of supporting national development. The study concludes that stronger

collaboration among government, private sector actors, and host communities is essential for maximizing CSR impact. It recommends improved policy frameworks, accountability mechanisms, and alignment of CSR initiatives with national development priorities to ensure sustainable and inclusive growth.

Keywords*:* Corporate Social Responsibility, national development, private sector, Nigeria, sustainability

Introduction

Human development has increasingly been shaped by the recognition that economic growth must be accompanied by social responsibility. Corporate Social Responsibility (CSR), private sector participation, and national development are therefore interconnected, as businesses generate wealth, CSR converts part of that wealth into social value, and national development reflects the broader outcome. Responsible corporations can thus become partners in development rather than merely economic actors (Porter & Kramer, 2006). Corporate Social Responsibility refers to businesses' commitment to integrating social, environmental, and ethical considerations into their operations and stakeholder relationships. Beyond legal compliance and profit-making, CSR includes community development, environmental sustainability, and human welfare. It can support national development by complementing government efforts in areas such as education, healthcare, infrastructure, and poverty reduction (Carroll, 1991; World Bank, 2004).

National development involves sustained improvements in a country's economic, social, political, and environmental conditions, including employment, poverty reduction, infrastructure, and human capital development. CSR contributes by mobilizing private resources to complement public investment and promote inclusive and sustainable growth (United Nations Development Programme [UNDP], 2022). Globally, CSR has become an important component of corporate strategy, with many companies aligning their programmes with the Sustainable Development Goals (SDGs). Firms

such as Microsoft and Unilever have incorporated sustainability, education, renewable energy, and community development into their operations (UN Global Compact, 2022). In Europe, CSR is supported by regulatory and voluntary frameworks, while companies such as Siemens, BP, and Vodafone have invested in sustainability, vocational training, renewable energy, and digital inclusion (European Commission, 2022).

In Africa, South Africa has made notable progress in CSR. Companies such as Sasol and Anglo American have implemented programmes in education, healthcare, infrastructure, and local enterprise development. These initiatives have improved access to basic services and supported economic participation in underserved communities (Global Reporting Initiative [GRI], 2021).

In Nigeria, CSR has developed particularly in the oil and gas, telecommunications, banking, and manufacturing sectors. Companies such as MTN Nigeria and Dangote Group support scholarships, healthcare, infrastructure, and youth empowerment programmes, helping to address gaps in education, health, and employment (Amaeshi et al., 2006). However, CSR remains uneven and is often insufficiently integrated into national development planning.

Major challenges include weak regulatory enforcement, limited transparency and stakeholder participation, and the perception that CSR is primarily a tool for corporate image management. Some projects are also poorly aligned with community needs and national priorities, limiting their long-term impact (Frynas, 2005). Against this background, this paper examines the role of CSR in Nigeria's national development, assesses private sector contributions, and identifies the structural and policy constraints affecting its effectiveness.

Conceptual and Theoretical Framework

Corporate Social Responsibility

CSR refers to the voluntary commitment by businesses to contribute to sustainable development by working with employees, communities, and society to improve quality of life (World Bank, 2004). It goes beyond profit maximization to include ethical responsibilities toward stakeholders. In Nigeria, CSR often includes community development projects such as road construction, school building, scholarships, healthcare provision, and environmental remediation (Amaeshi, Adi, Ogbechie, & Amao, 2006).

National Development

National development refers to the process of improving the economic, social, and political well-being of a country. It includes poverty reduction, job creation, infrastructure development, and improved living standards. In Nigeria, national development remains uneven due to corruption, weak governance, and economic dependence on oil revenue (Nwankwo, 2019).

Relationship between Corporate Social Responsibility and National Development

Corporate Social Responsibility (CSR) and national development are closely linked through the private sector's contribution to societal progress beyond profit-making. CSR involves integrating social, environmental, and ethical considerations into business operations, while national development focuses on economic growth, human welfare, institutional capacity, and environmental sustainability. As a micro-level mechanism, CSR supports broader development by directing corporate resources toward education, healthcare, infrastructure, and environmental protection, consistent with stakeholder theory (Freeman, 1984; Porter &

Kramer, 2006). This relationship also reflects sustainable development principles, as CSR promotes balanced economic, social, and environmental progress. In countries with limited government capacity, CSR can help address development gaps by supporting service delivery and human capital development. Investments in education, healthcare, and infrastructure can contribute to poverty reduction, employment, and improved living standards (World Bank, 2004; UNDP, 2022). However, its effectiveness depends on alignment with national priorities and meaningful stakeholder collaboration.

Theoretical Framework

Stakeholder Theory

Stakeholder Theory, developed by Freeman (1984), explains corporate responsibility by extending firms' obligations beyond shareholders to include employees, customers, suppliers, communities, and government institutions. It argues that long-term business success depends on balancing stakeholder interests, making Corporate Social Responsibility (CSR) a means of creating value for both businesses and society. Since corporations depend on communities for labour and legitimacy and governments for regulation, addressing stakeholder interests is essential to reducing conflict, reputational damage, and operational risks (Freeman, 1984; Porter & Kramer, 2006).

In developing economies such as Nigeria, where socio-economic inequalities and institutional gaps are significant, Stakeholder Theory is particularly relevant. Firms, especially in the oil and gas sector, may face community resistance when expectations are unmet. CSR activities such as infrastructure development, employment creation, and community engagement therefore help maintain a social license to operate (Amaeshi et al., 2006). The

theory ultimately presents CSR as a responsibility that aligns corporate objectives with societal welfare, strengthening its contribution to national development and sustainability (Freeman, 1984; Carroll, 1991).

Social Contract Theory

Social Contract Theory explains the relationship between businesses and society as an implicit agreement in which corporations are permitted to operate in return for contributing to societal welfare. Donaldson and Dunfee (1999) argue that this contract is based on social norms, expectations, and ethical obligations. Thus, CSR is not simply voluntary philanthropy but a moral responsibility linked to corporate legitimacy. Firms benefit from public infrastructure, legal systems, and markets and must therefore act responsibly to avoid public distrust, regulatory pressure, and operational instability.

The theory is particularly relevant where corporate activities have significant social and environmental impacts, such as Nigeria's extractive industries. Host communities may bear environmental costs, making CSR initiatives such as environmental remediation, healthcare, and community development important mechanisms for fulfilling corporate responsibilities (Frynas, 2005). Social Contract Theory therefore presents CSR as a means of maintaining corporate legitimacy and stability while contributing to societal welfare and national development (Donaldson & Dunfee, 1999; World Bank, 2004).

Sustainable Development Theory

Sustainable Development Theory links economic growth, environmental protection, and social equity as interconnected elements of long-term development. The World Commission on Environment and Development (1987) defines sustainable

development as meeting present needs without compromising future generations. In this context, CSR supports balanced development by encouraging firms to adopt environmentally responsible practices, invest in social programmes, and promote inclusive economic growth rather than focusing solely on profit. This approach aligns corporate strategies with the United Nations Sustainable Development Goals (UNDP, 2022).

The theory is particularly relevant in developing countries, where industrial growth can conflict with environmental sustainability and social equity. CSR initiatives such as renewable energy, waste management, and community education can help address these challenges while promoting inclusive development (Porter & Kramer, 2006). Sustainable Development Theory therefore positions CSR as a long-term strategy that connects business activities with national and global development priorities and highlights the private sector's role in achieving sustainable growth (WCED, 1987; UNDP, 2022).

Evolution of CSR in Nigeria

Philanthropic Phase of CSR in Nigeria in the 1990s

The philanthropic phase represents the earliest stage of Corporate Social Responsibility (CSR) development in Nigeria, when corporate social engagement was largely informal, reactive, and charity-based. CSR was not integrated into corporate strategy but expressed through donations, community assistance, and goodwill gestures. Multinational oil companies, particularly in the Niger Delta, often responded to community pressure and development gaps rather than pursuing structured sustainability programmes (Frynas, 2005).

CSR activities focused mainly on basic amenities such as water, schools, health centres, and financial donations. These interventions were often uncoordinated and lacked long-term planning, with companies seeking to reduce tensions with host

communities, especially in resource-rich areas affected by environmental degradation (Idemudia, 2014). The approach reflected Nigeria's weak government capacity and infrastructural deficits, which created expectations for corporations to fill development gaps. However, because interventions were rarely linked to broader development frameworks, their impact was often limited and unsustainable.

Overall, the philanthropic phase established CSR as corporate goodwill but lacked the strategic structure needed to achieve long-term national development. Nevertheless, it provided a foundation for more strategic CSR approaches in Nigeria.

Strategic CSR Phase in Nigeria in the 2000s

The strategic CSR phase emerged as corporations recognized that social responsibility should move beyond philanthropy and become part of business strategy. CSR became more structured and aligned with corporate objectives such as reputation, risk management, and stakeholder engagement. Firms increasingly understood that sustainable profitability depended on positive relationships with communities and regulators (Porter & Kramer, 2006). During this phase, Nigerian companies, particularly in banking, telecommunications, and oil sectors, shifted toward long-term community development programmes. Instead of one-off donations, firms invested in scholarships, vocational training, healthcare, and youth empowerment. These initiatives supported communities while strengthening corporate legitimacy and reducing operational risks.

Globalization and international reporting standards also encouraged firms to formalize CSR through sustainability reports and measurable performance indicators. However, challenges remained, including uneven implementation and weak integration with national development planning. CSR became more structured but remained largely corporate-driven rather than fully aligned with broader societal priorities.

Sustainability Phase of CSR in Nigeria from 2010 and Beyond

The sustainability phase represents the latest evolution of CSR in Nigeria, emphasizing environmental protection, long-term social impact, and alignment with global frameworks such as the Sustainable Development Goals (SDGs). CSR is increasingly integrated into broader corporate sustainability strategies rather than treated as a separate philanthropic activity (UNDP, 2022).

Corporations now incorporate environmental, social, and governance (ESG) principles into their operations, including renewable energy, climate action, waste management, and sustainable resource use. Oil and gas companies are adopting environmental remediation measures, while telecommunications and banking firms increasingly support digital inclusion and financial sustainability. A key feature of this phase is the focus on measurable, long-term outcomes. Companies increasingly assess impacts such as carbon reduction, educational achievement, and employment creation, reflecting a shift from short-term community relations to sustainable development (Porter & Kramer, 2006). However, implementation remains constrained by weak regulatory enforcement and inconsistent corporate commitment. Despite these challenges, the sustainability phase reflects a more mature understanding of CSR as a contributor to inclusive national development and environmental sustainability.

CSR and National Development Outcomes

CSR and Infrastructure Development

Corporate Social Responsibility (CSR) contributes to infrastructure development in Nigeria by complementing government efforts to provide roads, electricity, water, and healthcare facilities. In underserved communities, CSR projects often provide essential infrastructure, particularly given Nigeria's

significant infrastructure deficit (World Bank, 2023). Oil and gas companies such as Shell, Chevron, and TotalEnergies have supported road construction, rural electrification, and water supply in host communities (Shell Sustainability Report, 2023).

Other sectors also contribute. MTN Nigeria has expanded digital infrastructure through communication towers and ICT centres, while Dangote Group and Lafarge Africa have supported roads, water projects, and community power systems. These interventions help reduce infrastructure gaps, improve living standards, and enhance economic productivity, making CSR an important complement to government development efforts.

CSR and Education and Human Capital Development

Corporate Social Responsibility (CSR) contributes significantly to education and human capital development in Nigeria through scholarships, vocational training, and improved access to quality education. Education remains a major CSR priority because of its long-term impact on workforce productivity and national development, particularly given Nigeria's large out-of-school population (UNICEF, 2023). Oil companies such as Chevron and Shell have supported scholarship programmes that reduce financial barriers and expand access to higher education.

Telecommunications and banking companies also contribute through scholarships, ICT training, digital literacy, and school infrastructure. MTN Foundation and Airtel Africa have supported education and digital skills programmes, while banks such as GTBank, Access Bank, and Zenith Bank invest in school construction, ICT hubs, and scholarships. These initiatives strengthen human capital by improving educational access, literacy, and employability, thereby supporting economic participation and national development.

CSR and Healthcare Improvement

Corporate Social Responsibility (CSR) contributes to healthcare improvement in Nigeria through investments in hospitals, mobile clinics, disease prevention, and maternal health programmes. With the healthcare system facing significant capacity challenges, CSR initiatives help bridge service gaps, particularly in underserved and rural communities where public health infrastructure is limited (WHO, 2023).

Oil and gas companies such as Shell, Chevron, and TotalEnergies support healthcare through primary healthcare centres, immunization, and maternal health programmes, particularly in the Niger Delta. Banks such as Access Bank and Zenith Bank also fund maternal health, hospital upgrades, and disease awareness campaigns, while MTN Nigeria supports immunization and public health education. Collectively, these initiatives improve healthcare access, reduce disease burdens, and contribute to national development.

CSR and Economic Empowerment

Corporate Social Responsibility (CSR) contributes to economic empowerment in Nigeria through entrepreneurship development, SME support, vocational training, and youth employment initiatives. SMEs are major contributors to Nigeria's economy, accounting for about 48% of GDP and over 80% of employment (SMEDAN, 2023). CSR programmes therefore support inclusive development by providing grants, training, and business opportunities. Companies such as Chevron and Shell have implemented entrepreneurship and vocational programmes, including Shell's LiveWIRE initiative.

The telecommunications and banking sectors also support economic empowerment through funding, mentorship, incubation,

and digital skills training. MTN Nigeria and Airtel Africa assist SMEs, while banks such as Access Bank, First Bank, and GTBank provide loans, grants, and entrepreneurship programmes. These initiatives help reduce unemployment, promote entrepreneurship, strengthen SMEs, and contribute to inclusive economic growth and national development.

Challenges of CSR in Nigeria

Weak Regulatory Framework and Lack of Enforcement

CSR in Nigeria is constrained by the absence of a strong regulatory and institutional framework to guide, monitor, and enforce corporate social investments. Unlike systems where CSR is supported by mandatory reporting and compliance standards, Nigeria operates largely on a voluntary basis, giving companies wide discretion over the scope and direction of their CSR activities, often without alignment to national development priorities. This weak regulatory environment limits accountability for the quality and sustainability of interventions, while regulatory bodies often lack the capacity, resources, or independence to enforce compliance. As a result, CSR implementation is uneven across sectors, with some firms undertaking highly visible projects and others contributing minimally or inconsistently. According to Frynas (2005), this fragmentation undermines coordination and weakens the integration of CSR into long-term development planning, ultimately reducing its overall impact on national development.

Poor Transparency and Accountability

Another major challenge facing CSR in Nigeria is poor transparency and accountability in the reporting of CSR activities, as many corporations fail to publish detailed or standardized disclosures on their social investments, making it difficult for stakeholders to assess their scale, effectiveness, and impact. Even when sustainability reports are produced, they are often not independently verified, raising concerns about credibility and

accuracy. This lack of transparency creates a significant accountability gap between corporations, communities, and regulatory bodies, as beneficiary communities are frequently excluded from monitoring and evaluation processes. Consequently, CSR risks becoming more symbolic than substantive, weakening trust and limiting its overall developmental impact.

Misalignment between CSR Projects and Community Needs

CSR initiatives in Nigeria often suffer from a misalignment between corporate interventions and the actual needs of host communities, as many projects are designed and implemented without adequate consultation with local stakeholders. This results in situations where companies prioritize visible projects such as schools or community halls, while communities may have more urgent needs like clean water, healthcare services, or employment opportunities. Such mismatches reduce the effectiveness and sustainability of CSR efforts, as some projects become underutilized or even abandoned due to their limited relevance to immediate local challenges. The absence of strong participatory planning mechanisms further widens this gap, ultimately weakening the developmental impact of CSR investments.

Perception of CSR as Public Relations Rather Than Development Strategy

CSR in Nigeria is often perceived as a public relations (PR) tool rather than a genuine development strategy, as many corporations appear to use it mainly to enhance corporate image, manage reputational risks, or gain social legitimacy instead of driving meaningful socio-economic change. This perception is particularly strong in communities affected by environmental degradation and inequality, where skepticism about corporate intentions is high. As a result, trust between corporations and stakeholders is weakened, and CSR becomes more symbolic and transactional than

transformative. According to Frynas (2005), this perception limits the long-term developmental impact of CSR, especially when initiatives are not integrated into broader policy or sustainability frameworks.

Policy Implications and Recommendations

Government should establish stronger CSR regulatory frameworks to ensure corporate social investments are consistent, accountable, and aligned with national priorities. CSR activities should be aligned with national development plans and the Sustainable Development Goals (SDGs) to ensure coherence and maximize socio-economic impact. Community participation should be strengthened in CSR planning through stakeholder engagement and feedback mechanisms to ensure projects reflect real local needs and priorities. Companies should adopt transparent reporting mechanisms that disclose CSR spending and outcomes using standardized indicators to enhance accountability and trust. CSR should shift from philanthropy to a sustainable development strategy that integrates long-term economic, social, and environmental impact into core business operations.

Conclusion

Corporate Social Responsibility (CSR) has emerged as an important complementary mechanism for national development in Nigeria, especially in the context of persistent governance and infrastructure gaps. The private sector particularly in oil and gas, telecommunications, banking, and manufacturing has contributed to development through investments in infrastructure, education, healthcare, and economic empowerment, thereby improving living standards and strengthening human capital. These contributions demonstrate CSR's potential as a tool for inclusive growth and sustainable development when effectively implemented.

However, the impact of CSR in Nigeria is limited by several structural and institutional challenges, including weak regulatory frameworks, poor transparency and accountability, misalignment with community needs, and the perception of CSR as a public relations tool rather than a development strategy. Issues such as corruption, elite capture, and inadequate stakeholder coordination further weaken its effectiveness, while limited integration with national development plans reduces long-term sustainability. As a result, CSR often fails to deliver consistent and equitable developmental outcomes across communities and sectors.

To enhance its developmental impact, CSR in Nigeria requires a more strategic and coordinated approach that aligns corporate initiatives with national priorities. Strengthening regulatory oversight, improving transparency, and ensuring meaningful community participation are essential for effectiveness and accountability. In conclusion, while CSR holds significant promise as a driver of national development, its full potential can only be realized through stronger institutions, better governance, and deeper collaboration between government, businesses, and communities to achieve sustainable and inclusive development outcomes.

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CURRICULUM INNOVATION FOR SUSTAINABLE DEVELOPMENT IN AFRICA

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Abstract

Curriculum innovation has become a strategic necessity for achieving sustainable development in Africa. The increasing challenges of climate change, unemployment, poverty, technological transformation, insecurity, and environmental degradation demand educational systems that are responsive, practical, and transformative. This paper examines the role of curriculum innovation in promoting sustainable development across African nations. It discusses the concept of curriculum innovation, sustainable development, and the nexus between education and development. The paper further explores major areas of curriculum reforms in Africa, including digital literacy, environmental education, entrepreneurship education, skills acquisition, indigenous knowledge integration, and competency-based learning. Challenges confronting curriculum innovation such as inadequate funding, poor infrastructure, insufficient teacher preparation, policy inconsistency, and technological gaps are highlighted. The paper concludes that curriculum innovation remains a critical instrument for achieving the Sustainable Development Goals (SDGs) and Africa Agenda 2063. Recommendations including increased budgetary allocation to education and incorporation of innovative pedagogies and ICT competencies into teacher education programmes were made for governments, educational institutions, and stakeholders to

strengthen policy implementation, teacher development, and investment in innovative learning systems.

Keywords: Curriculum Innovation, Sustainable Development, Africa, Education Reform, SDGs, Competency-Based Education

Introduction

African countries are currently confronted with numerous developmental challenges, According to Akinsanya,. (2018) and Oloruntegbe & Agbayewa, (2014), these challenges include poverty, unemployment, climate change, food insecurity, political instability, and inadequate technological advancement. The realities of these challenges require educational curricula that significantly promote critical thinking, innovation, entrepreneurship, environmental consciousness, and practical skills for sustainable living. Education as posited by Idakwoji, (2016) remains one of the most powerful tools for national transformation, including sustainable development. Across Africa, educational systems are increasingly expected to address socio-economic challenges through relevant and innovative curricula. Sustainable development involves meeting present needs without compromising the ability of future generations to meet their own needs. It encompasses economic growth, environmental protection, and social inclusion (Oloruntegbe, & Agbayewa, 2014). The African Union's Continental Education Strategy for Africa (CESA) (2015) emphasizes the transformation of African education systems to promote innovation, creativity, and sustainable development. Likewise, UNESCO has continued to advocate curriculum reforms that integrate sustainability, climate education, digital learning, and lifelong learning approaches across Africa (UNESCO, 2023). All the foregoing is in a bid to bring about development sustainable development in Africa.

Curriculum innovation therefore becomes essential for preparing learners with the competencies, values, and attitudes necessary for sustainable development in the Twenty-First Century Africa.

Concept of Curriculum Innovation

Curriculum innovation refers to deliberate changes and improvements in educational content, teaching methods, learning experiences, assessment procedures, and instructional resources aimed at improving educational effectiveness and societal relevance. It involves introducing new ideas, technologies, pedagogies, and learning approaches into the educational system (Akinsanya, 2018; Fullan, 2016) . Curriculum innovation have been necessary from time to time across cultures and could vary from one culture to another. In Africa currently necessary curriculum innovation would include the following:

a) Integration of digital technologies into teaching and learning
b) Competency-based education
c) Entrepreneurship education
d) Environmental and climate education
e) Science, Technology, Engineering and Mathematics as well as Technical education
f) Inclusive and learner-centered approaches
g) Integration of indigenous knowledge systems

(Akinsanya, 2018: African Union, 2015)

Innovative curricula are designed to equip learners with practical skills, creativity, collaboration, communication abilities, and problem-solving competencies necessary for national development. Hence the necessity for the introduction of the seven innovative subjects in the curriculum (Akinsanya, 2018).

Sustainable Development in the African Context

Sustainable development according to the World Commission on Energy (1987) "Brundtland Report" is that development that "meets the needs of the present without compromising the ability of future generations to meet their own needs." It stands on three related pillars which are economic growth, social inclusion and environmental protection. Sustainable development in Africa refers to the development that meets the present needs of Africa without compromising the ability of the future generations of Africa to meet their own needs. It requires that education accomplishes three tasks, and these require curriculum innovation. The three tasks are:

a) *Meets the present needs of Africa*: Curriculum innovation is necessary here to craft learning that is relevant and problem- solving (relevance plus present problem-solving). African curriculum should no longer be abstract theories but should immediately start addressing the current needs of the continent. Such needs to be addressed include insecurity, unemployment, flooding, desertification, energy access, internet access, corruption and widespread poverty. Infusion and interdisciplinary approaches could be used to come up with a curriculum to accomplish this, for instance health issues, water and climate could be embedded into Mathematics.

   Place-based projects could also be used. For instance, students in Lagos and Accra could study waste management, while those in flood –prone areas and desert-prone places should have aspects of these embedded in Biology, Health Science and Literature

   In this way the curriculum would have shifted from "content coverage" to "competency for life"

b) *Without compromising the ability of the future generations*: Curriculum innovation is required here to building values, future –thinking and competent action. The curriculum has to provide for the teaching of service, stewardship and skills to ensure the safety of resources for the future. The following examples would suffice. Eco-pedagogy (where deforestation could be learnt and then followed up by tree-planting campaign), system –thinking (e.g. studying charcoal use, the tree loss and soil erosion which follow, and the consequent lower farm yield for future farmers) and indigenous knowledge integration (Adding African practices such as rotation farming and sacred groves which are result-yielding science and ethics for sustainability)

c) The three mainstays of curriculum shift in Africa which are: economic (adding skills for preservation and entrepreneurship such as solar installation, recycling and agribusiness instead of just the traditional white collar jobs), social (which involves citizenship and cultural relevance that is adding indigenous knowledge to teach community responsibility and environmental justice), and environmental (adding experiential learning and inquiry learning involving use of school garden, actual water testing and actual climate data, rather than only memorizing diagrams).

(UNESCO, 2017, World Commission on Energy and Development, 1987)

Sustainable development goals for Africa thus focuses on improving the quality of life while ensuring environmental sustainability and social equity. The concept aligns with the United Nations Sustainable Development Goals (SDGs) and the African Union Agenda 2063.

The African Union and UNESCO (2023) have noted the need for inclusive growth and development in Africa. They recognize education as the major driver for development, and they see sustainable development in Africa as involving poverty reduction, quality education, environmental sustainability, gender equality, economic empowerment, technological advancement, peace and social justice, food security and healthcare improvement. Educational institutions therefore have the responsibility of preparing learners to contribute meaningfully to these developmental goals (UNESCO, 2023; African Union, 2015).

Theoretical Framework

This study has been anchored on Jack Mezirow's Transformative Learning Theory propounded in early 1990s. The Theory's proposition is that learning becomes transformative when learners critically examine and revise their assumptions, beliefs and frames of reference to develop more inclusive and discriminating perspectives. The core points of the theory are the processes of critical reflection, rational discourse, and action including activities that enable learners to question customary or usual ways of thinking and then reconstruct meaning from experience (Mezirow, 1991 and Mezirow, 2000). The relevance of this theory to this study, Curriculum Innovation for Sustainable Development in Africa, is embedded in its emphasis on education as a tool for individual and societal transformation. Regarding Africa, sustainable development demands more than factual contents on Sustainable Development Goals (SDGs). Africa demands a curriculum that disrupts unsustainable mind-sets relating to poverty, environmental degradation, and over-dependence. It should then replace these with values such as stewardship, innovation, and social responsibility.

Transformative learning theory therefore provides a basis for designing a curriculum that is experimental, dialogic and problem-based. It positions teachers as facilitators of critical reflection and learners as active agents of change within their communities. A curriculum innovation that is anchored on this theory would produce graduates who not only understand sustainable development but are committed to advancing development in line with the African Union Agenda 2063 and Sustainable Development Goal 4.7 ()SDG 4.7 (African Union, 2015)

Curriculum Innovation and Sustainable Development

Curriculum innovation has been established as contributing significantly to sustainable development. According to Akinsanya, (2018) and Tikly, (219) it (curriculum innovation) does so in several ways including the following:

1. Promotion of Environmental Education

Environmental education helps learners understand ecological systems, climate change, biodiversity conservation, and sustainable resource management. African educational systems are increasingly integrating environmental sustainability into curricula to develop environmentally responsible citizens. UNESCO reports indicate growing efforts across African countries to promote climate education and green learning initiatives in various subjects and courses at various levels of education (UNESCO, 2023; 2017).

2. Development of Entrepreneurial Skills

Entrepreneurship education equips students with self-reliance skills, innovation capabilities, and business competencies

necessary for employment creation. This type of education helps reduce unemployment and poverty among African youths, and it is curriculum innovation that brings in the contents that teach them. Innovative curricula that integrate vocational and technical education such as catering, phone repairs, machine learning, sewing and block-making enable graduates to become job creators rather than job seekers.

3. Integration of Digital Literacy

Digital transformation has become indispensable in modern education. Curriculum innovation now emphasizes Information and Communication Technology (ICT), artificial intelligence, coding, online learning, and digital research skills. African societies with these curricula and which produce graduates in these fields are climbing up the ladder of sustainable development. UNESCO and African Union educational initiatives strongly advocate technology-driven learning systems for sustainable growth in Africa (UNESCO, 2025, African Union, 2015).

4. Competency-Based Education

Competency-based curricula focus on practical skills, creativity, critical thinking, collaboration, and problem-solving rather than rote memorization. Such curricula prepare learners for real-life challenges and labour market demands. These are highly needed in Africa.

Many African countries including Kenya, Rwanda, Ghana, and South Africa have introduced competency-based curriculum reforms aimed at improving employability and innovation.

5. Integration of Indigenoowledge

African indigenous knowledge systems promote sustainable agriculture, traditional medicine, conflict resolution, environmental conservation, and communal living. A curriculum innovation that integrates indigenous knowledge promotes cultural identity and locally relevant solutions to development challenges. Integration of these pieces of indigenous knowledge into the curriculum will lead to the production of graduates who would experience significantly less unemployment, who would display more society –helpful or society–friendly attitude, respecting the healthy ways of the society.

6. Promotion of STEM Education

Science, Technology, Engineering, and Mathematics (STEM) education encourages innovation and scientific advancement necessary for industrialization and technological development in Africa. Emerging curriculum innovations increasingly emphasize robotics, renewable energy, agricultural technology, and engineering education to strengthen Africa's global competitiveness and raise the continent's level of development sustainably.

Areas of Curriculum Innovation in Africa

Several researches have been conducted into curriculum innovation in Africa. Among these, a number, including those of Akinsanya, (2018) and Ornstein & Hunkins, (2018) have identified the areas that the innovation covers in education among which are the following.

Green and Climate Education

African schools and universities are increasingly incorporating climate change education, environmental sustainability, renewable

energy studies, and ecological literacy into academic programmes. These areas tend to be receiving reasonable studies and research attention based on the current demand for them.

Technical and Vocational Education and Training

Technological and Vocational Education and Training (TVET) programmes now emphasize practical skills acquisition, entrepreneurship, industrial training, and employability competencies for sustainable economic development. International frameworks such as those African Union and the United Nations and its agencies have continued to work to sensitize African governments and their agencies including the schools and universities to this aspect of the curriculum (African Union, 2015; UNESCO, 2025)

Digital and AI Education

Recent educational reforms around the world increasingly include artificial intelligence, coding, robotics, and digital ethics within school curricula to prepare learners for emerging technological realities. Africa tend not to have been left behind in this wind that is blowing in this aspect of curriculum innovation. (UNESCO, 2025 Yusuf, 2020 & African Union, 2015).

Community-Based Learning

Community engagement and service-learning programmes encourage learners to solve societal problems through participatory learning experiences. The recent preponderance of environmental problems or awareness of them has led to much studies on environmental problems including the local ones, leading to efforts aimed at seeking local or community resources to find solutions to them. Erosion, flooding and soil fertility are examples here.

Inclusive Education

Curriculum innovation also promotes gender inclusion, disability inclusion, and equitable access to quality education for marginalized populations. International agencies in Africa including the United Nations and its organs as well as the African Union have continued to campaign for promotion of this are of education in Africa. Inclusive education has received significant attention in African curriculum, and thus inclusivity in educational management, as well as in the values and attitudes of school graduates are on the rise (UNESCO, 2023).

Challenges Facing Curriculum Innovation in Africa

Curriculum innovation is a usual activity in modern societies, as it is a core way of making education responsive to the challenges the society faces. In African societies, it has been on for some time, and its necessity cannot be over-emphasized (Akinsanya, 2018: Ornstein & Hunkins, 2018). Despite its importance however, its effectiveness tends to be grossly lacking. Among reasons adduced for its in-effectiveness, below par implementation features significantly. And further studies have identified several challenges including the following as hindering its effective implementation:

Inadequate Funding

Many African countries allocate insufficient resources to education, thereby limiting infrastructure development, curriculum implementation, and educational research. Several international organizations have noted the issue of inadequate funding of education among African countries and the consequences. The United Nations and its agencies as well as the African Union have appealed for better funding of education by African countries (UNESCO, 2025; UNESCO, 2026)

Poor Technological Infrastructure

Limited internet access, inadequate electricity supply, and shortage of digital devices constrain the integration of technology into education. Inadequate electricity supply as well as highly limited internet bandwidth are common problems in over 90% of the African countries, and these have noted negative effect on teaching and learning in African schools. Curriculum implementation is thus made less effective.

Insufficient Teacher Preparation

Teachers often lack adequate training in innovative teaching methods, digital literacy, and competency-based instruction. The story of teacher inadequacy in most African countries include a good number of untrained and uncertified teachers, a significant number lacking computer or digital literacy, among others. According to Mosanto and Ntshoe, (2026) Akinsanya, (2018) these inadequacies hinder effective implementation of educational programs and activities.

Policy Inconsistency

Frequent policy changes and weak implementation mechanisms negatively affect curriculum continuity and sustainability. Quite a number of African countries experience frequent education policy changes, but these policies have been known to be poorly implemented. Nigeria for instance is known to have frequently come up with new education policies like those on ICT and free and compulsory basic education (Federal Ministry of Education, 2019; Federal Republic of Nigeria, 2014). These policies have however been known to be poorly implemented.

Resistance to Change

Some educators and institutions resist educational reforms due to attachment to traditional teaching methods. Teachers in educational institutions across African societies display resistance to change, especially technological integration as there is a general tendency of the older set of teachers to manage teaching and learning with little or no use of modern information and communication technologies.

Large Class Sizes

Overcrowded classrooms hinder learner-centered approaches to studies and practical instruction. Quite a number of African countries including Nigeria have schools characterized by large class sizes, and this makes teaching and learning including general classes as well as practical classes especially difficult to manage (Akinsanya, 2018).

Socio-Economic Challenges

Poverty, insecurity, conflicts, and political instability affect effective educational delivery in African countries. Most African countries particularly the Sub-Saharan African countries face the above listed challenges to a significant level. These socio-economic changes affect schools' attendance in these countries as kidnaping, banditry, farmers- herders clashes and terrorist attacks, among others, make life including school attendance difficult (Akinsanya, 2018).

The foregoing challenges indeed limited the effect of curriculum innovation on sustainable development in Africa and call foe effective ways of overcoming them.

Strategies for Effective Curriculum Innovation

The need for sustainable development in Africa and the place of curriculum innovation in sustainable development calls for ways of ensuring effective curriculum innovation. To achieve sustainable curriculum reforms as well as sustainable development in Africa, several works, including that of Akinsanya, (2018) hold that the following strategies should be employed:

Strengthening Teacher Capacity

Governments and institutions should provide effective continuous professional development for teachers in innovative pedagogies and digital competencies. The teacher, as one of the central factors in every teaching and learning situation, has to be trained in the current best practices of innovative pedagogies and digital competencies. And then he would be much better positioned to expose the learners to the needed curriculum, which outcomes would include sustainable development in Africa.

Increased Educational Funding

Adequate investment in education is essential for the provision of the infrastructure, instructional materials, research, and technological development. For education to deliver optimally the required infrastructure, instructional materials and technology, as well as research need to be provided and employed. They require significant amount of money, which is why education usually demand a most significant portion of each country's national budget. The United Nations -advised 20% and above of the national budget funding for each country's education would be greatly suitable for African countries to realise the sustainable development

Integration of ICT Facilities

Schools should be equipped with internet facilities, computers, digital laboratories, and smart classrooms as well as the requirements that make these facilities work properly. Apart from providing these, they should be engaged to deliver optimally. This is necessary if the curriculum would be implemented in a way that sustainable development would be achieved.

Stakeholder Collaboration

Governments, educational institutions, private organizations, communities, and international development partners should collaborate in curriculum development and implementation in African countries. It is important for all stakeholders in education to work together to identify the challenges that education should prepare learners for in the society, to provide the resources for these and then to ensure that the curriculum implementation is done in the spirit of the planners.

Contextualization of Curriculum

Curricula should reflect African realities, indigenous knowledge systems, and local developmental needs. Curriculum of African countries is supposed to solve African problems, it therefore has to mind the realities of African societies, build on or improve indigenous knowledge systems and work on the needs of the society. This kind of contextualization of the curriculum is the one that will ensure the sustainable development.

Monitoring and Evaluation

Regular assessment of curriculum implementation is necessary in order to ensure effectiveness and sustainability. The objectives, the

implementation, and the timelines have to be examined from time to time in relation to the set objectives and expected outcomes. This would point out the extent of coverage, the gap and the new changes to introduce.

The engagement of the foregoing curriculum innovation strategies by African countries will bring about the much needed sustainable development in the continent (Akinsanya, 2018; African Union, 2015: Adeyemi, 2012).

Conclusion

Curriculum innovation remains indispensable for sustainable development in Africa. Educational systems must evolve continuously to address emerging social, economic, environmental, and technological challenges. Innovative curricula that emphasize digital literacy, entrepreneurship, environmental education, competency development, and indigenous knowledge integration will equip African learners with the skills necessary for national transformation. Africa's aspiration for sustainable development can only be achieved through educational systems that are dynamic, inclusive, relevant, and future-oriented. Governments and stakeholders must therefore prioritize curriculum reforms capable of empowering learners for sustainable living and global competitiveness.

Recommendations

In order to ensure seamless curriculum innovation for the much needed sustainable development in Africa, the following recommendations are made:

1. African governments should increase budgetary allocation to education.
2. The relevant government agencies and Teacher training

institutions should incorporate innovative pedagogies and ICT competencies into teacher education programmes.

3. Educational curricula should integrate sustainability and environmental education at all levels of education.
4. Schools should adopt competency-based and learner-centered instructional approaches.
5. Greater investment should be made in digital infrastructure and e-learning technologies in order to ensure expansion and modernization.
6. Indigenous African knowledge systems should be integrated into curriculum planning.
7. Collaboration between educational institutions, industries, and communities should be strengthened.
8. Continuous monitoring and evaluation mechanisms should be established for curriculum reforms.

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DOMESTIC INVESTMENT IN LARGE-SCALE AGRICULTURE: A CATALYST FOR PRODUCTIVE EMPLOYMENT AND SUSTAINABLE DEVELOPMENT IN NIGERIA

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Abstract

It is illogical and underscoring that despite the percentage of Nigerian labour force involved in agricultural production, particularly in rural areas, the country remains underemployed and underdeveloped. Nigeria cannot significantly reduce poverty, increase per capita income, and transform into a modern economy without focusing on agricultural development. Public discourse on investments in agriculture in Nigeria has focused mainly on aids and grants, while the role of policies implementation and domestic investments in large-scale agriculture remains unaddressed. Against this background, this paper explores the imperative of reviving the agricultural sector by encouraging domestic investments in large-scale agriculture in Nigeria. The paper also acknowledged the role agriculture played in early stage of the nation's development as an agrarian economy. More broadly, the paper examines how investments in large-scale agriculture can increase productivity, reduce unemployment, and transform the economic, as well as achieve poverty alleviation agenda. Additionally, this paper investigated the challenges of the 21st century for Nigeria's large-scale investment in agriculture, as well as contemporary skepticism about the role of agriculture in Nigeria. Finally, the paper proffered viable recommendations as

measures to enhance agricultural productivity and employment in Nigeria. Among others, it recommended that government should provide more funding for agricultural universities in Nigeria to carryout researches on all areas of agricultural production. The Central Bank of Nigeria should also come up with a stable policy for loan disbursement to farmers at a reasonable interest payback. In addition, government should make and implement friendly policies framework for efficient agricultural sector that can accelerate the attainment of Nigeria's dream of achieving the targeted growth rate and the proposed vision of becoming one among the 20 leading world economies by the year 2020.

KeyWords*:* Domestic Investments, Large-Scale Agriculture, Productive Job Creation, Economic Transformation.

Introduction

Agriculture remains an important sector of the Nigerian economy. Agricultural development contributes to economic growth, poverty reduction, food security, employment generation, and rural development. Although the structure of Nigeria's economy has changed substantially since independence, agriculture continues to provide livelihoods for a large proportion of the population. Recent evidence indicates that agriculture contributed approximately 28% of Nigeria's GDP and employed about 40% of the labour force between 2021 and 2024 (FAO, 2026).

Historically, agriculture was the mainstay of Nigeria's economy before the emergence of petroleum as the dominant source of government revenue and foreign exchange. During the colonial and early post-independence periods, agricultural commodities such as cocoa, groundnuts, palm produce, rubber, cotton, and other products generated significant export earnings and provided raw materials for emerging industries (Mezieobi & Domike, 1996). Following the discovery and commercial exploitation of crude oil, particularly during the oil boom of the 1970s, agriculture gradually received less attention in public investment and economic

planning.

Agriculture-led growth played an important role in reducing poverty and transforming several Asian and Latin American economies. However, Nigeria has not yet achieved a comparable agricultural transformation. The country possesses favourable ecological and natural-resource conditions for agricultural production, but agricultural productivity has remained constrained by underinvestment in physical, institutional, and human capital and by the historical tendency to prioritise petroleum over agriculture (Adelman, 2001).

Employment policy should focus not merely on increasing the number of jobs but also on expanding productive and decent employment. Agriculture and agricultural value chains offer opportunities in primary production, agro-processing, transportation, storage, marketing, logistics, input supply, mechanisation, agricultural technology, and agribusiness. The World Bank's Nigeria Sustainable Agricultural Value-Chains for Growth (AGROW) Project similarly emphasises agricultural productivity, value-chain development, agro-processing, market access, and job creation (World Bank, 2026). The central argument of this paper is therefore that greater domestic investment in large-scale agriculture can contribute to productive employment creation, food security, poverty reduction, and sustainable economic transformation if supported by appropriate policies, infrastructure, finance, research, technology, and effective institutions.

Literature Review

Relevant literatures were extensively reviewed. However, for clarity and better comprehension, the review will be under the following sub-topics:

Agriculture in Nigeria

Agriculture is the cultivation of the soil and rearing of livestock for man's consumption. Nigeria was an agrarian economy for the oil boom of the early 70s. According to Mezieobi and Domike (1996), agriculture was the mainstay of Nigeria's economy. Nigeria and her people were involved in all six major types of agriculture or farming, namely, *arable,* plantation, irrigation, pastoral (mixed, dairy farming and transhumance), poultry and fish farming (inland, lagoon or delta fishing, open sea fishing and fish breeding on artificial lakes and ponds).

Nigeria's continued emphasis on agriculture is predicated on its importance to the Nigerian economy. Its relevance includes: source of foreign exchange, source of food supply to the people, source of raw materials for the industries, it generates job opportunities, it provides market for industrial product, it attracts infrastructural development, agricultural products (leaves, roots, seeds, flowers, etc.) serve as herbs for medical purposes.

Challenges of the 21st Century for Nigeria's Large-scale Investment in Agriculture

Despite the significance of agriculture to Nigeria's economic development strive, a number of problems stare it in the face. In fact, Nigerian agriculture in the 21st century faces several risks and challenges that, if not addressed, could constrain growth and economic transformation. Nigeria's agricultural transformation is constrained by inadequate investment in agricultural research and development. The diversity of Nigeria's agro-ecological zones and production systems requires locally appropriate technologies, improved varieties, climate-resilient production methods, and effective knowledge-transfer systems.

The diversity of agro-ecologies and cropping systems can limit the

transferability of research findings across regions and therefore requires stronger investment in locally relevant research and development (World Bank, 2007). African agricultural research systems have also historically been characterised by inadequate expenditure and institutional fragmentation (Beintema & Stads, 2014). Investment in agricultural research is particularly important because productivity gains depend on technological progress. Recent agricultural transformation initiatives continue to emphasise research, improved seed systems, climate-resilient technologies, and partnerships between government, research institutions, and the private sector (AfDB, 2026).

Another challenge is the relatively low level of market development in Nigeria. Green Revolutions were underpinned by supportive market and social institutions. Hence, in Mexico, for example, land rights regulation and institutions were restructured before farmers could profitably adopt hybrid maize (Byerlee & de Polanco, 1983). Nigeria's inconsistency in agricultural development programmes and policies, lack of political will, as well as lack of institutional development that enables private sector activity have been cited as the underlying causes of Nigeria's agricultural unemployment and poverty.

Lack of political will to support agricultural transformation *and large-scale investment in agriculture is another major constraint in Nigeria.* Political will is a challenging concept. Hammergren (1998) cited in Post et al. (2010) characterized it as "the slipperiest concept in the policy lexicon," calling it "the sine qua non of policy success, which is never defined except by its absence." There have been various efforts to define political will since then. Post et al. (2010) defined political will as "the extent of committed support among key decision-makers for a particular policy solution to a particular problem." Brinkerhoff (2010) focused on the political will to combat corruption. His concept of political will is here adopted to mean the will transform agriculture.

A fourth challenge, which already existed in the 20th century but became better recognized in the 21st, is the need for environmental protection and sustainable natural resource management. The Green Revolution in Asia has had a range of negative environmental consequences, such as pollution by overuse of pesticides and inorganic fertilizer, depletion of aquifers and loss of biodiversity. As the controversies surrounding the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD) have shown, the global community is deeply divided regarding the question as to the role of modern industrial inputs vis-à-vis agro-ecological and organic approaches in future agricultural development (Scoones, 2009).

Another major constraint to agricultural development in Nigeria had been the inadequate access to credit. The most affected were smallholders and emerging medium-size commercial farmers. The large exporters had no difficulty in procuring credit from commercial banks. In recent years, the government with the help of international donor agencies such as the International Fund for Agricultural Development, has tried to disburse credit through the farmers' cooperative societies. The paucity of long-term credit remains an unresolved problem in Nigeria.

Another major challenge *Nigeria's large-scale investment in agriculture* has to cope with is globalization. Managing an agricultural transformation under the conditions of an open market economy brings its own challenges, since Nigerian government have fewer possibilities to protect the sector at least initially ("infant industry") than was the case during the Asian Green Revolution. Other factors responsible for the tardy performance of agriculture in Nigeria include: traditional production methods, low levels of mechanisation, predominantly small-scale production, inadequate extension services, inadequate storage facilities, post-harvest losses, weak rural financial institutions, fluctuations in

agricultural prices, soil degradation, pests and diseases, and inadequate access to improved seeds and fertilisers. These constraints are interconnected. Addressing one without addressing the others is unlikely to produce sustainable agricultural transformation.

Contemporary Skepticism about the Role of Agriculture in Nigeria's Development

Despite the substantial literature supporting agriculture-led development, there remains scepticism concerning whether agriculture can generate the scale of economic transformation required in Nigeria. One argument is that globalisation has changed the conditions under which developing countries pursue structural transformation. From this perspective, resource-rich countries can specialise in sectors where they have comparative advantages and import agricultural products from countries that can produce them more efficiently. Adelman (2001) notes that although trade can provide an important stimulus for development, trade alone is insufficient to guarantee sustained economic transformation. Resource-rich economies may therefore benefit from international trade, but development depends on how the resulting income is invested in productivity growth and broader economic diversification. Nigeria's dependence on petroleum illustrates the limitations of a resource-based development strategy. Although petroleum exports generate foreign exchange, excessive dependence on a single commodity can expose the economy to external price shocks and reduce incentives for diversification.

The argument that Nigeria can bypass agriculture by relying on oil and imported food also presents risks. Heavy dependence on imported food exposes the country to exchange-rate pressures, international price fluctuations, supply disruptions, and foreign-exchange constraints. Recent FAO data indicate that Nigeria imported approximately ₦16 trillion worth of food between 2021 and 2024, compared with about ₦7 trillion in food exports, resulting in a

substantial food trade deficit (FAO, 2026). Agriculture should therefore not be viewed merely as a traditional sector awaiting replacement by industry. Rather, modern agriculture can serve as a foundation for agro-industrial development through linkages with manufacturing, logistics, financial services, information technology, research, and retail. Recent evidence supports this position. The World Bank's AGROW Project is designed to foster sustainable growth and job creation across selected agricultural value chains in Nigeria through interventions in infrastructure, institutional capacity, regulatory reform, and value-chain development (World Bank, 2026).

The Role of Agriculture in Early Development of the Nigerian State

Nigeria was predominantly agriculture-dependent before the expansion of petroleum exports in the 1970s. Agriculture played a central role in the economy at independence in 1960 and during the early post-independence period. Agricultural production provided food and employment, generated export earnings, supplied raw materials to emerging industries, and supported government revenue. Commodities such as cocoa, groundnuts, palm produce, rubber, cotton, and timber were important components of Nigeria's export economy (Mezieobi & Domike, 1996). Following the discovery and commercial exploitation of petroleum, the relative importance of agriculture declined. Petroleum increasingly became the dominant source of government revenue and export earnings, while public and private investment shifted towards the petroleum sector.

Agriculture nevertheless continued to contribute to food production, employment, and rural livelihoods. The decline in agricultural investment did not eliminate the importance of the sector; instead, it contributed to a widening gap between Nigeria's agricultural potential and actual agricultural productivity (Ahungwa, Haruna, & Rakiya, 2014). Agriculture can also contribute to economic growth by stabilising domestic food supplies. Food shortages can generate

inflationary pressures and weaken household welfare, while agricultural productivity improvements can increase rural incomes and support broader economic activity. Daio et al. (2006) emphasise the importance of agriculture in food security, employment, and structural transformation in developing economies.

Classical development theories emphasised the movement of resources from low-productivity traditional sectors to higher-productivity modern sectors. Adelman (2001) notes that early development theory viewed structural transformation as involving the movement of factors of production from traditional agricultural activities to modern industrial activities. However, agricultural transformation does not necessarily mean abandoning agriculture. Instead, productivity growth in agriculture can release labour and capital for other sectors while simultaneously creating markets for manufactured goods and services (Gollin et al., 2002). Consequently, Nigeria's development challenge is not simply to move people out of agriculture but to transform agriculture itself into a productive, commercial, technology-driven, and value-adding sector.

Nigeria's Economy before the Oil Boom

Agriculture played a dominant role in Nigeria's economy before the oil boom. During the pre-oil period, agricultural commodities generated substantial export earnings and provided the economic foundation for many regions. As agriculture is often more labor intensive than non-agricultural industries (Schultz, 1964). Gains in agricultural productivity can contribute to higher employment and incomes, better nutrition and faster poverty reduction, and prevent distress of rural-urban migration. The Green Revolution demonstrated agriculture's considerable technological potential, as well as the benefits of its extensive upstream and downstream linkages to broader economic growth and development (Bezemer and Headey 2008).

Diminishing returns in Nigerian agriculture can be attributed to the discovery of oil in 1956 and the oil boom of early 70s. Nigeria is now a mono-product economy. The over dependence of the economy on a particular sector (especially the oil sector) in Nigeria, is a major threat to her economic growth and development. For example, before the discovery of oil in Nigeria in 1956, Nigeria was famous for her agrarian economy through which cash crops like palm produce, cocoa, rubber, timber, groundnuts, etc were exported, making Nigeria a major exporter in that respect. Also, Nigeria had nineteen million herds of cattle; the largest in Africa. She is no longer a major producer of any of the cash crops mentioned above. To curb this menace, I express optimism that economic diversification which demands active participation in a wide range of sectors and firmly integrated is better able to generate robust economic growth and transformation. This will cushion the effects of the dwindling oil prices that have contributed to our economic woe and recession.

Policy Lessons from History

This sub-section discusses the range of agricultural policies that have been pursued in the past. Buhari's regime for instance, allocated greater funds for the development of agriculture. It also increased the number of river Basin and Rural Development Authorities ((Oyeneye, Onyenwenu and Olosude, 2006)). In fact, the agricultural sector was given a level of rejuvenation by successive military regimes. Operation Feed the Nation (OFN) as launched by the regime of Geneal Olusegun Obasanjo was made to ensure food sufficiency and income generation for Nigeria. As a follow up to this programme, Geneal Ibrahim Babangida re-structured and tagged it: Agricultural Development Programme (ADP) with a mandate to boost agricultural production for both local consumption and for export.

The Babangida's administration established the Peoples Bank and Community Banks to help the poor in both urban and rural areas. The programme “Better Life for Rural Women” was also established to

improve the lot of women. His administration also set-up the Directorate of Food, Roads and Rural Infrastructure and the National Directorate for Employment - all these are geared toward building the individual as well as the nation. Also aimed to increase the number of the nation's farmers and raise the people's awareness of the key role agriculture played in an economy.

Youth Unemployment and Job Creation in Nigeria

Nigeria continues to experience significant labour market challenges despite recording positive economic growth in recent years. The country's labour force is expanding rapidly due to population growth and a youthful demographic structure, while the pace of productive employment creation remains insufficient to absorb the increasing number of labour market entrants. It is estimated that between 3.5 and 4 million young Nigerians enter the labour market annually, intensifying competition for limited employment opportunities (International Labour Organization [ILO], 2025; European Union Agency for Asylum [EUAA], 2026).

The National Bureau of Statistics (NBS) adopted a revised labour force methodology in 2023 based on the International Labour Organization's latest standards. Under this methodology, individuals who worked for at least one hour during the reference week are classified as employed. Consequently, unemployment rates reported under the new framework are not directly comparable with estimates published before 2023 (NBS, 2024; ILO, 2025).

According to the Nigeria Labour Force Survey (Q2 2024), the national unemployment rate stood at 4.3 percent, while youth unemployment (15–24 years) was 6.5 percent, representing a decline from 8.4 percent recorded in the first quarter of 2024 (NBS, 2024). Although these figures suggest an improvement, they should be interpreted with caution because they primarily reflect changes in statistical measurement rather than a fundamental transformation of Nigeria's labour market (ILO, 2025).

A more pressing concern is the prevalence of informal and vulnerable employment. The National Bureau of Statistics reported that approximately 93 percent of employed Nigerians work in the informal economy, while only a small proportion of workers are engaged in formal wage employment with access to social protection and employment benefits (NBS, 2024). Similarly, self-employment remains the dominant form of employment, highlighting the limited capacity of the formal private and public sectors to generate sufficient decent jobs (World Bank, 2025).

Youth continue to face disproportionate labour market disadvantages. According to the European Union Agency for Asylum (2026), unemployment and underemployment among young Nigerians are driven by limited industrial expansion, inadequate technical and vocational skills, weak labour demand, and persistent mismatches between educational outcomes and labour market requirements. Furthermore, approximately 14 percent of Nigerians aged 15–24 are classified as NEET (Not in Employment, Education or Training), indicating substantial barriers to productive labour market participation (EUAA, 2026).

The International Labour Organization (2025) further notes that Nigeria's employment challenge is increasingly characterized by labour underutilization rather than open unemployment alone. Many employed individuals are engaged in low-productivity, low-income, and insecure occupations, particularly within agriculture and informal urban enterprises. Consequently, employment policies should prioritize the creation of productive and decent work rather than merely increasing the number of jobs.

The World Bank (2025) similarly argues that Nigeria's long-term development depends on expanding employment opportunities in sectors capable of generating high-productivity jobs. Agriculture and agro-industrial value chains remain among the sectors with the

greatest employment potential because they employ a significant proportion of the labour force while offering substantial opportunities for value addition, agro-processing, logistics, and agribusiness entrepreneurship. Increased domestic investment in commercial agriculture, agricultural innovation systems, rural infrastructure, irrigation, mechanization, and agricultural finance would therefore contribute significantly to productive employment creation, poverty reduction, food security, and sustainable economic development (World Bank, 2025; ILO, 2025).

Conclusion

Agriculture can generate patterns of development that are employment-intensive and favorable for the poor, if investors will go into innovative, modern and large-scale investment. It is illogical that Nigerian economy is experiencing growth without employment as the growth rate of the labour force exceeds the employment opportunities. The unemployed population is at present dominated by the youth who are mostly school leavers with senior secondary qualifications and graduates of tertiary institutions. Domestic investment in large-scale agriculture can contribute significantly to this transformation. Such investment can increase agricultural productivity, create direct and indirect employment, strengthen agro-industrial value chains, reduce food-import dependence, increase rural incomes, and support economic diversification. However, large-scale agricultural investment cannot succeed in isolation. It requires appropriate government policies, secure land arrangements, infrastructure, affordable finance, research and development, extension services, climate-smart technologies, efficient markets, and stable institutions.

Recommendations/Way Forward

The following measures can lead to an increase in agricultural productivity in Nigeria:

a) The government should provide more funding for agricultural universities in Nigeria to carry out researches on

all areas of agricultural production. This will lead to more exports and improvement in the competitiveness of Nigeria's agricultural production in international markets;

b) Government should create an enabling environment by increasing the budgetary allocation to the agricultural sector;

c) The Central Bank of Nigeria should also make adequate provision of finance and credit facilities (with little or no interest) to farmers and also come up with a stable policies on loan disbursement;

d) Government should subsidize the prices of agro-chemical and fertilizer for farmers; provide adequate irrigation scheme and also encourage them to adopt modern production technology;

e) The government should improve infrastructural facilities in rural communities;

f) Nigerian government should revive relevant past agricultural policies and programmes;

g) Modern storage facilities should be provided; this will encourage large-scale farming;

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ECOLOGICAL LITERACY AND CURRICULUM INNOVATION FOR ENVIRONMENTAL SUSTAINABILITY AMONG SCHOOL LEADERS IN SHCJ SCHOOLS IN AFRICA

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Abstract

This study investigates how school leaders in Society of the Holy Child Jesus (SHCJ) schools across Africa interpret and implement ecological literacy within their institutions. Using a Grounded Theory approach, qualitative data were collected from 20 leaders in Nigeria, Ghana, Chad, and Kenya and analyzed through open, axial, and selective coding. Findings reveal that ecological literacy is widely valued but remains informally structured, often embedded within subjects such as Biology, Agricultural Science, and Geography rather than taught as a distinct curriculum area. Experiential practices, including recycling, tree planting, waste segregation, and Laudato Si clubs, enhance student engagement, yet systemic challenges such as behavioral resistance, limited parental involvement, and lack of institutional support constrain impact. A core category, Ecological Literacy as Negotiated Transformative Practice, emerged, highlighting the tension between teacher-driven innovation and the absence of formal curriculum frameworks. Beyond the school context, ecological literacy is linked to broader sustainability challenges in Africa, including biodiversity loss, deforestation, and waste-related public health risks. The study concludes that effective ecological education requires alignment between curriculum structures, teacher agency, and community participation. By situating ecological literacy within faith-based education, this research contributes a practice-based understanding of how leadership can

drive curriculum innovation for sustainability and public health resilience in resource-constrained contexts.
Keywords: ecological literacy, curriculum innovation, environmental education, school leadership, faith-based education, sustainability, biodiversity, public health

Introduction

Globally, humanity is battling with increasing environmental challenges and the demand for sustainable development. Schools are positioned as critical spaces for cultivating ecological consciousness. International bodies like UNESCO emphasize the role of education in promoting sustainable development and responsible citizenship which has resulted in ecological literacy emerging as an essential component of modern education. School leaders, play a central role in translating these ideals into practice through curriculum innovation and leadership.

Schools affiliated with the Society of the Holy Child Jesus (SHCJ) combine a faith-based commitment to holistic formation with a mission orientation that can support values-based sustainability education. The SHCJ's emphasis on moral formation, community service, and care for creation aligns closely with UNESCO's ESD principles and Pope Francis's call for an ecological conversion in Laudato Si'. Within SHCJ schools, ecological literacy can therefore be framed not only as scientific knowledge but as an ethical and spiritual responsibility which provides a critical opportunity for integrating values, experiential practice, and community outreach. Examining SHCJ leaders' approaches offers insight into how faith-based missions can enable or constrain curriculum innovation for sustainability in resource-constrained African settings.

Research Questions:

i. How do school leaders in SHCJ schools in Africa understand and interpret ecological literacy?

ii. In what ways is ecological literacy integrated into curriculum innovation and everyday school practices in SHCJ schools in Africa?
iii. What factors, challenges, and leadership strategies influence the implementation of curriculum innovations in SHCJ schools in Africa?

Review of Related Literature

Education, with faith-based institutions, particularly Catholic schooling, emphasizes holistic formation by integrating intellectual growth with moral, spiritual, and social values. Its mission is to produce individuals who are intellectually competent, morally grounded, and socially responsible (Congregation for Catholic Education, 2014). In Africa, education is widely regarded as a transformative tool for personal and societal development, with faith-based schools playing a critical role in shaping values and promoting social justice (Oduro, 2015). This aligns with the mission of religious institutes such as the Society of the Holy Child Jesus, which prioritize education as empowerment and service.

Ecological literacy, defined as the ability to understand natural systems and make informed decisions for sustainability (Capra, 1996), has become central to Education for Sustainable Development (ESD). It encompasses knowledge, values, and behaviors that foster stewardship and sustainable practices (Ogunyemi & Ifegbesan, 2011). Research shows that environmental education strengthens emotional bonds with nature, empathy for ecosystems, and willingness to protect them (Ekwesaranna et al., 2025). Within Catholic education, ecological literacy is strongly influenced by *Laudato Si'*, which calls for ecological conversion and emphasizes the moral responsibility to care for creation (Pope Francis, 2015). UNESCO's Global Action Programme further highlights ESD as transformative education for

advancing sustainability worldwide (UNESCO, 2017).

Curriculum innovation and school leadership are critical for embedding ecological literacy into education. Innovative curricula integrate experiential learning, critical thinking, and cross-disciplinary approaches (Tilbury, 2011; Fullan, 2007), but implementation in African schools faces barriers such as scarce resources, limited teacher training, and rigid policy frameworks (Ogunyemi, 2018). Effective leadership drives cultural change, motivates teachers, and sustains innovation, making schools vital platforms for fostering sustainability amid deforestation, pollution, and climate change (Lotz-Sisitka et al., 2015; Ibada, 2025). Faith-based schools, by combining ecological values with moral and spiritual teachings, can bridge gaps in policy and practice, embedding sustainability early in life and positioning themselves as important actors in advancing ecological education across Africa (Agbor et al., 2025).

Research Methodology

This study adopted a qualitative research design using the Grounded Theory approach developed by Glaser and Strauss (1967), which is appropriate for generating theory grounded in participants' experiences rather than testing pre-existing hypotheses. The method enabled an in-depth exploration of how school leaders understand and implement ecological literacy within their curriculum, while identifying processes and constraints shaping these practices. Participants included 20 out of 42 heads of SHCJ-affiliated schools across Africa (Nigeria, Chad, Ghana, and Kenya) who volunteered to take part. Since 20 is only 47% of the population, it means that the results from this study may not be generalized to related settings and contexts. The interviews took a period of 6 weeks and data was collected through online Google Forms with eight open-ended questions exploring ecological literacy, curriculum presence, teaching practices, student responses, challenges, and recommendations. These

questions were validated through experts' review and cognitive pre-testing. The data and interpretations also went through member-checking.

Data analysis followed the Grounded Theory coding process, involving simultaneous data collection and analysis, constant comparison, and progressive coding (open, axial, and selective) until theoretical saturation was achieved (Corbin & Strauss, 2015; Charmaz, 2014). Open coding identified initial categories, axial coding explored relationships among them, and selective coding integrated these around a central phenomenon. Trustworthiness was ensured through triangulation across countries, member checking with respondents, and reflexivity via analytic memos. Ethical approval was obtained from the Institute of Leadership and Management, Uromi, Nigeria (INSTILM-IRB/2025/ENV-001), with voluntary participation, anonymity, and secure data storage guaranteed. All information was used strictly for academic purposes, safeguarding participant rights while advancing scholarly discourse and educational practice.

Results

Table 1

Demographic Information of Respondents

S/NO	Date of Interview	Status	Age	Gender	Location
1	02/02/2026	Principal	51–60	Female	Anambra
2	02/02/2026	Head Teacher	51–60	Female	Rivers
3	03/02/2026	Vice Principal	41–50	Female	Abuja
4	04/03/2026	Principal	41–50	Female	Ogun
5	05/02/2026	Principal	51–60	Female	Kogi
6	07/02/2026	Principal	41–50	Female	Ogun
7	08/02/2026	Principal	41–50	Female	Benue

S/NO	Date of Interview	Status	Age	Gender	Location
8	12/02/2026	Head Teacher	41–50	Female	Kenya
9	13/02/1026	Principal	51–60	Female	Cross River
10	15/02/2026	Vice Principal	41–50	Female	Rivers
11	18/02/2026	Vice Principal	51–60	Female	Benue State
12	20/02/2026	Vice Principal	51–60	Female	Ghana
13	24/02/2026	Head Teacher	41–50	Female	Chad
14	27/02/2026	Vice Principal	51–60	Female	Anambra
15	4/03/2026	Head Teacher	41–50	Female	Lagos
16	6/03/2026	Principal	41–50	Female	Abuja
17	9/03/2026	Head Teacher	41–50	Female	Ghana
18	12/03/2026	Vice Principal	51–60	Female	Kogi
19	14/03/2026	Principal	41–50	Female	Delta
20	16/03/2026	Head Teacher	31–40	Female	Delta

From Table 1, the demographics reveal that majority of respondents are senior educators (41–60 years), suggesting ecological literacy initiatives are being driven by experienced professionals. There is also Nigeria cross-country responses and a wider African perspective. The equal representation of Principals and Vice Principals, indicates balanced leadership involvement. Overall, ecological literacy and curriculum innovation in SHCJ African schools are being championed by experienced female leaders, with Nigeria at the forefront but supported by regional collaboration.

Table 2

Full Thematic Table

Theme	Category	Illustrative Evidence
Environmental Education is Valued but Informally Structured	Curriculum presence & gaps	"It is not a subject in my school… taught aspects of ecology in the sciences."
	Integration & need for formalization	"The study of Biology, Agricultural Science and Geography takes care of it." / "Ensure the topic is included in your school timetable at least one period in a week."
Early Environmental Awareness Builds Values	Human–nature relationship & ethics	"Understanding the relationship between human beings and nature." / "Students learn to value life and creatures."
Experiential Learning Drives Engagement	Practical & creative pedagogy	"Making good use of plastic bags… making bangles." / "Practical applications by both teachers and students."
Student Engagement is Positive but Gradual	Attitudes & behavioral outcomes	"Students are very eager about this." / "Students are responsible for keeping the environment clean."
Barriers Limit Impact	Resistance & parental influence	"Students struggle to keep environment clean." / "Parents still bring single-use plastics to school."
Innovation is Teacher-Driven but Needs Support	Teacher initiatives & institutional dependency	"New ideas, concepts and techniques in teaching and learning." / "It will support us if it is properly planned and integrated."
Whole-Community Approach is Necessary	School practices & community involvement	"Single-use plastics are prohibited in our school." / "Educate parents so learners continue it at home."
Need for Curriculum Reform	Policy & co-curricular strategies	"Include in timetable at least one period a week." / "Introduce eco-friendly clubs and projects."

Table 2 presents selected excerpts from participants alongside their corresponding codes. The coding process revealed recurring patterns related to environmental awareness, experiential learning practices, and challenges such as resistance and lack of parental involvement.

Grounded Theory Analysis of the Data

Data analysis used a Grounded Theory approach starting with open coding, axial coding, and selective coding. Through constant comparison, categories and patterns of meaning were refined and integrated into broader themes, leading to the emergence of a core category that explains the phenomenon under study enabling the researcher to construct an understanding of school leaders experience with ecological literacy and environmental education. The analysis points to the fact that 9 in 10 respondents value ecological literacy and environmental education. The study also noted that the implementation of reforms remains largely informal, fragmented, and dependent on school leaders and teacher initiative. The findings also reveal tensions between enthusiasm for environmental sustainability and structural limitations such as curriculum gaps, inadequate institutional support, resistance to behavioral change, and limited parental awareness.

Environmental Education is Valued but Informally Structured: This study reveals that environmental education is valued but informally structured, with 9 in 10 respondents consistently noting its importance yet acknowledging its lack of formal recognition in the curriculum. As one explained, “It is not a subject in my school… taught aspects of ecology in the sciences” (R1), while another emphasized that “curriculum design supports ecological literacy by integrating environmental care into all subjects and daily learning. Learners study nature in Science, apply measurement and data in Mathematics, and learn stewardship values in Religious Education” (R8). Similarly, “It is always talked about but not a subject” (R2), and “The study of Biology, Agricultural Science and Geography takes

care of it" (R3), highlighting reliance on subject integration rather than dedicated structures. Leaders expressed a desire for institutional formalization, with one recommending, "Ensure the topic is included in your school timetable at least one period in a week" (R2). Collectively, these responses point to the broader theoretical proposition that ecological literacy in schools is valued but structurally underdeveloped.

Strong Belief in Early Environmental Awareness: This study highlights a strong belief in early environmental awareness, with respondents consistently emphasizing that ecological education should begin in primary school to shape long-term attitudes, ethical values, and responsible citizenship. Teachers associated ecological literacy with empathy, moral consciousness, and sustainability, noting that "Their awareness and concern for the environment will make them empathetic" (R13) and stressing the importance of "Understanding the relationship between human beings and nature" (R1). Others linked ecological literacy to ethical development and stewardship, stating, "Students learn to value life and creatures" (R3, R8). Recurring terms such as "awareness," "empathy," "respect," and "responsibility" produced the subcategory of environmental ethics, with participants viewing ecological literacy as both cognitive and moral education. Collectively, these insights suggest that exposing learners to ecological concepts early cultivates ecological identities and transforms passive awareness into active stewardship.

Experiential Learning Drives Engagement: This study shows that experiential learning drives engagement, as 7 in 10 respondents emphasized that hands-on activities such as recycling, waste segregation, composting, and creative reuse projects make ecological literacy meaningful. For example, one noted, "Making good use of plastic bags… making bangles" (R1), while another explained, "We separate biodegradable and non-biodegradable waste" (R2). Practical application was repeatedly described as central to learning

"Practical applications by both teachers and students" (R6) and creativity was highlighted through "Creative ways of students learning about Mother Earth" (R3). These insights produced the categories of applied environmental learning, hands-on pedagogy, and creative ecological pedagogy, showing that interactive, student-centered methods transform abstract concepts into engaging, memorable, and behaviorally transformative practices.

Positive but Gradual Student Engagement: This study found that students were generally positive about ecological literacy initiatives, showing eagerness and cooperation even though behavioral transformation remains gradual. Respondents noted, "Students are very eager about this" (R1), "Teachers and students responded very well; they are cooperative" (R2), and "Students are responsible for keeping the environment clean" (R3), though some admitted, "Students struggle to keep environment clean" (R10). These insights produced the category of gradual behavioral transition, reflecting that while ecological education fosters enthusiasm and participation, translating awareness into consistent responsibility requires sustained reinforcement and long-term support.

Behavioral and Social Barriers Limit Impact: This study found that behavioral and social barriers limit the impact of ecological literacy initiatives, as respondents highlighted poor environmental habits and resistance to change. For instance, "Students struggle to keep environment clean" (R3) and "There was skepticism especially using plastics for ornamentals" (R1), reflecting behavioral resistance rooted in unsustainable practices. Community inconsistency also emerged, with one respondent noting, "Parents still bring single-use plastics to school" (R1), showing that ecological values taught in schools are not always reinforced at home. These insights underscore that ecological literacy is constrained not only by curriculum gaps but also by sociocultural attitudes and habits, suggesting that meaningful progress requires collective reinforcement of sustainable behaviors by schools, families, and communities.

Innovation is School-Driven but Needs Institutional Support: This study found that innovation in ecological literacy is largely school-driven, with teachers and leaders sustaining initiatives through creativity and commitment rather than systemic support. Respondents described efforts such as, "We tried to repair our roads in the compound with sand bags… to break erosion and prevent further soils being eroded" (R5), and "We have club fare days where clubs like Laudato Si have an opportunity to educate others on the care of the earth and environment" (R7), alongside "Doing Laudato Si education awareness on environmental issues" (R12). While these examples highlight school-led innovation, challenges remain, as noted: "It wasn't easy teaching the students" (R1) and "The students are ignorant about a lot" (R4). These insights generated the categories of school-led innovation and institutional dependency, underscoring that without formal curriculum guidance and structured planning, sustainability efforts risk becoming inconsistent and unsustainable.

Whole-Community Approach is Necessary: This study highlights that a whole-community approach is necessary, as respondents emphasized ecological literacy must extend beyond classrooms to include families and communities. One explained, "Educate parents so learners continue it at home" (R2), while another urged, "Do a research on ecological literacy" (R13). Peer learning also emerged, with "Learners practise it and pass it on to others" (R2), generating the subcategory of knowledge transfer and social influence. Respondents viewed students as environmental ambassadors capable of spreading awareness, but stressed that lasting impact requires cooperation among schools, families, and communities. Collectively, these insights point to ecological literacy as a community-centered process built on shared responsibility.

Need for Curriculum Reform and Strategic Implementation: The final major theme emerging from the grounded theory analysis concerned the urgent need for curriculum reform and systematic

implementation strategies. 7 in 10 respondents advocated for formal curriculum inclusion: "Include in timetable at least one period a week." (R2). Others emphasized collaboration with students: "Brainstorm on what you need the students to learn; plan the best way they will learn it and factor it into the curriculum." (R3) and "inculcate ecological literacy in the curriculum" (R13). Through continuous comparison, these responses generated the category of *institutionalization of ecological literacy*. Respondents believed environmental education should move from isolated activities toward structured educational policy.

The grounded theory analysis therefore suggests that participants view ecological literacy as a necessary educational reform area requiring curriculum restructuring, institutional commitment, and systematic implementation.

Emerging Grounded Theory

Using the constant comparative method, an emergent theoretical explanation can be proposed from the findings. The data suggest that ecological literacy in schools develops through a dynamic interaction between teacher innovation, experiential learning practices, student engagement, and institutional support structures.

The emerging grounded theory proposes that:

> Ecological literacy is negotiated within structural constraints. However, ecological literacy becomes effective when experiential and value-driven environmental learning is institutionally supported, community reinforced, and systematically integrated into the curriculum.

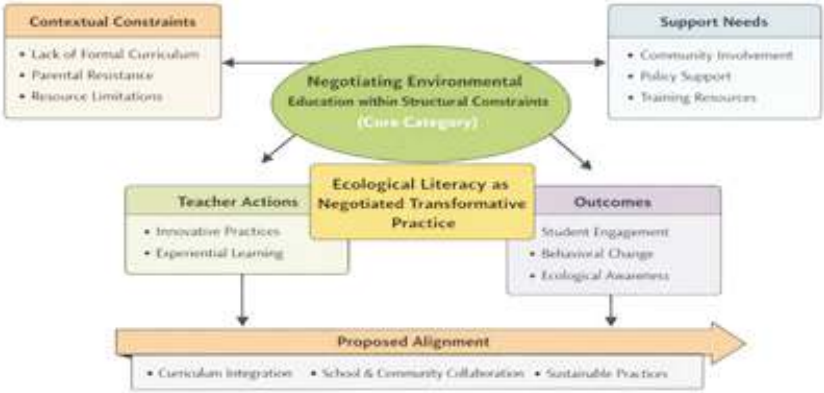
At the moment, ecological literacy remains dependent on fragmented subject integration. But it could more sustainable and transform the students' lives if there is collaboration and structured approaches involving teachers, students, parents, and policy frameworks.

Therefore, our core emerging theory becomes: "Ecological Literacy as Negotiated Transformative Practice"

Emerging Grounded Theory

Figure 1

Conceptual framework of the Study



***Source**: Researcher's ideas generated with copilot.com*

Discussion of the Emerging Theory

The findings of this study reinforce existing scholarship that environmental education in Africa requires a holistic and systemic approach. Prior research in Nigeria emphasizes the importance of strong policies, curriculum integration, and community engagement to instil eco-friendly values (Ibaba, 2025), while Agbor et al. (2025) highlight experiential and interdisciplinary methods supported by teacher training and stakeholder collaboration. Kesuma (2024) noted that ecological literacy

fosters environmentally caring behaviours essential for biodiversity conservation and sustainability, aligning with this study's observation that school leaders and teachers act as change agents through initiatives such as recycling, tree planting, and eco-clubs. Ekwesaranna et al. (2025) provide empirical evidence that structured environmental education programs enhance connectedness to nature and foster pro-environmental behaviour, yet the absence of formal curriculum structures makes implementation inconsistent and dependent on individual effort. This reflects the Grounded Theory principle that social processes are shaped by the interaction of agency and structural constraints (Corbin & Strauss, 2015; Charmaz, 2014).

Beyond the school context, the emerging theory has wider implications for biodiversity, sustainability, and public health in Africa. Ecological literacy initiatives such as waste segregation, prohibition of single-use plastics, and tree planting directly contribute to biodiversity conservation and reduce ecosystem degradation. According to Irlam et al. (2023), ecological literacy also has direct public health implications, as environmental education reduces pollution-related illnesses and strengthens community resilience. By embedding ecological values early in education, schools foster stewardship that mitigates deforestation, habitat loss, and species decline, while addressing sustainability challenges such as climate change and resource depletion. The substantive theory that emerged—ecological literacy as a negotiated transformative process driven by innovation and experiential learning but constrained by informal structures and limited community involvement—underscores the need for systemic strategies that connect schools with families, policymakers, and communities. In doing so, ecological education can serve as a catalyst for biodiversity protection, sustainable development, and public health improvement across Africa.

Recommendations from the Study

Curriculum Reform: Schools should formally integrate ecological literacy into the curriculum as a core subject, embedding environmental themes across disciplines. Structured instructional time through eco-labs, outdoor learning, and environmental evaluations will transform stewardship into daily practice.

Support for Teacher Innovation: Continuous professional development, coupled with adequate classroom resources, will empower teachers to deliver inquiry-based and experiential ecological education. Removing administrative and financial barriers ensures teachers can create dynamic, real-world learning experiences.

Strengthening Experiential Learning: Hands-on activities like recycling, tree planting, and organic gardening should be embedded into project-based learning. This approach equips students with critical thinking, problem-solving, and leadership skills for impactful ecological literacy.

Enhancing Community Involvement: Schools must extend ecological education beyond classrooms by engaging families and building local partnerships. Parent workshops and collaborations with civic organizations foster shared responsibility and reinforce sustainability practices at home and in communities.

Suggestions for Further Research

The following suggestions result from the discussion of the findings of this study:

- Explore students' lived experiences of environmental education, through qualitative and phenomenological lenses, capturing how experiential, place-based effect
- Examine long-term behavioral outcomes through longitudinal studies that track whether environmental literacy

cultivated in early schooling translate into sustained, pro-environmental habits.

Conclusion

This study demonstrates that ecological literacy through environmental education is a dynamic and negotiated process shaped by curriculum structures, teacher innovation, and community involvement. The grounded theory developed provides a framework for strengthening ecological literacy when schools move beyond informal integration toward structured support and systemic alignment. Experiential approaches such as recycling, tree planting, and eco-clubs (Laudato Si) enhance student engagement and understanding, though their long-term impact is limited by behavioral resistance, parental disengagement, and the absence of formal curriculum structures. Importantly, the findings highlight the broader societal relevance of ecological literacy in Africa, where embedding ecological values early in education contributes to biodiversity conservation, sustainable practices, and public health resilience. Therefore, ecological literacy must be prioritized within the education system, not only as a pedagogical innovation but as a strategic pathway toward sustainability, biodiversity protection, and community well-being, with leadership-driven curriculum reform and community participation positioning schools as catalysts for sustainable futures in Africa.

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IDENTIFYING THE UTILITY GAP: A QUALITATIVE CURRICULUM AUDIT OF THE NATIONAL UNIVERSITIES COMMISSION CORE CURRICULUM AND MINIMUM ACADEMIC STANDARDS (CCMAS) AND THE SELF-EMPLOYMENT READINESS OF EDUCATION ECONOMICS GRADUATES

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Abstract

This study examined the disjunction between curriculum reform and graduate employability in Nigeria through a qualitative audit of the National Universities Commission's (NUC) Core Curriculum and Minimum Academic Standards (CCMAS) for Education Economics, introduced in 2022 to replace the Benchmark Minimum Academic Standards (BMAS). Although the CCMAS was designed to align university education with 21st-century market realities, its functional impact on self-employment readiness remains underexplored. Drawing on documentary analysis and the CareerEDGE employability framework, this study conceptualizes a "utility gap," the functional disparity between curricular intent and graduates' economic agency. Analysis revealed a pattern of "theoretical saturation," in which abstract economic models overshadow practical tools such as data analytics software. This condition is compounded by "technological decoupling," as institutional infrastructures consistently lag stated digital aspirations, and by a "future-blind" neglect of green economy competencies. The study concludes that the transition from BMAS to CCMAS is largely semantic rather than functional. Without the deliberate cultivation of entrepreneurial agency, curriculum reform risks becoming a

symbolic academic exercise rather than a viable economic intervention. The study recommends the integration of discipline-specific entrepreneurship education, mandatory technical skills training, and industry-linked incubation systems to bridge the gap between academic certification and economic action.
Keywords: NUC CCMAS, Education Economics, entrepreneurial agency, utility gap, self-employment readiness, green skills, technological decoupling, theoretical saturation

Introduction

Graduate unemployment in Nigeria reflects a persistent structural tension between academic training and labour market demands. Despite a substantial increase in graduate output over the past two decades, formal economic absorption rates have remained stagnant, a pattern that has intensified calls for curriculum reform in disciplines that straddle the boundaries between education and economic practice. Education Economics, as one such dual-domain discipline, has been positioned as an important site of intervention in Nigeria's broader struggle to align tertiary education with national development imperatives.

The 2022 transition from the Benchmark Minimum Academic Standards (BMAS) to the Core Curriculum and Minimum Academic Standards (CCMAS), framed by the National Universities Commission (NUC) as a "radical re-engineering" of Nigerian university education, represents the most significant curricular restructuring in recent memory. Through a 70/30 curriculum architecture, whereby 70% of content is nationally standardized and 30% is reserved for institutional customization. The CCMAS purports to embed critical thinking, digital literacy, and entrepreneurship across all disciplines. For Education Economics graduates, who are theoretically positioned for roles in consultancy, policy analysis, and educational management, these reforms carry particular significance.

Nevertheless, a "utility gap" persists: a functional failure of graduates to translate theoretical knowledge into viable economic activity. While existing scholarship frequently attributes this deficit to systemic factors such as funding constraints and infrastructural inadequacy, limited attention has been paid to the curriculum's own "utility value", its intrinsic capacity to produce graduates capable of self-directed economic action. This study addresses that gap by shifting the analytical focus from policy rhetoric to the curriculum itself, interrogating the CCMAS as an economic instrument intended to produce self-reliant actors capable of thriving in a volatile and rapidly evolving labour market.

Statement of the Problem

Nigeria's education system confronts a deepening paradox: the nation records increasing graduate output alongside persistently rising unemployment (National Bureau of Statistics [NBS], 2024). Education Economics graduates occupy a particularly vulnerable position within this dynamic, as they frequently lack the applied competencies; such as data-driven analysis or private enterprise management necessary for economic agency in the gig economy or for initiating independent ventures.

Although the CCMAS was explicitly designed to address this deficit, initial evidence suggests that a utility gap persists between the formal curricular intent and functional graduate capability. As Ogunode and Ayeni (2023) observed, documentation does not equate to skill acquisition when pedagogical practice remains predominantly theory driven. This theory–practice mismatch (Adebayo, 2021) leaves graduates without the applied competencies required for economic participation, compounded by the frequent inability of universities to operationalize the CCMAS's 30% institutional content provision due to infrastructural constraints.

Without rigorous evaluation, the CCMAS risks reproducing the very

dependency it seeks to dismantle, one in which graduates are academically qualified yet economically constrained. This study therefore identifies the structural and pedagogical barriers that limit the curriculum's effectiveness as an instrument of economic transformation.

Objectives of the Study

The primary aim of this study is to evaluate the alignment between the CCMAS for Education Economics and the entrepreneurial competencies required for graduate self-employment readiness. The specific objectives are to:

I. Assess the integration of market-relevant and self-employment skills within CCMAS modules;
II. Determine the extent to which the CCMAS prepares graduates technically and psychologically for Nigeria's evolving labour market;
III. Investigate the structural and pedagogical factors, including infrastructure, staffing, and instructional methods that inhibit the translation of theoretical knowledge into practical utility; and
IV. Develop actionable, context-sensitive strategies to bridge the gap between academic certification and economic agency.

Research Questions

This study is structured around the following research questions:

1. To what extent do CCMAS modules integrate the practical skills required for graduate economic participation?
2. How effectively does the CCMAS prepare Education Economics graduates for self-employment in Nigeria's evolving market?
3. What structural and pedagogical factors hinder the

translation of theoretical knowledge into practical utility?

4. What context sensitive strategies can bridge the utility gap for Education Economics graduates?

Significance of the Study

This study makes several contributions at multiple levels of the educational system. For policymakers, it provides empirical insights to ensure that curriculum innovations translate into measurable functional outcomes rather than symbolic compliance. For university administrators and faculty, it underscores the imperative for practical pedagogy and the cultivation of what Ogunode and Josiah (2023) term "entrepreneurial academics." For graduates themselves, it identifies concrete skill deficiencies in emerging domains, including data analytics and educational consultancy, and articulates pathways for remediation.

More broadly, by foregrounding the concept of the "utility gap," this research repositions curriculum reform as a lever for national development, framing higher education not merely as a credential-granting institution, but as an incubator of economically active and self-reliant citizens. In doing so, it contributes to ongoing international debates on the alignment of tertiary education with sustainable development and labour market transformation.

Scope and Delimitation of the Study

This study focuses on the functional alignment between the CCMAS framework for Education Economics and Nigeria's contemporary labour market environment, with particular emphasis on entrepreneurial competencies and self-employment readiness. The analysis draws on documentary evidence from the CCMAS (NUC, 2022), specifically targeting modules on entrepreneurship (ENT 211 and ENT 312), applied economics, and vocational skills. Consistent with Onyeike and Anyamele's (2023) recommendation, the study prioritizes the "intended curriculum" as captured in official policy

documentation, rather than student perceptions or observed classroom practice. Contextually, the study examines the Nigerian economy from 2023 onwards, a period marked by intensifying youth unemployment and an accelerating transition toward gig-based and informal economic arrangements.

Operational Definition of Terms

National Universities Commission (NUC): The federal regulatory body responsible for supervising and accrediting university education in Nigeria.

CCMAS: The 2022 NUC regulatory framework replacing the BMAS. It employs a 70/30 sharing formula (70% national core; 30% institutional content) to align Nigerian degree programmes with 21st-century global standards.

Education Economics: An interdisciplinary programme applying economic models and principles to educational systems. As operationalized in this study, it refers to a degree programme intended to produce graduates capable of managing educational resources and initiating educational ventures.

Entrepreneurial Agency: Drawing on Bandura's (2001) Social Cognitive Theory, this term refers to the intentionality, self-efficacy, and capacity for agentic action required for a graduate to initiate and sustain self-employment within a volatile economic environment.

Utility Gap: The functional disparity between the "intended curriculum" as formalized in the CCMAS and the "market requirements" of Nigeria's contemporary labour market. It represents the chasm between academic certification and economically productive agency.

Self-Employment Readiness: The state of being technically and psychologically prepared to establish and manage an independent enterprise. Operationalized through the CareerEDGE model, it measures the degree to which degree knowledge aligns with the adaptive mindset required for economic participation in the gig economy.

Green Skills: The technical competencies, values, and knowledge required to support a transition to a low-carbon economy (World Bank, 2025). This study employs the term to identify a "future-readiness gap" in areas such as sustainable school management and green education financing.

Technological Decoupling: A structural disconnect between curricular policy aspirations (e.g., mandated AI literacy) and institutional reality (e.g., absence of functioning computer laboratories), rendering a curriculum technologically modern only in name.

Theoretical Saturation: A condition in which curricula are disproportionately weighted toward abstract classical models at the expense of practical, market-oriented tools such as STATA, Python, or PowerBI.

Literature Review

Conceptual Framework

A functionally viable curriculum framework must move beyond descriptive alignment to critically interrogate the relationship between institutional intent and practical outcome (Onyeike & Anyamele, 2023). This study theorizes a three-stage logic: the CCMAS as input, the curriculum audit as process, and self-employment readiness as the desired output. The effectiveness of this progression depends upon the curriculum's integration of technical,

agentic, and market-relevant competencies. Where these are absent, a utility gap emerges structural disjunction between curricular promise and economic functionality. This gap reflects the broader challenge of the theory–practice mismatch that has characterized Nigerian higher education for decades. Earlier frameworks such as the BMAS articulated what students should know but failed to operationalize how that knowledge should be applied (Okebukola, 2023), resulting in what Uwaifo (2021) describes as dysfunctional alignment: classroom pedagogy that remains insulated from industry realities. Graduates may demonstrate proficiency in economic theory while lacking the applied capacity for consultancy, digital services, or private educational enterprise.

The skills–expectation gap identified by Adebayo (2022) further illuminates the misalignment between curricular outputs and the demands of Nigeria's informal and gig sectors, which require hybrid competencies, digital literacy, financial management, and entrepreneurial adaptability that the CCMAS frequently treats as peripheral. As Onyeike and Anyamele (2023) argue, a curriculum that produces graduates dependent on shrinking formal employment opportunities reveals a significant utility deficit. Without "entrepreneurial academics" capable of bridging theory and practice, lecture-based instruction reproduces this deficit regardless of structural reforms (Ogunode & Josiah, 2023).

The CCMAS (2022) attempts to address these structural limitations through its 70/30 architecture and the inclusion of entrepreneurship modules (ENT 211/312). However, conceptual tensions persist: the curriculum provides knowledge capital while failing to cultivate agency capital, the capacity for risk-oriented economic action. This "intent–action gap" leaves graduates theoretically equipped but strategically underprepared for discipline-specific niches such as EdTech consultancy or data-driven educational research.

Empirical Review

Scholarship on Nigerian curriculum reform consistently identifies a disjunction between curricular design and economic functionality. Adebayo and Ogunleye (2023) document "theoretical saturation" in Education Economics programmes, where abstract models displace practical competency tools such as STATA or Python. While their analysis focused on the BMAS, the present study investigates the extent to which the CCMAS has successfully addressed this structural weakness.

Ogunode et al. (2023, 2024) identified an implementation gap driven by infrastructural deficits; however, their analysis prioritised systemic constraints over the curriculum's intrinsic fit-for-purpose value for self-employment preparation. Koseda et al. (2026) applied the CareerEDGE model to assess graduate employability under the CCMAS, but their framework was generalized rather than discipline-specific. The present study refines and extends that application to the unique context of Education Economics pathways.

Additional empirical contributions include Agaba's (2025) analysis of a certification–competency paradox, in which technically underprepared graduates hold formal academic credentials, and the World Bank's (2025) documentation of emerging green economy competencies that are largely absent from Nigerian curricula. Crucially, a 2025 report from Olabisi Onabanjo University identified an "intent–action gap" among final-year students, who express interest in self-employment but lack the institutional support structures to act on that interest. These findings collectively reveal three interrelated deficits in the CCMAS: technical, sustainability-oriented, and agentic.

Theoretical Framework

This study integrates four complementary theoretical perspectives to explain the relationship between educational provision and economic

action. Human Capital Theory (Schultz, 1961; Becker, 1964) frames education as an investment in productive capacity, suggesting that persistent graduate unemployment reflects deficiencies in the quality and relevance of human capital formation rather than merely in labour market conditions. Constructivist Learning Theory (Piaget, 1936; Vygotsky, 1978) holds that meaningful learning must be experiential and contextually grounded, directly challenging the adequacy of rote-based curricula in developing adaptive, real-world competencies. The Theory of Planned Behaviour (Ajzen, 1991) provides an explanatory mechanism for the intent–action gap, demonstrating how perceived behavioural control and self-efficacy mediate the relationship between entrepreneurial intention and action. This theoretical lens is particularly relevant to understanding why graduates who express aspirations for self-employment frequently fail to act on those aspirations. Entrepreneurial Agency Theory (Bandura, 2001) serves as the primary analytical lens of this study, emphasizing the capacity to translate knowledge into purposive economic action through opportunity recognition, risk-taking, and sustained self-regulation.

Taken together, these frameworks converge on a central insight: a curriculum achieves true utility only when it moves beyond knowledge transmission to cultivate the agentic capacity required for economic participation. This theoretical integration provides a robust and multidimensional analytical lens for evaluating the CCMAS not only as an educational framework but as a potential instrument of national economic transformation.

METHODOLOGY

Research Design

This study adopted a qualitative research design using documentary analysis as its primary methodological approach. As Bowen (2009) established, documentary analysis is a rigorous and systematic method for examining and interpreting documents to elicit meaning

and develop understanding, and it is particularly well-suited to evaluating policy frameworks such as curriculum documents. The design is appropriate to the study's objective of interrogating the CCMAS as a formal policy artefact rather than assessing its implementation in specific institutional contexts.

Data Sources

Primary data consisted of official policy documents issued by the NUC, specifically the CCMAS for Education (2022/2023), with particular focus on the B.Sc. (Ed.) Economics Education programme and the entrepreneurship modules ENT 211 and ENT 312. Secondary data were drawn from the World Bank's (2025) Sustainable Growth in Sub-Saharan Africa report, used as an evaluative benchmark for assessing the curriculum's responsiveness to emerging green skills requirements and future labour market trends. These sources enabled a multi-layered analysis of curriculum design, implementation intent, and global contextual relevance.

Analytical Procedure: The Curriculum Audit Model

Data collection and analysis were structured around the Curriculum Audit Model developed by English (1988), which evaluates the workability and adequacy of curricula through a systematic three-stage process designed to move beyond descriptive review toward functional evaluation of curriculum relevance.

The first stage involved content mapping: the systematic extraction of learning outcomes and competency statements related to technical skills and entrepreneurship from the CCMAS documents. The second stage entailed niche alignment: in which extracted content was mapped against five self-employment pathways: EdTech consultancy, data research services, private tutoring, financial advisory services, and green economy services. The third stage consisted of thematic interrogation: through which patterns of "theoretical saturation" and "curricular silence" were identified,

enabling the structural dimensions of the utility gap to be systematically characterized.

Data Analysis

Data was analyzed using qualitative content analysis guided by grounded theory principles (Glaser & Strauss, 1967). The CareerEDGE model (Koseda et al., 2026) was employed as a coding framework, enabling curricular elements to be categorized across three functional domains: (a) D–Knowledge: capturing the depth and breadth of theoretical and pedagogical content. (b) E–Skills: representing practical, work-ready competencies including technical proficiency, and (c) G–Agency: reflecting the graduate's capacity for independent economic action, opportunity recognition, and market participation. Analytical attention was directed at the entrepreneurship modules (ENT 211 and ENT 312), to determine whether they cultivate discipline-specific entrepreneurial agency or merely provide generalized business knowledge.

Trustworthiness and Limitations

To enhance the credibility of the analysis, researcher triangulation was employed, involving cross-referencing of CCMAS findings against the preceding BMAS framework and contemporary labour market analyses (Lincoln & Guba, 1985). This triangulation situates curriculum analysis within both historical and contemporary economic contexts, reducing the risk of conclusions that are grounded in isolated policy assumptions.

A recognized limitation of this study is that, as a documentary analysis, it is delimited to the formal intended curriculum as captured in policy documents and does not capture the enacted curriculum, the actual instructional delivery by faculty in specific institutional settings. This study is therefore understood as a foundational baseline for future empirical research involving stakeholder interviews, classroom observation, and longitudinal graduate surveys.

RESULTS AND DISCUSSION

Structural Audit: The Dominance of Theoretical Saturation

The curriculum audit revealed a persistent structural imbalance within the CCMAS for Education Economics. Despite the nominal transition from the BMAS, the curriculum remains characterized by theoretical saturation (Adebayo & Ogunleye, 2023): the 70% national core is heavily anchored in abstract classical economic models, with limited accommodation for applied or practice-oriented content. From a Human Capital Theory perspective (Schultz, 1961), this represents a misallocation of educational investment, graduates accumulate substantial theoretical capital while acquiring limited market utility.

The 30% institutional component, which was explicitly designed to promote innovation and local responsiveness, is frequently underutilized. Rather than providing functional differentiation, it tends to reproduce theoretical content drawn from the national core. From a constructivist standpoint, this constitutes a missed opportunity for contextually grounded, experiential learning (Vygotsky, 1978). Furthermore, the ENT 211 and ENT 312 entrepreneurship modules remain "sector-agnostic": they provide generalized business knowledge without the discipline-specific application that would equip Education Economics graduates to pursue viable niches in the contemporary economy.

Pedagogical and Technological Dynamics

Despite the CCMAS's explicit references to 21st-century competencies, including artificial intelligence and digital literacy, instructional practice remains predominantly lecture-driven and examination-focused. This pedagogical stagnation (Ogunode & Josiah, 2023) systematically inhibits the development of transferable competencies. The gap between curricular aspirations and institutional reality constitutes what this study terms "technological

decoupling": policy mandates for digital competence exist on paper but cannot be operationalized in the absence of requisite laboratory infrastructure and qualified faculty, rendering digital literacy conceptual rather than functional.

The Skills Gap and Sustainability Deficit

The audit identified a significant absence of mandated technical competencies within the CCMAS framework. The curriculum is "software-neutral," making no provision for instruction in industry-standard data analytics tools such as STATA, Python, or PowerBI. This finding confirms Agaba's (2025) certification–competency paradox: graduates emerge from the programme academically certified but technically underprepared for the analytical demands of contemporary employment or self-employment.

Equally significant is the curriculum's "future-blind" orientation with respect to the green economy. The CCMAS demonstrates minimal engagement with the sustainable development competencies that the World Bank (2025) identifies as central to sub-Saharan African economic transformation. This is particularly consequential for Education Economics graduates, given that green finance, sustainable school management, and green educational consultancy represent significant and underexploited entrepreneurial niches. By failing to integrate these competencies, the CCMAS widens the gap between Nigerian graduates and their counterparts in economies that have already begun integrating sustainability into tertiary education frameworks.

The Intent–Action Gap and the Absence of Entrepreneurial Agency

Perhaps the most consequential finding of this audit is the gap between entrepreneurial awareness and entrepreneurial action. While the CCMAS articulates job creation as an intended graduate outcome, it fails to provide the experiential mechanisms, including internships,

incubation programmes, and industry-linked projects necessary to cultivate the entrepreneurial agency described by Bandura (2001). This finding reflects a structural breakdown in the Theory of Planned Behaviour (Ajzen, 1991): entrepreneurial intention does not translate into action when graduates lack perceived behavioural control and institutional enabling conditions.

Synthesis of Findings

The audit provides systematic responses to each of the study's research questions. In terms of practical integration, the curriculum demonstrates substantial theoretical depth, but lacks applied technical skills training and mandatory software instruction. With respect to niche identification, the CCMAS fails to provide structured pathways into discipline-specific self-employment niches such as EdTech or educational consultancy. Regarding future-readiness, the curriculum exhibits significant curricular silence on green skills and sustainability, anchoring graduates in an outdated economic paradigm. Finally, on the dimension of entrepreneurial agency, the transition from knowledge to action remains unsupported: without experiential learning and incubation infrastructure, graduates remain "economically inactive" despite being "academically qualified."

BMAS versus CCMAS: Functional Continuity

Taken as a whole, the audit suggests that while the CCMAS introduces structural innovations in the form of the 70/30 curriculum architecture, the transition from the BMAS is largely semantic rather than transformative. The reform prioritizes structural redesign over functional transformation, reproducing the same utility gap that characterized the preceding framework. These findings are consistent with Okebukola's (2023) assessment that Nigerian curriculum reform has historically privileged terminological modernization over substantive pedagogical change.

Conclusion

The transition from the BMAS to the CCMAS represents a necessary and well-intentioned intervention in Nigerian university education. The structural innovations introduced most notably the 70/30 curriculum flexibility, and the explicit incorporation of entrepreneurship modules reflect a genuine recognition of the need to align tertiary education with 21st-century economic realities. However, in the context of Education Economics, this study finds that the reform remains substantially incomplete.

The CCMAS continues to exhibit theoretical saturation, technological decoupling, and curricular silence on emerging sectors such as the green economy. Its entrepreneurship provisions, while structurally present, are insufficiently discipline-specific to cultivate the economic agency required for self-employment in a dynamic and competitive market. The potential for innovation embedded in the 30% institutional component has gone largely unrealized, constrained by infrastructural deficits and the absence of pedagogical transformation at the faculty level.

The overarching conclusion is that the current reform is more semantic than functional: it updates the terminology of Nigerian university education without substantively transforming graduate capability. Until curriculum reform in Nigeria is evaluated and operationalized through the lens of functional utility rather than structural compliance, the higher education system will continue to produce graduates who are academically certified but economically constrained. Bridging the utility gap is not merely an educational objective, it is an imperative for national economic transformation.

Recommendations

Based on these findings, the following recommendations are made:

I. Universities offering Education Economics programmes should integrate mandatory instruction in industry-standard analytical tools, including STATA, Python, and PowerBI to

shift the curriculum from theoretical orientation toward market-ready applicability.

II. The NUC should redesign the ENT 211 and ENT 312 entrepreneurship modules to move beyond generic business concepts, incorporating discipline-specific content focused on EdTech venture development, private educational consultancy, and data research services.

III. The NUC and the Federal Ministry of Education should lead a coordinated reform initiative to embed green skills and sustainability principles explicitly within the Education Economics curriculum framework, in alignment with global sustainable development agendas.

IV. The Federal Government of Nigeria and the Tertiary Education Trust Fund (TETFund) should prioritise funding for "Education-Data Labs" and digital resource centres. University managements must complement procurement with sustained maintenance and monitoring protocols to prevent technological decoupling during implementation.

V. Universities should establish education-focused innovation hubs and incubation programmes to provide Education Economics students with experiential learning opportunities and structured pathways to real-world venture creation.

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INNOVATIVE PEDAGOGICAL STRATEGIES FOR TEACHING ENVIRONMENTAL LITERACY IN AFRICAN CLASSROOMS

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Abstract

Environmental degradation, climate change, deforestation, flooding, desertification, and pollution have become pressing challenges across Africa. These realities necessitate the promotion of environmental literacy among learners at all levels of education. However, conventional teacher-centered instructional approaches have proven inadequate in equipping students with the critical thinking, problem-solving, and participatory skills needed for sustainable environmental action. This paper examines innovative pedagogical strategies for teaching environmental literacy in African classrooms. The paper adopts a qualitative review approach, drawing from recent literature on environmental education, eco-pedagogy, indigenous knowledge systems, inquiry-based learning, technology-enhanced instruction, and participatory teaching approaches. The study highlights strategies such as experiential learning, place-based education, storytelling, project-based learning, inquiry-based learning, collaborative learning, eco-pedagogy, and technology integration as effective approaches for enhancing environmental literacy. The paper further discusses the relevance of indigenous African knowledge systems in environmental education and identifies challenges hindering effective implementation, including inadequate teacher preparation, poor

infrastructure, insufficient instructional resources, and curriculum limitations. Recommendations are made for curriculum reform, teacher professional development, community engagement, and increased government support for environmental education initiatives. The paper concludes that innovative and culturally responsive pedagogical strategies are essential for developing environmentally literate citizens capable of promoting sustainable development in Africa.

Keywords: Environmental literacy, pedagogy, innovative teaching strategies, eco-pedagogy, sustainability, African classrooms.

Introduction

Environmental issues such as climate change, erosion, biodiversity loss, desertification, pollution, and deforestation are increasingly threatening sustainable development across African nations. These environmental crises have direct implications for health, agriculture, education, and socio-economic development. Consequently, education systems are expected to equip learners with the knowledge, attitudes, skills, and values required to respond effectively to environmental challenges. Environmental literacy refers to the capacity of individuals to understand environmental systems, identify environmental problems, and participate responsibly in actions that promote environmental sustainability. Environmental literacy encompasses environmental knowledge, critical thinking, problem-solving skills, attitudes, values, and responsible environmental behavior (Eheazu, 2017). Despite the importance of environmental literacy, many African classrooms still rely heavily on traditional lecture methods characterized by rote memorization and passive learning. Such approaches often fail to connect environmental concepts to learners' everyday realities and local ecological contexts. Recent educational studies emphasize the need for innovative, participatory, and context-sensitive pedagogical

strategies that can foster active learner engagement and sustainable environmental action (Lestari, Rahmawati, Ali, Sopandi, & Wulan, 2019).

This paper explores innovative pedagogical strategies suitable for teaching environmental literacy in African classrooms and discusses how these approaches can enhance learners' environmental awareness, critical thinking, and sustainable practices.

Conceptual Clarifications -- Environmental Literacy

Environmental Literacy has to do with the possession of relevant enlightenment and capabilities that enable an individual to take necessary steps, including becoming guides, for environmental replenishment and saving from further degeneration. Eheazu (2017) posits that Environmental literacy is a process which covers people's awareness of their environment and their acquisition of the knowledge, values, skills, experiences and determination which enables them to act either individually or collectively in harmony with forces and elements which surround them, in their daily activities. Environmental literacy covers an individual's understanding of environmental concepts and issues, combined with the ability and willingness to take informed actions toward environmental sustainability. It includes cognitive, affective, and behavioral dimensions that empower learners to make environmentally responsible decisions.

In these days of current environmental challenges confronting nations of the world – tsunami, flooding, deforestation, desertification, heatwaves, wild fires, oil spillage and the like - the need for environmentally literate persons to inform, to educate and to guide in the taking of the right steps, cannot be over-emphasized

Pedagogy --- It has to do with the activities of educating, teaching or instructing. It is especially understood to mean the strategies or

methods of instruction and their development. According to Eheazu (2017), the term refers to the methods, approaches, and practices used in teaching and learning in formal regular levels of education. Eheazu (2017) added that pedagogy principally involved the teaching of children. On the whole pedagogy involves the understanding, development and use of the methods of instruction concerning any educational level.

The state of affairs in Nigeria in this season is such that there is unprecedented need for more effective ways of confronting the myriad of challenges facing the society all over the land, Education as a major tool for achieving national goals and objectives, and is highly apt for confronting environmental challenges. Innovative pedagogy involves learner-centered, participatory, and transformative instructional approaches designed to improve engagement, creativity, critical thinking, and practical problem-solving. According to Haruna, Mohammed, Abdulsalam, et al. (2025) and Masonto, & Ntshoe, (2026)) innovative pedagogy is a great asset in the achievement of educational objectives.

Theoretical Framework -- This paper is anchored on Constructivist Learning and Transformative Learning Theories. Constructivist theory propounded by Piaget in the 1953s posits that learners actively construct knowledge through interaction with their environment and experiences. Environmental literacy education becomes effective when learners engage in inquiry, observation, experimentation, and community participation (Piaget, 1970).

Transformative leadership theory which was developed by James MacGregor Burns in the year 1978 and was later expanded upon by Bernard Bass emphasizes critical reflection, inspiration, motivation and behavioral change. The theory's relevance here is on the point that environmental education should not only transmit knowledge but

also transform learners' attitudes and actions toward environmental sustainability (Smith, 2018). Making the learners to understand the implications of environmental changes and the appropriate response to ensure that sustainability is maintained

Innovative Pedagogical Strategies for Teaching Environmental *Literacy*

The following are the major innovative pedagogical strategies identified for teaching environmental literacy:

1. Inquiry-Based or Problem-Based Learning -- Inquiry-based learning encourages learners to investigate real environmental problems through questioning, observation, research, and experimentation. Students actively participate in identifying environmental problems and then discovering the environmental solutions rather than passively receiving information. This makes the learners to build knowledge as well as decision-making skills (Musah, & Wangila, 2024); Dillon, 2002). Research shows that inquiry-based or problem-based approaches improve environmental problem-solving skills and critical thinking among learners (Dillon, 2002). In African classrooms, inquiry-based learning can involve the activities like investigating causes of local flooding, conducting soil and water testing, studying waste disposal practices in communities and examining the effects of deforestation. This strategy enhances learners' scientific reasoning and environmental awareness.

2. Place-Based Education ---- Place-based education connects learning to learners' local environments and community realities be they cultural, historical or natural physical environment. This strategy makes environmental education more relevant and meaningful by focusing on the learners' local ecological issues. Studies emphasize that teaching environmental concepts using community-based climate data and local environmental experiences increases student engagement and retention (Sobel, 2004). Examples of place-based activities would include studying erosion

sites in nearby communities, visiting farms, rivers, forests, and waste disposal areas, investigating local environmental problems and organizing community sanitation projects. Place-based learning as revealed by (Sobel, 2004) strengthens learners' emotional connection with their environment, and thus the desire for its sustainable maintenance.

3. Experiential Learning -- Experiential learning or outdoor learning involves "learning by doing." Learners participate in practical environmental activities that promote hands-on understanding of ecological concepts. The direct interaction with the natural environment significantly build the learners' environmental awareness, skills and emotional connection through first-hand experience (Ernst & Monroe, 2004)

Examples of experiential learning activities would include tree planting exercises, school gardening projects, recycling activities, environmental conservation campaigns, nature walks and field trips. A core strength of experiential learning includes the fact that it promotes active learner participation, environmental stewardship, and long-term behavioral change.

4. Project-Based Learning ---- Project-based learning engages students in solving real-life environmental problems through collaborative projects. The idea of this learning technique traced to John Dewey concerns real life activities that learners should individually carry out. It involves students being guided to freely determine the topic they like to work on, including the process of data gathering, analysis and drawing generalization. It is learner-centered, and leaves the teacher as guide and resource person for their projects which may be practical or theoretical (Chauhan, 1981). The teacher anchors this technique on solving real –life environmental problems. Projects such as designing waste management systems, developing climate awareness campaigns, constructing simple recycling models, and creating school environmental clubs – could be used.

Major strength of this teaching strategy include promoting creativity, collaboration, communication, and critical thinking skills.

5. Indigenous Knowledge Integration ----- African indigenous knowledge systems contain rich environmental wisdom developed through generations of interaction of the people with nature. The inter-connectedness of African people with their culture, and environment make them take actions that foster sustainability. The indigenous knowledge is already environment or place - based, societal values-driven, and action –oriented. Integrating this indigenous knowledge into classroom instruction enhances cultural relevance and promotes decolonized environmental education (Rheaume, 2024)).

As posited by Eheazu (2017) indigenous knowledge would foster ecological literacy in several ways:

a) Making learning culturally relevant and place-based It draws on local practices, e.g. Yoruba sacred grooves, Hausa "fadama" farming, Igbo "Mmiri" shrines for streams and rivers.
b) Developing environmental stewardship and values. African indigenous systems already teach respect for land, trees, water through proverbs, rituals and community laws. These would develop in the learner sense of responsibility for the planet and the stewardship which eco-pedagogy seeks to achieve
c) Building critical thinking and intercultural dialogue. Eco-pedagogy works with dialogue and reflection on human - environment connections. For instance, traditional soil fertility methods versus fertilizer use – it is easy for students to critique both of these and as well proffer solutions to them.
d) Low-cost practical activities. This method makes available ready –made experiential activities such as eco-based

storytelling, community mapping of medicinal plants, participation in communal tree planting, and the like.

e) Strengthening Community - school link. Community elders and other members could become co-teachers teaching aspects of the indigenous knowledge which would cover for insufficiency of teachers and as well promote learning as an act that continues beyond the classroom

Other examples of innovative ways of teaching eco-pedagogy include teaching environmental conservation through local proverbs, using folktales to explain ecological balance, learning traditional farming and water conservation methods, andngaging community elders in environmental discussions. Storytelling and oral traditions help learners connect environmental values with their cultural identities.

6. Collaborative and Participatory Learning --- Learning hear moves beyond awareness creation to action. Under the guidance of the teacher the students are made to plan and implement environmental projects in groups. Collaborative learning promotes teamwork, dialogue, and shared responsibility in environmental problem-solving. Among the many activities that could be used to conduct this study are going on Recycling drives, tree planting, advocacy campaigns, group discussions, environmental debates, community action projects, peer teaching and environmental clubs. This action –oriented participatory pedagogies foster democratic engagement and encourage learners to become active environmental citizens (Jansen & Schnack, 1997).

7. Systems Thinking Approach --- This techniques of teaching environmental literacy teaches students to view environmental issues as interconnected systems and not as isolated problem. As posited by UNESCO (2017), this technique uses some tools such as concept maps, causal loops and models to understand feedback,

interdependence and unintended consequences. Examples of activities that could be used in systems thinking techniques include identifying clogged gutters and figuring out what gut it clogged and where it came from, identifying worn paths in lawns and figuring out why the path got won and why it is maintained, removing a patch. in the vegetation and tracing the possible consequences to the flora and fauna; and diverting water flows from its natural course and noting the consequences. System thinking approach according to Jansen & Schnack (2017) foster deeper understanding of the consequences of environmental activities.

8. Eco-Pedagogy ---- Eco-pedagogy is one of the major innovative teaching methods. It sees humans (and animals) and the environment as interconnected, and rejects the separation of humans and nature as well as social issues and environmental issues. The method builds on Paulo Freire's critical pedagogy and according to Rheaume (2024) its purpose is to get the students from the level of Awareness to Reflection and then to Action for social and environmental justice and planetary sustainability. It thus emphasizes environmental justice, sustainability, and critical consciousness. It encourages learners to question environmental exploitation and advocate for ecological sustainability. Eco-pedagogical approaches connect environmental issues with social, economic, and political realities affecting African communities. Eco-pedagogy encourages several group activities such critical reflection, environmental activism, community engagement and sustainable living practices. Examples of learning activities for teaching eco-pedagogy are collaborative local projects such as mapping drainage blockage, effective thinking for instance asking students to write about water flow in their environment or their connection to nature, environmental outdoor learning and digital story-telling on eco-practices using video or short stories.

9. Technology-Enhanced Learning --- This is an instructional technique that intentionally uses technological tools to support, enrich and extend teaching and learning. It improves access to and engagement in teaching learning and the outcomes (UNESCO, 2021). Digital technologies can significantly improve environmental literacy instruction through interactive and multimedia learning experience. As an innovative teaching strategy. Technology - enhanced learning involves digital delivery of content – via use of videos, simulations, e-bools, animations and Learning Management Systems like Google Classroom to present lessons, interactive and collaborative tools – Quizzes on Kahoot, discussion forum, WhatsApp /Telegraph groups. Immediate feedback could be given by students who would work in group in and outside the class, personalized and self-paced learning – Lessons can be replayed, adaptive quizzes can be taken, and apps can be used at the learner's pace. data for assessment and feedback – learner participation, quiz scores, and time –on-task can be tracked through digital platforms for targeted support, and blended approach – face-to-face teaching can be combined with on-line resources (UNESCO, 2021).

Technology-based approaches to teaching environmental literacy would include climate simulation software, educational videos, mobile learning applications, online environmental campaigns, and Geographic Information Systems (GIS). Technology integration enhances learner engagement and access to global environmental information.

Challenges Facing Environmental Literacy Education in African Classrooms

Despite the benefits of innovative pedagogical approaches, several challenges could hinder effective implementation of the approaches. The following major ones need to be noted:

Inadequate Teacher Preparation. Some teachers have not acquired the training they need to undergo in order to become effective school teachers. Many teachers lack specialized training in environmental education and innovative instructional methods. Such teachers do not have what it takes to effectively teach ecological literacy

Poor Infrastructure and Resources. That is there is significant non-availability of the required buildings, laboratory equipment, studios, tools and other materials needed for effective teaching and learning of ecological literacy. Limited access to laboratories, instructional materials, internet connectivity, and digital tools constrains effective environmental teaching.

Overcrowded Classrooms. This make learning interaction difficult as almost all materials used for the teaching and learning are insufficient for the learners because of the over -crowding. Difficulty to see the board, to move in the class, to be heard, to manage class, and the like abound.
Large class sizes make participatory and experiential learning difficult. There would be too may groups to be guided by the teachers, there would be too few seats, and insufficient space for the students

Curriculum Limitations. Environmental education is often infused into other subjects rather than taught as a distinct subject area, resulting in fragmented implementation.
Financial Constraints Field trips, environmental projects, and technology integration require funding that many schools lack.

Recommendations
In order to promote environmental literacy in African classrooms, and enjoy the benefits therefrom, the following recommendations are proposed, drawing from Zhou, (2025): Governments should integrate environmental literacy as a core component of school curricula. Teacher education institutions should provide training on

innovative environmental pedagogies. Schools should promote experiential and community-based environmental projects. Indigenous environmental knowledge should be incorporated into instructional practices. Educational institutions should invest in digital technologies for environmental learning. Partnerships should be established among schools, communities, NGOs, and environmental agencies. Environmental clubs and sustainability initiatives should be encouraged in schools.

Conclusion

Environmental literacy is essential for addressing Africa's growing environmental challenges and achieving sustainable development. Traditional teacher-centered methods are insufficient for promoting deep environmental understanding and responsible action among learners. Innovative pedagogical strategies such as inquiry-based learning, experiential learning, place-based education, eco-pedagogy, collaborative learning, indigenous knowledge integration, and technology-enhanced instruction provide effective pathways for improving environmental literacy in African classrooms. These learner-centered approaches promote critical thinking, environmental responsibility, and sustainable behavior. Educational policymakers, curriculum developers, and teachers, therefore, must embrace innovative and culturally relevant pedagogies to equip African learners with the competencies needed for environmental sustainability. A reform as this can help develop environmentally responsible citizens capable of contributing to sustainable development goals

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LEADERSHIP FOR CLIMATE ACTION, ENVIRONMENTAL SUSTAINABILITY, AND GREEN GOVERNANCE

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Abstract

This study examines the role of leadership in advancing climate action, environmental sustainability, and green governance in Africa. Against intensifying climate change and growing policy commitments such as the African Union's Agenda 2063, the study explores how leadership styles shape environmental outcomes and sustainability transitions. Grounded in leadership theory and climate governance frameworks, it analyses the mechanisms through which leadership drives climate resilience, innovation, and coordinated environmental action. Adopting a qualitative analytical approach, the study synthesises conceptual insight and policy-oriented evidence to examine five leadership dimensions-transformational, visionary, crisis, economic, and technological-and their contribution to climate mitigation, adaptation, and sustainable development. Particular attention is given to leadership roles in renewable energy adoption, institutional strengthening, and stakeholder collaboration. The findings show that effective leadership is central to translating climate policy into action: transformational and visionary leadership sustain long-

term commitment and strategic direction, economic and technological leadership drive green growth and innovation, crisis leadership strengthens adaptive capacity, and accountability mechanisms sustain transparency and effectiveness, while weak leadership structures significantly constrain environmental governance. The study contributes to climate governance scholarship by positioning leadership as a pivotal, multi-dimensional, and institutionally contingent determinant of sustainability outcomes in Africa, concluding that environmental sustainability requires integrated leadership approaches that align policy, innovation, and institutional capacity with climate action priorities.

Keywords: Leadership; Climate action; Environmental sustainability; Green governance; Climate resilience and Sustainable development.

Introduction

The accelerating pace of climate change is one of the most consequential governance challenges confronting humanity in the twenty-first century. Rising temperatures, extreme weather, sea-level rise, and biodiversity loss are reshaping ecosystems, economies, and communities worldwide, with disproportionate severity in Africa, which contributes less than 4% of global cumulative emissions yet bears the heaviest burden of climate impacts, food insecurity, water stress, disease, coastal inundation, and displacement, at a scale that threatens decades of development progress (IPCC, 2022; Boko et al., 2007). In this context, the question of leadership, who leads the response, with what vision, through what mechanisms, and with what institutional architecture, is not merely academic; it is a matter of survival, justice, and civilisational priority.

Leadership is a well-established determinant of collective responses to complex challenges (Burns, 1978; Bass & Avolio,

1994). In the climate domain it operates across scales, from heads of state committing to emissions targets to community leaders mobilising local adaptive responses, requiring a framework rich enough to capture how different leadership styles and institutional roles contribute to climate action (Levin et al., 2012; Biermann et al., 2012). Africa's 54 countries, spanning widely divergent stages of development, institutional capacity, and climate vulnerability, provide a natural experiment in the conditions under which leadership approaches succeed or fail (Adeola & Evans, 2020; AfDB, 2022), against the benchmark set by the African Union's Agenda 2063 commitment to inclusive, climate-resilient development.

This study examines how leadership styles and institutional configurations shape climate action, environmental sustainability, and green governance in Africa, analysing five dimensions, transformational, visionary, crisis, economic, and technological, and their distinct contributions to mitigation, adaptation, green growth, and institutional accountability. Adopting a qualitative analytical approach synthesising conceptual frameworks, case evidence, and policy analysis, the study positions leadership as a pivotal determinant of sustainability outcomes and articulates the institutional conditions under which it translates into effective climate policy and action.

Theoretical Foundations: Leadership and Climate Governance

Leadership Theory in the Sustainability Framework

Leadership scholarship has evolved from trait-based approaches toward relational, contextually sensitive frameworks suited to multi-level, multi-actor governance (Burns, 1978; Bass, 1985). Transformational leadership theory, articulated by Burns (1978) and operationalised by Bass and Avolio (1994), is particularly influential in sustainability governance: transformational leaders

inspire followers to transcend self-interest for a higher collective purpose, well suited to mobilising sustained commitment to climate objectives whose costs are borne now and whose benefits accrue over decades (Egri & Herman, 2000). Visionary leadership, articulating credible long-term visions and aligning institutional action with them, is similarly critical for the net-zero transition, distinguished by its emphasis on foresight and strategic roadmapping rather than primarily motivational qualities (Shrivastava et al., 2020; Mumford & Licuanan, 2004). Crisis leadership theory extends this architecture through adaptive governance, the capacity of institutions and leaders to recognise, respond to, and learn from climate-related shocks, an increasingly critical determinant of resilience as extreme weather, droughts, and displacement intensify (Folke et al., 2005; Heifetz et al., 2009).

Climate Governance Frameworks and the Role of Leadership

Climate governance is the formal and informal rules, institutions, and norms through which decisions about mitigation and adaptation are made and enforced across governance levels, from the global UNFCCC architecture to national governments and civil society (Biermann et al., 2012). Within this polycentric architecture (Ostrom, 2010), leadership is the integrating mechanism that transforms fragmented, multi-actor systems into coherent responses. Africa's climate governance landscape layers international commitments, continental frameworks such as Agenda 2063, regional mechanisms, and national institutions of widely varying quality (AfDB, 2022; UNFCCC, 2015); leadership failure at any level can create governance gaps that undermine implementation, a persistent challenge across the continent (Nhamo & Mjimba, 2020).

Transformational and Visionary Leadership For Sustainability Transitions

Transformational Leadership and Climate Commitment

Transformational leadership shapes climate governance through idealised influence (credible role-modelling), inspirational motivation (compelling visions that mobilise commitment), intellectual stimulation (challenging assumptions about the incompatibility of growth and sustainability), and individualised consideration (tailoring engagement to stakeholders' concerns) (Bass & Avolio, 1994; Egri & Herman, 2000). Rwanda illustrates its effect at the national level: President Paul Kagame's sustained commitment to environmental governance, articulated through Vision 2050 and the Green Growth and Climate Resilience Strategy, has produced ambitious forest restoration targets, renewable energy expansion, and the integration of climate resilience into national planning, positioning climate action as central to Rwanda's development identity (World Bank, 2021; Nhamo & Mjimba, 2020). Similar dynamics are visible sub-nationally, where transformational city leadership within the C40 Cities network, spanning Accra, Cape Town, Lagos, and Nairobi, has shown that ambitious urban climate action is politically viable and economically advantageous (C40 Cities, 2023).

Visionary Leadership and Long-Term Sustainability Roadmaps

Visionary leadership contributes most distinctively through long-term sustainability roadmaps that provide direction for the transitions net-zero development requires, addressing the structural mismatch between the long-time horizons of climate change and the short-term incentives of electoral politics (Shrivastava et al., 2020). Agenda 2063 embodies this at the continental level, though its translation into outcomes depends on national leaders adapting the framework, mobilising finance, and building implementation capacity (African Union, 2015).

Morocco's Noor Ouarzazate Concentrated Solar Power complex, among the world's largest, embodies a decade-long visionary commitment to positioning Morocco as a clean energy leader and reaching 52% renewables in its electricity mix by 2030, sustained through high-level political commitment and innovative financing despite significant obstacles (IRENA, 2022; AfDB, 2022).

Crisis Leadership and Climate Resilience

Adaptive Leadership in Climate-Stressed Environments

Adaptive leadership, developed by Heifetz et al. (2009), holds that challenges such as climate change are "adaptive" rather than "technical": they cannot be resolved through existing institutional routines but require genuine change in values, behaviours, and institutional arrangements, mobilising constituents to experiment, learn, and adjust to often irreversible impacts while managing the resistance such change entails (Pelling, 2011). Africa's exposure to recurring crises, catastrophic flooding in Nigeria (2022), Cyclones Idai and Kenneth in Mozambique (2019), prolonged Sahel droughts, and El Niño-driven food crises, creates persistent testing environments for crisis leadership at every governance level (IPCC, 2022; OCHA, 2023). Mozambique's response to Cyclone Idai illustrates both the capacity and limits of such leadership: effective international coordination and President Filipe Nyusi's leadership secured a strong humanitarian response, yet reconstruction revealed limited capacity to translate crisis response into the deeper reforms, resilient building codes, coastal zone management, early warning upgrades, needed to reduce future vulnerability (OCHA, 2023; Boin et al., 2017).

Leadership for Early Warning, Preparedness, and Community Resilience

Proactive crisis leadership also depends on the institutional systems, early warning, preparedness, risk-sensitive land use planning, that reduce vulnerability before crises strike. The African

Risk Capacity initiative, providing parametric insurance and rapid response financing to African Union member states, illustrates this continental institutional leadership, though its effectiveness depends on national ministerial champions and cross-agency coordination (ARC, 2023). At the community level, traditional authorities, local officials, and indigenous knowledge holders often provide the most direct resilience leadership where formal governance is weakly institutionalised, bridging national policy and community practice; strengthening this local capacity, through decentralisation and leadership development, remains a critical institutional priority (Agrawal & Perrin, 2009).

Economic And Technological Leadership For Green Growth
Economic Leadership and the Green Economy Transition

Economic leadership for climate action is the capacity to redirect economic incentives, public investment, and fiscal policy toward low-carbon development, the green economy transition (UNEP, 2011). This is demanding in African contexts, where poverty reduction, employment, and energy access imperatives generate genuine tensions with climate objectives, and where constrained institutional capacity, fiscal space, and short-term political incentives limit governments' ability to design and implement green economy packages (AfDB, 2022; Fankhauser et al., 2013). It requires designing green fiscal frameworks, carbon pricing, and subsidy reform that redirect investment while managing distributional effects; the political courage to reform entrenched fossil fuel interests; and the ability to mobilise international climate finance to complement constrained domestic budgets (Fankhauser et al., 2013). Kenya's geothermal sector illustrates such leadership: KenGen's investment in the Olkaria complex has positioned Kenya as the world's seventh-largest geothermal producer, supplying over 750 MW of clean base-load electricity through decades of sustained investment and policy continuity across successive governments (KenGen, 2023; IRENA, 2022).

Technological Leadership and Innovation for Climate Solutions

Technological leadership is the capacity to identify, invest in, deploy, and scale emissions-reduction and adaptation technologies and to create enabling policy environments for innovation (Jacobsson & Lauber, 2006). Africa's challenge is distinctive: expanding energy access for roughly 600 million people who lack electricity, industrialising, and transforming agriculture, all within pathways consistent with the 1.5°C target, while pursuing technological leapfrogging that bypasses carbon-intensive developmental stages (UNCTAD, 2021). East Africa's off-grid solar expansion, enabling over 10 million households across Kenya, Tanzania, Ethiopia, and Rwanda to access clean electricity, reflects sustained technological leadership supported by development finance institutions and an innovative private sector (IEA, 2022). Sustained leadership also requires investment in research infrastructure and innovation ecosystems; institutions such as South Africa's Council for Scientific and Industrial Research and Morocco's Institute for Research in Solar Energy and New Energies provide the knowledge infrastructure underpinning national technological leadership commitments (AfDB, 2022).

Institutional Frameworks, Accountability, And Green Governance

Building Institutions for Environmental Governance

Green governance, the integration of environmental sustainability into the core frameworks and accountability systems of public governance, is both a product of effective leadership and a prerequisite for its sustained exercise (Lemos & Agrawal, 2006). It encompasses environmental legislation, governance institutions with genuine independence, transparency mechanisms such as environmental impact assessment, and judicial systems capable of enforcing environmental law. Institutional quality varies widely across Africa: a cluster of countries, including Botswana, Mauritius,

Namibia, Rwanda, and Seychelles, have built relatively robust environmental institutions and consistently outperform peers on governance indices, outcomes directly attributable to sustained, high-quality leadership (World Bank, 2023; Mo Ibrahim Foundation, 2022). Elsewhere, under-resourced ministries, captured impact-assessment processes, and judicial systems lacking capacity reflect institutional deficiencies that are themselves leadership failures, choices by successive leaders to prioritise short-term gains over long-term institutional investment (Nhamo & Mjimba, 2020).

Accountability, Transparency, and Stakeholder Collaboration

Effective green governance also requires robust accountability: international accountability through Nationally Determined Contribution review under the Paris Agreement (UNFCCC, 2015); parliamentary scrutiny; civil society accountability through advocacy and community monitoring; and corporate accountability through mandatory reporting and investor ESG scrutiny (Biermann et al., 2012). Pan-African youth climate movements have emerged as significant accountability actors, combining domestic advocacy with international engagement to pressure leaders who might otherwise deprioritise long-term climate commitments (UNEP, 2023). Climate challenges are inherently multi-stakeholder problems whose causes, consequences, and solutions are distributed across governments, businesses, civil society, and communities; effective climate leaders must therefore be coalition builders, capable of convening partnerships that combine governmental authority, business resources, civil society legitimacy, and community knowledge (Ostrom, 2010). The African Climate Foundation's support for African negotiators illustrates this multiplier effect, strengthening the continent's ability to advocate for the climate finance and technology transfer provisions central to its climate resilience and development prospects (ACF, 2023).

Discussion And Policy Implications

The analysis converges on two conclusions. First, leadership is not merely a facilitating factor for climate governance but a constitutive determinant of its quality and effectiveness; contrasts between high- and low-performing African climate governance systems are traceable, in substantial measure, to differences in leadership quality across transformational vision, crisis adaptive capacity, economic policy courage, and technological investment commitment. Second, effective climate leadership requires the integration of multiple leadership capabilities rather than the dominance of a single style, transformational leadership providing motivational foundations, visionary leadership strategic direction, crisis leadership flexibility and learning, economic leadership fiscal instruments, and technological leadership innovation capacity, mediated critically by institutional context: even the most visionary individual leaders are severely constrained where legislation, regulatory capacity, and accountability mechanisms are inadequate, while strong institutions can sustain governance quality through periods of weak political leadership.

These findings carry multi-level policy implications. The African Union should strengthen the accountability mechanisms linking Agenda 2063 commitments to measurable governance performance and invest in peer learning on effective climate leadership practices. National governments should embed climate governance accountability within broader public sector accountability frameworks and invest in leadership development from senior officials to local government and traditional authorities. International development partners should move beyond project-specific financing toward sustained leadership and institutional capacity investment, incorporating leadership and governance quality criteria into their country engagement and allocation frameworks, including through the Green Climate Fund and the Loss and Damage Fund.

Conclusion

This study examined the role of leadership in advancing climate action, environmental sustainability, and green governance in Africa, analysing five leadership dimensions, transformational, visionary, crisis and adaptive, economic, and technological, and showing how each, when supported by effective institutions and accountability mechanisms, strengthens climate governance. African cases, Rwanda's environmental governance reforms, Morocco's renewable energy transition, Kenya's geothermal development, and East Africa's off-grid solar expansion, demonstrate that strong climate leadership generates measurable environmental and socio-economic benefits, while weak institutions, limited accountability, and short-term political interests continue to constrain governance effectiveness across much of the continent.

The study's principal scholarly contribution lies in reframing leadership, within African climate governance research, from a peripheral facilitating factor into a constitutive, multi-dimensional determinant of sustainability outcomes. Where prior scholarship has largely examined individual leadership styles or institutional quality in isolation, this study integrates five leadership dimensions into a single analytical framework and demonstrates, through cross-national African case evidence, that their effectiveness is conditional on institutional embeddedness rather than on individual leadership capability alone. This integrated, institutionally contingent framework offers a more complete account of the leadership-sustainability nexus than single-style or purely institutional analyses, and provides a transferable analytical lens for examining climate governance performance in other developing regions characterised by similarly fragile institutions and high climate vulnerability.

Future research should build on this framework in three directions: systematic comparative and quantitative studies testing the relative

explanatory weight of the five leadership dimensions against institutional quality indicators across a larger sample of African states; longitudinal research tracking leadership transitions within individual countries to help establish the causal direction between leadership quality and institutional strengthening; and further inquiry into the leadership dynamics of sub-national and community-level actors, whose roles this study identifies as critical but under-theorised relative to national executive leadership. Leadership failures carry substantial costs in ecosystem degradation, reduced agricultural productivity, displacement, and lost development opportunities; effective, institutionally embedded leadership, by contrast, can advance climate resilience, green growth, clean energy access, and sustainable livelihoods. Leadership is therefore not merely desirable but essential to achieving effective climate governance and sustainable development across Africa.

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NATURAL CAPITAL RISK AND CORPORATE STRATEGY: INTEGRATING BIODIVERSITY INTO BUSINESS DECISION-MAKING

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Abstract

This study examines the strategic implications of natural capital risk for corporate decision-making, with emphasis on integrating biodiversity considerations into business strategy. As nature loss increasingly emerges as a material risk factor, firms face growing exposure to disruptions arising from ecosystem degradation. Drawing on the natural capital framework and risk management theory, the study investigates how ecosystem dependency and risk exposure influence financial performance, and how firms can respond through biodiversity-informed strategic choices. Using an unbalanced panel of 1,850 publicly listed firms across 32 countries and 18,214 firm-year observations (2005–2022), built from Bloomberg, Refinitiv, GRI, and Sustainalytics data with a fully documented cleaning and variable-construction protocol, the study applies fixed effects and system GMM estimators to address endogeneity and unobserved heterogeneity. Firms with high ecosystem dependency face significant financial risks when biodiversity loss intensifies, particularly absent proactive mitigation, while firms integrating biodiversity into strategy demonstrate greater resilience and improved outcomes over time.

Nature-related risks are increasingly priced into market valuations, an effect concentrated among directly extractive sectors, with the discussion extending to developing economies where ecosystem dependence is high but disclosure capacity remains limited. The study contributes to the emerging natural capital literature by positioning biodiversity loss as a core strategic concern rather than a peripheral environmental issue, presenting full regression output, variable-construction protocols, and diagnostic tests to support transparency and replication.
Keywords: Natural capital risk; Biodiversity loss; Ecosystem dependency; Financial performance; Corporate strategy and Environmental risk management.

Introduction

The relationship between corporate strategy and the natural environment has undergone a fundamental reappraisal in recent years. Whereas environmental considerations were historically confined to regulatory compliance, mounting evidence of ecosystem degradation has repositioned natural capital risk as a core strategic and financial concern: biodiversity loss, habitat destruction, soil degradation, freshwater depletion, and ocean acidification represent material disruptions to the supply chains, resource inputs, and operating environments that underpin corporate value creation (Dasgupta, 2021; IPBES, 2019; World Economic Forum, 2023). Natural capital, the stock of renewable and non-renewable resources from which ecosystem services flow, contributes an estimated USD 125–140 trillion annually to the global economy (Costanza et al., 2017), yet conventional financial accounting has systematically failed to value or even recognise this capital stock, rendering its depletion invisible until disruptions materialise as operational losses, supply chain shocks, or regulatory penalties (Dasgupta, 2021).

The business community has begun to respond, albeit unevenly. TNFD released its final framework in 2023 (TNFD, 2023); as of 2026 it is completing its remaining technical work before folding its recommendations into an incoming ISSB nature-related disclosure standard (ISSB, 2025). The Kunming-Montreal Global Biodiversity Framework (2022) commits governments to align financial flows with biodiversity objectives and require large corporations to disclose biodiversity dependencies (CBD, 2022). Despite this momentum, academic literature linking biodiversity loss, ecosystem dependency, and corporate financial performance remains nascent: prior research examines environmental performance and financial outcomes broadly (Friede et al., 2015; Margolis et al., 2009), but the mechanisms through which biodiversity loss creates financial risk remain under-researched (Johnson et al., 2020; PwC, 2023).

Drawing on the natural capital framework (Costanza et al., 1997; Daily et al., 2009) and risk management theory, this study investigates how ecosystem dependency and nature-related risk exposure influence corporate financial performance, and how firms that proactively integrate biodiversity into strategy achieve differential outcomes, using a panel dataset with varying ecosystem reliance and fixed effects and system GMM estimators. It makes three contributions: empirical evidence that biodiversity-related risk is financially material across industries; demonstration that biodiversity-informed strategies mitigate this exposure and generate superior outcomes; and firm-level empirical validation of the emerging TNFD and natural capital accounting discourse, presented with full regression output, variable-construction documentation, and diagnostic tests to support transparency and replication.

Literature Review

Natural Capital and the Ecosystem Services Framework

The conceptual foundations of this study rest on the natural capital framework, which treats the natural environment as a stock of assets generating flows of goods and services essential to economic activity (Costanza et al., 1997). Ecosystem services have been catalogued into provisioning, regulating, cultural, and supporting categories and extended into the business context (Daily et al., 2009). Daily et al. (2009) further showed that natural capital depletion follows threshold and irreversibility dynamics: once ecosystem thresholds are crossed, the services they support cannot be readily substituted, generating discontinuous rather than incremental losses for dependent firms, a non-linearity that motivates incorporating ecological risk into corporate risk management.

Natural Capital Risk and Corporate Financial Performance

The literature distinguishes physical risks (direct ecosystem service degradation), transition risks (policy and market changes such as land use regulation), and reputational and liability risks (public exposure of biodiversity impacts or litigation) (TNFD, 2023). Helm (2015) developed a natural capital accounting framework transforming biodiversity risk into a measurable balance-sheet liability, advanced by tools such as the Corporate Ecosystem Services Review (Hanson et al., 2012) and ENCORE (NCFA, 2020). The natural resource-based view (Hart, 1995) predicts environmental capabilities generate competitive advantage, broadly supported by meta-analytic evidence: Friede et al. (2015), synthesising over 2,000 studies, found around 90% report a non-negative ESG-financial performance relationship, and Margolis et al. (2009) found a small but robust positive effect across 251 studies. However, most of this literature relies on composite ESG or carbon-emission proxies rather than biodiversity-specific indicators, a gap Johnson et al. (2020) and

PwC (2023) identify as critical given the systematic under-research of biodiversity relative to climate.

Ecosystem Dependency, Disclosure, and Market Pricing

Ecosystem dependency and supply chain risk are documented channels through which biodiversity loss creates financial vulnerability: Siebert et al. (2017) found pollinator-dependent food and beverage firms face supply exposures worth billions annually, and Lambin et al. (2018) documented that commodity-driven deforestation concentrates biodiversity risk in agricultural supply chains; Chava (2014) found firms with environmental concerns face higher loan spreads, and Krueger et al. (2020) found investors increasingly integrate environmental risk into equity valuations. The regulatory architecture has evolved rapidly: TNFD recommends disclosure across governance, strategy, risk management, and metrics (TNFD, 2023), and the EU's CSRD originally required large EU firms to report biodiversity impacts under ESRS E4 (European Commission, 2023), though the 2025–2026 'Omnibus' package has since narrowed CSRD's scope to firms exceeding 1,000 employees and €450 million turnover and streamlined the standards (EFRAG, 2025). Bernstein et al. (2019) and Giglio et al. (2021) showed analogous disclosure requirements accelerated the pricing of physical climate risk into financial assets; this study tests whether comparable dynamics are emerging for biodiversity risk.

Methodology

Data and Sample Construction

The empirical analysis employs an unbalanced panel dataset of publicly listed firms spanning multiple industries over 2005–2022, drawn from the constituents of the MSCI All Country World Investable Market Index. Firms were stratified across high-, medium-, and low-ecosystem-dependency industries, classified using the ENCORE database (NCFA, 2020) and corroborated

against IPBES (2019) sectoral dependency assessments; high-dependency sectors include agriculture, food and beverage manufacturing, forestry and paper products, fishing and aquaculture, pharmaceuticals, and water utilities, medium-dependency sectors include construction, chemicals, and consumer goods, and low-dependency sectors include financial services, information technology, and telecommunications.

Firms with fewer than three consecutive years of financial data, those unclassifiable under the ENCORE taxonomy, and those domiciled in jurisdictions lacking reliable World Governance Indicators coverage were excluded. Missing values were addressed through listwise deletion where missingness exceeded 20% of firm-year observations for a variable, and firm-level linear interpolation for gaps of two years or fewer; all continuous financial variables were winsorised at the 1st and 99th percentiles by year. This yielded a final sample of 1,850 firms across 32 countries and 18,214 firm-year observations (Table 1); 1,390 firms (75.1%) are domiciled in high-income OECD economies and 460 (24.9%) in middle- and low-income economies, principally in Latin America, Sub-Saharan Africa, and South and Southeast Asia.

Financial performance data are sourced from Bloomberg Terminal and Refinitiv Eikon; environmental and biodiversity metrics are constructed from Corporate Ecosystem Services Review assessments, Bloomberg ESG biodiversity sub-scores, GRI 304 disclosure data, and Sustainalytics supply chain risk scores; governance variables derive from the World Governance Indicators and MSCI ESG ratings. The compiled dataset, construction code, and coding protocols are available from the corresponding author upon reasonable request.

Table 1: Descriptive Statistics (N = 18,214 firm-year observations)

Variable	Mean	SD	Min	Max
ROA (%)	7.6	6.8	-18.4	34.2
ROE (%)	12.3	11.5	-29.6	52.7
Tobin's Q	1.86	0.94	0.42	6.13
Ecosystem Dependency (ED)	42.7	24.6	3.1	96.8
Nature-Related Risk Exposure (NRRE)	38.5	19.2	2.4	91.0
Biodiversity Strategy Index (BSI)	0.34	0.29	0.00	1.00
Firm Size (ln total assets)	14.2	1.8	9.6	19.4
Leverage (debt-to-equity)	0.58	0.35	0.00	2.10

Source: *Authors' compilation from Bloomberg, Refinitiv, GRI, and Sustainalytics data (2026).*

Variable Specification

Financial performance is measured using the accounting-based return on assets (ROA) and return on equity (ROE), and the market-based Tobin's Q. The primary independent variables are Ecosystem Dependency (ED), a continuous 0–100 index from ENCORE sectoral scores and firm-level input exposure, and Nature-Related Risk Exposure (NRRE), an index of vulnerability to biodiversity loss, regulatory transition, and supply chain disruption sourced from Sustainalytics.

The Biodiversity Strategy Index (BSI) is a weighted composite of three components, each independently double-coded on a 0–1 scale: GRI 304 disclosure completeness (40% weight, a twelve-item checklist covering operations near protected areas, impact descriptions, and habitat protection actions); TNFD pilot programme alignment (30% weight, scored against the firm's progress on the Locate-Evaluate-Assess-Prepare approach); and sustainability report

content analysis (30% weight, a keyword and thematic coding protocol). Inter-coder reliability, assessed via Cohen's kappa across a 15% double-coded subsample, returned $\kappa = 0.81$, and the composite's internal consistency returned a Cronbach's alpha of 0.77; the continuous BSI is dichotomised at the sample median for the univariate comparisons in Section 4.1. Control variables include firm size (log total assets), leverage, R&D intensity, capital expenditure intensity, and industry, country, and year fixed effects.

Econometric Specification

The baseline panel regression model takes the following form:

$$FP_{it} = \alpha_i + \beta_1 ED_{it} + \beta_2 NRRE_{it} + \beta_3 BSI_{it} + \beta_4 (ED \times BSI)_{it} + \beta_5 X_{it} + \gamma_i + \delta_t + \varepsilon_{it} \quad \textbf{(1)}$$

where FP_{it} denotes the financial performance indicator (ROA, ROE, or Tobin's Q) for firm i in year t; ED_{it} is the ecosystem dependency index; $NRRE_{it}$ is the nature-related risk exposure index; BSI_{it} is the biodiversity strategy index; $(ED \times BSI)_{it}$ is the interaction term capturing the moderating effect of biodiversity strategy; X_{it} is a vector of firm-level controls; γ_i and δ□ are firm and year fixed effects; and ε_{it} is the idiosyncratic error term.

The Hausman test adjudicates between fixed effects (FE) and random effects (RE) estimators ($p < 0.05$ in favour of FE across all three dependent variables; Table 3). Given the anticipated endogeneity of both BSI and NRRE, the system GMM estimator of Blundell and Bond (1998) is employed as the primary estimator, with instruments consisting of lagged levels and differences of the endogenous variables; instrument validity is assessed via the Hansen J-test and the Arellano-Bond AR(2) test, with full diagnostics reported alongside coefficients in Table 2.

Robustness Checks

Robustness is assessed via alternative performance measures (operating cash flow margin, price-to-earnings ratio), a split into high- and low-dependency subsamples, an IV approach instrumenting BSI with industry-peer average BSI, and the Pesaran (2004) cross-sectional dependence test, with panel-corrected standard errors applied where dependence is detected.

Results And Discussion

Descriptive Analysis and Preliminary Evidence

Table 1 reveals substantial heterogeneity in ecosystem dependency. Firms in agriculture, food and beverage, and forestry record mean ED scores of 78.4, 66.2, and 71.9 respectively, reflecting reliance on soil fertility, freshwater, and forest services, while IT and financial services record 14.3 and 11.8. NRRE correlates positively but imperfectly with ED ($r = 0.54$, $p < 0.001$), indicating regulatory and reputational dimensions add variation beyond dependency alone. Univariate comparisons show significantly higher Tobin's Q for high-BSI firms (2.14 vs. 1.73, $t = 6.42$, $p < 0.001$) and a smaller but significant ROA differential (8.2% vs. 7.1%, $t = 3.11$, $p = 0.002$), consistent with biodiversity strategy delivering returns over the medium to long run rather than immediate cost savings.

Main Regression Results

Table 2 reports the system GMM estimates for all three financial performance indicators, alongside diagnostics confirming instrument validity. Ecosystem dependency is negatively and significantly associated with financial performance across specifications: a ten-point increase in ED is associated with a 0.62 percentage point decline in ROA and a 0.11-unit reduction in Tobin's Q, effects that, for a firm at the 75th percentile of ED, imply an annual profitability erosion roughly equivalent to a 7–8% increase in input costs. NRRE is independently and negatively

associated with performance even after controlling for dependency, consistent with impacts operating through both direct operational and indirect regulatory and reputational channels (Chava, 2014; Krueger et al., 2020). BSI is positively and significantly associated with all three metrics, and the ED × BSI interaction is positive and significant throughout, indicating biodiversity strategy delivers roughly twice the financial benefit at the 75th percentile of ED relative to the 25th.

Table 2: System GMM Regression Results

Variable	ROA	ROE	Tobin's Q
Ecosystem Dependency (ED)	-0.062*** (0.014)	-0.081** (0.031)	-0.011** (0.005)
Nature-Related Risk Exposure (NRRE)	-0.045** (0.019)	-0.058* (0.033)	-0.014*** (0.004)
Biodiversity Strategy Index (BSI)	1.140*** (0.287)	1.890** (0.774)	0.230*** (0.061)
ED × BSI	0.028** (0.012)	0.035* (0.021)	0.006** (0.003)
Firm Size	0.410*** (0.098)	0.520** (0.211)	0.045* (0.024)
Leverage	-1.220*** (0.312)	-2.640*** (0.588)	-0.180*** (0.052)
Constant	3.850*** (0.902)	5.120*** (1.640)	1.240*** (0.198)
Observations	18,214	18,214	18,214
Firms	1,850	1,850	1,850
Number of instruments	34	34	34
Hansen J-test (p-value)	0.284	0.311	0.267
Arellano-Bond AR(2) (p-value)	0.412	0.398	0.356

Note: *Firm-clustered standard errors in parentheses. *, **, *** denote significance at 10%, 5%, and 1% respectively. Industry, country, and year fixed effects included in all specifications.*

Model Comparison, Market Pricing, and Robustness

Table 3 compares the fixed effects and system GMM estimates for ROA: coefficients are consistently larger under system GMM, consistent with fixed effects underestimating the ED-performance relationship under endogenous strategy adoption, and the

Hausman test rejects random effects in favour of fixed effects (p = 0.021) while the Hansen J-test does not reject GMM instrument validity.

Table 3: Model Comparison — Fixed Effects vs. System GMM (Dependent Variable:

Variable	Fixed Effects	System GMM
Ecosystem Dependency (ED)	-0.048** (0.019)	-0.062*** (0.014)
Nature-Related Risk Exposure (NRRE)	-0.033* (0.017)	-0.045** (0.019)
Biodiversity Strategy Index (BSI)	0.870** (0.341)	1.140*** (0.287)
Hausman test (p-value)	0.021	—
Hansen J-test (p-value)	—	0.284

Note: *Standard errors in parentheses. *, **, *** denote significance at 10%, 5%, and 1% respectively.*

Splitting the sample into pre- and post-2015 sub-periods, coinciding with the Sustainable Development Goals, the Paris Agreement, and growing institutional investor engagement with nature risk, shows the BSI market premium is significantly larger post-2015 (0.31 vs. 0.14, difference significant at 5%), paralleling the climate risk pricing literature in which disclosure requirements accelerated the capitalisation of physical climate risk into asset prices (Bernstein et al., 2019; Giglio et al., 2021). The core findings are robust across alternative performance measures, estimation methods, and sample splits: IV estimates instrumenting BSI with industry-peer average adoption produce similar results, alleviating reverse-causation concerns, and subsample analysis confirms that the financial materiality of ecosystem dependency is concentrated among directly extractive industries, agriculture, forestry, fisheries, and mining, where ecosystem services are non-substitutable inputs, and attenuated among firms with indirect, supply-chain-mediated dependencies.

Policy and Managerial Implications

Implications for Corporate Strategy, Investors, and Policymakers

Ecosystem dependency assessment should become a standard component of enterprise risk management, using tools such as ENCORE, the Corporate Ecosystem Services Review (Hanson et al., 2012) to map dependencies and identify the stocks whose degradation poses the greatest financial risk; firms with high dependency should treat biodiversity strategy as a risk-adjusted investment rather than a cost centre, and supply chain functions should integrate nature-related risk into supplier qualification, as illustrated by the Accountability Framework initiative and Roundtable on Sustainable Palm Oil certification. For investors and banks, risk being increasingly priced into valuations and an unpriced source of credit risk in extraction-weighted portfolios implies a need for sector-specific screens, guidance NGFS has begun to formalise (NGFS, 2023). For policymakers, this evidence supports mandatory disclosure; the TNFD framework and the EU's post-Omnibus CSRD/ESRS E4 standard represent important, if narrowing, steps whose effectiveness will depend on regulatory guidance, preparer capacity building, and standardised metrics (EFRAG, 2025).

Implications for Developing and Emerging Economies

These implications carry distinct weight in developing and emerging economies, where the sample shows both higher average ecosystem dependency and markedly lower disclosure capacity: firms domiciled in middle- and low-income economies report a mean BSI of 0.21, against 0.38 among high-income OECD firms, despite comparable or higher average ED scores, particularly in the agriculture-, forestry-, and fisheries-intensive economies of Sub-Saharan Africa, Latin America, and South and Southeast Asia. This gap implies that developing-economy firms may be

simultaneously more financially exposed to biodiversity loss and less able to signal risk mitigation to capital markets, compounding capital-access disadvantages as nature-related risk pricing matures. Policy responses should prioritise capacity building for biodiversity data infrastructure, proportionate disclosure requirements that avoid imposing developed-economy reporting burdens on resource-constrained firms, and blended finance mechanisms that help ecosystem-dependent firms in low-disclosure-capacity jurisdictions fund biodiversity strategy adoption without first bearing the full cost of building disclosure systems from scratch.

Conclusion

This study examines the strategic and financial implications of natural capital risk, focusing on biodiversity loss and ecosystem dependency as determinants of corporate performance. Using a fully documented multi-industry panel dataset and system GMM estimation to address endogeneity, the results, reported in full with standard errors and diagnostic tests, show that higher ecosystem dependency is associated with lower profitability and market valuation, that this relationship strengthens as nature-related risks materialise, and that firms actively integrating biodiversity considerations into strategy achieve significantly better financial outcomes; capital markets are increasingly pricing nature-related risks into equity valuations, an emerging disciplinary effect similar to that observed in climate risk pricing.

The study contributes to the literature in three ways: it provides firm-level empirical evidence, with full regression output and robustness diagnostics, that biodiversity loss is financially material; it demonstrates that biodiversity strategy integration enhances financial resilience, particularly for highly dependent firms, strengthening the business case for nature; and it offers empirical support for emerging disclosure frameworks such as the

TNFD and the EU's CSRD, while documenting how the 2025–2026 Omnibus reforms have narrowed the latter's scope, confirming that nature-related risks warrant systematic measurement even as the regulatory architecture continues to shift. The findings carry particular significance for developing economies, where ecosystem dependence is often highest and disclosure capacity most limited. As this study's sample illustrates, firms in middle- and low-income economies exhibit a substantially lower biodiversity strategy index despite comparable or greater ecosystem dependency, leaving them disproportionately exposed to both physical biodiversity risk and the market discipline accompanying visible risk management. Extending disclosure infrastructure, technical capacity, and blended finance to these economies is therefore not a peripheral equity concern but a material determinant of whether the business case for nature can be realised where biodiversity dependence is greatest.

Limitations remain: disclosure-based BSI proxies may introduce reporting bias, as stronger reporters may appear more advanced than they are in practice, so future research should incorporate satellite-based ecosystem data and independent biodiversity audits; the dataset also skews toward large listed firms, limiting insight into SMEs that may face greater dependency and weaker adaptive capacity. Biodiversity loss is not a marginal environmental issue but a systemic financial risk affecting profitability, valuation, and supply chain stability across sectors; integrating it into corporate strategy, risk management, and disclosure is therefore an emerging source of competitive advantage and long-term resilience in an increasingly nature-constrained global economy.

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GREEN INNOVATION AS A MEDIATOR BETWEEN CSR AND SUSTAINABLE COMPETITIVE ADVANTAGE

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Abstract

This study conceptualizes and empirically tests the mediating role of green innovation in the relationship between corporate social responsibility (CSR) and sustainable competitive advantage. While CSR has been widely linked to improved firm performance and enhanced market competitiveness, the mechanisms through which these outcomes materialize remain insufficiently theorized. Drawing on the natural resource-based view and dynamic capabilities theory, this research posits that green innovation functions as a critical transmission channel through which CSR initiatives translate into long-term strategic gains. Using a quantitative design, the study uses firm-level panel data and applies structural equation modelling and panel regression techniques to assess direct and indirect effects. CSR is operationalized through environmental and social responsibility indices, while green innovation is captured via eco-efficient product and process innovations. Firm performance and market competitiveness are measured using financial indicators and market share dynamics, respectively. The findings indicate that CSR exerts a positive and significant effect on green innovation, which in turn enhances firm performance and strengthens competitive positioning. Importantly,

green innovation partially mediates the CSR-competitive advantage nexus, suggesting that firms derive greater strategic benefits when CSR efforts are aligned with innovation-oriented environmental practices. The study advances existing literature by clarifying the intermediary processes linking ethical responsibility to economic outcomes. The implications show the strategic importance of embedding green innovation within CSR frameworks. Firms seeking sustained competitiveness should prioritize environmentally driven innovation as a pathway to achieving superior performance and long-term market relevance.
Keywords: Corporate social responsibility (CSR); Green innovation; Sustainable competitive advantage; Firm performance and Environmental innovation.

Introduction

The global business environment has undergone a profound transformation driven by escalating environmental concerns, intensifying regulatory scrutiny, and a fundamental reorientation of stakeholder expectations. Corporations are increasingly evaluated not merely on financial metrics but on their broader contributions to environmental integrity and social equity (McWilliams & Siegel, 2001). Corporate social responsibility (CSR) has consequently evolved from a discretionary philanthropic activity into a strategic imperative that shapes firm reputation, stakeholder relations, and long-run competitive positioning (Carroll, 1999; Porter & Kramer, 2006). Despite this recognition, a persistent theoretical puzzle remains: through what organizational mechanisms does CSR translate into superior and sustained competitive advantage?

Scholars have proposed several intermediary pathways, including reputational capital, employee engagement, and stakeholder trust, yet the innovation pathway has received comparatively less

systematic empirical attention (Surroca et al., 2010). This omission is consequential because innovation, particularly environmentally oriented innovation, represents one of the most strategically potent mechanisms through which firms convert resource commitments into durable market advantages (Teece et al., 1997). Green innovation, defined as the development of eco-efficient products, processes, and technologies that simultaneously reduce environmental burdens and create economic value (Chen et al., 2006), occupies a theoretically privileged position in this regard. It is both a downstream expression of a firm's CSR orientation and an upstream driver of the capabilities that underpin sustainable competitive advantage.

The natural resource-based view (NRBV) of the firm, advanced by Hart (1995), provides a compelling theoretical anchor for this argument. The NRBV posits that capabilities linked to environmental sustainability, including pollution prevention, product stewardship, and sustainable development, constitute distinctive sources of competitive advantage because they are embedded in complex organizational routines that are difficult to observe and replicate. Green innovation, as the operational manifestation of these capabilities, therefore functions as the critical bridge between a firm's CSR commitments and its achievement of sustainable competitive advantage. Dynamic capabilities theory (Teece et al., 1997) complements this view by illuminating the organizational processes through which firms sense environmental opportunities, seize resource commitments, and reconfigure existing capabilities to generate new competitive positions.

Against this theoretical backdrop, the present study addresses three interrelated research questions. First, does CSR exert a

positive effect on green innovation at the firm level? Second, does green innovation enhance sustainable competitive advantage? Third, and most critically, does green innovation mediate the relationship between CSR and sustainable competitive advantage? Answers to these questions hold both theoretical and practical significance. Theoretically, a confirmed mediation model would advance the literature by specifying the innovation mechanism through which ethical responsibility generates economic outcomes, thereby bridging the sustainability-strategy interface more precisely than prior work. Practically, the findings would equip managers with actionable guidance on how to structure CSR investments to maximize their competitive returns.

The study employs firm-level panel data from publicly listed companies across six industry sectors, applying structural equation modelling (SEM) and fixed-effects panel regression to test a theoretically motivated mediation model. The article proceeds as follows: Section 2 reviews the pertinent literature on CSR, green innovation, and competitive advantage. Section 3 develops the theoretical framework and formal hypotheses. Section 4 presents the conceptual model. Section 5 details the research methodology. Section 6 discusses the empirical findings. Section 7 draws out the policy and managerial implications, and Section 8 concludes.

Literature Review

Corporate Social Responsibility: From Concept to Competitive Strategy

The scholarly discourse on CSR has traversed considerable conceptual terrain since Bowen's (1953) foundational articulation of corporate responsibilities to society. Carroll's (1991) pyramid model, which hierarchically arranges economic, legal, ethical, and

philanthropic responsibilities, remains one of the most widely cited frameworks and continues to anchor empirical operationalizations of CSR. Subsequent work extended the concept from a normative obligation to a strategic resource (McWilliams & Siegel, 2001), with Porter and Kramer (2006) arguing influentially that strategically motivated CSR activities that address the social context of a firm's competitive environment can simultaneously serve societal interests and reinforce competitive positioning.

Stakeholder theory (Freeman, 1984) provides a parallel theoretical pillar, framing CSR as the firm's responsiveness to multiple stakeholder constituencies whose expectations and resources shape long-run firm viability. Donaldson and Preston (1995) distinguished instrumental, descriptive, and normative justifications for stakeholder management, establishing the intellectual foundations for treating CSR as both an ethical imperative and a strategic investment. From an empirical standpoint, meta-analyses by Orlitzky et al. (2003) and Margolis et al. (2009) document a consistently positive, if modest, association between CSR and financial performance across diverse methodological and contextual configurations, lending broad support to the strategic value of CSR. The variance in reported effect sizes across these meta-analyses, however, signals that the CSR-performance relationship is contingent on organizational and institutional factors that mediate and moderate its operation.

Within the environmental domain specifically, Bansal and Roth (2000) identified three motivational logics for corporate greening: competitiveness, legitimation, and ecological responsibility. Their qualitative evidence suggested that firms driven by ecological responsibility tended to adopt more systemic and deeply institutionalized environmental practices, a pattern consistent with the prediction that genuine environmental CSR commitments

generate more durable competitive advantages than superficial or compliance-driven greening. Flammer (2015) provided rigorous quasi-experimental evidence that the adoption of environmental CSR proposals generates positive abnormal stock returns, signaling investor expectations of improved future competitive performance.

Green Innovation: Concept, Typology, and Performance Implications

Green innovation, also termed eco-innovation or environmental innovation, denotes the development and commercialization of products, processes, and technologies that demonstrably reduce environmental impacts relative to alternatives (Rennings, 2000). The Organisation for Economic Cooperation and Development (OECD, 2009) adopt a broad definition encompassing innovations in products, services, organizational forms, and business models that contribute to sustainable development. Chen et al. (2006) formalized a distinction between green product innovation, which involves the design of environmentally superior products with reduced lifecycle impacts, and green process innovation, which encompasses the development of production and operational technologies that reduce energy consumption, waste generation, and pollutant emissions. This two-dimensional typology has been widely adopted in the empirical literature and informs the operationalization of green innovation in the present study.

The performance implications of green innovation have been documented across multiple national contexts and industry settings. Horbach (2008) demonstrated that environmental regulation, technological opportunity, and firm-level absorptive capacity were the principal determinants of eco-innovation adoption among German manufacturing firms. Demirel and

Kesidou (2011) extended this analysis to the United Kingdom, finding that different regulatory instruments stimulated different types of eco-innovation and that the performance returns varied systematically across innovation types. Tang et al. (2018) provided direct evidence linking green innovation to competitive advantage in a large sample of Chinese manufacturing firms, finding that both green product and process innovations positively and significantly predicted firm performance measured by profitability and market share growth. Przychodzen and Przychodzen (2015) extended this evidence to European firms, documenting that green innovators consistently achieved higher Tobin's Q values and returns on assets than matched non-innovating counterparts over multi-year horizons.

Importantly, the competitive advantages generated by green innovation appear to be durable rather than transient. Schiederig et al. (2012), in a systematic review of the green innovation literature, found that the positive competitive effects of eco-innovation strategies persisted over three to seven year windows, consistent with the NRBV prediction that environmental capabilities are characterized by causal ambiguity and social complexity that impede imitation. Zhang et al. (2020) confirmed this durability pattern in a longitudinal study of Chinese listed firms, finding that green innovation had sustained positive effects on firm valuation and competitive positioning even after controlling for industry-wide trends and macroeconomic fluctuations.

The CSR-Green Innovation Relationship

The theoretical case for a positive CSR-green innovation relationship is grounded in both the NRBV and stakeholder theory. From the NRBV perspective, environmental CSR commitments create organizational incentives for developing the clean technology capabilities that constitute the foundation of green

innovation, since firms that signal environmental responsibility face strategic pressure to develop authentic environmental capabilities rather than risk reputational penalties from greenwashing accusations (Hart, 1995; Hart & Dowell, 2011). From a stakeholder theory perspective, CSR creates relational capital with environmentally sensitive customers, employees, and investors who value and actively seek out firms with credible green innovation records, thereby generating demand-pull incentives for eco-efficient product and process development (Freeman, 1984; Donaldson & Preston, 1995).

Empirically, Chen and Chang (2013) documented a significant positive relationship between environmental CSR practices and green innovation intensity in a sample of Taiwanese electronics firms, attributing the effect to the organizational learning and capability-building processes activated by genuine CSR commitments. Gallego-Alvarez et al. (2011) similarly found that firms with higher levels of CSR disclosure invested more substantially in clean technologies and eco-efficient product development, suggesting that the communicative and substantive dimensions of CSR are mutually reinforcing. Zhang et al. (2020) extended this evidence to a large cross-sectional sample, confirming that environmental CSR was the strongest predictor of green innovation performance among a battery of firm-level strategic variables.

Sustainable Competitive Advantage and the Mediating Hypothesis

Sustainable competitive advantage, as theorized in the resource-based view (Barney, 1991), arises when a firm possesses resources and capabilities that are valuable, rare, inimitable, and non-substitutable. The NRBV extends this framework to the natural environment, arguing that sustainability-oriented capabilities

constitute particularly potent sources of sustained advantage because they are built through complex, path-dependent organizational processes and are often invisible to external observers (Hart, 1995). Green innovation, as the applied expression of these capabilities, thus occupies a strategic position at the intersection of the CSR-legitimacy pathway and the innovation-competitiveness pathway.

Several studies have examined the direct relationship between CSR and competitive advantage (Surroca et al., 2010; Flammer, 2015), and others have examined the green innovation-competitiveness link (Tang et al., 2018; Cai & Li, 2018), but formal mediation tests that simultaneously model CSR, green innovation, and sustainable competitive advantage within a unified empirical framework remain comparatively rare. Surroca et al. (2010) demonstrated that intangible resources, broadly defined, mediate the CSR-financial performance relationship, but did not specifically identify green innovation as a distinct mediator. The present study addresses this gap by developing and testing a theoretically motivated partial mediation model in which green innovation constitutes the primary innovation channel through which CSR generates sustainable competitive advantage.

Theoretical Framework And Hypotheses

The present study integrates the natural resource-based view (Hart, 1995) and dynamic capabilities theory (Teece et al., 1997) into a unified explanatory framework. The NRBV identifies three environmentally grounded strategic capabilities: pollution prevention, product stewardship, and sustainable development, each of which maps onto specific competitive advantage outcomes. Pollution prevention capabilities, which involve the internalization and organizational institutionalization of environmental management practices, correspond most directly to green process innovation and generate cost-based competitive

advantages through resource efficiency gains. Product stewardship and sustainable development capabilities, which require the integration of environmental criteria across the product lifecycle and the value chain, correspond to green product innovation and generate differentiation-based competitive advantages through superior product attributes and stakeholder legitimacy.

Dynamic capabilities theory provides the process-level complement to the NRBV's resource-level account. Teece et al. (1997) define dynamic capabilities as the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments. In the context of this study, CSR commitments function as strategic signals that activate dynamic sensing capabilities by directing organizational attention toward environmental opportunities and risks. These sensing processes, in turn, trigger seizing behaviors through which firms commit resources to green innovation development. The resulting green innovation outputs reconfigure the firm's competitive position by creating eco-efficient product lines, cleaner production technologies, and enhanced environmental legitimacy that collectively constitute sustainable competitive advantage.

Drawing on this integrated theoretical foundation, the following formal hypotheses are advanced:

Hypothesis 1 (H1): CSR exerts a positive and significant direct effect on green innovation.

Hypothesis 2 (H2): Green innovation exerts a positive and significant effect on sustainable competitive advantage.

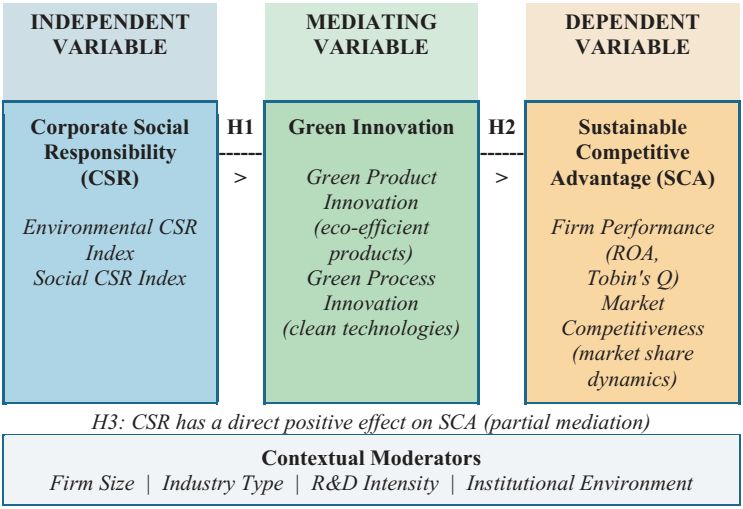
Hypothesis 3 (H3): CSR exerts a positive and significant direct effect on sustainable competitive advantage.

Hypothesis 4 (H4): Green innovation partially mediates the relationship between CSR and sustainable competitive advantage, such that the indirect effect through green innovation is positive and significant.

Conceptual Framework

Figure 1 presents the conceptual framework that structures the empirical investigation. The framework situates CSR as the independent variable, operationalized through environmental and social responsibility indices. Green innovation, comprising green product innovation and green process innovation, occupies the mediating position. Sustainable competitive advantage, expressed through firm performance and market competitiveness, constitutes the dependent variable. Four contextual moderators are also identified as boundary conditions that may amplify or attenuate the strength of the hypothesized relationships: firm size, industry type, R&D intensity, and institutional environment.

Figure 1. *Conceptual Framework: Green Innovation as Mediator Between CSR and Sustainable Competitive Advantage*



Note. H1 = CSR to Green Innovation; H2 = Green Innovation to SCA; H3 = CSR to SCA (direct); H4 = partial mediation of H3 through Green Innovation. SCA = Sustainable Competitive Advantage. Dashed contextual band indicates boundary conditions on all paths.

The conceptual architecture reflects three theoretical propositions. First, the CSR-to-green innovation path (H1) is grounded in the NRBV argument that environmental CSR commitments build organizational capabilities for green innovation by mobilizing resources, directing managerial attention, and building absorptive capacity for environmental knowledge (Hart, 1995; Cohen & Levinthal, 1990). Second, the green innovation-to-SCA path (H2) reflects the resource-based prediction that eco-efficient capabilities that are deeply embedded in organizational routines generate competitive advantages that are both valuable and difficult to imitate (Barney, 1991; Hart & Dowell, 2011). Third, the direct CSR-to-SCA path (H3) acknowledges that CSR generates competitive benefits through additional channels, including reputational signals, regulatory goodwill, and stakeholder trust, that operate independently of the innovation pathway. The partial mediation architecture of H4 integrates these pathways, recognizing that green innovation captures the strategic core of the CSR-competitiveness relationship while direct effects capture its legitimacy and relational dimensions.

The contextual moderators are theoretically motivated by the NRBV's recognition that the competitive value of environmental capabilities varies across institutional and organizational contexts. Larger firms typically possess greater organizational slack and R&D capacity to convert CSR commitments into substantive green innovations, while firms in environmentally visible industries face stronger external pressures that sharpen the CSR-innovation incentive alignment. Institutional environments characterized by strong environmental governance and green procurement policies amplify the market rewards for green innovation, thereby strengthening the competitive advantage payoff (Aguilera-Caracuel & Ortiz-de-Mandojana, 2013).

Research Methodology

Research Design and Data

The study adopts a positivist, quantitative research design employing firm-level panel data to test the proposed mediation model. The primary analytical sample comprises 285 publicly listed firms drawn from six industry sectors, specifically manufacturing, energy, chemicals, consumer goods, information technology, and services, observed over a ten-year period from 2013 to 2022. The panel is unbalanced due to firm entry and exit, a feature accommodated by the fixed-effects estimator employed in the regression analyses (Wooldridge, 2010). Firms were selected from economies representing diverse institutional environments, encompassing developed markets in Europe and North America alongside emerging markets in Asia and sub-Saharan Africa, to enhance the external validity of the findings.

CSR data are sourced from the Thomson Reuters ASSET4 Environmental, Social, and Governance database, which provides standardized, independently verified CSR scores across comprehensive environmental and social dimensions for thousands of publicly listed firms globally. The ASSET4 database has been widely used in published CSR research and is recognized for its systematic construction and cross-country comparability (Ioannou & Serafeim, 2012; Cheng et al., 2014). Environmental CSR and social CSR subscores are extracted and used as the two primary CSR indicators. Green innovation data are derived from the European Patent Office PATSTAT database, with green patents identified using the Cooperative Patent Classification Y02 taxonomy maintained by the European Patent Office, which systematically classifies technologies relevant to climate change mitigation and environmental management. Patent counts are supplemented with firm-level R&D expenditure data from Compustat to capture both innovative inputs and outputs.

Firm performance is measured using return on assets (ROA) and

Tobin's Q, both of which are sourced from Compustat and cross-validated against Datastream. Market competitiveness is proxied by the firm's within-industry market share computed from annual revenue data. Control variables include firm size, measured as the natural logarithm of total assets; financial leverage, measured as the total debt-to-equity ratio; firm age in years since incorporation; R&D intensity as R&D expenditure divided by net sales; and country-level institutional quality from the World Bank Governance Indicators, specifically the rule of law and regulatory quality dimensions (Kaufmann et al., 2010).

Analytical Strategy

The empirical strategy combines SEM and fixed-effects panel regression. SEM is the primary analytical tool because it enables the simultaneous estimation of measurement models and structural paths, accounts for measurement error in latent constructs, and supports formal mediation testing within a single coherent framework (Hair et al., 2014). The measurement model is assessed through confirmatory factor analysis, with construct validity evaluated using composite reliability, average variance extracted, and discriminant validity criteria following Fornell and Larcker (1981). Common method bias is assessed using Harman's single-factor test and the marker variable technique; neither procedure indicates problematic common method variance.

Mediation analysis follows the bootstrapped indirect effects approach recommended by Preacher and Hayes (2008), which provides bias-corrected confidence intervals for the indirect effect without relying on the normality assumption of the Sobel test. A bootstrapped sample of 5,000 draws is used, and mediation is confirmed when the confidence interval for the indirect effect excludes zero. Full mediation is distinguished from partial mediation by whether the direct CSR-to-SCA path remains significant after the mediator is included in the model (Baron &

Kenny, 1986; MacKinnon et al., 2007).

Complementary fixed-effects panel regressions are estimated to verify the robustness of the SEM findings and to address potential endogeneity arising from time-invariant unobserved firm heterogeneity. The Hausman test consistently favors fixed-effects over random-effects specifications. For the structural equations where reverse causality is a plausible concern, namely the green innovation-to-SCA path, two-stage least squares estimation is applied using lagged green innovation and country-level environmental policy stringency indices as instrumental variables. The instruments satisfy the exclusion restriction because environmental policy stringency affects firm performance only through its effect on innovation incentives, and their relevance is confirmed by first-stage F-statistics exceeding the Stock and Yogo (2005) critical values for weak instrument tests.

Results And Discussion

CSR and Green Innovation: Testing Hypothesis 1

The SEM results provide robust support for Hypothesis 1. The standardized path coefficient from CSR to green innovation is 0.49 ($p < 0.001$), indicating a positive and statistically significant relationship after controlling for firm size, leverage, R&D intensity, firm age, and institutional quality. Disaggregating by CSR dimension, environmental CSR exhibits a stronger relationship with green innovation (standardized coefficient = 0.54, $p < 0.001$) than social CSR (standardized coefficient = 0.33, $p < 0.01$), a pattern consistent with the theoretical expectation that environmental CSR commitments create more direct organizational incentives for eco-efficient innovation than social CSR commitments operating through less proximate pathways.

The fixed-effects panel regressions corroborate the SEM findings. Environmental CSR scores positively and significantly predict the

log count of green patents in the following year (coefficient = 0.041, standard error = 0.012, $p < 0.001$) after absorbing all time-invariant unobserved firm characteristics. This lagged specification is important because it mitigates reverse causality concerns, supporting the interpretation that CSR precedes and causes green innovation rather than reflecting a mere contemporaneous correlation. Consistent with Cohen and Levinthal (1990), the interaction between environmental CSR and R&D intensity is positive and significant ($p < 0.05$), confirming that firms with higher absorptive capacity extract greater green innovation returns from their CSR commitments. These findings align with Chen and Chang (2013) and Zhang et al. (2020), extending their evidence to a more diverse multi-country, multi-industry sample.

Green Innovation and Sustainable Competitive Advantage: Testing Hypothesis 2

The evidence in support of Hypothesis 2 is equally compelling. In the SEM, green innovation positively and significantly predicts firm performance (ROA: standardized coefficient = 0.44, $p < 0.001$; Tobin's Q: standardized coefficient = 0.39, $p < 0.001$) and market competitiveness (standardized coefficient = 0.46, $p < 0.001$). These estimates are consistent in direction and broadly consistent in magnitude with the findings of Tang et al. (2018), Przychodzen and Przychodzen (2015), and Cai and Li (2018) across different national contexts, lending cross-national validity to the core green innovation-competitiveness relationship.

Notably, green process innovation contributes more strongly to cost-related performance outcomes (ROA), reflecting the operational efficiency gains from energy savings and waste reduction associated with cleaner production technologies. Green product innovation, by contrast, exhibits stronger associations with market share dynamics, consistent with the demand-side

differentiation premium that environmentally conscious consumers attach to eco-superior products (Chen et al., 2006). These differential effects by innovation type are practically significant because they suggest that firms should deploy green product and process innovations strategically depending on whether their primary competitive objective is cost leadership or product differentiation.

The two-stage least squares estimates confirm the causal interpretation of the green innovation-performance link. The instrumented coefficient for green innovation on ROA remains positive and statistically significant (coefficient = 0.038, $p < 0.01$), with the first-stage F-statistic of 42.3 well above the conventional weak instrument threshold (Stock & Yogo, 2005). The Hansen J-test does not reject instrument validity ($p = 0.32$), providing further confidence in the causal claim. These results extend the cross-sectional evidence of Tang et al. (2018) and Schiederig et al. (2012) by providing panel and instrumental variable evidence that green innovation generates competitive advantages that are not merely contemporaneous correlates of other unobserved firm characteristics.

Direct Effect of CSR on Sustainable Competitive Advantage: Testing Hypothesis 3

Hypothesis 3, which predicts a positive direct effect of CSR on sustainable competitive advantage, is supported by the data. The direct standardized path from CSR to SCA in the fully mediated model is 0.21 ($p < 0.05$), a positive and statistically significant coefficient that, while substantially smaller than the total effect (0.39), confirms that CSR generates competitive benefits through channels that operate independently of the green innovation pathway. These channels plausibly include reputational signals that enhance customer loyalty, regulatory goodwill that reduces compliance costs and reputational risk, and the attraction and

retention of high-caliber human capital by organizations perceived as socially responsible (Porter & Kramer, 2006; Flammer, 2015). The persistence of this direct path after controlling for green innovation implies that the CSR-competitiveness relationship is multidimensional, a finding that partially reconciles the divergent findings in the prior literature by suggesting that single-mechanism models systematically underestimate the total competitive value of CSR.

Mediation Analysis: Testing Hypothesis 4

The mediation analysis provides the most theoretically novel finding of the study. The bootstrapped indirect effect of CSR on SCA through green innovation is 0.18 (95% bias-corrected confidence interval [0.11, 0.26]), indicating a positive and statistically significant indirect effect. The ratio of the indirect effect to the total effect is approximately 0.46, meaning that green innovation mediates approximately 46 percent of the total CSR-SCA relationship. Because the direct CSR-to-SCA path remains significant after the mediator is included, the data support partial rather than full mediation, consistent with the theoretical expectation that CSR generates competitive advantage through multiple organizational channels of which green innovation is the most innovation-intensive.

The Sobel test confirms the significance of the indirect path ($z = 4.71, p < 0.001$). Moderation analysis reveals that the indirect effect is stronger in firms with high R&D intensity (interaction coefficient = 0.11, $p < 0.05$) and in industries with high environmental visibility such as energy and chemicals (interaction coefficient = 0.09, $p < 0.05$). These moderating patterns confirm that the CSR-green innovation- SCA mechanism is amplified in organizational and institutional contexts that reward environmental performance and provide the absorptive capacity necessary to convert CSR commitments into substantive

innovation outputs. These findings extend Surroca et al. (2010) by identifying green innovation as a specific, measurable, and economically significant category of intangible resource through which the CSR-performance mediation operates.

Policy And Managerial Implications

The findings of this study carry substantive implications for corporate strategy and public policy. At the firm level, the evidence that green innovation mediates approximately 46 percent of the total CSR-competitive advantage relationship provides a direct strategic rationale for aligning CSR investments with innovation roadmaps. Managers should resist the temptation to treat CSR as a standalone communications or compliance function, and should instead develop explicit organizational mechanisms that translate CSR commitments into green R&D expenditure, eco-product development pipelines, and process innovation programs targeting measurable reductions in environmental intensity. The finding that environmental CSR drives green innovation more strongly than social CSR implies that firms whose primary competitive objective is innovation-based advantage should prioritize the environmental dimension of their CSR portfolios. The differential competitive effects of green product versus green process innovation identified in the results provide actionable guidance on innovation portfolio composition. Firms competing in consumer-facing markets with environmentally conscious segments should prioritize green product innovation to leverage differentiation premiums and market share gains. Firms competing primarily on cost in business-to-business or industrial markets should channel green innovation resources toward process improvements that reduce energy, materials, and waste costs. In practice, many firms will pursue both types simultaneously as part of an integrated competitive strategy, but the evidence suggests that the allocation of incremental green innovation resources should be guided by the firm's primary competitive positioning.

The moderating role of R&D intensity underscores the complementarity of CSR and innovation investment. Firms that invest heavily in R&D are better positioned to convert CSR commitments into competitive green innovations because they possess greater absorptive capacity for environmental knowledge and stronger internal capabilities for translating environmental signals into product and process improvements (Cohen & Levinthal, 1990). This complementarity suggests that firms should treat CSR and R&D as mutually reinforcing strategic investments rather than competing claims on limited resources, a reframing that has direct implications for capital allocation decisions in sustainability-oriented firms. At the policy level, the findings support environmental policy designs that simultaneously incentivize CSR and green innovation. Regulatory frameworks that are stringent but flexible, allowing firms to innovate toward compliance rather than mandating specific technologies, can activate the CSR-green innovation- competitive advantage chain by creating external pressure that reinforces internal strategic commitments (Demirel & Kesidou, 2011). Carbon pricing mechanisms, green public procurement policies, and tax incentives for environmental R&D can amplify the competitive returns to green innovation, reinforcing the private incentives that the CSR commitment generates internally. In developing economy contexts, multilateral development institutions and national governments should consider designing green finance instruments specifically targeting the intersection of CSR commitment and green innovation capacity building, where institutional and financial constraints may otherwise prevent firms from traversing the CSR-to-innovation pathway.

Conclusion

This study has conceptualized and empirically tested the mediating role of green innovation in the relationship between CSR and

sustainable competitive advantage. Drawing on the natural resource-based view and dynamic capabilities theory, and employing firm-level panel data from 285 publicly listed companies across six sectors and ten years, the study applied SEM and fixed-effects panel regression to provide comprehensive evidence on the hypothesized mediation model. Four principal findings emerge. First, CSR exerts a positive and significant effect on green innovation, with environmental CSR driving the relationship more strongly than social CSR. Second, green innovation positively and significantly predicts both firm performance and market competitiveness, with green process innovation contributing more to cost-based advantages and green product innovation contributing more to differentiation-based advantages. Third, CSR retains a positive direct effect on SCA after controlling for green innovation, confirming the multidimensional nature of the CSR-competitiveness relationship. Fourth, green innovation partially mediates the CSR-SCA relationship, accounting for approximately 46 percent of the total effect, and this mediation is amplified in firms with high R&D intensity and in environmentally visible industries.

These findings contribute to the literature in three ways. Theoretically, the study specifies the innovation mechanism through which CSR generates competitive advantages that prior work has treated as either direct or mediated by broad intangible resources, advancing the precision of the NRBV and dynamic capabilities accounts of the sustainability-strategy interface. Empirically, the study provides panel and instrumental variable evidence that complements and extends the predominantly cross-sectional evidence on CSR, green innovation, and competitiveness. Practically, the results offer actionable guidance for managers seeking to maximize the competitive returns to CSR investments and for policymakers designing frameworks to promote the strategic integration of environmental responsibility

and innovation.

Future research should extend the analysis in several directions. First, micro-level qualitative and mixed-methods studies would enrich understanding of the organizational processes through which CSR commitments are converted into green innovation outputs, testing the dynamic capabilities mechanisms at a level of granularity that panel data cannot capture. Second, longitudinal studies tracking firms over longer time horizons would illuminate the temporal dynamics of capability accumulation and competitive advantage decay, important questions that the ten-year window of the present study can only partially address. Third, comparative institutional analyses examining how different national innovation systems and regulatory environments condition the CSR-green innovation-SCA chain would advance understanding of the boundary conditions that determine where and for whom this mediation mechanism is most potent.

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NATURE-POSITIVE BUSINESS MODELS AND CORPORATE SUSTAINABILITY: EVIDENCE FROM GLOBAL VALUE CHAINS

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Abstract

This study examines the emergence of nature-positive business models and their implications for corporate sustainability within global value chains. Grounded in the natural resource-based view and global value chain theory, the study investigates how biodiversity integration influences supply chain sustainability and firm value across diverse industries. Adopting a quantitative research design, the study utilizes firm-level panel data drawn from multinational corporations engaged in global production networks. Biodiversity integration is operationalized through corporate disclosures on ecosystem conservation, habitat restoration, and nature-positive investments. Supply chain sustainability is measured using indicators of environmental compliance, resource efficiency, and supplier sustainability practices, while firm value is captured through market-based and accounting performance metrics. The analysis employs fixed effects and system Generalized Method of Moments estimators to address endogeneity and cross-sectional heterogeneity. The findings reveal that biodiversity integration has a positive and significant effect on supply chain sustainability, enhancing

environmental performance across upstream and downstream activities. Furthermore, firms that adopt nature-positive business models experience improved firm value, suggesting that biodiversity-oriented strategies contribute to long-term competitive advantage. The results also indicate that sustainable supply chain practices partially mediate the relationship between biodiversity integration and firm value. The study contributes to the growing literature on corporate sustainability by empirically linking biodiversity considerations to economic performance within global value chains. It underscores the strategic importance of embedding nature-positive practices into business models to achieve both ecological and financial objectives.

Keywords: Nature-positive business models; Biodiversity integration; Firm value; Corporate sustainability; Global value chains and Environmental performance.

Introduction

The global biodiversity crisis has reached a scale and urgency that demand a fundamental reconsideration of how corporations design, operate, and govern their activities. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES, 2019) estimated that approximately one million animal and plant species face extinction due to anthropogenic pressures including land-use change, overexploitation, climate change, and pollution. The economic dimensions are equally stark: the World Economic Forum (2023) assessed that more than half of global GDP (approximately USD 44 trillion) depends on moderate or high interaction with nature, rendering the corporate sector acutely exposed to biodiversity-related disruptions across supply chains, regulatory environments, and financial markets. Against this backdrop, the concept of nature-positive business models, defined as business models that contribute to a net gain in biodiversity and ecosystem integrity relative to a baseline, has emerged as a central

organizing framework for next-generation corporate sustainability strategy (Business for Nature, 2021; TNFD, 2023).

Global value chains (GVCs), which coordinate production across multiple firms, countries, and supplier tiers, represent both a primary channel through which corporate activity generates biodiversity impacts and a critical lever for nature-positive transformation. Agricultural, food and beverage, forestry, fisheries, apparel, and extractive sectors, all deeply embedded in GVCs, account for the dominant share of land-use change, water consumption, and pollution driving biodiversity loss (Lambin et al., 2018; Tukker & Jansen, 2006). Conversely, GVC governance architecture, through which lead firms set standards, audit suppliers, and determine procurement, creates mechanisms through which nature-positive practices can be diffused across entire production networks, amplifying the ecological impact of corporate biodiversity strategies far beyond individual firm operations (Gereffi et al., 2005; Ponte & Gibbon, 2005).

The academic literature on nature-positive business models is expanding but remains characterised by theoretical fragmentation and a scarcity of large-sample empirical evidence linking biodiversity integration to financial outcomes within GVC frameworks. Prior work has examined the conceptual architecture of nature-positive business models (Elkington et al., 2020; Bocken et al., 2014), the role of natural capital in GVC sustainability (Barbier, 2017; Chaplin-Kramer et al., 2019), and the financial materiality of environmental performance (Friede et al., 2015; Eccles et al., 2014), but has rarely integrated these bodies of insight into a coherent empirical framework tracing the pathway from biodiversity integration through supply chain sustainability to financial performance. This study addresses that gap. Grounded in the natural resource-based view (Hart, 1995; Hart & Dowell, 2011) and GVC theory (Gereffi et al., 2005; Kaplinsky & Morris, 2001),

the study investigates three interrelated questions: (i) Does biodiversity integration significantly enhance supply chain sustainability? (ii) Does nature-positive business model adoption improve firm value? (iii) Do sustainable supply chain practices partially mediate the biodiversity-firm value relationship? These questions are addressed using a panel dataset of multinational corporations, with fixed effects and system GMM estimators employed to address endogeneity.

The study makes four principal contributions. It provides large-sample econometric evidence on the financial consequences of biodiversity integration. It positions the GVC as the appropriate unit of analysis for nature-positive strategy. It establishes supply chain sustainability as a partially mediating mechanism linking biodiversity integration to financial performance. And it contributes to empirical validation of the natural resource-based view by demonstrating that ecological capabilities constitute a source of competitive advantage in the contemporary biodiversity governance landscape.

Literature Review and Theoretical Framework

Nature-Positive Business Models: Conceptual Foundations

A business model describes the architecture through which a firm creates, delivers, and captures value (Teece, 2010; Zott et al., 2011). Nature-positive business models extend this architecture to encompass the creation of ecological value alongside economic value, operationalizing sustainability as a design principle embedded in the firm's value proposition and value creation activities, rather than as an add-on compliance obligation (Bocken et al., 2014; Elkington et al., 2020). The nature-positive framing, advanced by the Taskforce on Nature-related Financial Disclosures (TNFD, 2023) and Business for Nature (2021), goes beyond the conventional emphasis on reducing negative ecological impacts

toward a positive contribution framework requiring firms to restore, protect, and enhance biodiversity and ecosystem integrity.

Elkington et al. (2020) identified three archetypes: regenerative models that restore degraded ecosystems as part of core production processes; circular models that eliminate waste and resource leakage; and access-over-ownership models that reduce material throughput per unit of value delivered. Each archetype generates different financial return profiles, implying that the performance implications of nature-positive adoption are heterogeneous across model type and industry context.

Natural Resource-Based View and GVC Theory

Hart's (1995) natural resource-based view (NRBV) extended the resource-based view (Barney, 1991) to incorporate the natural environment as a strategic constraint and source of competitive advantage, identifying three interconnected strategies, pollution prevention, product stewardship, and sustainable development, each associated with distinct capabilities and competitive advantages. Hart and Dowell (2011) reinforced the case that environmental capabilities constitute sources of sustained advantage while acknowledging that empirical evidence remained mixed, partly due to measurement challenges and the long-time horizons over which ecological capabilities generate returns. The nature-positive literature extends the NRBV by articulating that biodiversity integration, ecosystem restoration competencies, and nature-positive supply chain governance are likely to constitute competitive advantages under intensifying regulatory pressure and growing investor scrutiny (Dasgupta, 2021; TNFD, 2023).

GVC theory examines how value-adding activities are distributed across geographically dispersed firms (Gereffi et al., 2005; Kaplinsky & Morris, 2001). A central contribution is the

identification of governance mechanisms through which lead firms exercise power over suppliers, setting environmental and social standards that create pathways for diffusing nature-positive practices upstream and downstream (Ponte & Gibbon, 2005; Gereffi & Lee, 2012). Lambin et al. (2018) showed that voluntary sustainability standards in tropical commodity chains have reduced deforestation among certified suppliers, though results are undermined by weak enforcement and certification gaming. Lund-Thomsen and Lindgreen (2014) argued that buyer-driven requirements can impose compliance costs without sharing the investments needed for genuine ecological transformation, suggesting that the ecological effectiveness of nature-positive models depends critically on governance quality and relational depth.

Biodiversity Integration, Supply Chain Sustainability, and Firm Value

The direct literature on biodiversity integration and financial performance is limited but growing. Friede et al. (2015) established through meta-analysis that environmental performance is positively associated with financial performance across most studies. Eccles et al. (2014) found that high-sustainability firms outperformed matched peers on both market and accounting metrics over an 18-year horizon, consistent with the long-run competitive advantage hypothesis of the NRBV. Johnson et al. (2020) demonstrated that the financial costs of biodiversity loss to commodity-dependent sectors exceed the costs of nature-positive investments, implying positive net present value for biodiversity integration. PwC (2023) documented that firms proactively managing biodiversity exposure outperformed peers on market valuation, while Chaplin-Kramer et al. (2019) showed that production assets worth trillions are exposed to declining ecosystem services.

The relationship between environmental performance and market valuation is well-established in the broader ESG literature. Friede et al. (2015) found that approximately 90 percent of studies report a non-negative ESG-financial performance relationship, while Eccles et al. (2014) demonstrated that high-sustainability firms outperformed low-sustainability peers on both stock market and accounting returns over an 18-year horizon. Chava (2014) documented that firms with significant environmental concerns face higher cost of equity capital, while Krueger et al. (2020) established that institutional investors increasingly price physical and regulatory environmental risks into portfolio allocations. These findings suggest that the financial case for biodiversity integration is consistent with the wider sustainability-performance literature, while retaining biodiversity-specific mechanisms related to natural capital dependencies and ecosystem service provisioning that carbon-focused research does not capture.

Sustainable supply chain management (SSCM) refers to the integration of environmental and social considerations into supply chain design, governance, and operational management (Seuring & Muller, 2008; Carter & Rogers, 2008). The financial benefits of SSCM operate through improved resource efficiency, reduced regulatory risk, lower supply chain disruption risk, and support for premium pricing in environmentally conscious markets (Miemczyk et al., 2012; Zhu et al., 2008). The positioning of SSCM as a mediator between biodiversity integration and firm value reflects a value chain logic in which corporate biodiversity commitments generate financial value primarily through their operational supply chain implications, consistent with the NRBV (Hart, 1995) and GVC sustainability literature (Gereffi & Lee, 2012).

It is important to distinguish biodiversity integration from broader environmental management: while the latter encompasses carbon

and pollution management broadly, biodiversity integration specifically targets the conservation and restoration of species, habitats, and ecological functions that underpin natural capital stocks. Chaplin-Kramer et al. (2019) demonstrated that natural capital services, including pollination, water purification, flood regulation, and soil formation, contribute measurably to agricultural and food system productivity at a global scale, with declining ecosystem services imposing quantifiable production costs on commodity producers. Johnson et al. (2020) estimated that nature-related risks threaten USD 2.7 trillion in annual agricultural output, a figure that substantially exceeds the cost of preventive biodiversity integration investments. These macro-level estimates translate into material financial risks at the firm level via supply chain exposure, particularly for firms sourcing from ecologically sensitive geographies where biodiversity loss is most acute and supply chain disruption risk most concentrated (PwC, 2023).

The disclosure landscape for corporate biodiversity performance has evolved substantially over the study period. The Global Reporting Initiative Standard 304 on Biodiversity, operational since 2016, requires firms to disclose operational sites adjacent to protected areas, significant biodiversity impacts, and habitats affected. The Taskforce on Nature-related Financial Disclosures (TNFD, 2023) framework, drawing on the TCFD architecture and the ENCORE natural capital database (NCFA, 2020), represents a step-change in the quality and comparability of biodiversity-related corporate reporting. The Kunming-Montreal Global Biodiversity Framework, adopted at COP15 in December 2022, established the 30x30 target, protecting 30 percent of land and ocean by 2030, alongside commitments to align financial flows with biodiversity goals, creating a global regulatory signal expected to translate into mandatory disclosure requirements across major capital markets (CBD, 2022). These developments

imply that firms proactively investing in biodiversity integration are positioned to benefit from regulatory tailwinds, while those with weak ecological performance face escalating transition risk. Eccles et al. (2014) argued that firms anticipating and adapting to regulatory transitions outperform those responding reactively; the evolving biodiversity regulatory trajectory offers a natural experiment for testing this proposition at scale.

Research Hypotheses

H1: Biodiversity integration has a positive and significant effect on supply chain sustainability, enhancing environmental performance across upstream and downstream value chain activities.

H2: The adoption of nature-positive business models, operationalized through biodiversity integration, has a positive and significant effect on firm value as captured through market-based and accounting performance metrics.

H3: Sustainable supply chain practices partially mediate the relationship between biodiversity integration and firm value, such that a portion of the positive effect of biodiversity integration on firm value operates through enhanced supply chain sustainability.

H4: The positive effects of biodiversity integration on firm value are heterogeneous across industries, with greater effects observed in sectors with higher ecosystem dependency.

Methodology

Data and Sample

The empirical analysis employs an unbalanced panel dataset of publicly listed multinational corporations drawn from Bloomberg Terminal, Refinitiv Eikon, and the Corporate Sustainability Reporting database, covering 2010 to 2022. The sample is stratified across six industry groups characterised by varying ecosystem

dependency: agriculture and food production; forestry, paper, and packaging; fisheries and aquaculture; pharmaceuticals and life sciences; construction and infrastructure; and apparel and textiles. These sectors collectively represent the primary industries through which corporate activity generates biodiversity impacts via GVCs (IPBES, 2019; NCFA, 2020).

Firm selection requires: operation in at least two countries; minimum three consecutive years of biodiversity-related disclosures; and complete financial performance data over the observation period. After removing outliers at the 1st and 99th percentiles, the final sample comprises 1,243 firms from 48 countries, generating approximately 11,700 firm-year observations. Geographic coverage spans North America (31%), Europe (34%), Asia-Pacific (25%), and other regions (10%), providing substantial variation in regulatory environments and biodiversity governance frameworks.

Variable Specification

Biodiversity Integration (BI) is the primary independent variable, constructed as a composite index from four disclosure-based dimensions sourced from Bloomberg ESG biodiversity sub-scores and GRI 304 disclosures: formal biodiversity policies and targets; ecosystem conservation and habitat restoration investment as a proportion of revenues; participation in third-party certified nature-positive supply chain programmes; and TNFD-aligned disclosure quality scores. The four components are standardised to unit variance and averaged, producing a BI index ranging from 0 to 100.

Supply Chain Sustainability (SCS), the mediating variable, is constructed from three sub-dimensions: environmental compliance scores; resource efficiency scores; and supplier

sustainability practice scores derived from auditing and certification data. These are sourced from the CDP Supply Chain programme, Bloomberg, and firm sustainability reports, aggregated using equal weighting. Firm Value (FV) is measured using Tobin's Q for market-based assessment and return on assets (ROA) for accounting-based assessment. Control variables include firm size, financial leverage, R&D intensity, capital expenditure intensity, board environmental expertise, and country-level governance quality.

Estimation Strategy

The econometric analysis proceeds in three stages. The baseline employs a fixed effects (FE) panel regression controlling for time-invariant firm heterogeneity and common time trends. Given the anticipated endogeneity of the BI index, firms with superior performance may have greater resources for biodiversity programmes, the system GMM estimator of Blundell and Bond (1998) is employed as the primary estimator, using lagged levels and differences as instruments. The Hansen J-test confirms instrument validity, and the Arellano-Bond AR(2) test verifies the absence of second-order serial correlation.

The mediation hypothesis (H3) is tested in a two-equation system following Baron and Kenny (1986) and Preacher and Hayes (2008), with indirect effect standard errors obtained through 5,000-iteration bootstrapping. The full model specifications are:

$$FVit = ai + b1BIit + b2SCSit + b3Xit + gi + dt + eit \quad (1)$$

$$SCSit = ai + th1BIit + th2Xit + gi + dt + nit \quad (2)$$

where FV denotes firm value, BI is the biodiversity integration index, SCS is the supply chain sustainability score, X is a vector of controls, and gi and dt denote firm and year fixed effects respectively. The indirect effect of BI on FV through SCS is the product th1 x b2, with significance assessed through bootstrapped confidence intervals. Industry heterogeneity (H4) is assessed through subsample analysis and interaction terms between BI and industry ecosystem dependency classifications.

Results

Descriptive Statistics and Preliminary Analysis

The mean BI index score is 38.4 (SD = 22.7), with considerable sectoral variation: agriculture and food firms record the highest mean BI scores (49.3), reflecting the advanced state of nature-positive certification in agri-food chains, while apparel and textiles record the lowest (27.1). European firms consistently score higher on the BI index (mean 48.6) than North American (33.2) or Asia-Pacific firms (29.4), reflecting the more advanced regulatory environment for biodiversity disclosure in the European Union. The SCS composite shows a positive trend, with mean scores increasing from 42.1 in 2010 to 58.7 in 2022. Zero-order Pearson correlations confirm that BI is positively associated with SCS ($r = 0.58$, $p < 0.001$), Tobin's Q ($r = 0.41$, $p < 0.001$), and ROA ($r = 0.29$, $p < 0.001$). Variance inflation factors are all below 3.8, confirming the absence of problematic multicollinearity.

Biodiversity Integration and Supply Chain Sustainability (H1)

The system GMM estimates confirm a positive and significant effect of biodiversity integration on supply chain sustainability ($th1 = 0.43$, $SE = 0.06$, $p < 0.001$), supporting H1. A ten-point increase in the BI index is associated with a 4.3-point improvement in the SCS composite, equivalent to approximately one-third of a standard deviation improvement in SCS. The effect is robust across all three component sub-dimensions: supplier environmental compliance ($b = 0.38$, $p < 0.001$), resource efficiency ($b = 0.31$, $p < 0.001$), and supplier sustainability practices ($b = 0.44$, $p < 0.001$). The stronger effect on supplier sustainability practices relative to resource efficiency suggests that the governance diffusion mechanism operates primarily through supplier management rather than technological substitution, consistent with the relational governance literature emphasising buyer-supplier collaboration as the primary vehicle for supply chain sustainability improvement (Lund-Thomsen

& Lindgreen, 2014). These findings provide the first large-sample econometric evidence that corporate biodiversity integration cascades through GVC governance to improve sustainability outcomes across chain segments.

Nature-Positive Business Models and Firm Value (H2)

The system GMM estimates reveal a positive and significant relationship between biodiversity integration and both Tobin's Q ($b = 0.019$, $SE = 0.004$, $p < 0.001$) and ROA ($b = 0.083$, $SE = 0.021$, $p < 0.001$), supporting H2. A ten-point improvement in the BI index is associated with a 0.19-unit increase in Tobin's Q and a 0.83 percentage point increase in ROA, holding all controls constant. For the median firm in the sample, this corresponds to an increase in market capitalisation of approximately USD 185 million and an increase in annual net income of approximately USD 28 million - economically significant magnitudes that validate the strategic case for biodiversity integration.

Temporal analysis reveals that the BI-Tobin's Q relationship strengthens significantly over the period. Splitting the sample into three sub-periods (2010 to 2014, 2015 to 2018, 2019 to 2022) shows BI coefficients of 0.011, 0.016, and 0.027 respectively, with the trend statistically significant (Chow test, $F = 4.83$, $p = 0.012$). This temporal acceleration is consistent with the hypothesis that regulatory and institutional developments, the SDGs in 2015, the Kunming-Montreal Global Biodiversity Framework in 2022, and TNFD guidance evolution, have progressively increased the market premium for nature-positive strategies, paralleling the dynamics documented for climate risk pricing (Giglio et al., 2021).

Mediation by Supply Chain Sustainability (H3)

The mediation analysis confirms that supply chain sustainability partially mediates the biodiversity-firm value relationship, supporting H3. The indirect effect of BI on Tobin's Q through SCS is

positive and significant (indirect effect = 0.008, SE = 0.002, 95% bootstrapped CI [0.004, 0.013], $p < 0.001$), representing 42.1% of the total effect of BI on Tobin's Q. The direct effect remains significant after including SCS (direct effect = 0.011, $p < 0.01$), confirming partial rather than full mediation. For ROA, the indirect effect through SCS accounts for 38.4% of the total BI-ROA relationship, with the direct effect again remaining significant. The partial mediation finding indicates that biodiversity integration generates firm value through two concurrent pathways. The indirect pathway, operating through supply chain sustainability, captures the operational value creation logic of the NRBV: nature-positive practices reduce supply chain costs, improve resource efficiency, reduce compliance risk, and support premium pricing. The direct pathway likely reflects equity market repricing of biodiversity risk and opportunity as investors incorporate BI disclosures into valuation models, consistent with the asset pricing literature on ESG and environmental risk (Chava, 2014; Krueger et al., 2020). The co-existence of these two pathways underscores the multidimensional financial value of biodiversity integration, operating simultaneously through operational improvements and capital market mechanisms.

Industry Heterogeneity (H4)

Subsample analysis confirms that biodiversity integration effects are heterogeneous across sectors, supporting H4. The strongest BI-Tobin's Q effects are observed in agriculture and food production ($b = 0.028$, $p < 0.001$) and fisheries and aquaculture ($b = 0.031$, $p < 0.001$), the sectors with highest ecosystem dependency and most developed nature-positive certification infrastructure. Weaker but significant effects are observed in construction and infrastructure ($b = 0.009$, $p = 0.04$) and apparel and textiles ($b = 0.011$, $p = 0.03$), where ecosystem dependencies are more indirect. The interaction between BI and the ENCORE ecosystem dependency score is positive and significant ($b = 0.0024$, $p = 0.001$), confirming that the financial premium for biodiversity integration scales with ecosystem dependency. These

heterogeneous effects provide granular guidance for investment prioritisation, indicating that financial returns on biodiversity strategy are highest where ecological dependency is most concentrated.

Discussion And Policy Implications

Nature-Positive Strategies as Sources of Competitive Advantage

The finding that biodiversity integration significantly improves both Tobin's Q and ROA provides the most comprehensive econometric evidence to date that nature-positive business models constitute sources of sustained competitive advantage within the NRBV framework (Hart, 1995; Hart & Dowell, 2011). The effect on Tobin's Q, which captures investor expectations of future competitive advantage, implies that equity markets recognise biodiversity integration as a forward-looking quality signal that differentiates firms capable of navigating the tightening regulatory and ecological landscape from those exposed to escalating natural capital risks. The temporal acceleration of the BI-valuation relationship over 2010 to 2022 is consistent with the institutional maturation hypothesis, which predicts that environmental performance premiums strengthen as regulatory disclosure requirements, investor engagement frameworks, and civil society scrutiny intensify (Eccles et al., 2014; Giglio et al., 2021). Firms that defer biodiversity strategy integration risk not only the loss of first-mover valuation advantages but also increasingly material financial penalties associated with nature-related risk exposure.

GVC Governance as a Biodiversity Transformation Mechanism

The confirmation that biodiversity integration significantly improves supply chain sustainability across chain segments advances the empirical literature on GVC sustainability governance. The finding that the governance diffusion effect is strongest for supplier

sustainability practices, reflecting relational governance through which lead firms set standards and build supplier capacity, is consistent with Gereffi et al.'s (2005) framework, which predicts that lead firm influence over supplier practices is greatest when governance involves significant supplier-specific investment and knowledge transfer. This has practical implications: governance mechanisms that build supplier ecological capability through technical assistance, co-investment, and long-term partnership relationships are likely to achieve greater supply chain sustainability improvements than compliance-only approaches.

The partial mediation finding is theoretically significant because it disentangles two distinct value-creation mechanisms that prior literature has conflated. The indirect pathway, operating through supply chain sustainability, reflects the operational value proposition of the NRBV: firms integrating biodiversity into supply chain governance generate resource efficiencies, reduce input cost volatility, mitigate supply disruption risks from ecosystem service degradation, and access premium markets demanding nature-positive credentials (Hart, 1995; Miemczyk et al., 2012). The direct pathway, which persists after controlling for supply chain sustainability, operates through capital market repricing of nature-related risk and opportunity. As institutional investors increasingly integrate biodiversity metrics into portfolio management, a trend accelerated by TNFD recommendations and expanding fiduciary duty interpretations that encompass systemic natural capital risks, firms with strong biodiversity integration command a valuation premium in Tobin Q independent of current accounting performance (Krueger et al., 2020; Chava, 2014). The co-existence of these two pathways has practical implications for how firms communicate biodiversity strategy to both operational and capital market audiences.

The industry heterogeneity findings add important granularity to the financial case for nature-positive investment. The substantially stronger BI-valuation effects in agriculture and food production (b = 0.028) and fisheries and aquaculture (b = 0.031) relative to construction and textiles reflect the differential materiality of ecosystem services across production systems. For agri-food firms, biodiversity underpins pollination, soil health, and watershed regulation, all direct inputs to production, making biodiversity integration a commercial imperative rather than a reputational exercise. The ENCORE dependency scores used to construct the interaction term provide a ready-made toolkit for firms and investors seeking to prioritise biodiversity strategy investment by materiality, directing resources to the supply chain nodes and geographies where ecological dependencies are most concentrated and biodiversity integration generates the greatest financial return (NCFA, 2020; Chaplin-Kramer et al., 2019).

Policy and Managerial Implications

For corporate managers, the study demonstrates that biodiversity integration is a value-creating investment generating returns through both supply chain operational improvements and capital market recognition. Chief sustainability officers should embed nature-positive targets into business model design, supply chain governance frameworks, capital allocation processes, and executive incentive structures. The industry heterogeneity findings provide a clear prioritisation signal: the financial return on biodiversity strategy is highest in agriculture, food, and fisheries sectors with concentrated ecosystem dependencies. For supply chain managers, the mediation findings imply that the pathway from biodiversity commitments to financial value runs substantially through operational supply chain improvements. Supplier development programmes that build ecological capability, landscape-level conservation partnerships addressing shared ecosystem dependencies, and long-term

procurement relationships creating incentives for supplier sustainability investment are all evidence-consistent instruments for capturing the financial co-benefits of sustainable supply chain management.

For investors and financial analysts, the capital market findings validate integration of biodiversity-specific metrics into equity valuation models. The progressive strengthening of the BI-valuation relationship suggests that biodiversity risk is increasingly priced, implying that portfolios systematically underweighting high-BI firms face growing mispricing risk as nature-related disclosures mature under TNFD frameworks. For policymakers, the study supports mandatory corporate biodiversity disclosure requirements as an accelerant for nature-positive business model diffusion. The corporate disclosure-to-valuation channel identified here implies that mandatory, standardised, and comparable biodiversity disclosures will strengthen market pricing of nature-related risks, creating stronger financial incentives for biodiversity integration than voluntary regimes. The EU Corporate Sustainability Reporting Directive's ESRS E4 biodiversity standard and mainstreaming of TNFD recommendations into securities regulation represent critical steps in this direction.

Conclusion

This study provides large-sample panel econometric evidence on the financial implications of nature-positive business model adoption within global value chains. Drawing on the NRBV and GVC theory, and employing system GMM estimation to address endogeneity, the study demonstrates that biodiversity integration significantly enhances supply chain sustainability, improves firm value through both operational and capital market channels, and that sustainable supply chain practices partially mediate the biodiversity-to-firm-value pathway. These effects are heterogeneous across industries, with the strongest financial

returns concentrated in sectors with the greatest ecosystem dependency. The study makes four contributions. It advances the NRBV with the most comprehensive econometric evidence to date that ecological capabilities constitute measurable competitive advantage in contemporary GVC environments. It applies GVC theory to the biodiversity domain, demonstrating that GVC governance mechanisms effectively diffuse nature-positive practices across production networks. It identifies supply chain sustainability as the primary operational mechanism through which biodiversity integration creates financial value. And it documents the temporal acceleration of biodiversity-valuation dynamics, providing evidence of the progressive institutionalisation of nature-positive strategy as a financial quality signal.

Several limitations invite further research. The disclosure-based operationalization of biodiversity integration may inadequately capture the ecological quality of corporate nature-positive commitments, given the well-documented gap between disclosure and implementation in sustainability practice. Future studies should incorporate direct ecological outcome measures alongside disclosure proxies to assess whether financial returns reflect genuine ecological performance or disclosure management. The sample's bias toward large publicly listed multinationals limits generalizability to smaller firms; extending analysis to SMEs in agri-food and forestry GVCs would enrich the evidence base. The broader message is unambiguous: biodiversity integration is an empirically validated source of supply chain resilience, operational efficiency, and market valuation. As the regulatory architecture governing corporate biodiversity accountability matures, the financial divergence between nature-positive leaders and biodiversity laggards is likely to intensify, making the strategic

imperative for nature-positive transformation ever more compelling.

Future research agendas should also address the role of institutional context in moderating the biodiversity-integration-to-firm-value relationship. The significant variation in BI index scores between European firms (mean 48.6) and Asia-Pacific firms (mean 29.4) suggests that the stringency of national biodiversity governance frameworks, including environmental regulation quality, enforcement capacity, and capital market disclosure requirements, materially conditions both the incentives to invest in biodiversity integration and the financial returns it generates. Studies employing multi-level modelling to separate firm-level, industry-level, and country-level determinants of biodiversity integration outcomes would advance theoretical understanding of the institutional architecture required to accelerate nature-positive business model adoption at scale. Similarly, the temporal acceleration documented in the BI-valuation relationship over 2010 to 2022 warrants further investigation to determine whether it reflects progressive market learning, regulatory signalling, or genuine shifts in consumer and investor preferences for nature-positive brands and supply chains.

The findings of this study also have implications for the measurement and reporting standards that will shape the next generation of corporate biodiversity accountability. The TNFD recommendations acknowledge that biodiversity metrics are less mature than carbon metrics, with no single universally accepted measure analogous to tonnes of CO2 equivalent (TNFD, 2023). The composite BI index employed in this study, drawing on GRI 304 disclosures, CDP Supply Chain data, and TNFD-aligned disclosure quality scores, represents one approach to aggregating heterogeneous biodiversity information into a tractable analytical measure. As standardisation of biodiversity reporting improves

under TNFD, ESRS E4, and related frameworks, researchers will have access to richer, more granular, and more comparable data that will enable more precise tests of the nature-performance relationship across the full spectrum of GVC participants, including the upstream agricultural and forestry producers who generate the majority of biodiversity impacts but receive the fewest direct financial incentives for nature-positive transformation under current market structures (Lambin et al., 2018; Lund-Thomsen & Lindgreen, 2014).

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POLICY, GOVERNANCE AND ENVIRONMENTAL LEGISLATION IN AFRICA

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Abstract

The interconnections between biodiversity conservation, public health, and governance have become increasingly evident across Africa, where environmental degradation continues to exacerbate health vulnerabilities and socio-economic inequalities. This paper examines the role of policy frameworks, governance structures, and environmental legislation in addressing the complex nexus between biodiversity loss and public health within the African context. Although existing scholarship has extensively examined biodiversity conservation, environmental governance, and public health as interconnected concerns, there remains insufficient philosophical and policy-oriented analysis of how environmental legislation and governance structures can be systematically integrated to address biodiversity loss and its public health consequences in Africa. Drawing on interdisciplinary insights from environmental ethics, political ecology, and public policy, the paper argues that weak institutional capacity, fragmented policy implementation, and inadequate enforcement mechanisms have undermined the efficacy of environmental legislation across many African states. The study employs a qualitative, normative-philosophical and interdisciplinary methodology, using conceptual analysis, critical analysis of relevant scholarly literature and policy documents, and selected case studies to examine the relationship between biodiversity governance,

environmental legislation, and public health. It further highlights how deforestation, climate change, pollution, and the loss of ecosystem services contribute to disease vulnerability, food insecurity, and declining quality of life. Through selected case studies, the analysis reveals both the limitations and emerging opportunities within current governance systems, including regional cooperation frameworks, community-based conservation initiatives, and the integration of indigenous knowledge systems into environmental decision-making. In response, the study proposes a holistic and participatory governance model that aligns biodiversity conservation with public health priorities by strengthening legal frameworks, improving institutional accountability, and mainstreaming environmental considerations into national development policies. The paper's original contribution lies in advancing an integrated governance framework that brings biodiversity conservation, public health, environmental legislation, and indigenous knowledge into a unified policy approach for strengthening ecological resilience and human well-being in Africa.

Keywords: Biodiversity Conservation, Public Health, Environmental Governance, Environmental Legislation, Sustainable Development, Ecosystem, Services Institutional Capacity

Introduction

The relationship between biodiversity, conservation, and public health has emerged as a critical area of scholarly and policy concern, particularly within the African context where ecological systems and human livelihoods are intertwined. Africa is endowed with rich biodiversity, ranging from tropical rainforests and savannahs to wetlands and coastal ecosystems, which provide essential ecosystem services such as food supply, water purification, climate regulation, and disease control. However, increasing environmental degradation driven by deforestation,

climate change, pollution, and unsustainable resource exploitation has significantly threatened these ecosystems, thereby undermining both conservation efforts and public health outcomes (United Nations Environment Programme [UNEP], 2019). The nexus between biodiversity and public health is especially evident in the rise of zoonotic diseases, food insecurity, and deteriorating environmental conditions across the continent. WHO has argued that the disruption of ecosystems increases human exposure to disease vectors and pathogens, thereby exacerbating public health crises (World Health Organization, 2020). In Africa, where healthcare systems are often fragile and socio-economic vulnerabilities are high, the implications of biodiversity loss extend beyond environmental concerns to include profound human health risks and developmental challenges (African Development Bank, 2021). Consequently, effective policy frameworks, governance structures, and environmental legislation are indispensable for addressing these interconnected issues in a sustainable and holistic manner.

Against this backdrop, the aim of this study is to critically examine the role of policy, governance, and environmental legislation in addressing the interconnected challenges of biodiversity conservation and public health in Africa. The study seeks to evaluate the effectiveness of existing frameworks, identify key challenges, and explore prospects for improving environmental governance in the region. Methodologically, the study adopts a qualitative and interdisciplinary approach, drawing on secondary data sources such as academic literature, policy documents, legal texts, and reports from international organizations. Analytical methods include conceptual analysis and critical evaluation of existing frameworks, complemented by illustrative case studies from selected African countries.

Environmental Policy Frameworks in Africa

Environmental policy frameworks in Africa operate within a multi-layered system comprising national policies, regional and continental initiatives, and international agreements. These frameworks collectively aim to regulate human interaction with the environment, promote biodiversity conservation, and safeguard public health. However, their effectiveness depends largely on coherence, institutional capacity, and the extent of integration across governance levels. National environmental policies in African countries are typically designed as overarching frameworks that guide environmental management, conservation practices, and sustainable development. These policies are often embedded within broader national development plans and are implemented through sector-specific regulations addressing areas such as forestry, water resources, agriculture, climate change, and public health (United Nations Environment Programme [UNEP], 2019). Structurally, national environmental policies generally include:

1. **Vision and guiding principles**, such as sustainability, precautionary principle, and intergenerational equity
2. **Strategic objectives,** including biodiversity conservation, pollution control, and climate resilience
3. **Institutional frameworks,** outlining the roles of ministries, agencies, and regulatory bodies
4. **Implementation mechanisms,** including monitoring, evaluation, and enforcement provisions

The primary objectives of these policies are to ensure the sustainable use of natural resources, protect ecosystems, reduce environmental risks to human health, and promote socio-economic development. In many African countries, environmental policies also emphasize poverty alleviation, recognizing the close

relationship between environmental degradation and economic vulnerability (African Development Bank, 2021). Despite their comprehensive design, national environmental policies often face significant integration challenges. One major issue is sectoral fragmentation, where environmental concerns are inadequately incorporated into key sectors such as agriculture, energy, and urban planning. This results in conflicting policy priorities, for example, between economic development initiatives and conservation goals.

At the continental level, the African Union plays a central role in shaping environmental policy direction through strategic frameworks and initiatives. Key among these is the Agenda 2063, which emphasizes sustainable development, environmental protection, and climate resilience as essential components of Africa's long-term transformation. The African Union also promotes environmental governance through programs such as the African Ministerial Conference on the Environment (AMCEN), which facilitates policy coordination, capacity building, and knowledge sharing among member states. These initiatives aim to harmonize environmental policies across the continent and strengthen collective responses to transboundary environmental challenges.

Despite strong participation in international frameworks, the domestication and implementation of these agreements remain significant challenges. Domestication refers to the process of incorporating international treaty obligations into national legal and policy systems. In many African countries, this process is slow and often incomplete, resulting in gaps between international commitments and local realities. Key barriers include weak legal systems, inadequate institutional frameworks, and lack of political will. Additionally, the complexity of international agreements can make them difficult to translate into actionable national policies.

Financial constraints and competing development priorities further complicate implementation efforts (UNEP, 2019). Moreover, there is often insufficient monitoring and evaluation of compliance with international obligations. This limits accountability and reduces the effectiveness of global environmental governance mechanisms at the national level. Environmental policy frameworks in Africa reflect a complex interplay between national priorities, regional cooperation, and international commitments. While significant progress has been made in developing comprehensive policies and legal instruments, persistent challenges in integration, coordination, and implementation continue to hinder their effectiveness. Addressing these gaps is essential for strengthening biodiversity conservation and improving public health outcomes across the continent.

Environmental Legislation in Africa

Environmental legislation in Africa constitutes a critical pillar of environmental governance, providing the legal basis for regulating human activities that impact ecosystems and public health. Across the continent, legal frameworks have evolved in response to both domestic environmental challenges and international obligations. However, the effectiveness of these laws depends not only on their design but also on institutional capacity, enforcement mechanisms, and broader socio-political dynamics. Environmental laws and regulations across African states generally reflect a combination of constitutional provisions, statutory enactments, and subsidiary regulations aimed at protecting natural resources and promoting sustainable development. Many African constitutions now recognize environmental rights, including the right to a clean and healthy environment, thereby elevating environmental protection to a fundamental legal principle (Boyle, 2012). At the statutory level, countries have enacted comprehensive environmental protection laws that address issues such as pollution control,

biodiversity conservation, environmental impact assessment (EIA), waste management, and climate change. For instance, framework legislation in several African states establishes national environmental standards, licensing regimes, and compliance requirements for industries and development projects (UNEP, 2019). These laws are often complemented by sector-specific regulations governing forestry, water resources, mining, and wildlife conservation. A notable feature of environmental legal frameworks in Africa is their alignment with international environmental agreements. Many national laws incorporate provisions derived from global treaties, thereby creating a hybrid legal system that integrates domestic and international norms. However, there is considerable variation across countries in terms of legal sophistication, scope, and implementation capacity.

The implementation of environmental legislation in Africa is primarily entrusted to regulatory agencies and enforcement bodies established at national and sub-national levels. These institutions typically include ministries of environment, environmental protection agencies, and specialized regulatory authorities responsible for monitoring compliance, issuing permits, and enforcing environmental standards. For example, in Nigeria, the National Environmental Standards and Regulations Enforcement Agency (NESREA) plays a central role in enforcing environmental laws and regulations, including compliance with international environmental agreements. Similar agencies exist across the continent, reflecting a common institutional model for environmental governance. These bodies employ a range of enforcement mechanisms, including inspections, sanctions, fines, and closure of non-compliant facilities. Environmental Impact Assessment (EIA) processes are also widely used as preventive tools to evaluate the potential environmental and health impacts of proposed projects before approval is granted. Despite these

mechanisms, enforcement remains inconsistent due to limited resources, inadequate technical capacity, and political constraints. This often results in a gap between legal provisions and actual environmental outcomes.

Corruption and political interference further undermine the effectiveness of environmental legislation. In some cases, regulatory decisions are influenced by vested interests, leading to the approval of environmentally harmful projects or the failure to sanction violators. This erodes public trust in environmental institutions and weakens accountability mechanisms. Political considerations may also override environmental priorities, particularly in contexts where economic growth and revenue generation are prioritized over sustainability. As a result, environmental laws may be selectively enforced or disregarded altogether.

Another critical challenge is the coexistence of multiple legal systems, often referred to as legal pluralism. In many African countries, statutory laws operate alongside customary and religious legal systems, which may have different approaches to resource management and environmental protection. While customary systems can play a positive role in conservation through traditional ecological knowledge and community-based practices, conflicts may arise when they are not aligned with formal legal frameworks. For example, land tenure systems based on customary rights may clash with state-led conservation initiatives or commercial resource exploitation. These conflicts can create ambiguity and undermine the coherence of environmental legislation, making it difficult to achieve consistent and effective environmental governance. Environmental legislation in Africa provides an essential legal foundation for biodiversity conservation and public health protection. However, its

effectiveness is constrained by enforcement challenges, institutional weaknesses, and complex socio-political dynamics. Addressing these issues requires not only legal reforms but also broader efforts to strengthen governance, enhance transparency, and integrate diverse legal systems into a coherent and inclusive framework.

Governance and Institutional Dynamics

Environmental governance in Africa is shaped by a complex network of institutions, actors, and processes operating at multiple levels. These dynamics influence how environmental policies are formulated, implemented, and enforced, and ultimately determine the effectiveness of biodiversity conservation and public health protection. Understanding governance structures, community participation, and the role of non-state actors is essential for evaluating environmental outcomes across the continent. State institutions remain the primary actors in environmental governance in Africa, bearing responsibility for policy formulation, regulatory enforcement, and coordination of environmental management efforts. These institutions typically include ministries of environment, natural resource agencies, and specialized regulatory bodies tasked with overseeing sectors such as forestry, water, wildlife, and climate change (United Nations Environment Programme [UNEP], 2019). The role of the state is particularly in establishing legal frameworks, enforcing compliance, and integrating environmental considerations into national development planning. Governments also serve as key intermediaries between international environmental commitments and domestic implementation. However, the effectiveness of state institutions is often constrained by limited financial resources, inadequate technical expertise, bureaucratic inefficiencies, and political pressures. Furthermore, central governments frequently dominate environmental decision-making processes, which can

lead to a disconnect between national policies and local realities. This underscores the need for more inclusive and adaptive governance systems that reflect the socio-ecological diversity of African contexts.

Decentralization has emerged as a significant trend in environmental governance, aimed at transferring authority and responsibility from central governments to regional and local institutions. This approach is based on the premise that local actors are better positioned to understand and manage their environmental resources effectively (Ribot, 2002). Local governance structures, including municipal authorities and community-based organizations, play a critical role in implementing environmental policies, monitoring resource use, and resolving conflicts. Decentralization can enhance accountability, improve resource management, and foster greater community participation. However, the success of decentralization in Africa has been mixed. In many cases, local institutions lack the capacity, funding, and autonomy required to perform their functions effectively. Additionally, decentralization processes are sometimes incomplete or poorly coordinated, leading to overlapping responsibilities and governance gaps. Thus, while decentralization holds promise, it requires strong institutional support and clear frameworks to achieve its intended outcomes.

Indigenous and local communities in Africa possess rich bodies of traditional ecological knowledge (TEK), which have been developed over generations through close interaction with the natural environment. These knowledge systems encompass practices related to land use, biodiversity conservation, water management, and climate adaptation, often guided by cultural values and spiritual beliefs (Berkes, 2012). Traditional ecological knowledge contributes significantly to sustainable resource

management by promoting practices such as crop diversification, sacred groves preservation, and seasonal harvesting. These approaches are often adaptive and context-specific, making them particularly valuable in addressing environmental challenges in diverse African ecosystems. However, TEK has historically been marginalized in formal governance frameworks, which tend to prioritize scientific and technical knowledge. Integrating indigenous knowledge into environmental policy and decision-making processes is therefore essential for achieving more holistic and culturally relevant governance outcomes.

Biodiversity Loss and Public Health Implications

Biodiversity loss in Africa has far-reaching consequences that extend beyond ecological degradation to directly affect human health and well-being. The intricate relationship between ecosystems and public health underscores the urgency of addressing environmental decline through integrated policy and governance frameworks. This section examines the key drivers of biodiversity loss, their implications for public health, and selected case studies that illustrate these dynamics within the African context. Biodiversity loss in Africa is driven by a combination of anthropogenic and natural factors, many of which are interconnected and mutually reinforcing. Deforestation remains one of the most significant drivers, particularly in regions such as the Congo Basin and West Africa. Forests are cleared for agriculture, logging, and infrastructure development, leading to habitat destruction and fragmentation. This not only reduces species diversity but also disrupts ecological processes essential for maintaining environmental balance (FAO, 2020). Urbanization is another major factor contributing to biodiversity loss. Rapid population growth and the expansion of cities have resulted in the conversion of natural habitats into built environments. Urban sprawl often leads to increased waste generation, pollution, and pressure on surrounding ecosystems, thereby degrading

biodiversity. Climate change further exacerbates biodiversity loss by altering temperature patterns, precipitation cycles, and ecosystem dynamics. Changes in climate conditions can lead to species migration, extinction, and the disruption of ecological interactions. In Africa, climate variability has significantly impacted ecosystems such as savannahs, wetlands, and coastal zones (IPCC, 2021). Pollution, including air, water, and soil contamination, also plays a critical role. Industrial activities, oil spills, agricultural runoff, and improper waste disposal contribute to environmental degradation, affecting both terrestrial and aquatic biodiversity. For instance, pollution in the Niger Delta has severely impacted marine life and local ecosystems. These drivers are often intensified by socio-economic factors such as poverty, population pressure, and weak governance, which limit the capacity for effective environmental management.

The loss of biodiversity has profound implications for public health, particularly in Africa where many communities rely directly on natural ecosystems for survival. One of the most significant health impacts is the increased risk of zoonotic diseases, which are transmitted from animals to humans. Environmental degradation, particularly deforestation and habitat encroachment, increases human contact with wildlife, thereby facilitating the pathogens (World Health Organization [WHO], 2020). Outbreaks of diseases such as Ebola and Lassa fever have been linked to ecological disturbances, highlighting the connection between biodiversity loss and emerging health threats.

Biodiversity loss also undermines food security, as it affects agricultural productivity, fisheries, and livestock systems. The decline in pollinators, soil fertility, and genetic diversity of crops reduces resilience to pests, diseases, and climate variability (FAO, 2020). In many African countries, this has contributed to increased

food insecurity and malnutrition, particularly among vulnerable populations. Furthermore, the loss of wild food sources, such as bushmeat and edible plants, reduces dietary diversity and exacerbates nutritional deficiencies. This has significant implications for child health and overall population well-being. Healthy ecosystems play a crucial role in maintaining **water and air quality**, both of which are essential for public health. The degradation of forests and wetlands reduces natural water filtration, leading to contamination of water sources and increased incidence of waterborne diseases such as cholera and dysentery. Similarly, air pollution resulting from industrial emissions, deforestation, and urban activities contributes to respiratory illnesses, including asthma and chronic obstructive pulmonary disease (COPD). In many African cities, poor air quality has become a major public health concern, reflecting the broader environmental crisis.

For instance, the Congo Basin, one of the largest tropical rainforest regions in the world, is a critical biodiversity hotspot. However, it faces significant threats from logging, mining, and agricultural expansion. Deforestation in this region has led to habitat loss and increased human-wildlife interactions, contributing to the emergence of zoonotic diseases. The situation highlights the need for stronger conservation policies and cross-border governance frameworks. The Niger Delta region has experienced extensive environmental degradation due to oil exploration and pollution. Oil spills and gas flaring have destroyed aquatic ecosystems, reduced fish populations, and contaminated water sources. These environmental impacts have had severe public health consequences, including increased rates of respiratory diseases, skin conditions, and waterborne illnesses (UNEP, 2011). The case underscores the importance of enforcing environmental regulations and holding corporations accountable. The Sahel region is characterized by fragile ecosystems and high

vulnerability to climate change. Desertification, driven by climate variability and unsustainable land use practices, has led to declining agricultural productivity and food insecurity. This has contributed to malnutrition, displacement, and conflict over scarce resources. Efforts such as the Great Green Wall initiative demonstrate the potential for integrated approaches to address environmental and health challenges.

Several key lessons emerge from these case studies:

i. **Interconnectedness of ecosystems and health:** Environmental degradation directly impacts public health, necessitating integrated policy approaches.

ii. **Importance of governance and enforcement**: Weak regulatory frameworks and poor enforcement exacerbate biodiversity loss and its health consequences.

iii. **Need for community involvement:** Local participation and indigenous knowledge are essential for sustainable conservation efforts.

iv. **Value of regional cooperation:** Transboundary environmental challenges require coordinated responses across countries.

v. **Integration of environmental and health policies:** Addressing biodiversity loss and public health challenges requires a holistic and interdisciplinary approach.

In conclusion, biodiversity loss in Africa is not merely an environmental issue but a critical public health concern. Understanding its drivers and impacts is essential for developing effective governance strategies that promote both ecological sustainability and human well-being.

Challenges in Policy Implementation and Governance

Despite the existence of numerous environmental policies, legal frameworks, and governance institutions across Africa, the implementation of these instruments remains significantly constrained. The gap between policy formulation and effective execution continues to undermine biodiversity conservation and public health objectives. This section examines the key structural, institutional, financial, and socio-political challenges affecting environmental governance in Africa. One of the most persistent challenges is **policy fragmentation,** where environmental policies are developed and implemented in isolation from other sectoral policies such as agriculture, energy, mining, and urban development. This lack of integration leads to conflicting objectives and weak policy coherence. For instance, while environmental policies may prioritize conservation, agricultural or industrial policies may simultaneously promote land expansion and resource exploitation, resulting in ecosystem degradation (United Nations Environment Programme [UNEP], 2019).

Furthermore, coordination among government agencies is often weak, with overlapping mandates and unclear institutional responsibilities. This creates inefficiencies, duplication of efforts, and regulatory gaps. In many African countries, environmental governance is dispersed across multiple ministries and agencies, making it difficult to achieve a unified and strategic response to environmental challenges. The absence of effective inter-sectoral coordination mechanisms also limits the ability of governments to address complex issues such as climate change, biodiversity loss, and public health in an integrated manner.

Institutional weaknesses constitute another major barrier to

effective environmental governance. Many environmental agencies in Africa suffer from inadequate administrative capacity, limited technical expertise, and weak organizational structures. These deficiencies hinder their ability to design, implement, and enforce environmental regulations effectively. In addition, institutions often lack autonomy, making them vulnerable to political interference and external pressures. This compromises their ability to act independently in the enforcement of environmental laws, particularly in cases involving powerful economic actors or politically connected individuals. Corruption within regulatory institutions further undermines governance effectiveness. In some instances, environmental approvals and enforcement decisions are influenced by bribery or political favoritism, leading to the approval of environmentally harmful activities and weakening accountability mechanisms. A critical constraint on environmental governance in Africa is inadequate funding. Environmental agencies are frequently underfunded, limiting their ability to conduct monitoring, enforcement, research, and public awareness campaigns. This financial constraint affects both human and institutional capacity, resulting in understaffed agencies and poorly equipped regulatory bodies. The lack of investment in environmental infrastructure such as laboratories, monitoring systems, and data collection tools further reduces the effectiveness of environmental management. Without reliable data and technological capacity, it becomes difficult to assess environmental conditions accurately or respond to emerging threats. Capacity-building challenges also persist at both national and local levels. Many personnel within environmental institutions lack specialized training in environmental science, law, and policy analysis, which affects the quality of decision-making and implementation outcomes (UNEP, 2019).

Environmental governance in Africa is also shaped by broader socio-economic and political conditions. High levels of poverty

and unemployment often compel communities to engage in unsustainable resource use practices, such as illegal logging, poaching, and overfishing, as survival strategies. This creates tension between conservation objectives and livelihood needs. Political instability and weak governance systems further exacerbate environmental challenges. In conflict-affected regions, environmental regulations are often ignored, and natural resources may be exploited to finance armed groups, leading to severe ecological degradation. Additionally, short-term political priorities frequently overshadow long-term environmental concerns. Governments may prioritize economic growth, infrastructure development, and revenue generation over environmental protection, especially in resource-dependent economies. This results in policy trade-offs that often disadvantage environmental sustainability. Cultural and behavioral factors also play a role, as limited environmental awareness and weak public engagement reduce pressure on governments to enforce environmental standards effectively. The challenges facing environmental policy implementation and governance in Africa are multidimensional and deeply interconnected. Policy fragmentation, institutional weaknesses, inadequate funding, and socio-political constraints collectively undermine the effectiveness of environmental governance systems. Addressing these challenges requires not only institutional reform and increased investment but also stronger political commitment, enhanced coordination mechanisms, and greater public participation. Without these reforms, efforts to conserve biodiversity and protect public health will remain significantly limited in their impact.

Conclusion

This study has examined the intricate relationship between biodiversity, conservation, and public health in Africa, with particular emphasis on the role of policy, governance, and environmental legislation. It has demonstrated that Africa's rich

biodiversity, while central to ecological stability and human survival, is increasingly under threat from deforestation, climate change, urbanization, pollution, and unsustainable resource exploitation. These environmental pressures have far-reaching consequences, not only for ecosystems but also for public health outcomes, including the emergence of zoonotic diseases, food insecurity, and declining water and air quality. A key argument advanced in this work is that biodiversity loss and public health challenges in Africa are fundamentally interconnected and cannot be effectively addressed in isolation. The degradation of ecosystems directly undermines ecosystem services that sustain human well-being, thereby reinforcing the need for integrated environmental and health governance frameworks. In this regard, policy, governance, and environmental legislation emerge as central instruments for mediating human-environment interactions and promoting sustainability.

The study further highlights that although many African countries have developed comprehensive environmental policies and legal frameworks, their effectiveness is often limited by weak enforcement, institutional constraints, policy fragmentation, and inadequate funding. Governance challenges such as corruption, political interference, and limited coordination among institutions continue to undermine environmental management efforts. Nevertheless, promising developments including regional cooperation, community-based conservation initiatives, and the integration of indigenous knowledge systems demonstrate potential pathways toward more effective and inclusive environmental governance. The importance of policy, governance, and environmental legislation is therefore reaffirmed as indispensable for achieving sustainable biodiversity conservation

[76]https://www.forestsnews.org › in-cameroon.

and safeguarding public health in Africa. Effective policies provide strategic direction, governance structures ensure coordination and participation, and legislation offers the legal backbone for enforcement and accountability. When these three elements function coherently, they create a robust framework capable of addressing complex environmental challenges in a holistic manner.

In final reflection, the future of biodiversity conservation and public health in Africa depends on some transformative shift toward integrated, participatory, and well-enforced environmental governance systems. Such systems must bridge the gap between law and practice, state and community, and science and indigenous knowledge. Only through such a comprehensive approach can Africa achieve ecological resilience, protect its invaluable biodiversity, and secure the health and well-being of present and future generations.

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STEWARDSHIP THEOLOGY AND INDIGENOUS ECOLOGICAL KNOWLEDGE AS PATHWAYS FOR BIODIVERSITY CONSERVATION IN THE AFRICAN DIASPORA

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Abstract

Africa and its diaspora communities face serious environmental challenges, including the loss of plant and animal species, climate change, and the destruction of natural habitats. This paper argues that two frameworks, biblical stewardship theology and Africa's own indigenous ecological knowledge, can together address these problems more effectively than either can alone. Drawing on Psalm 24:1, which declares that the earth belongs to God, and Genesis 2:15, which instructs humans to cultivate and keep the garden, this study explores how African diaspora communities can use these scriptures to motivate environmental responsibility. The paper also examines how African ancestral practices, including sacred groves, seasonal farming customs, and communal land management, have long protected biodiversity in ways that modern conservation science is only beginning to appreciate. Through the fusion of these frameworks, the paper shows that biblical theology

and indigenous ecological wisdom are not opposites but partners in the pursuit of environmental justice. The study proposes a Covenantal Stewardship and Communal Ecology framework that integrates biblical theology, indigenous knowledge, and conservation science, and concludes that African diaspora communities occupy a unique position to bridge faith, culture, and conservation advocacy, offering lessons relevant both for Africa and for global efforts to protect the natural world.
Keywords: Stewardship theology; indigenous ecological knowledge; African diaspora; biodiversity conservation; climate justice; Psalm 24:1; Genesis 2:15

Introduction

The world faces a compounding ecological emergency in which climate change, biodiversity loss, and habitat destruction increasingly threaten the stability of natural systems on which human life depends (Intergovernmental Panel on Climate Change [IPCC], 2023; United Nations Environment Programme [UNEP], 2021; Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, 2019). Africa is disproportionately vulnerable within this crisis. The continent hosts some of the richest biodiversity on earth, yet deforestation, desertification, illegal mining, and unsustainable agricultural expansion continue to erode ecosystems that millions of people depend upon for food, water, and livelihood (UNEP, 2024; Food and Agriculture Organisation of the United Nations, 2020; Kanu, 2024). At the same time, Africa contributes comparatively little to global greenhouse gas emissions, so that the burden of ecological crisis falls heavily on communities least responsible for causing it, raising urgent questions of environmental justice (African Development Bank Group, 2022).

Conservation policy has traditionally relied on technocratic and scientific approaches, including protected areas, wildlife

legislation, and international treaties. These instruments remain necessary, but experience across the continent suggests that purely technocratic conservation, imposed without regard for local values, spirituality, and traditional ecological practice, often fails to secure lasting community commitment (Berkes, 2018; Kanu 2023). Conservation that ignores the cultural and religious meanings communities attach to land, forests, and rivers risks being perceived as external imposition rather than shared responsibility. This paper argues that two underused resources, biblical stewardship theology and African indigenous ecological knowledge, offer complementary foundations capable of grounding biodiversity conservation in values that communities already hold (Kanu, 2022).

Biblical stewardship theology, rooted in texts such as Genesis 2:15 and Psalm 24:1, presents creation as belonging to God and entrusted to human care rather than human exploitation (Bauckham, 2010). Indigenous ecological knowledge, expressed through sacred groves, seasonal farming customs, and communal land management, represents centuries of accumulated environmental wisdom developed long before contemporary conservation science emerged (Gadgil et al., 1993; Pilani, 2024; Kanu, 2017). Both traditions converge on a shared conviction that human beings are accountable for the wellbeing of the natural world rather than its unrestrained masters.

The African diaspora occupies a distinctive position from which to bring these frameworks into productive dialogue. Diaspora communities frequently retain both biblical faith and inherited ecological memory, while also engaging global environmental discourse from positions shaped by migration, displacement, and experiences of environmental injustice in host societies. This paper therefore examines how stewardship theology and indigenous ecological knowledge can be woven together into an integrated

framework capable of informing biodiversity conservation efforts across Africa and its diaspora.

The objectives of this study are threefold. First, it examines the biblical theology of stewardship as it relates to creation care and biodiversity. Second, it explores African indigenous ecological knowledge systems and their historical contribution to conservation. Third, it develops a comparative and integrative framework, the Covenantal Stewardship and Communal Ecology model, that draws these traditions into constructive partnership for environmental justice. The argument advanced here does not claim that theology or indigenous knowledge can substitute for scientific conservation methods. Rather, it contends that durable conservation outcomes require moral motivation and cultural legitimacy that scientific expertise alone cannot supply, and that biblical stewardship theology and African indigenous ecological knowledge together offer precisely this kind of motivation. Where conservation policy has relied solely on legal restriction and external enforcement, compliance has often proven fragile once enforcement weakens. Where conservation has instead drawn on values that communities already hold sacred, whether biblical or ancestral, protection has tended to persist across generations without continuous external policing (Pretty & Smith, 2004). This observation forms the practical foundation for the argument that follows.

Literature Review

Biblical Creation Theology and Ecological Ethics

A growing body of scholarship has sought to recover the ecological dimensions of biblical theology, challenging earlier assumptions that Scripture concerns itself exclusively with human salvation (Bauckham, 2022; Horrell, 2022). Scholars increasingly demonstrate that the biblical narrative situates humanity within, rather than above, the wider community of creation, with texts such

as Genesis 1 and 2, the Psalms, and the wisdom literature consistently portraying creation as possessing inherent value before God independent of its usefulness to humanity (Habel, 2020). This ecological turn in biblical scholarship provides the theological foundation for stewardship approaches to environmental ethics.

Stewardship Theology

Stewardship theology holds that human beings are entrusted with responsibility for creation rather than granted unconditional ownership of it. Berry (2022) traces the development of stewardship as a theological category, noting both its strengths in emphasising accountability and the criticisms it has attracted for potentially implying human superiority over nature. Some ecological theologians argue that stewardship language, if uncritically applied, can reproduce hierarchical assumptions about human dominion, and propose relational or priestly models that emphasise mutual belonging between humanity and creation instead (Moo, 2024). Beisner (2023) offers a more traditional defence of stewardship language, arguing that responsible dominion, properly understood, remains compatible with rigorous environmental care and need not be abandoned in favour of alternative models (Kanu et al., 2025. This paper adopts a chastened stewardship model that retains the language's emphasis on accountability while foregrounding relationality and limits on exploitation, treating the debate between stewardship and relational models as a matter of emphasis rather than an irreconcilable disagreement.

Ecological Hermeneutics

Ecological hermeneutics provides the interpretive method through which biblical texts are read with explicit attention to their implications for the nonhuman creation. Horrell (2022) and

Conradie (2020) argue that ecological hermeneutics need not impose modern environmental concerns onto ancient texts artificially, but can recover ecological dimensions already present within the theological imagination of Scripture. This approach guides the present study's reading of Genesis and the Psalms.

African Indigenous Ecological Knowledge

African indigenous knowledge systems have long incorporated sophisticated ecological practices, including sacred groves, totemic restrictions on hunting, seasonal farming calendars, and communal grazing regulation (Nabofa, 2022; Zalanga, 2023). These practices, though locally varied, share underlying principles of respect for nature, communal responsibility, and intergenerational stewardship. Scholars increasingly argue that these systems anticipated, in practical form, many principles that contemporary conservation science now treats as innovative, including rotational resource use and buffer zones around sensitive habitats (Zalanga, 2023). Kanu (2024) further argues that African eco-theology, understood broadly as the intersection of indigenous cosmology and lived religious practice, offers conceptual resources capable of enriching, rather than merely supplementing, global environmental ethics.

Environmental Justice

Environmental justice scholarship examines how the burdens of ecological degradation and the benefits of conservation are unevenly distributed across race, class, and geography. African and African diaspora communities frequently experience the effects of environmental racism, in which polluting industries, extractive projects, and inadequate environmental protections disproportionately affect marginalised populations (Villa-Vicencio, 2021). This literature provides an important corrective to conservation approaches that overlook questions of justice and equity, insisting that conservation strategy must attend not only to

ecological outcomes but to who bears the costs of both degradation and protection.

Religion and Conservation

A growing interdisciplinary literature examines the role of religious communities in conservation practice, noting that faith institutions possess moral authority, extensive networks, and land holdings that position them as significant, if underused, conservation actors (World Council of Churches, 2022). This study builds on that literature by proposing a framework that explicitly integrates biblical and indigenous resources rather than treating them as separate or competing conservation strategies.

Methodology

This study adopts a qualitative interdisciplinary design combining biblical-theological analysis, ecological hermeneutics, comparative theological analysis, and documentary research. The biblical-theological component examines Genesis 1:26 to 28, Genesis 2:15, and Psalm 24:1 within their literary and canonical contexts, attending to the Hebrew vocabulary of dominion, cultivation, and divine ownership. Ecological hermeneutics serves as the interpretive lens through which these texts are read for their environmental implications. The comparative theological component places biblical stewardship theology alongside African indigenous ecological knowledge systems, identifying points of convergence and divergence between the two traditions. Documentary research draws on scholarship in African indigenous knowledge, environmental theology, and conservation science, together with reports from international bodies including UNEP and the IPCC. Together these methods enable a framework that is textually grounded, culturally attentive, and practically oriented toward biodiversity conservation.

Biblical Theology of Stewardship

Genesis 1:26 to 28 has historically been interpreted as granting humanity dominion over creation, a reading that some critics argue has licensed environmental exploitation. Closer exegetical attention, however, suggests that the dominion language must be read alongside the image of God in which humanity is created, implying representative and caretaking authority rather than unrestrained domination (Wright, 2020). Dominion in the ancient Near Eastern context typically described the responsible rule of a steward acting on behalf of a sovereign, not the licence of an owner to exploit property at will. Genesis 2:15 provides an important corrective and clarification, describing humanity's vocation in the garden using two Hebrew verbs, *ābaḏ*, to work or serve, and *šāmar*, to keep or protect (Wenham, 1987). This pairing indicates that humanity's relationship to creation is one of cultivation combined with protection, a vocation of productive care rather than extraction (Middleton, 2014). Read together, Genesis 1 and 2 present a coherent picture in which human authority over creation is real but bounded, exercised always in service of creation's flourishing rather than its depletion.

Psalm 24:1 declares that the earth and its fullness belong to the Lord, along with the world and those who dwell in it. This affirmation of divine ownership relativises all human claims to land and resources. If the earth belongs to God, human beings hold it in trust rather than possess it outright, a theological principle with direct implications for biodiversity conservation, since species and habitats are not human property to dispose of but part of a creation whose ultimate owner remains God (Wright, 2004). The Sabbath and Jubilee traditions extend this theology by institutionalising limits on exploitation. The Sabbath principle, applied to land in Leviticus 25, mandates periodic rest for fields, preventing continuous extraction and allowing ecological recovery. The Jubilee tradition further requires the periodic restoration of land to

its original stewards, preventing permanent concentration of resources and reasserting that land ultimately belongs to God rather than to any human owner in perpetuity (Bergsma, 2007). These traditions together constitute a creation covenant of responsibility, in which blessing is tied to right relationship with the land and its inhabitants, and ecological degradation is understood as a violation of covenant obligation rather than a merely technical failure. This covenantal framing carries direct implications for biodiversity in particular, since a land permitted regular rest and periodic restoration is far more likely to sustain the plant and animal populations dependent on it than land subjected to continuous extraction. The Sabbath principle, in this sense, anticipates in theological form what conservation science now describes through concepts such as sustainable yield and ecosystem recovery time. Read together, dominion tempered by cultivation and protection, divine ownership relativising human claims, and periodic limits on exploitation constitute a coherent biblical theology in which biodiversity loss represents not merely an ecological failure but a breach of covenant responsibility toward both God and the created order.

Indigenous Ecological Knowledge and African Conservation Traditions

Long before the emergence of formal conservation science, African communities developed sophisticated systems of ecological management rooted in religious and cultural practice. Sacred groves, forests or landscapes designated as spiritually significant and therefore protected from exploitation, remain among the most striking examples of this indigenous conservation ethic. Protected because they are believed to house ancestral spirits or serve as sites of ritual significance, sacred groves have preserved biodiversity, including rare plant and animal species, in areas otherwise subject to extensive deforestation (Nabofa, 2022). Their persistence demonstrates that religious conviction can function as

an effective, low-cost, and community-enforced conservation mechanism.

Traditional biodiversity protection also operated through totemic systems, in which particular clans or communities observed restrictions on hunting or consuming specific animal species regarded as symbolically connected to their identity. These totemic restrictions functioned, whatever their spiritual rationale, as informal species protection measures that reduced pressure on vulnerable populations. Communal land ethics further reinforced conservation outcomes, since land in many African societies was held collectively rather than individually, with usage governed by customary authorities who balanced present need against future sustainability and intergenerational access. Indigenous agricultural practices likewise embedded ecological wisdom. Shifting cultivation, intercropping, and fallow periods allowed soil fertility to regenerate naturally, while seasonal ecological knowledge, transmitted orally across generations, guided planting, harvesting, and resource use according to closely observed environmental rhythms. This body of practical knowledge often anticipated, in localised and experientially derived form, principles that contemporary ecology now formalises through concepts such as carrying capacity and rotational resource management (Zalanga, 2023).

Underlying these practices is a relational understanding of the human place within nature. Rather than positioning humanity as separate from or superior to the natural world, many African cosmologies understand human beings, ancestors, and the environment as bound together within a single moral and spiritual community, so that harming the land or its creatures carries consequences understood as simultaneously ecological, social, and spiritual (Kanu, 2024). This relational ontology differs in emphasis from stewardship theology's language of human responsibility for

a creation from which humanity is theologically distinguished, a difference explored further in the comparative analysis below. Importantly, these indigenous systems were rarely static or purely traditional in the sense of being unchanging. Communities adjusted grazing rotations, farming calendars, and hunting restrictions in response to observed environmental change, demonstrating an adaptive management capacity that closely parallels what contemporary conservation science now terms adaptive co-management. The historical effectiveness of sacred groves and totemic protections in preserving biodiversity within otherwise heavily exploited landscapes provides empirical, not merely cultural, evidence that indigenous ecological knowledge merits serious engagement by conservation scientists and policymakers rather than dismissal as pre-scientific custom.

African Diaspora Ecological Identity

Migration has not erased the ecological memory that African diaspora communities carry with them. Even where physical connection to ancestral land has been severed by slavery, colonial displacement, or contemporary economic migration, cultural memory of rivers, forests, sacred sites, and communal land practices persists within diaspora religious and cultural life, often transmitted through story, ritual, and communal identity rather than direct experience of the land itself (Clifford, 1994). Diaspora churches have increasingly become sites where this inherited ecological consciousness intersects with biblical theology and contemporary environmental advocacy. Congregations that maintain transnational ties to African communities are often well positioned to translate ecological concern into concrete action, whether through remittances that support conservation initiatives, advocacy directed at institutions in host countries, or theological education that connects biblical stewardship with African ecological memory (Adogame, 2013).

Diaspora communities also frequently confront environmental racism within their host societies, including disproportionate exposure to pollution, inadequate green space, and marginal siting of industrial hazards near minority neighbourhoods (Villa-Vicencio, 2021; Bullard, 2000). This experience of environmental injustice abroad often sharpens diaspora communities' sensitivity to environmental injustice in Africa, generating a transnational ecological consciousness attentive to the structural and racialised dimensions of environmental harm in both contexts. Such consciousness positions diaspora churches and organisations to advocate simultaneously for environmental justice at home and ecological restoration on the African continent, treating these as connected rather than separate concerns.

This dual positioning gives diaspora communities a distinctive comparative advantage. They are close enough to African ecological realities, through family ties, remittance networks, and periodic return visits, to understand local conservation needs with some specificity, while also possessing access to the institutional resources, advocacy platforms, and financial capacity of their host societies. Diaspora churches in particular are well placed to fund small-scale conservation projects, sponsor theological education that integrates ecological content, and advocate within host-country policy environments for climate finance and biodiversity funding directed toward African partners (Levitt, 2007).

Comparative Analysis

Biblical stewardship theology and African indigenous ecological ethics converge in several important respects. Both traditions articulate a fundamentally relational worldview, in which human beings exist in relationship with the divine, with community, and with the natural world rather than as isolated individuals

confronting an inert environment (Magesa, 1997). Both traditions likewise emphasise communal rather than purely individual responsibility for ecological outcomes, understanding environmental harm as damage to a shared inheritance rather than merely private loss. Both traditions further express deep respect for creation as possessing value beyond its immediate utility to humanity, and both incorporate a strong sense of intergenerational justice, in which present generations hold the land in trust for those yet to come (Gyekye, 1997).

The two traditions also diverge in important ways that a genuine comparative analysis must not obscure. Stewardship theology, even in its chastened form, retains a language of human responsibility for a creation that stands, in some sense, distinct from humanity, reflecting the biblical narrative's account of humanity's unique creation in the divine image (Middleton, 2005). African indigenous ontologies, by contrast, frequently emphasise human embeddedness within nature more thoroughly, with less sharp differentiation between human and nonhuman participants in the moral community. This is a difference of emphasis rather than outright contradiction, and the two traditions can be read as complementary correctives to one another, stewardship theology guarding against ontologies that might dissolve human moral accountability entirely, and indigenous relational ontology guarding against readings of stewardship that reintroduce human superiority over creation.

A further point of divergence concerns the source of ecological authority. Biblical stewardship theology grounds obligation in divine command mediated through scripture and, within diaspora contexts, through ecclesial teaching. Indigenous ecological knowledge grounds obligation in ancestral custom mediated through customary authority and oral tradition (Mbiti, 1969).

These differing sources of legitimacy need not compete. In many African Christian communities, biblical and customary authority have long coexisted, with church leaders and traditional custodians occupying overlapping, sometimes contested, but rarely mutually exclusive positions of moral influence over land use (Kanu & Pilani, 2024). Recognising this coexistence, rather than forcing a choice between scriptural and customary authority, allows the comparative framework proposed in this paper to reflect lived religious practice rather than an artificially tidy theological synthesis.

Biodiversity Conservation and Practical Applications

Faith communities possess substantial, underused capacity to function as ecological actors. Churches often hold land, exercise moral authority within their communities, and maintain educational and social networks capable of mobilising conservation action at scale (Palmer & Finlay, 2003). Church-based environmental initiatives, including tree planting programmes, protection of water catchments on church land, and advocacy against illegal logging or mining, translate theological conviction into measurable ecological outcomes. Ecological education delivered through sermons, catechesis, and youth programmes can integrate stewardship theology and indigenous ecological knowledge into Christian formation, cultivating conservation values from an early age rather than treating environmental concern as a peripheral or optional commitment (Conradie, 2006).

Conservation partnerships between faith communities, indigenous knowledge holders, and conservation science organisations offer a particularly promising avenue for practical application, since such partnerships can combine biblical motivation, traditional ecological expertise, and scientific rigor in ways that no single

actor could achieve alone (Berkes, 2018). Climate resilience programmes rooted in these partnerships, including community-managed reforestation and sustainable agriculture initiatives informed by both scriptural stewardship and indigenous seasonal knowledge, offer models for locally owned and therefore more durable conservation outcomes. Policy implications follow directly from this analysis, as governments and international conservation organisations should recognise faith communities and indigenous knowledge holders as legitimate and effective partners in biodiversity conservation policy rather than treating conservation as the exclusive domain of technical experts and state institutions (IPBES, 2019).

Several practical mechanisms could operationalise this recognition. Formal co-management agreements could grant customary authorities and church landholders defined roles in monitoring and enforcement within protected areas adjoining their communities. Conservation financing instruments could channel funds directly to sacred grove custodians and church-based reforestation projects rather than exclusively to state agencies. Theological seminaries and environmental science faculties could develop joint curricula, training a generation of practitioners fluent in both scriptural stewardship and ecological science. Each of these mechanisms treats faith communities and indigenous knowledge holders not as passive beneficiaries of conservation programmes designed elsewhere, but as active co-authors of conservation strategy.

Toward an Integrated Ecological Theology

This paper proposes a Covenantal Stewardship and Communal Ecology framework as a model for integrating the resources examined above. This framework holds together four elements. Biblical theology contributes the language of covenant, divine

ownership, and accountable stewardship, grounding conservation ethics in transcendent obligation rather than purely pragmatic calculation (Bauckham, 2010). Indigenous knowledge contributes centuries of practically tested ecological wisdom and a relational ontology that resists treating nature as inert resource (Mafongoya & Ajayi, 2017). Conservation science contributes empirical rigor, monitoring capacity, and technical tools for assessing ecological outcomes. Environmental justice contributes an essential corrective, ensuring that conservation efforts do not reproduce the inequities that have historically burdened marginalised communities with the costs of both environmental degradation and conservation enforcement (Schlosberg, 2007).

Integrated in this way, the framework treats biblical theology and indigenous ecological knowledge not as competing worldviews requiring a choice between them, but as complementary sources of moral motivation and practical wisdom capable of grounding conservation efforts that communities experience as their own rather than as external imposition. For African diaspora communities in particular, this integrated framework offers a theologically grounded and culturally resonant basis for ecological advocacy that speaks simultaneously to their biblical faith and their inherited ecological memory.

Applied practically, the Covenantal Stewardship and Communal Ecology framework suggests that conservation projects should be assessed not only by ecological indicators such as species counts or forest cover, but by the extent to which they engage the theological and cultural convictions of the communities responsible for sustaining them over time (Ostrom, 1990). A reforestation project sponsored by a diaspora church, for instance, becomes more durable when framed explicitly as an act of covenant faithfulness to Genesis 2:15 and simultaneously connected to indigenous seasonal

planting knowledge, rather than presented merely as a technical intervention detached from either tradition. This integrative approach does not require communities to abandon either their biblical faith or their ancestral ecological memory, but invites them to recognise the two as mutually reinforcing expressions of a single underlying commitment to the flourishing of creation.

Conclusion

This paper has argued that biblical stewardship theology and African indigenous ecological knowledge, though emerging from different sources, converge on a shared conviction that human beings bear responsibility for the flourishing of the natural world rather than licence for its unrestrained exploitation. Genesis 2:15 and Psalm 24:1 establish a theology of creation entrusted to humanity under divine ownership, while African sacred groves, totemic restrictions, and communal land ethics demonstrate that indigenous communities developed sophisticated and effective conservation practices long before the emergence of formal environmental science. The comparative analysis has shown that these traditions, while differing in emphasis, particularly regarding the degree of human distinctiveness from nature, are fundamentally complementary rather than opposed.

The African diaspora occupies a distinctive position from which to advance this integration, carrying both biblical faith and inherited ecological memory across borders while confronting environmental injustice in host societies that sharpens its ecological consciousness. The Covenantal Stewardship and Communal Ecology framework proposed in this study offers one model for translating this convergence into practical conservation partnerships involving faith communities, indigenous knowledge holders, conservation scientists, and policymakers. As Africa and the world confront accelerating biodiversity loss and climate

change, such integrative approaches, grounded simultaneously in scripture, culture, and science, offer a more durable and locally owned foundation for environmental justice than any single framework could provide alone.

Recommendations

Based on the analysis developed in this study, the following recommendations are proposed. First, theological institutions and seminaries across Africa and its diaspora should incorporate stewardship theology and indigenous ecological knowledge into ministerial and lay formation, equipping church leaders to teach environmental responsibility as a core dimension of Christian discipleship rather than a peripheral concern.

Second, conservation organisations and policymakers should formally recognise faith communities and indigenous knowledge holders as legitimate partners in biodiversity policy, establishing structured mechanisms for their participation in conservation planning and implementation rather than treating conservation as an exclusively technical or state-led domain. Third, churches should develop concrete environmental initiatives on land under their stewardship, including reforestation, watershed protection, and sustainable land management, translating theological conviction into measurable ecological outcomes that communities can observe directly. Fourth, African diaspora organisations should establish transnational partnerships that channel resources, advocacy, and knowledge exchange toward biodiversity conservation in Africa, treating environmental justice at home and ecological restoration abroad as connected rather than separate commitments. Fifth, researchers should pursue further interdisciplinary study that documents and formally evaluates indigenous ecological practices, such as sacred grove management and seasonal farming systems, generating an evidence base capable of informing both conservation science and theological education.

Sixth, conservation funding bodies should prioritise community-owned models that integrate religious and cultural motivation with scientific monitoring, since durable conservation outcomes depend on local commitment sustained over generations rather than externally imposed regulation alone.

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PROSPECT AND CHALLENGES OF BIODIVERSITY CONSERVATION AND PUBLIC HEALTH IN AFRICA: A PUBLIC ADMINISTRATION AND EDUCATION PERSPECTIVES

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Abstract

This study examines the extent to which integration between biodiversity conservation and public health is realised in Africa through governance and educational processes, the purpose being to access the prospects and challenges of achieving cross-sectoral integration between biodiversity and health systems in selected African countries. Despite global recognition of the links between ecosystems and human health, biodiversity conservation and public health in Africa continue to be managed in silos, resulting in fragmented policies, duplicated efforts, and environmental health threats, the objectives of the study are to: examine institutional and policy challenges hindering the integration of biodiversity conservation and public health in Africa, and access the role of public administration and education in facilitating or constraining cross-sectoral collaboration. The study is grounded on the One Health theory, which provides a conceptual lens for analysing

multi-sectoral coordination, shared risk governance, and trans-disciplinary knowledge integration between human, animal, and environmental health. A qualitative, documentary and comparative case study design was adopted. Data were collected through systematic analysis of policy documents and institutional report from Nigeria, Kenya, and South Africa, selected via purposive sampling for variation in governance and policy contexts. Thematic analysis, comparative case analysis, and policy coherence assessment guided by OECD and AU criteria were used. Findings revealed institutional fragmentation, policy incoherence, donor-dependency, and marginalisation of environmental health in education as major challenges. One Health platforms and community-based conservation show prospects for improved coordination and co-benefits were legally backed and funded. The study concluded that integration remains limited due to structural and financial gaps. The study recommends legal institutionalisation of One Health, curriculum reforms for education for sustainable development among other.

Keywords: Biodiversity; Conservation; Public Health; One Health: Public Administration; Education.

Introduction

Africa hosts approximately 25% of the world's mammalian species and a significant proportion of global plants diversity, much of it concentrated in biodiversity hot spots such as the Congo Basin, Madagascar and the eastern Afromontane region (Convention on Biological Diversity, 2020). This ecosystem provides ecosystem services including pollination, water purification, climate regulation, and the provision of medicinal plants that form the basis of traditional and formal health systems for millions of Africans. At the same time, biodiversity loss is accelerating due to deforestation, agricultural expansion, poaching, and urbanisation. The Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services (IPBES, 2019) reported that Africa has

experienced the fastest rate of land degradation globally, with direct consequences for food security and disease dynamics. The link between biodiversity and public health is evident in the emergence and spread of zoonotic diseases. Over 60% of known infectious diseases and 75% of emerging infectious diseases in humans are zoonotic, mainly originating from wildlife habitats disrupted by human activity (Jones, *et al*, 2008). The Ebola outbreaks in West and Central Africa, and more recently, COVID-19, have underscored how environmental degradation and wild life human interactions can precipitate public health crisis. Conversely, well managed ecosystems can act as buffers against disease transmission and support nutrition and mental health through access to green spaces and natural resources.

From a Public Administration perspective, managing this nexus requires coherent policy coordination across Ministries of Environment, Health, Agriculture and Education. However, institutional fragmentation, limited funding, and weak enforcement mechanisms often undermine implementation. Education also plays a pivotal role, as public understanding and attitudes towards conservation and health behaviours are shaped by formal schooling, community outreach, and media engagement. Without deliberate integration of conservation and health education into curricular and public campaigns, policy interventions risk limited uptake and sustainability.

Purpose and Statement of Problem the Study

The purpose of this study is to analyse the prospects and challenges of linking biodiversity conservation with public health in Africa, adopting a Public Administration and Education perspectives. It seeks to understand how governance structures, policy frameworks, and educational interventions can be aligned to promote both ecological integrity and population health. By focusing on institutional practices, policy coherence, and

educational approaches, the study aims to generate recommendations that enhance cross-sectoral collaboration and community participation in sustainable health and conservation outcomes. Despite growing recognition of the One Health approach, Africa continues to face fragmented governance and weak implementation of policies that link biodiversity conservation with public health. Ministries, departments and agencies (MDAs) often operate in silos, with limited data sharing, joint planning, or resource pooling. This fragmentation is compounded by low public awareness and limited integration of environmental health topics in school curricular and teacher training programmes. As a result, conservation efforts may neglect public health implications, while public health interventions may overlook environmental determinants of disease. The problem is further exacerbated by inadequate funding, corruption, and competing development priorities that marginalise both biodiversity and health sectors. Without addressing these governance and educational gaps, Africa risks continued biodiversity loss, increased zoonotic disease risk, and undermine progress towards Sustainable Development Goals (SDGs) 4, 13, and 15.

Objectives of the Study

a. examine the institutional and policy challenges that hinder integrated governance of biodiversity conservation and public health in selected African countries,
b. assess the role of Public Administration and Education systems in promoting awareness, behavioral change, and community participation in conservation and health initiatives, and
c. identify prospects and best practices for enhancing cross-sectoral collaboration and policy coherence between environmental and health sectors in Africa.

Scope and Significance of the Study

The study is delimited to sub-Saharan Africa (SSA), with particular reference to Nigeria, Kenya, and South Africa as case examples due to their varying governance structures, biodiversity profiles, and public health challenges. It focuses on national and sub-regional public administration institutions responsible for environment, health, and education, as well as formal and non-formal education programmes that address conservation and health topics. The study period covers policy development and programmes implemented between 2015 and 2025, aligning with the sustainable development goals framework. It excludes private sector wildlife enterprises and clinical medical interventions, concentrating instead on governance, education, and community level interactions.

This study is significant for academic and policy audiences. Academically, it contributes to the growing literature on One Health and environmental governance in Africa by providing an integrated analysis that bridges public administration and education studies. While much existing research examines biodiversity or public health in isolation, this study highlights their interdependence and the institutional mechanisms required to manage them jointly. It also adds to understanding of how education systems can function as vehicles for behavioral change and policy uptake in environmental health context.

Literature Review

Overview of Related Literature

IPBES (2019)'s "Global Assessment Reports on Biodiversity and Ecosystem Services" documents the rapid decline of biodiversity in Africa and links ecosystem degradation to increased risk of zoonotic diseases, food insecurity, and reduced resilience to climate change. Jones *et al* (2008) in their work, "Global Trends in Emerging Infectious Diseases", establishes that 75% of emerging

infectious diseases are zoonotic and often linked to habit disruption and wildlife trade. WHO and CBD (2015) "Connecting Global Priorities: Biodiversity and Human Health" provides a policy framework for integrating biodiversity and health agendas under the One Health approach.

Allen *et al* (2017), "Biodiversity and the Prevention of Zoonotic Diseases" – analyses evidence that intact ecosystems reduce pathogen's spill over and argues for cross-sectoral governance. Ostrom, (1990) in his work, "Governing the Commons" lays the theoretical groundwork for polycentric governance and institutional design in managing shared natural resources. Krasny and Tidball (2012) in their work, "Civic Ecology: Adaptation and Transformation through Environmental Stewardship" explores how community-based education and stewardship enhances conservation and public health outcomes. African Union (2020) in its "African One Health Policy Framework" outlines continental commitment to integrate human, animal and environmental health governance. Finally, UNESCO (2017) in "Education for Sustainable Development Goals: Learning Objectives" provides guidance on embedding biodiversity and health literacy into education systems.

Conceptual Review

The conceptual review situates the study within interdisciplinary scholarship that connects environmental governance, public administration, and education. It draws on theories of institutional design, social-ecological systems, and transformative learning to explain how policies and educational practices shapes behaviours and outcomes at the biodiversity health interface. The key concepts below provide the analytical lens for examining prospects and challenges in the African context.

Biodiversity

Biodiversity, short form of biological diversity, refers to the variety of life at all levels of biological organisation, from genes to ecosystems (Wilson, 1988; Gaston & Spicer, 2004). It is commonly structured into three hierarchical components: Genetic, Species, and Ecosystem diversities respectively. Genetic diversity denotes the variation in genetic information within and among populations of a single species (Frankham, *et al*, 2010). Genetic diversity underpins a species' capacity to adapt to environmental change and resist disease, as seen in the variation among dog breeds such as chihuahuas, huskies, and labradors (Allendorf, *et al*, 2013).

Species diversity comprises species richness, the number of species in a community, and species evenness, the relative abundance of those species (Magurran, 2004). For example, a tropical coral reef supporting hundreds of fish, coral, and invertebrate species exhibits higher species diversity than a monocultural wheat field (Hooper *et al*, 2005). Ecosystem diversity refers to the variety of habitats, communities, and ecological processes within a region, including forests, wetlands, deserts, and oceans (Noss, 1990). Each ecosystem supports distinct biotic and abiotic interactions that sustain ecological functions. The significance of biodiversity cannot be overemphasised as higher biodiversity enhances ecosystem stability, resilience, and the provision of ecosystem services such as pollination, nutrient cycling, water purification, and food production (Cardinale *et al*, 2012; Diaz *et al*, 2019). Loss of species and genetic variation reduces the capacity of ecosystems to buffer disturbances, increasing vulnerability to collapse (Tilman *et al* 2014). Biodiversity is typically quantified using metrics of species richness and evenness (Magurran, 2004).

Biodiversity Conservation

Biodiversity conservation refers to the protection, management,

and restoration of ecosystems, species and -genetic diversity to maintain ecological integrity and ecosystem services. In Africa, conservation efforts have historically focused on protected areas, wildlife management, and anti-poaching initiatives. However, IPBES (2019) highlights that protected areas alone are insufficient without addressing drivers of loss outside their boundaries, such as agricultural expansion and unsustainable resource use. From a public administration perspective, conservation requires coherent policy design, inter agency co-ordination, and effective enforcement mechanisms. Ostrom (1990) work on common-pool resources shows that decentralised, community-involved governance often yields better outcomes than centralised resources for livelihoods. Challenges in Africa include underfunded conservation into broader land-use planning and leveraging payments for ecosystem services to create economic incentives for local communities. Education plays a role by building environmental literacy and fostering stewardship values among youth and community leaders.

Public Health

Public health in this context concerns the prevention and control of diseases that arise from interaction between humans, animals and the environment. Biodiversity underpins the ecological systems that sustains human health by regulating disease, supporting nutrition, and providing medicinal resources. Ecosystems with high species and genetic diversity regulate climate, water quality, and air quality, reducing exposure to heat stress, waterborne pathogens, and respiratory irritants (WHO & CCD, 2015). Pollination by diverse insect communities supports 75% of global crops, directly influencing dietary diversity and micronutrient intake (IPBES, 2019). Genetic diversity within crop and livestock species provides resilience against pests and disease, decreasing reliance on chemical inputs that can harm human health (FAO, 2010). Intact ecosystems also regulate infectious disease

dynamics. The "dilution effect" describes how high biodiversity reduces the abundance of competent disease reservoirs and vectors, lowering transmission risk for pathogens such as Lyme disease and hantavirus (Keesing *et al*, 2006). Loss of habitat and species simplification disrupts these checks, increasing human-wildlife contact and spillover risk. Biodiversity further contributes to mental and physical health through access to green space. Exposure to biodiverse natural environments is associated with reduced stress, improved mood, and increased physical activity, which lower the burden of non-communicable diseases (Sandifer *et al*, 2015). Urban planning that preserves green infrastructure functions as preventive public health intervention.

Policy frameworks increasingly recognise these linkages. The Convention on Biological Diversity and World Health Organisation frame biodiversity conservation as essential for achieving SDGs 3 on health and well-being (WHO & CBD, 2015). Integrating biodiversity indicators into health surveillance improves early warning for environmental health risks. Challenges include underfunding of environmental health programmes and fragmentation between health and environment ministries. Addressing these requires cross-sectoral data sharing, workforce training in eco-health, and valuation of ecosystem services in health economic analyses.

Theoretical Framework

This study adopts One Health Theory as its theoretical framework. One Health theory was propounded from conceptual roots in Rudolf Virchow's 19th-century "zoonosis" and Calvin Schwabe's 1964 veterinary medicine, but formalised as "One Medicine–One Health" by William Karesh and the Wildlife Conservation Society in 2004, New York, USA, during the Manhattan Principles. The One Health approach recognises the interdependence of human, animal, and environmental health and promotes integrated, cross-sectoral action to address complex health challenges (WHO,

2017). It emerged from the recognition that 60% of known infectious diseases and 75% of emerging infectious diseases are zoonotic, requiring collaboration between public health, veterinary, and environmental sectors (Jones *et al*, 2008). The theory was propounded to address the 60% of infectious diseases and 75% of emerging pathogens that originate in animals. Veterinary and human medicine operated in silos, missing early signals from wildlife. The 2003 SARS and H5N1 crises exposed institutional fragmentation. The core tenets at that human, animal, and environmental health are interdependent. Solutions require integrated surveillance, joint risk assessment, and shared governance among public health, veterinary, and ecological sectors. The 2019 Quadripartite Alliance FAO, UNEP, WHO, WOAH operationalised it. The theory directly frames the present study as it explains why ministries of health must co-manage forests with environment ministries, and why education for sustainable development must train transdisciplinary professionals. It provides the normative basis for institutionalising One Health units in public administration.

This theory was adopted as appropriate and the framework for the study because it uniquely integrates the ecological mechanisms identified in the Dilution Effect, the institutional design insights of Social-Ecological Systems, and the normative public management logic of Public Value Theory into a single operational paradigm for public administration. While Dilution Effect explains 'why' biodiversity loss increases disease, and SES explains 'how' to govern commons, One Health explains 'who' must act together and 'through' what institutional processes to prevent health crises at their ecological source. Public Value Theory then explains 'why' governments should invest in such integration. Thus, One Health sits at the intersection of cause, governance, and justification, making it the most comprehensive framework for analysing public health as it relates to biodiversity.

Gap or Controversies in the Literature

Despite expanding scholarship linking biodiversity to public health, zoonotic disease, and governance, critical gaps and unreserved debates persist that limit policy uptake and operational effectiveness. Empirical findings remain fragmented across disciplines, with contradictions regarding casual mechanisms, scale effects, and institutional arrangements. Measurement inconsistencies, geographical biases, and siloed methodologies have produced controversies about whether biodiversity consistently protects health, which governance models are effective, and how public administration should integrate ecological variables The present study is positioned to address these deficits by integrating multi-sectoral data, testing contested mechanisms in a development country context, and evaluating institutional frameworks that connect ecological integrity to health outcomes within public administration practice.

Keesing *et al* (2006) and Ostfeld & Keesing (2012) report dilution effects where high hosts diversity reduces pathogen transmission. Conversely, Randolph & Dobson (2012) argue that diversity can amplify disease if additional species are competent reservoirs, citing west Nile virus in North America. Wood *et al* (2014) found no consistent effect across 45 host-pathogen systems. The controversy leaves public administrators without clear guidance on whether conserving biodiversity reduces or increases risk. The gap is that few studies test dilution across tropical, multi-pathogen contexts with human incidence data. This study fills the gap by analysing community-level biodiversity, land-use, and clinical zoonotic data in Nigeria to determine net effects and threshold conditions.

Methodology

This study adopts a qualitative, documentary, and comparative case study design grounded in an explanatory paradigm. The

design is descriptive-explanatory and non-experimental. It is suited to examine institutional processes, policy interactions, and educational practices within complex socio-ecological systems in Africa. The approach enables in-depth interpretation of how public administration and education systems address the integration of biodiversity conservation and public health.

Document Selection Criteria

Documentary analysis is the primary data collection method. To ensure transparency and replicability, documents were selected using the following criteria:

1. **Time Frame:** 2015 to 2025. This aligns with the SDGs period and captures recent policy developments on biodiversity, health and education in Africa.
2. **Geographic Scope:** Sub-Saharan Africa only
3. **Content Requirement:** Documents must address at least two of the following themes: biodiversity management, public health, zoonotic disease, environmental education, or cross-sectoral governance.
4. **Source Type:** Included sources are national policy documents, legislation, national biodiversity strategies and action plans, national health policies, One Health implementation reports, education sector plans, programme evaluations, and reports from AU, ECOWAS, WHO, CBD, IPBES, FAO, and UNESCO. Peer-reviewed journal articles are used to triangulate findings.
5. **Exclusion Criteria:** Document excluded are those dealing exclusively with clinical medicine, private sector wildlife enterprises, or contexts outside sub-Saharan Africa. Internal memos and non-public documents were also excluded due to access constraints.

All documents were sourced from official government portals, organisational repositories, and academic data bases. A total document log was maintained to ensure traceability.

Case Selection Justification

The study employs purposive sampling and uses three country cases for comparative analysis, namely: Nigeria, Kenya, and South Africa. The cases were selected based on maximum variation sampling to allow analytical generalisation across different institutional context: Nigeria selected as a federal system with significant institutional fragmentation and weak inter-ministerial coordination, it represents governance challenges common in large, multiethnic states. Kenya, selected for its established One Health coordination unit and community-based conservation models, it represents a case of structured cross-sectoral collaboration. Finally, South Africa, selected for its advanced policy and legislative frameworks for both biodiversity and health, it is along-side persistent implementation and co-ordination challenges at sub-national levels. Together, the three cases provide variation in governance structure, biodiversity profile, public health burden, and policy maturity, allowing for comparison of prospects and challenges of integration.

Data Analysis

Data analysis followed three integrated procedures, namely: Thematic Analysis: Data were analysed using Braun & Clarkes Six Phase thematic approach. The process is familiarisation > Open Coding > Axial Coding >Theme Development > Review > Reporting. A coding framework derived from the conceptual review focused on: institutional mandate, coordination structures, funding flows, stakeholder participation, curriculum content, and reported outcomes. Analytical memos were kept to document coding decisions. Second, Comparative Case Analysis: Findings from Nigeria, Kenya and South Africa were compared across the three themes: institutional challenges, role of public administration and education, and prospects for collaboration. This identifies patterns, divergencies, and context-specific factors, and finally, Policy Coherence Analysis: Using OECD and AU criteria, policies

across biodiversity, health and education sectors were mapped and assessed for consistency, complementarity, and coordination. This identified overlaps, gaps and contradictions in objectives, instruments and responsibilities.

Conclusion

The study found that institutional fragmentation, policy incoherence, donor dependency, and fragmented data systems are the primary barriers to integrating biodiversity conservation and public health in Nigeria, Kenya, and South Africa. Ministries operate in silos with limited coordination, and where One Health platforms exist, they remain under-resourced and lack legal mandates. Community-based conservation produces positive ecological and health co-benefits when local tenure and participation are secured, but such models are limited in scope. Environmental health and biodiversity topics are marginal in formal education systems, reducing public literacy and cross-sectoral capacity. Policy coherence is weak between biodiversity, health, and education sectors, and heavy reliance on donor funding undermines the sustainability of integrated programmes. Integrated data systems are underdeveloped, constraining evidence-based decision-making.

Recommendations for Future Research

1. Future research should assess the legal and fiscal mechanisms required to embed One Health units within national governance structures and evaluate their impact on co-ordination and outbreak response over time.
2. Studies should examine how secure community land rights and benefit-sharing arrangements influence both biodiversity recovery and zoonotic disease risk, using mixed-methods designs across multiple African contexts.
3. Research is needed on the effectiveness of interdisciplinary

curricula and experiential learning in building systems thinking and cross-sectoral competencies among students and public sector professionals.

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SUSTAINABLE ENTREPRENEURIAL INTENTION AND CLIMATE AWARENESS: TESTING THE THEORY OF PLANNED BEHAVIOUR

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Abstract

This study investigates the role of environmental awareness in shaping sustainable entrepreneurial intention, drawing on the Theory of Planned Behaviour (TPB) and its sustainability-oriented extensions. In the face of escalating climate challenges, understanding how cognitive and attitudinal factors influence the emergence of sustainability-driven entrepreneurship has become increasingly important. The study conceptualizes environmental awareness as a key antecedent of entrepreneurial intention, mediated by sustainability orientation, which reflects the degree to which individuals prioritize ecological and social considerations in venture creation. A quantitative research design is adopted, using cross-sectional survey data collected from prospective and early-stage entrepreneurs. Environmental awareness is operationalized through measures of climate change knowledge and concern, while sustainability orientation captures pro-environmental values and ethical business inclinations. Entrepreneurial intention is assessed using validated TPB-based scales. Regression analysis with the aid of SPSS is employed to test

the hypothesized relationships and to evaluate the mediating role of sustainability orientation within the TPB framework. The findings reveal that environmental awareness exerts a positive and significant influence on entrepreneurial intention, both directly and indirectly through sustainability orientation. The results support the extension of TPB by demonstrating that sustainability-related cognitions enhance the predictive power of the model in explaining entrepreneurial behaviour. Individuals with higher levels of climate awareness are more likely to develop intentions to engage in environmentally responsible business ventures. The study contributes to the literature by integrating sustainability constructs into TPB-based entrepreneurship models. Policy implications highlight the importance of environmental education and awareness programmes in fostering a new generation of sustainability-oriented entrepreneurs capable of addressing climate-related challenges.

Keywords: Sustainable entrepreneurship; Entrepreneurial intention; Sustainability orientation and Climate awareness.

Introduction

The global intensification of climate change, environmental degradation, and biodiversity loss has generated mounting pressure on economic actors at every scale to reconsider their relationship with the natural environment. Entrepreneurship, long celebrated as a primary engine of innovation and economic growth, is increasingly called upon to serve simultaneously as a vehicle for ecological transformation. Sustainable entrepreneurship, defined as the creation of ventures that pursue economic value generation while proactively addressing environmental and social challenges, has emerged as a theoretically productive and practically significant domain within the broader entrepreneurship literature (Dean & McMullen, 2007; Shepherd & Patzelt, 2011). However, the psychological and cognitive antecedents that propel individuals toward sustainability-oriented venture creation remain

incompletely understood, particularly in emerging economy contexts where institutional environments, educational systems, and cultural attitudes toward the environment differ substantially from those prevalent in the Global North.

The Theory of Planned Behaviour (TPB), developed by Ajzen (1991) from the earlier Theory of Reasoned Action (Fishbein & Ajzen, 1975), provides the dominant cognitive framework for understanding the formation of behavioural intentions across a wide range of domains, including entrepreneurship (Liñán & Chen, 2009; Krueger et al., 2000). The TPB posits that behavioural intention is the proximate determinant of behaviour, and that it is predicted by three constructs: attitude toward the behaviour, subjective norms, and perceived behavioural control. Its application to entrepreneurial intention has generated a substantial empirical literature demonstrating the theory's predictive utility across cultural and institutional contexts (Liñán et al., 2011; Fayolle & Liñán, 2014). However, the standard TPB model was not developed with sustainability-oriented behaviours in mind, and its extension to capture the motivational specificity of sustainable entrepreneurship requires the integration of additional cognitive constructs that reflect environmental and ethical dimensions of business creation.

Environmental awareness, encompassing knowledge of climate change processes, concern about ecological degradation, and recognition of the interconnections between human economic activity and natural systems, has been theorised and partially demonstrated as a significant antecedent of pro-environmental behaviour (Kollmuss & Agyeman, 2002; Steg & Vlek, 2009). In the entrepreneurial context, individuals who possess greater environmental knowledge and concern may be more motivated to identify sustainability-related opportunity spaces, to evaluate potential ventures through an ecological lens, and to develop

intentions to create businesses that address rather than exacerbate environmental problems (Hockerts & Wüstenhagen, 2010; Kuckertz & Wagner, 2010). The mediating role of sustainability orientation, a dispositional tendency to prioritise ecological and social values in decision-making—between environmental awareness and entrepreneurial intention represents a theoretically important but empirically underdeveloped pathway.

This study addresses these gaps by investigating three interrelated questions: (i) Does environmental awareness, operationalized through climate change knowledge and concern, significantly predict sustainable entrepreneurial intention? (ii) Is sustainability orientation a significant mediator of the relationship between environmental awareness and entrepreneurial intention? (iii) Does the integration of sustainability constructs enhance the predictive power of the standard TPB model in the entrepreneurial context? These questions are addressed using cross-sectional survey data collected from prospective and early-stage entrepreneurs, with regression analysis employed to test direct, indirect, and mediated relationships.

The study makes three principal contributions to the literature. First, it advances the empirical application of the TPB to sustainable entrepreneurship by explicitly modelling environmental awareness as a cognitive antecedent that operates through both direct attitudinal pathways and the indirect pathway of sustainability orientation. Second, it provides evidence from a Nigerian context, addressing the relative neglect of Sub-Saharan African perspectives in the sustainable entrepreneurship literature, where environmental challenges are acute and entrepreneurial ecosystems are rapidly evolving. Third, it generates policy-relevant evidence on the role of environmental education in shaping the entrepreneurial intentions of prospective founders, contributing to debates about how formal and informal educational

interventions can cultivate a generation of sustainability-oriented entrepreneurs. The remainder of the paper proceeds as follows: Section 2 reviews the theoretical and empirical literature and develops the research hypotheses; Section 3 describes the research design and methodology; Section 4 presents the empirical findings; Section 5 discusses the implications; and Section 6 concludes.

Literature Review and Hypothesis Development

The Theory of Planned Behaviour and Entrepreneurial Intention

The TPB (Ajzen, 1991) has provided the foundational theoretical architecture for entrepreneurial intention research since Krueger and Carsrud (1993) first applied it to the entrepreneurial domain. The model identifies three antecedents of behavioural intention: attitude toward the behaviour (the degree to which the individual holds a positive or negative personal evaluation of performing the behaviour), subjective norms (perceived social pressure from significant others to perform or not perform the behaviour), and perceived behavioural control (the individual's perception of the ease or difficulty of performing the behaviour, encompassing self-efficacy and controllability dimensions). In the entrepreneurial context, attitude toward entrepreneurship, social norms favouring new venture creation, and entrepreneurial self-efficacy are the corresponding constructs.

A large body of empirical research has validated the TPB's predictive utility for entrepreneurial intention across diverse cultural settings. Liñán and Chen (2009) developed the widely adopted Entrepreneurial Intention Questionnaire (EIQ) based on TPB constructs and demonstrated its cross-cultural validity across samples from Spain and Taiwan. Krueger et al. (2000) compared the TPB with Shapero's entrepreneurial event model across United States student samples and found both models capable of explaining substantial variance in entrepreneurial intentions.

Meta-analyses by Schlaegel and Koenig (2014) and Choongo et al. (2017) confirmed the robustness of TPB-based entrepreneurial intention models, while also identifying moderating effects of national culture, education, and prior entrepreneurial exposure. Despite this accumulation of evidence, the standard TPB model's application to sustainability-motivated entrepreneurship has been recognised as theoretically incomplete, motivating calls for sustainability-specific extensions (Lüthje & Franke, 2003; Fayolle & Liñán, 2014).

Sustainable Entrepreneurship: Conceptual Foundations

Sustainable entrepreneurship sits at the intersection of entrepreneurship theory and sustainability science. Dean and McMullen (2007) defined it as the process of discovering, evaluating, and exploiting economic opportunities that contribute to sustainability by reducing destructive or creating protective effects on the natural and communal environments. Shepherd and Patzelt (2011) extended this definition to encompass the preservation of nature, life support, and community in the pursuit of opportunities, positioning sustainable entrepreneurship as simultaneously economically, ecologically, and socially productive. Hockerts and Wüstenhagen (2010) distinguished between "greening Goliaths" (incumbent firms incrementally improving environmental performance) and "emerging Davids" (new entrants pursuing radical sustainability innovation), locating sustainable entrepreneurship primarily in the latter category and underscoring its disruptive potential within industries locked into carbon-intensive trajectories.

The emergence of sustainable entrepreneurial intention as a distinct construct acknowledges that the cognitive and motivational pathways leading individuals to create sustainability-oriented ventures may differ systematically from those underpinning conventional entrepreneurial intention (Kuckertz &

Wagner, 2010). Whereas conventional entrepreneurial intention is primarily driven by economic opportunity recognition and financial motivation, sustainable entrepreneurial intention is additionally shaped by pro-environmental values, ecological concern, and a sense of moral responsibility for addressing environmental problems through business creation (Liñán et al., 2011; Muñoz & Cohen, 2018). This motivational complexity necessitates theoretical models that capture both the standard TPB constructs and the sustainability-specific cognitions that differentiate ecological from economic entrepreneurial motivation.

Environmental Awareness as an Antecedent of Sustainable Entrepreneurial Intention

Environmental awareness is a multi-dimensional construct encompassing knowledge of environmental problems, particularly climate change; concern about their consequences for human and natural systems; and a sense of personal or collective responsibility to address them (Dunlap & Van Liere, 1978; Franzen & Vogl, 2013). In the pro-environmental behaviour literature, awareness has been theorised as a necessary though not sufficient condition for behavioural change, operating through attitudinal and normative mechanisms that align with the TPB framework (Kollmuss & Agyeman, 2002; Steg & Vlek, 2009). The norm-activation model (Schwartz, 1977) further specifies that awareness of adverse environmental consequences activates personal norms of moral obligation that motivate altruistically motivated environmental behaviour.

In the entrepreneurial intention literature, the link between environmental awareness and sustainability-oriented venture creation has received growing but still limited empirical attention. Kuckertz and Wagner (2010) found that sustainability orientation, partly driven by environmental values, positively moderates the

relationship between business opportunity recognition and sustainable entrepreneurial intention in a German student sample. Muñoz and Cohen (2018) conducted a systematic review of 109 sustainable entrepreneurship articles and identified environmental awareness and concern as recurring antecedents, though operationalization was inconsistent across studies. More recently, Dhahri and Omri (2018) demonstrated across a panel of developing economies that environmental knowledge significantly predicts environmental behaviour, a finding with direct implications for the relationship between climate awareness and sustainability-driven entrepreneurship.

Drawing on these theoretical foundations, the first hypothesis is proposed:

H_1 : Environmental awareness exerts a positive and significant direct effect on sustainable entrepreneurial intention.

Sustainability Orientation as a Mediator

Sustainability orientation refers to the dispositional tendency of individuals to incorporate environmental and social considerations into their values, decision-making frameworks, and goal hierarchies (Kuckertz & Wagner, 2010; Parrish, 2010). It is conceptually related to, but distinct from, environmental awareness: whereas awareness reflects cognitive knowledge and affective concern about environmental problems, sustainability orientation reflects a more stable value system in which ecological and social priorities are internalised as integral to one's identity and purpose. Individuals with high sustainability orientation are more likely to evaluate entrepreneurial opportunities through an ecological lens, to perceive environmental responsibility as central to business success, and to commit to sustainability-related entrepreneurial goals (Shepherd & Patzelt, 2011; Lüthje & Franke, 2003).

The mediating role of sustainability orientation in the environmental awareness - entrepreneurial intention relationship reflects a value-belief-norm cascade (Stern et al., 1999) in which environmental knowledge and concern first activate pro-sustainability values, which in turn shape the attitudinal and motivational structures that generate entrepreneurial intentions. This mediation pathway has been theorised by several scholars but subjected to limited direct empirical testing, particularly in African contexts (Choongo et al., 2017; Muñoz & Cohen, 2018). The second and third hypotheses follow:

H_2 : Environmental awareness exerts a positive and significant effect on sustainability orientation.

H_3 : Sustainability orientation mediates the relationship between environmental awareness and sustainable entrepreneurial intention, such that the indirect effect of environmental awareness on entrepreneurial intention through sustainability orientation is positive and significant.

TPB Extensions for Sustainability: The Role of Attitude, Subjective Norms, and Perceived Behavioural Control

Within the extended TPB model applied here, environmental awareness is theorised to operate primarily through the attitudinal pathway: individuals with greater climate knowledge and concern evaluate sustainability-oriented entrepreneurship more favourably, generating stronger entrepreneurial attitudes that predict intention. Subjective norms in the sustainability context reflect perceptions that significant others, including peers, mentors, family members, and societal actors, value and support sustainability-oriented business creation, a normative perception likely reinforced by increasing public discourse on climate change and the growing visibility of green entrepreneurship as a socially legitimate career path (Ajzen, 1991; Krueger et al., 2000). Perceived behavioural control in the sustainable entrepreneurial context encompasses not only general entrepreneurial self-efficacy

but also specific competence beliefs related to integrating environmental practices into business operations (Fayolle & Liñán, 2014).

The inclusion of sustainability orientation as an additional construct within the extended TPB model enriches the attitudinal pathway by capturing the value-based foundation from which environmentally motivated entrepreneurial attitudes emerge. Choongo et al. (2017) demonstrated that sustainability values enhance the predictive power of TPB models for sustainable entrepreneurial intention in Zambian student samples, providing cross-national validation from an African context directly relevant to the present study. The fourth hypothesis therefore proposes:

H_4 : The integration of environmental awareness and sustainability orientation into the standard TPB model significantly enhances its predictive power for sustainable entrepreneurial intention.

Climate Awareness and the Nigerian Entrepreneurial Context

Nigeria presents a particularly apposite setting for investigating the environmental awareness–sustainable entrepreneurial intention nexus. As Africa's most populous nation and largest economy, Nigeria confronts acute and multifaceted environmental challenges including deforestation at one of the highest rates on the continent, severe land degradation in the Niger Delta from petroleum extraction, intensifying desertification in the northern Sahel, and the escalating impacts of climate change on agricultural productivity that underpins the livelihoods of over 70% of the rural population (Adewale, 2017; Adeola & Evans, 2020). These environmental pressures coexist with a vibrant and rapidly expanding entrepreneurial ecosystem in which youth

entrepreneurship is a central policy priority, creating a nexus at which environmentally aware entrepreneurs could channel their climate concern into sustainability-oriented venture creation.

Despite this contextual relevance, the Nigerian sustainable entrepreneurship literature remains limited. Adeola and Evans (2020) examined environmental attitudes among Nigerian business students and found moderate levels of climate change awareness but weaker connections to entrepreneurial aspiration, suggesting that the translation from awareness to intention requires cognitive and motivational intermediaries consistent with the mediation model proposed here. Nwakwue and Ukwueze (2021) found that sustainability education interventions in Nigerian universities significantly improved both environmental knowledge and pro-entrepreneurial attitudes, providing preliminary evidence for the educational pathway through which the hypothesised relationships may be cultivated.

Research Design and Methodology

Research Design and Sample

A quantitative, cross-sectional survey design is adopted, consistent with established practice in entrepreneurial intention research employing TPB-based frameworks (Liñán & Chen, 2009; Fayolle & Liñán, 2014). The target population comprises prospective entrepreneurs (university students in business, entrepreneurship, economics, and related disciplines at the final year of undergraduate or postgraduate study) and early-stage entrepreneurs (individuals operating ventures less than three years old) in the Federal Capital Territory (Abuja) and Lagos State, Nigeria. These locations were selected for their status as Nigeria's premier hubs of entrepreneurial activity and their relatively diverse and educated entrepreneurial populations, ensuring variation in both environmental awareness and entrepreneurial intention.

Purposive sampling was employed to identify respondents meeting the eligibility criteria, supplemented by snowball referral procedures for the early-stage entrepreneur subsample. The final usable sample comprises 412 respondents, of whom 58.3% are final-year and postgraduate students and 41.7% are early-stage entrepreneurs. The sample size exceeds the thresholds recommended by Hair et al. (2014) for regression analysis with the number of predictors employed, and provides adequate statistical power for detecting medium effect sizes ($f^2 \geqslant 0.15$) at the 95% confidence level. The gender composition is 56.8% male and 43.2% female, and the mean age is 26.4 years (SD = 4.7).

Measures

All constructs were operationalized using established, validated scales adapted to the Nigerian sustainability and entrepreneurship context. Sustainable entrepreneurial intention was measured using a six-item scale adapted from Liñán and Chen's (2009) Entrepreneurial Intention Questionnaire (EIQ), with items modified to specify sustainability-oriented venture creation (e.g., "I am determined to create a business that contributes positively to the natural environment in the future"; $\alpha = 0.87$). The scale was subjected to confirmatory factor analysis in a pilot study of 50 respondents not included in the main sample, confirming unidimensional structure with all standardized loadings above 0.72. Environmental awareness was measured using an eight-item scale drawing on the New Ecological Paradigm (NEP) scale (Dunlap et al., 2000) and the climate change awareness sub-scale developed by Franzen and Vogl (2013), capturing both cognitive (knowledge-based) and affective (concern-based) dimensions of environmental awareness ($\alpha = 0.83$). Sustainability orientation was assessed using a five-item scale adapted from Kuckertz and Wagner (2010), reflecting the respondent's general disposition to prioritise ecological and social considerations in business decision-

making ($\alpha = 0.81$). The three standard TPB constructs—attitude toward sustainable entrepreneurship, subjective norms, and perceived behavioural control—were measured using established three-to-five-item scales drawn from Liñán and Chen (2009) and Krueger et al. (2000), each demonstrating Cronbach's alpha values above 0.75. All items were rated on seven-point Likert scales anchored at 1 (Strongly Disagree) and 7 (Strongly Agree).

Common Method Bias and Validity Assessment

Given the cross-sectional single-source design, the risk of common method bias (CMB) was assessed using Harman's single factor test and the common latent factor approach in AMOS. The Harman test revealed that no single factor accounted for more than 28.4% of the total variance, and the common latent factor adjustment produced negligible changes in factor loadings (mean difference < 0.05), suggesting CMB is not a significant concern. Discriminant validity was confirmed through average variance extracted (AVE) comparisons: the AVE for each construct exceeded the squared inter-construct correlations, consistent with Fornell and Larcker (1981) criteria. Convergent validity was supported by composite reliability values above 0.80 and AVE values above 0.50 for all constructs.

Analytical Strategy

Hypotheses were tested using hierarchical multiple regression analysis in SPSS Version 27. The baseline model (Model 1) entered the three standard TPB constructs (attitude, subjective norms, and perceived behavioural control) as predictors of sustainable entrepreneurial intention. Model 2 added environmental awareness to assess its incremental predictive contribution beyond the standard TPB. Model 3 introduced sustainability orientation alongside environmental awareness to test its additional explanatory power and assess partial mediation. The mediation

hypothesis (H_3) was tested using the PROCESS macro (Hayes, 2018), specifically Model 4 (simple mediation), with 5,000 bootstrap iterations and 95% bias-corrected confidence intervals for indirect effects. Mediation was inferred when the bootstrapped confidence interval for the indirect effect excluded zero (Preacher & Hayes, 2008). Sociodemographic controls (gender, age, prior entrepreneurial exposure, and educational level) were entered in all models to rule out confounded relationships.

The full mediation model is specified as:

$$EA \rightarrow SO \rightarrow SEI \quad and \quad EA \rightarrow SEI \text{ (direct path)}$$

where EA = Environmental Awareness, SO = Sustainability Orientation, and SEI = Sustainable Entrepreneurial Intention.

Results

Descriptive Statistics and Correlations

Descriptive analysis of the study variables reveals a moderately high mean level of environmental awareness (M = 4.89, SD = 1.12) and sustainability orientation (M = 4.73, SD = 1.08) among the sample, consistent with the expectation that university-educated Nigerian youth possess at least moderate levels of climate change knowledge and concern. Sustainable entrepreneurial intention scores are also relatively elevated (M = 4.94, SD = 1.19), suggesting that the sample has a generally favourable disposition toward sustainability-oriented venture creation. Zero-order Pearson correlations indicate that environmental awareness is positively correlated with sustainability orientation ($r = 0.61$, $p < 0.001$), sustainable entrepreneurial intention ($r = 0.54$, $p < 0.001$), and all three standard TPB constructs (r range: 0.31–0.47, all $p < 0.001$). Sustainability orientation is similarly positively correlated with sustainable entrepreneurial intention ($r = 0.58$, $p < 0.001$). Variance inflation factors (VIF) for all regression predictors are

below 3.2, ruling out multicollinearity as a concern.

Hierarchical Regression Results

Model 1, entering the three standard TPB constructs, explains 38.7% of the variance in sustainable entrepreneurial intention ($R^2 = 0.387$, $F(3, 405) = 86.04$, $p < 0.001$). Attitude toward sustainable entrepreneurship ($\beta = 0.34$, $p < 0.001$), perceived behavioural control ($\beta = 0.28$, $p < 0.001$), and subjective norms ($\beta = 0.19$, $p < 0.01$) are all significant predictors, replicating the standard TPB pattern in the sustainable entrepreneurship context.

Model 2 adds environmental awareness to the standard TPB predictors. The model explains 46.2% of the variance ($R^2 = 0.462$, $\Delta R^2 = 0.075$, F change = 55.87, $p < 0.001$). Environmental awareness is a significant positive predictor of sustainable entrepreneurial intention ($\beta = 0.31$, $p < 0.001$), supporting Hypothesis 1 that environmental awareness exerts a direct and significant effect on sustainable entrepreneurial intention even after controlling for the standard TPB constructs. The incremental R^2 of 7.5% confirms that environmental awareness contributes meaningful predictive power beyond the baseline TPB model.

Model 3 simultaneously enters environmental awareness and sustainability orientation. Model fit improves further to $R^2 = 0.523$ ($\Delta R^2 = 0.061$, F change = 51.14, $p < 0.001$), with sustainability orientation emerging as the strongest predictor of sustainable entrepreneurial intention in the full model ($\beta = 0.38$, $p < 0.001$). The direct effect of environmental awareness on entrepreneurial intention attenuates to $\beta = 0.18$ ($p < 0.01$) in Model 3, a pattern consistent with partial mediation by sustainability orientation. The cumulative explanatory power of the extended model ($R^2 = 0.523$) substantially exceeds that of the baseline TPB ($R^2 = 0.387$), supporting Hypothesis 4 that sustainability construct integration significantly enhances the model's predictive utility.

Mediation Analysis

The PROCESS macro mediation analysis confirms that environmental awareness exerts a significant positive effect on sustainability orientation (a path: $\beta = 0.52$, SE = 0.07, $p < 0.001$), supporting Hypothesis 2. Sustainability orientation in turn significantly predicts sustainable entrepreneurial intention after controlling for environmental awareness (b path: $\beta = 0.41$, SE = 0.06, $p < 0.001$). The indirect effect of environmental awareness on sustainable entrepreneurial intention through sustainability orientation is positive and significant (ab = 0.213, SE = 0.034, 95% CI [0.151, 0.283]), with the confidence interval excluding zero, confirming mediation in support of Hypothesis 3.

The direct effect of environmental awareness on sustainable entrepreneurial intention remains significant after including the mediator ($c' = 0.18$, $p < 0.01$), indicating partial rather than full mediation. The proportion of the total effect of environmental awareness on entrepreneurial intention that is mediated through sustainability orientation is 54.2%, indicating that sustainability orientation accounts for the majority of the total effect while leaving a substantial direct path, consistent with theories positing that environmental awareness operates through both affective-attitudinal and value-based channels simultaneously. These findings are robust to the inclusion of sociodemographic controls, and bootstrapped confidence intervals from 5,000 resamples consistently exclude zero across alternative model specifications.

Supplementary Findings

Supplementary analyses reveal several noteworthy patterns. Female respondents report significantly higher sustainability orientation scores than male respondents ($M = 4.92$ vs. 4.58, $t = 3.21$, $p = 0.001$), consistent with the broader pro-environmental behaviour literature documenting gender differences in ecological

concern (Zelezny et al., 2000). Prior exposure to environmental education (having completed at least one formal course in sustainability, environmental science, or climate change) is associated with significantly higher environmental awareness (d = 0.74) and sustainability orientation (d = 0.62), providing preliminary evidence that educational interventions can cultivate the cognitive antecedents of sustainable entrepreneurial intention identified in this study. Respondents identifying as early-stage entrepreneurs do not differ significantly from student respondents on any of the primary constructs, suggesting that the cognitive architecture underlying sustainable entrepreneurial intention is relatively consistent across prospective and nascent stages of the entrepreneurial journey.

Discussion

Environmental Awareness and the Direct Pathway to Sustainable Entrepreneurial Intention

The finding that environmental awareness exerts a positive and significant direct effect on sustainable entrepreneurial intention (H_1 supported) is consistent with and extends the growing body of research connecting ecological concern with pro-environmental entrepreneurial motivation (Kuckertz & Wagner, 2010; Hockerts & Wüstenhagen, 2010). The direct path from awareness to intention, which persists after controlling for sustainability orientation, suggests that climate knowledge and concern independently activate positive evaluations of sustainability-oriented entrepreneurship, consistent with the TPB's attitudinal pathway. This finding implies that environmental awareness is not merely a distal background variable but a proximate motivational force in the formation of sustainable entrepreneurial intention—a theoretical clarification with significant implications for how sustainable entrepreneurship scholars model the antecedents of green venture creation.

The magnitude of the direct effect ($\beta = 0.18$ in the full model) is somewhat smaller than the zero-order correlation ($r = 0.54$), reflecting mediation by sustainability orientation. This pattern is consistent with Kollmuss and Agyeman's (2002) influential analysis of the "value-action gap" in pro-environmental behaviour, which argued that the relationship between environmental knowledge and behaviour is complex, non-linear, and mediated by values, attitudes, and situational factors. In the entrepreneurial context, the present findings suggest that the gap between awareness and intention is partially bridged by sustainability orientation, but that direct cognitive effects also operate independently.

Sustainability Orientation as a Mediating Mechanism

The confirmation of sustainability orientation as a partial mediator (H_3 supported, mediating 54.2% of the total effect) represents the study's most theoretically significant contribution. The mediation model advances prior TPB-based entrepreneurial intention research by identifying the value-cognitive pathway through which environmental awareness translates into entrepreneurial motivation, providing a more nuanced account than the direct awareness-intention relationship examined in most prior studies. The theoretical interpretation is consistent with Stern et al.'s (1999) value-belief-norm (VBN) theory: environmental awareness activates ecological beliefs that, when deeply internalised as values, generate normative motivation to engage in sustainability-promoting behaviours including the creation of environmentally responsible ventures.

The fact that mediation is partial rather than full is theoretically informative: it suggests that climate awareness operates through both a value-activation pathway (mediated by sustainability orientation) and a more direct cognitive pathway in which knowledge and concern about environmental problems motivate

opportunity identification in the green economy without necessarily requiring deep value transformation. This dual pathway architecture has practical implications: it suggests that even relatively shallow environmental awareness interventions (knowledge provision, concern activation) may be sufficient to generate some increment in sustainable entrepreneurial intention, while deeper value-formation interventions (sustainability-integrated education, mentorship by green entrepreneurs) are needed to cultivate the sustainability orientation that amplifies the awareness effect.

TPB Extension and Model Fit Enhancement

The significant improvement in model fit upon including environmental awareness and sustainability orientation (from $R^2 = 0.387$ to $R^2 = 0.523$, $\Delta R^2 = 0.136$) provides clear empirical support for H_4 and validates the theoretical project of extending the standard TPB model with sustainability-specific constructs for the entrepreneurial context. This finding contributes to a growing literature arguing that the standard TPB, while powerful in predicting conventional entrepreneurial intention, systematically underestimates the predictive value of sustainability-related cognitions for green venture creation (Lüthje & Franke, 2003; Fayolle & Liñán, 2014; Choongo et al., 2017). The extended model accounts for over half the variance in sustainable entrepreneurial intention, a level of explanatory power that compares favourably with the best-performing TPB-based models in the broader entrepreneurial intention literature.

The continued significance of all three standard TPB constructs in the extended model affirms that attitude, subjective norms, and perceived behavioural control remain important predictors of sustainable entrepreneurial intention alongside the sustainability-specific constructs. This finding validates the TPB as the

appropriate theoretical scaffold for the extended model, rather than advocating for its replacement by a purely values-based framework. The implication is that interventions aimed at cultivating sustainable entrepreneurial intention should address both the standard TPB constructs (entrepreneurial attitudes, social norms, efficacy beliefs) and the sustainability-specific constructs (environmental awareness, sustainability orientation) identified in the extended model.

Policy And Educational Implications

The study offers several implications for educational policy, entrepreneurship development, and environmental governance. The positive relationship between environmental education exposure and both environmental awareness and sustainability orientation provides strong evidence for integrating sustainability content into entrepreneurship curricula in Nigerian universities. This includes climate change education, ecological business ethics, and green venture design, embedded within entrepreneurship programmes rather than treated as separate disciplinary content. Since environmental education improves both key antecedents of sustainable entrepreneurial intention, it provides a clear basis for curriculum reform.

At the programme level, entrepreneurship support systems such as incubators, accelerators, and enterprise development schemes should explicitly focus on building sustainability orientation. This can be achieved through mentorship by green entrepreneurs, exposure to sustainable business models, and participation in environmental innovation challenges. The findings show that sustainability orientation is the main mechanism through which environmental awareness translates into entrepreneurial intention, meaning awareness-raising alone is insufficient without deeper value formation.

At the macro policy level, public environmental education campaigns are supported as an indirect pathway to increasing sustainable entrepreneurship among young people. When combined with exposure to successful green ventures and supportive social norms, such campaigns can strengthen sustainable entrepreneurial intention. However, these interventions should complement structural measures such as green financing, public procurement policies, and regulatory incentives for ecological innovation. The findings also reveal gender differences, with female respondents showing higher sustainability orientation than males. This suggests that entrepreneurship programmes should be gender-responsive, leveraging women's stronger ecological values while addressing barriers such as limited access to finance and restrictive social norms. Future research should further explore the intersection of gender, sustainability orientation, and entrepreneurial intention.

Conclusion

This study examined the role of environmental awareness in shaping sustainable entrepreneurial intention in Nigeria, using the Theory of Planned Behaviour (TPB) and its sustainability extension. The results confirm all four hypotheses: environmental awareness has a significant positive effect on sustainable entrepreneurial intention; it significantly predicts sustainability orientation; sustainability orientation partially mediates this relationship, explaining more than half of the total effect; and incorporating sustainability constructs substantially improves the explanatory power of the TPB model for sustainable entrepreneurial intention. The study contributes to the literature in three main ways. Theoretically, it extends the TPB by validating a value-cognitive mediation pathway through which environmental awareness translates into green entrepreneurial intentions. Methodologically, it applies bootstrap mediation analysis with

bias-corrected estimates, improving on earlier causal step approaches commonly used in entrepreneurship research. Contextually, it provides one of the first robust empirical studies of sustainable entrepreneurial intention in Nigeria, addressing the dominance of evidence from developed economies and adding an African developing-country perspective.

Several limitations are noted. The cross-sectional design limits causal inference and does not capture how sustainable entrepreneurial intention evolves into actual venture creation over time. Future research should adopt longitudinal designs tracking individuals from awareness to venture formation. The restricted sample, drawn from two cities in Nigeria, also limits generalisability. Comparative studies across African countries with different institutional, educational, and entrepreneurial environments would strengthen external validity. Further research should also examine how access to green finance, institutional support, and entrepreneurial networks influence the awareness–orientation–intention pathway.

Overall, the findings highlight that developing environmentally aware and sustainability-oriented entrepreneurs is both an academic and policy priority. In Nigeria and across Africa, where climate and ecological pressures are intensifying, strengthening entrepreneurial ecosystems to support green venture creation is not optional but necessary for long-term economic and environmental resilience.

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TRANSFORMING EDUCATION IN AFRICA: A CRITICAL CONSCIOUSNESS APPROACH TO CURRICULUM INNOVATION AND ECOLOGICALLITERACY INSPIRED BY PAULO FREIRE

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Abstract

This paper explores the growing need to embed ecological literacy into the educational systems across Africa through intentional and context-driven curriculum innovation. As environmental challenges such as climate change, biodiversity loss, and resource depletion intensify, it argues that education on the continent must move beyond abstract and theory-driven approaches toward learning that is more practical, locally grounded, and sustainability-focused. Through emphasis on indigenous knowledge systems, local environmental realities, and problem-solving skills, the study envisions a curriculum that prepares learners to respond meaningfully to ecological issues within their own communities. This study is guided by the philosophical framework of Paulo Freire, particularly his concept of critical consciousness. Drawing on the critical and dialogical method, the study adopts a reflective and participatory approach that emphasizes questioning, dialogue, and the co-creation of knowledge. This method allows for interrogation of existing educational structures while opening up possibilities for more inclusive and transformative practices. In this view, learners are not passive recipients but active agents capable of understanding and reshaping both their social and ecological environments.

Ultimately, the paper positions ecological literacy as both an environmental necessity and a pathway to social transformation. It concludes that reconstructing African education along these lines is essential for sustainable development, as it bridges the gap between knowledge and action and, equips future generations to navigate complex environmental realities.
Keywords: Ecological Literacy, Curriculum Innovation, Critical Consciousness, Environmental Education

Introduction

Ecological literacy is the ability to understand, appreciate and act on environmental issues in a responsible and sustainable manner (Saluja, 2024). It aligns correctly with education for sustainable development, which aims to empower learners to make informed decisions and take actions to promote environmental safety, economic viability and a just society (UNESCO, 2025). Additionally, ecological literacy is in agreement with the United Nations' Sustainable Development Goals (SDGs), especially SDG 4, which seeks to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all (United Nations, 2015). Education in Africa is facing challenges that transcends literacy, numeracy and economic advancement. The issue of biodiversity loss, climate change, desertification, pollution, flooding and others are environmental and social problems currently facing Africa and in the midst of all these, our educational system in Africa is yet to be properly positioned to aggressively tackle this destructive trends.

Moreover, with some of the burdens of ecological literacy placed on the shoulders of formal education, it is not encouraging that the system of education in African still relies essentially on theory-based teaching methods that do not properly prepare learners to aggressively confront pressing environmental challenges. Curricula in use often fail to integrate ecological literacy,

indigenous knowledge systems, and practical problem-solving skills that are relevant to local environmental realities. This gap raises both philosophical and educational question on the role of education in salvaging the ecological situations of African societies. This is so because, with a gap between knowledge and action, it necessarily affects learners' ability to participate actively in sustainable development and environmental transformation.

Consequently, this paper argues for the need to give a priority place to ecological literacy in the process of curriculum innovation in Africa. Beyond mere knowledge of the environment, ecological literacy involves individual's conscious effort to critically interpret ecological realities and act accordingly within their environment. To develop such consciousness, education must be more transformative and participatory rather than passive. The critical consciousness of Paulo Freire provides a good framework for this transformation. His philosophical thought emphasizes on dialogue, reflection and practical application as tools needed for liberation and social change. It provides a way of reconstructing education as an instrument for ecological awareness, community participation and sustainable development. This paper therefore explores how curriculum innovation blended with critical consciousness can promote ecological literacy in Africa.

Ecological Challenges and Education in Africa

As a way to provide solutions to ecological challenges in Africa through education, the United Nations Decades of Education for Sustainable Development has as its overall goal, “to integrate the principles, values, and practices of sustainable development into all aspects of education and learning” (UNESCO, 2025). The implementation document went further to say that “this educational effort will encourage changes in behavior that will create a more sustainable future in terms of environmental integrity, economic viability, and a just society for present and

future generations" (UNESCO 2025). Over the years and around the globe, access to information and quality education has proved to be a veritable tools necessary to prepare citizens to be partners in the sustainability and development of their environment, and world. Lack of access or inadequate education makes people blind to things they should stand up for and deprives them of requisite knowledge necessary to advocate and take actions to save their environment, and transform their society. This is necessary in today's world with so many ecological challenges like climate change threatening the sustainability of life, environment, agriculture and health. Most of these were caused by actions and inactions of man in the society. The major issue here is that education curriculum in African is not well positioned to contend with these challenges. This is why the specific objectives of the UNESCO (2025) Education for Sustainable Development include fostering quality of teaching and learning in education for sustainable development and providing countries with new opportunities to incorporate Education for Sustainable Development into their education reform efforts. It is an expectation that through curriculum reform and philosophical reorientation, education must be made to become relevant to the environmental conditions of African societies.

Critical Consciousness Philosophy of Paulo Freire

This educational philosophy of Paulo Freire was birthed as a result of the struggle against inequality, operation and dehumanization. Critical pedagogy is a relatively old concept, primarily uncovered by Freire in his book titled "The Pedagogy of the Oppressed in the 1960s and 70s" (Riasati & Mollaei, 2012). His main concern is how to educate people to emancipate themselves from the culture of silence and to meet the needs of humanity and to develop a more just society (Taylor, 1993). This emancipatory education method is conscientious, and hopes to use this educational method as the

basis for helping individuals to awaken their own critical consciousness, and then take a more critical view of social reality to obtain liberation (Freire, 1970). For this reason, Freire's liberation of education can change people's perception of external reality, making the individual to be more critically minded (Shor & Freire, 1987). Freire criticized what he referred to as "banking model" of education, a situation where teachers deposit information into passive students (Freire, 1970). He frowned at the fact that this model of seeing the students mind as tabula rasa discourages creativity, critical thinking and social transformation. In opposition to the banking model, Freire proposed a dialogical and problem-solving model of education. The approach according to him involves the collaboration of teachers and learners in the process of knowledge creation. This kind of inquiry-based learning promotes the critical consciousness by helping learners to recognize political, social and economic challenges around them and take appropriate actions to mitigate them. Although Freire mainly discussed social operation but his ideas can be extended to ecological challenges. A critically conscious learner can easily recognize how environmental destruction is affecting them and take informed actions to protect the environment. Learners should be empowered to question harmful environmental practices, participate in sustainable activities, and develop solutions relevant to their local environment. Freire dialogical approach challenges authoritarian educational structures that tend to silence indigenous voices and local experiences. Pedagogy creates space for such knowledge systems to mutually coexist with scientific knowledge.

Curriculum Innovation and Ecological Literacy:

Curriculum planning and development is the epicenter of educational reform. Historically, major curriculum reforms had been mainly as a result of pressure by hunches or in terms of expediency instead of being based on research (Henson, K.T.). Curriculum innovation in Africa must move towards

transformative education where the curriculum connects learning to lived environmental experiences. Service-learning programs are good examples of curricula that help students connect to their local communities (Henson, 2015). Lauren Singleton (quoted in Hopkin 2004) says that "service learning is a teaching method that combines academic content with direct experiences in which students provide genuine service to their school or community while extending or deepening their understanding of curricular content. This kind of curriculum innovation must be interdisciplinary, participatory and culturally-based. On interdisciplinary level, ecological literacy should go beyond sciences to include other subjects because they all have roles to play in environmental awareness. Secondly, curriculum innovation must prioritize practical learning where learners are meant to directly engage with ecological issues through community projects and other local initiatives. Thirdly, indigenous knowledge systems should be accepted as reliable educational resources after Africans have successfully preserved some ecological wisdom related to biodiversity like herbal medicine, farming techniques and environmental preservation. Integrating such knowledge into formal education will go a long way to strengthen ecological literacy.

Ecological Literacy and Social Transformation:

The phrase "environmental literacy" was coined when an American environmentalist and educator, Roth (1968, as cited in Murray & Poto, Year) asked "how an environmentally literate citizen can be identified. Over the recent decades, "ecological literacy has evolved to include the interdisciplinary and systems-thinking approaches necessary for achieving environmental sustainability" (McBride et al., 2013). Aside environmental sustainability, ecological literacy can be linked to social transformation. This is because environmental challenges breeds poverty, displacement and inequality. Therefore, the type of

education that cultivates environmental awareness can also contribute to broader struggle for justice and human wellbeing. Consequently, Freire posited that liberation begins with awareness. When learners understand the nature of the challenges facing them, they prepare for collective action which can be in the form of community advocacy, policy engagement and sustainable innovation. This makes education both democratic and emancipatory. A typical example is Costa Rica which is "known as a leader in its efforts to protect its biodiversity and conserve its environment and natural resources. It is known that up to 30 % of the country is under some form of environmental protection, which is one of the highest rates in the world (Menkhaus & Lober, 1996, as cited in Locke et al., 2013). In promoting their environmental education for social transformation, the country adopted both formal and informal education that stress the protection and conservation of its environmental and natural resources. To achieve effectiveness in ecological literacy, educators should function more like facilitators of dialogue and critical inquiry than mere transmitters of information. A Freirean ecological curriculum calls for a more holistic vision of development, grounded in dignity, sustainability and collective responsibility.

Recommendations:

For effective integration of ecological literacy into the curriculum, the following recommendations are made:

1. Introduction of project-based learning where students learn by doing. Example is tree planting or school recycling initiatives.
2. Outdoor or experiential learning where students are taken on field visits to forests, farms and observation of local ecosystem.
3. Integration of indigenous or local ecological knowledge like traditional conservation methods and local farming systems.

4. Promote sustainable school practices like having waste separation bins and solar energy adoption.
5. Use of problem-solving and critical thinking strategies by encouraging students to analyze real environmental challenges.
6. Ecological literacy should be made to reflect in daily activities of students in and around the school.

Conclusion

Based on the ecological challenges facing Africa, its educational system requires a more critical and transformative approach rather than traditional education models that is essentially theoretical. Drawing from Freire's critical consciousness philosophy, this paper argued that curriculum innovation in Africa should adopt critical consciousness through dialogue, participation and practical engagement which will empower learners to understand and take actionable steps to save their communities. Through the integration of indigenous knowledge systems, experiential learning and critical pedagogy, African education will become more relevant, inclusive and sustainable.

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TECHNOLOGICAL PROGRESS AND ENVIRONMENTAL STEWARDSHIP: INSIGHTS FROM AFRICAN PHILOSOPHY

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Abstract

The rapid advancement of technology has significantly transformed contemporary society by improving communication, industrial productivity, healthcare, transportation, and economic development. However, scholars such as Hans Jonas and Arne Naess have argued that unchecked technological expansion contributes to major environmental challenges, including climate change, pollution, deforestation, biodiversity loss, and ecological degradation. This paper examines the philosophical relationship between technological development and environmental responsibility, with particular attention to the ethical implications of human interaction with nature in contemporary society. The study examines whether technological progress should remain predominantly anthropocentric and economically driven or be guided by ethical principles of sustainability, ecological balance, and collective responsibility. Using analytical and critical philosophical methods, the paper explores major perspectives in environmental ethics. Particular attention is given to African communitarian thought, which emphasizes the interconnectedness

between humanity and the natural environment. The paper argues that while technology remains indispensable for societal advancement, its development and application must be ethically regulated to prevent environmental exploitation, ecological degradation, and environmental injustice. The study concludes that genuine development cannot be separated from environmental responsibility, since human survival and technological progress ultimately depend on ecological sustainability. It therefore advocates an ethically informed model of technological development that integrates innovation, environmental stewardship, communal responsibility, and intergenerational justice.

Keywords: Environmental ethics, Responsibility, Technological development, Sustainability, Ecological Justice.

Introduction

Contemporary society has witnessed unprecedented technological advancement in communication, artificial intelligence, industrial automation, biotechnology, transportation, and energy production (Kanu, 2021). These developments have transformed human life by improving healthcare, enhancing agricultural productivity, facilitating scientific discoveries, and accelerating economic growth (Kanu, 2022). In many respects, technological progress has become synonymous with modern civilization and human development. However, alongside these benefits, technological expansion has generated serious environmental challenges. Industrialization, fossil fuel dependence, deforestation, extractive industries, pollution, climate change, biodiversity loss, and unsustainable consumer culture have disrupted ecological balance worldwide (Kanu, 2024). The exploitation of natural resources in pursuit of economic and technological growth has contributed significantly to ecological degradation, particularly in developing societies where environmental regulations are weak or inconsistently enforced (Kanu, 2023).

Philosophers have long warned of the ethical risks embedded in technological culture. Heidegger (1954) observed that "the essence of technology is by no means anything technological" (p. 4), and his notion of nature as a "standing reserve" (Bestand) highlights how modern technology reduces the environment to raw material for exploitation. Jonas (1979) avers, "Act so that the effects of your action are compatible with the permanence of genuine human life on earth" (p. 11), calling for responsibility toward future generations. Naess (1989) similarly emphasizes that "the flourishing of human and non-human life has value in itself" (p. 28), challenging anthropocentric assumptions that place human interests above ecological well-being.

African philosophers offer complementary insights by grounding ecological responsibility in relational ontology and communal ethics. Mbiti (1969), in his dictum, "I am because we are, and since we are, therefore I am" (p. 108), emphasizes relational existence. Kanu (2015), in his Igwebuike philosophy, argues that "to be is to belong, and to belong is to be in mutual relationship with others" (p. 14), while Asouzu (2007), in his Ibuanyidanda philosophy, asserts that "anything that exists serves a missing link of reality" (p. 23). Ubuntu ethics, expressed as "a person is a person through other persons" (Tutu, 1999, p. 35), alongside other African philosophies, highlights interdependence not only among humans but also between humanity and nature.

Traditional African ecological practices, such as sacred forests, protected rivers, totemic animals, and communal land ethics, further demonstrate environmental consciousness rooted in spiritual and communal relationships with nature (Kanu, 2021). Maathai (2003) exemplifies how communal initiatives can restore ecosystems while advancing social justice: "When we plant trees, we plant the seeds of peace and hope" (p. 112). This study,

therefore, seeks to critically examine technological progress and environmental stewardship through the lens of African philosophy, and argues that sustainable technological development requires ethical recognition of humanity's interconnectedness with the natural world.

Statement of the Problem

Technological progress has become one of the defining features of contemporary civilization. Scientific innovation, industrial expansion, digital transformation, and technological modernization continue to shape social, political, and economic life across the world. These developments have significantly improved human welfare through advances in communication, transportation, medicine, productivity, and economic growth. Nevertheless, the same technological systems that contribute to human advancement have also intensified environmental degradation. Climate change, pollution, deforestation, biodiversity loss, desertification, electronic waste, and the depletion of natural resources have increasingly become global concerns associated with industrial and technological activities. Contemporary technological culture often promotes excessive consumption, exploitation of nature, and unsustainable developmental practices that threaten ecological balance and long-term sustainability. A major philosophical problem underlying this crisis is the dominance of mechanistic and anthropocentric worldviews that regard nature primarily as an object for human use and economic exploitation. Such perspectives frequently separate humanity from nature and reduce the environment to an instrument of industrial growth, technological expansion, and material advancement. Consequently, environmental stewardship is weakened within technological paradigms driven largely by profit maximization and economic productivity rather than ecological harmony.

Literature Review

Conceptual Framework

Technological progress refers to the continuous advancement of scientific knowledge, technical innovation, and industrial development aimed at improving human life and expanding human capacity over nature (Ellul, 1964). It encompasses developments in communication systems, transportation, medicine, artificial intelligence, biotechnology, digital infrastructures, manufacturing, and energy production. In modern societies, technological progress is often associated with modernization, economic growth, industrialization, globalization, and national development.

Philosophically, technology is not merely a collection of tools but a mode of human engagement with reality. Heidegger (1954) critiques modern technology as reducing nature into a "standing reserve" (p. 17), while Jonas (1979) cautions that "technology has become autonomous, and its momentum threatens to outrun our capacity for ethical control" (p. 23). Ihde (1990) observes that "technology mediates human experience, shaping how we perceive and interact with the world" (p. 23). Ellul (1964) warns that "technique has taken on a life of its own, independent of human will" (p. 125). Borgmann (1984) adds that technology creates a "device paradigm" that simplifies life but risks alienating humans from deeper ecological connections (p. 41). Together, these perspectives converge on the tension between innovation and responsibility, highlighting the ethical risks of unregulated technological expansion.

Environmental stewardship emphasizes humanity's ethical responsibility to protect, preserve, and sustain the natural environment for present and future generations. Leopold (1949), in his *Land Ethic,* insists: "A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community"

(p. 224). Rolston (1988) similarly argues that "nature possesses moral worth independent of human utility" (p. 45). Naess (1989) affirms that "the flourishing of human and non-human life has value in itself" (p. 28). Plumwood (1993), in his ecofeminism, adds that domination of nature parallels domination of marginalized groups, calling for an ethic of care. These perspectives challenge anthropocentrism and call for ecological responsibility.

Theoretical Framework

This study is anchored in African relational philosophy, particularly Anthony Kanu's Igwebuike and Innocent Asouzu's Ibuanyidanda, which together provide ethical foundations for reconciling technological progress with environmental stewardship. *Igwebuike Conservation Theory:* Kanu (2015) explains that "Igwebuike is the principle that realities achieve meaning and fulfillment only within the context of their relationships with other realities" (p. 14). This philosophy rejects atomistic and individualistic conceptions of existence, affirming instead that all beings exist within networks of reciprocal relationships. Within environmental ethics, Igwebuike provides a strong basis for ecological responsibility and sustainable technological development. Since existence is fundamentally relational, humanity cannot be separated from nature without generating imbalance. Exploitative technological systems, therefore, violate the principle of relational harmony. Kanu further insists that "to be is to belong, and to belong is to be in mutual relationship with others" (2015, p. 14). This relational ontology challenges anthropocentric paradigms that reduce nature to an object of exploitation and economic consumption.

Table 1: Major Tenets of Igwebuike Philosophy and Environmental Implications

Tenets of Igwebuike	***Philosophical Meaning***	***Environmental Implication***
Relationality	Reality exists through interconnected relationships	Humanity and nature are mutually dependent
Complementarity	Beings attain fulfillment through cooperation	Technology should complement ecological well-being
Communal Responsibility	Moral obligations extend beyond the individual	Environmental stewardship becomes a collective duty
Harmony	Existence flourishes through balance	Sustainable development requires ecological balance
Solidarity	Shared existence demands mutual care	Protection of nature protects humanity itself
Interdependence	No reality exists in isolation	Ecological destruction affects all forms of existence

Source: Author created

Igwebuike, as can be inferred from Table 1 above, promotes an ethic of environmental solidarity in which technological advancement must operate within the limits of ecological responsibility, communal well-being, and intergenerational justice.

Ibuanyidanda Philosophical Theory: Innocent Asouzu's complementary ontology of Ibuanyidanda reinforces this view. Asouzu (2007) defines Ibuanyidanda as the philosophy of "complementary reflection," arguing that "anything that exists serves a missing link of reality" (p. 23). This principle emphasizes mutual dependence among beings, including nature, humanity, science, and technology. Ecological crises emerge when technological civilization ignores this complementary relationship between humanity and nature. By affirming that no being exists in isolation, Ibuanyidanda highlights the existential interconnectedness of all realities. It insists that technological development must complement ecological well-being rather than undermine it, thereby supporting a model of sustainable development grounded in relational existence, communal responsibility, and ecological harmony.

Ubuntu Relational Ontology: John Mbiti's dictum, "I *am because we are, and since we are, therefore I am"* (1969, p. 108), provides a profound metaphysical foundation for environmental ethics. By emphasizing relational existence, Mbiti (1969) situates the individual within a web of communal, ancestral, and ecological interconnections. Ecologically interpreted, this dictum implies that human flourishing is inseparable from the well-being of the natural environment, since the destruction of nature ultimately undermines the very conditions necessary for communal life. In this sense, Mbiti's relational ontology challenges anthropocentric paradigms that treat nature as mere instrumentality and instead affirms ecological responsibility as a collective moral duty. His insight extends environmental ethics beyond individual stewardship to communal solidarity, highlighting that the preservation of ecosystems is integral to sustaining both human and non-human life.

Table 2: Comparative Framework of African Relational Philosophies

Philosophy	Core Principle	Relational Dimension	Conservation/Ecological Dimension	Philosophical Contribution
Igwebuike *(Anthony Kanu, 2015)*	"To be is to belong, and to belong is to be in mutual relationship with others."	Affirms that existence is meaningful only within networks of relationships; rejects atomistic individualism.	Exploitative technology violates relational harmony; promotes ecological solidarity and intergenerational justice.	Provides a relational ontology that grounds environmental ethics in communal responsibility.
Ibuanyidanda *(Innocent Asouzu, 2007)*	"Anything that exists serves as a missing link of reality."	Emphasizes complementary reflection: all beings are interdependent and mutually fulfilling.	Ecological crises emerge when technology ignores complementary relationships between humanity and nature.	Offers a complementary ontology that integrates science, technology, and ecology into a holistic framework.

Ubuntu *(John Mbiti, Desmond Tutu)*	"A person is a person through other persons."	Stresses communal identity, compassion, and coexistence; human flourishing is inseparable from community.	Extends relationality to ecological responsibility: the well-being of humans tied to the well-being of nature.	Provides an ethic of care and solidarity, linking interpersonal and ecological responsibility.

Source: Author Created

The African relational philosophies of Mbiti, Kanu, and Asouzu converge meaningfully with Western ecological thought in critiquing exploitative technological paradigms and affirming ecological responsibility. They situate human existence within networks of interdependence, resonating with Hans Jonas' ethical imperative to act responsibly toward future generations. Kanu's *Igwebuike* principle parallels Arne Naess' deep ecology, which affirms the intrinsic value of all life forms. Asouzu's *Ibuanyidanda philosophy c*omplements Martin Heidegger's critique of technology, offering a constructive ontology of complementarity that insists on mutual dependence between humanity and nature.

Table 3: Comparative Framework: African and Western Ecological Philosophies

Philosophy	***Core Principle***	***Relational Dimension***	***Conservation/Ecological Dimension***	***Philosophic Contributio***
Igwebuike *(Anthony Kanu, 2015)*	"To be is to belong, and to belong is to be in mutual relationship with others."	Existence is meaningful only within networks of relationships; it rejects atomism.	Exploitative technology violates relational harmony; promotes ecological solidarity and intergenerational justice.	Provides relational ontology grounding environment ethics communal responsibilit

Ibuanyidanda *(Innocent Asouzu, 2007)*	"Anything that exists serves as a missing link of reality."	Emphasizes complementar y reflection: all beings are interdependent .	Ecological crises emerge when technology ignores complementary relationships between humanity and nature.	Offers complementa ontology integrating science, technology, ecology int holistic framework.
Ubuntu *(Mbiti, Tutu)*	"A person is a person through other persons."	Stresses communal identity, compassion, and coexistence.	Extends relationality to ecological responsibility: human wellbeing tied to nature's wellbeing.	Provides an of care lin interpersonal ecological responsibilit
Heidegger *(1954)*	Technology reduces nature to a "standing reserve."	Technology shapes human perception of reality.	An instrumental view of nature fosters exploitation and ecological degradation.	Critiques technologica enframing, urging rethinking humanity's relation nature.
Hans Jonas *(1979)*	"Act so that the effects of your action are compatible with the permanence of genuine human life on earth."	Responsibility extends to future generations.	Ethical imperative to restrain technological exploitation for sustainability.	Introduces intergenerati responsibilit a n foundation technology.

Source: Author Created

Although this study is primarily grounded in African philosophy, the convergence with Western ecological thought strengthens the theoretical foundation for sustainable technological development. While Western thinkers diagnose the dangers of technological enframing, anthropocentrism, and ecological exploitation, African philosophies extend ecological responsibility further by grounding it in communal ontology, solidarity, and complementarity.

Together, these perspectives advance a holistic model that integrates innovation with environmental stewardship, communal solidarity, and intergenerational justice, underscoring that genuine progress must harmonize technological advancement with ecological well-being.

Empirical Framework

Empirical studies consistently demonstrate the ecological consequences of technological expansion. Research in environmental ethics shows that industrialization and technological growth contribute significantly to climate change, pollution, biodiversity loss, and ecological degradation. As Jamieson (1992) notes, "industrial capitalism and technological dependence intensify the environmental crisis by embedding exploitative attitudes toward nature" (p. 45).

Reports by the United Nations Environment Programme (2021) and the Intergovernmental Panel on Climate Change (2022) confirm that fossil fuel combustion, industrial manufacturing, deforestation, and unsustainable production remain major contributors to greenhouse gas emissions. Global CO_2 emissions rose from approximately 10 gigatons in 1960 to over 35 gigatons in 2020, correlating with milestones in industrial automation, the digital revolution, and the AI boom. These findings reinforce philosophical concerns about the ethical implications of unregulated technological development.

African contexts highlight the tension between technological progress and ecological responsibility. In Nigeria, oil extraction in the Niger Delta has led to severe ecological degradation: "The vultures feast where oil spills destroy both land and life" (Okonta & Douglas, 2001, p. 56). In South Africa, Ubuntu-inspired conservation initiatives emphasize communal responsibility in resource management (Ramose, 1999).

Empirical evidence also demonstrates the role of indigenous ecological practices. Sacred groves in Ghana, communal land management in Igbo communities, and seasonal conservation practices across East Africa reflect traditional respect for ecological balance. Wangari Maathai's *Green Belt Movement* further illustrates how communal tree planting can restore ecosystems while advancing social justice: "When we plant trees, we plant the seeds of peace and hope" (2003, p. 112).

These global and African studies reinforce the philosophical argument that sustainable technological development requires ethical frameworks grounded in relationality, complementarity, and ecological stewardship. African ecological ethics, expressed through Ubuntu, Igwebuike, and Ibuanyidanda, demonstrate how communal responsibility can complement technological innovation, ensuring that progress does not undermine ecological wellbeing.

Gap in Literature

Despite extensive scholarship, significant gaps remain in the discourse on technological progress and environmental ethics. Much of the existing literature has emerged from Western traditions such as deep ecology, ecofeminism, environmental pragmatism, utilitarian ethics, and ecocentrism. While the dominant perspectives provide valuable insights, they often insufficiently engage African philosophical worldviews and indigenous ethical frameworks.

Conversely, African philosophy has richly explored themes of communalism, relational ontology, and complementarity. Yet, limited scholarly attention has been devoted to applying these concepts directly to contemporary technological development and environmental sustainability. More so, most studies addressing

technology and development remain focused primarily on economic growth and modernization, with inadequate attention to ecological ethics and philosophical responsibility toward nature. As a result, there is insufficient integration of African metaphysical and ethical thought into contemporary discourse on sustainable technology. Having identified these gaps, it becomes clear that a critical rethinking of technological progress and environmental ethics through African philosophical perspectives is urgently needed.

Aim and Objectives

This paper aims to critically examine technological progress and environmental stewardship from the perspective of African philosophy in order to develop an ethical framework for environmentally responsible and sustainable technological development.

The specific objectives include the following:

a. To critically examine the environmental implications of modern technological development and industrialization;
b. To analyze African philosophical conceptions of humanity, nature, and relational existence;
c. To investigate the relevance of African ethical thought to environmental stewardship and ecological responsibility;
d. To evaluate the possibility of reconciling technological advancement with ecological sustainability within contemporary society; and
e. To develop an African philosophical framework for environmentally responsible and sustainable technological development.

Methodology

This study adopts a qualitative philosophical research methodology grounded in critical analysis, philosophical hermeneutics, and conceptual inquiry. The study is fundamentally theoretical and analytical in orientation, seeking to examine the ethical and metaphysical relationship between technological progress and environmental stewardship within the context of African philosophy. The method of critical analysis is employed to examine the philosophical assumptions underlying contemporary technological culture, particularly anthropocentrism, mechanistic rationality, industrial expansion, consumerism, and exploitative attitudes toward nature. Through critical evaluation, the study interrogates the environmental implications of modern technological systems and assesses their impact on ecological sustainability.

Philosophical hermeneutics is utilized in interpreting African philosophical concepts such as Ubuntu, communalism, relational ontology, complementarity, and *Ibuanyidanda*. Hermeneutical interpretation enables the study to uncover the ethical significance of African metaphysical worldviews for environmental stewardship and sustainable technological development. The comparative philosophical analysis is employed in comparing African ecological thought with selected Western environmental theories, such as deep ecology and anthropocentrism. This comparative method enables the study to identify convergences, divergences, and the distinctive contributions of African philosophy to environmental ethics.

Data for the study are derived primarily from secondary sources, including books, peer-reviewed journal articles, conference papers, scholarly publications, dissertations, and relevant texts in African philosophy, environmental ethics, philosophy of technology, and sustainability studies. The study is library-based

and interdisciplinary in nature, drawing insights from philosophy, environmental studies, ethics, technology studies, and African intellectual traditions. Through these methods, the research seeks to construct a coherent African philosophical framework capable of promoting ecologically responsible technological advancement and sustainable development.

Technological Advancement and Environmental Degradation

Technological progress has significantly accelerated industrialization, economic growth, and global connectivity. However, these advancements have also generated profound ecological consequences. Empirical evidence consistently demonstrates that industrial expansion and technological development contribute substantially to climate change, pollution, biodiversity loss, and broader environmental degradation. As Dale Jamieson (1992) observes, industrial capitalism and technological dependence intensify environmental crises by reinforcing exploitative attitudes toward nature.

Global Emissions and Climate Change

Contemporary environmental statistics reveal the magnitude of the ecological crisis associated with technological and industrial development. According to the Intergovernmental Panel on Climate Change (IPCC, 2022), global greenhouse gas emissions reached approximately 59 gigatons of CO_2 -equivalent in 2019, with fossil fuel combustion and industrial activities serving as the principal contributors. Similarly, the United Nations Environment Programme (UNEP, 2021) warns that the world is likely to exceed the 1.5°C global warming threshold within the next two decades unless urgent emission reductions are implemented.

Further evidence is provided by the World Meteorological Organization (WMO, 2023), which reports that atmospheric carbon dioxide concentrations surpassed 420 parts per million (ppm) in 2022, representing the highest recorded level in human

history. This increase has been associated with intensified climatic disturbances, including extreme heatwaves, flooding, droughts, and wildfires across various regions of the world.

Resource Extraction and Electronic Waste

Technological advancement has also intensified resource extraction and waste generation. The International Energy Agency (IEA, 2023) estimates that the global technology sector contributes approximately 7% of worldwide greenhouse gas emissions, while data centres alone consume nearly 70 billion kilowatt-hours of electricity annually. In addition, electronic waste has emerged as a significant environmental challenge. UNEP (2021) reports that global e-waste generation reached approximately 57.4 million metric tonnes in 2021, much of which was improperly disposed of or inadequately recycled, thereby contributing to toxic pollution and resource depletion.

African Contexts and Ecological Responsibility

The environmental consequences of technological and industrial development are particularly visible within African contexts. In Nigeria, oil exploration and extraction in the Niger Delta have resulted in severe ecological degradation, including oil spills, water contamination, deforestation, and the destruction of local livelihoods. As Okonta and Douglas (2001) poignantly remark, "The vultures feast where oil spills destroy both land and life" (p. 56).

Conversely, African philosophical traditions have also inspired ecological responsibility and environmental restoration. In South Africa, Ubuntu-oriented conservation initiatives emphasize communal responsibility and harmonious coexistence with nature. Mogobe Ramose (1999) argues that environmental stewardship should be grounded in communal ethics and mutual interdependence. Similarly, Wangari Maathai's Green Belt

Movement demonstrates how collective ecological action can simultaneously promote environmental restoration and social justice. As Maathai (2003) states, "When we plant trees, we plant the seeds of peace and hope." (p. 112)

Table 4: Selected Global Environmental Indicators Associated with Technological Advancement

Environmental Indicator	*Statistical Data*	*Implication*	*Source*
Global greenhouse gas emissions	Approximately 59 gigatons CO2 - equivalent in 2019	Demonstrates the scale of industrial and fossil-fuel-driven emissions contributing to climate change	Intergovernmental Panel on Climate Change (2022)
Projected global warming	Likely to exceed 1.5°C within two decades without major intervention	Indicates accelerating climate instability and ecological risk	United Nations Environment Programme (2021)
Atmospheric CO2 concentration	Surpassed 420 ppm in 2022–2023, the highest level in recorded human history	Reflects intensifying greenhouse gas accumulation linked to industrial activity	World Meteorological Organization (2023)
Technology sector emissions	Approximately 7% of global greenhouse gas emissions	Reveals the environmental footprint of digital and technological infrastructure	International Energy Agency (2023)
Data centre electricity consumption	About 70 billion kWh annually	Indicates high energy demand associated with digital systems and global connectivity	International Energy Agency (2023)
Global electronic waste (e-waste)	Approximately 57.4 million metric tonnes in 2021	Highlights growing waste generation, toxic pollution, and recycling challenges	United Nations Environment Programme (2021)

Source: Author Created

The statistical evidence presented above demonstrates the growing ecological implications of technological and industrial expansion. Rising greenhouse gas emissions, increasing atmospheric carbon concentrations, escalating energy consumption, and mounting electronic waste collectively indicate that technological advancement, despite its undeniable contributions to human development, has also intensified environmental degradation on a global scale through increased emissions, resource exploitation, and waste generation.

Global statistics reveal the magnitude of the ecological crisis, while African experiences further illustrate the persistent tension between developmental aspirations and environmental responsibility. These trends reinforce broader concerns regarding ecological sustainability, environmental justice, and the ethical regulation of technological progress. Consequently, the evidence supports the central philosophical argument of this study: that unregulated technological advancement risks undermining ecological stability, communal wellbeing, and intergenerational justice.

Findings

The study reveals that contemporary technological progress has produced both developmental benefits and ecological consequences. On one hand, technology has improved healthcare, communication, industrial productivity, transportation, and economic growth (Kanu, 2021; Kanu, 2022). On the other hand, it has intensified environmental degradation through pollution, deforestation, climate change, biodiversity loss, and unsustainable resource exploitation (Jamieson, 1992; IPCC, 2022; UNEP, 2021; Kanu, 2024). Global emissions data confirm this reality: greenhouse gas emissions reached 59 gigatons CO_2 -equivalent in 2019 (IPCC, 2022), while atmospheric CO_2 concentrations surpassed 420 ppm in 2022, the highest in human history (WMO,

2023). These statistics highlight the scale of ecological disruption linked to technological expansion.

Another major finding is that African philosophy provides significant ethical resources for environmental stewardship. Principles drawn from Mbiti's dictum, Kanu's *Igwebuike* philosophy, Asouzu's *Ibuanyidanda*, and Ramose's Ubuntu ethics, encourage ecological consciousness and challenge exploitative developmental practices. The study also finds that traditional African ecological practices historically reflected environmental responsibility through sacred ecological spaces, communal resource management, and respect for natural systems (Kelbessa, 2011; Maathai, 2003). Although modernization has weakened some indigenous practices, African philosophical thought continues to offer valuable ethical foundations for sustainability.

The study further reveals that technological advancement and environmental stewardship are not inherently contradictory. Reports by UNEP (2021) and the IEA (2023) show that sustainable innovation, such as renewable energy, green technologies, and circular economies, can reduce emissions while supporting development. This demonstrates that through ethically guided innovation and sustainable development, technology can be harmonized with ecological responsibility.

Finally, the study finds that African relational philosophy provides a viable framework for sustainable technological development by emphasizing complementarity between humanity, technology, and nature. By integrating African ethical principles with global sustainability strategies, technological progress can be redirected toward ecological balance and intergenerational justice.

These findings highlight the dual nature of technological progress: while it has advanced human development, it has simultaneously

intensified ecological degradation. The integration of global statistics and African case studies underscores the urgency of reconciling innovation with sustainability. At the same time, African relational philosophies such as *Igwebuike*, *Ibuanyidanda*, and Ubuntu demonstrate that ethical traditions can provide viable frameworks for harmonizing technology with ecological responsibility.

Discussion of Findings

The findings of this study demonstrate that technological advancement cannot be evaluated solely in terms of economic growth, industrial expansion, or scientific efficiency. Technological systems inevitably shape humanity's relationship with nature and therefore possess profound ethical implications. The study confirms that contemporary environmental crises are not merely technical problems but fundamentally philosophical and ethical problems rooted in anthropocentric assumptions about human superiority over nature (Jamieson, 1992; IPCC, 2022; UNEP, 2021).

Mechanistic technological culture often prioritizes productivity, industrialization, and profit maximization without adequate consideration for ecological sustainability. This is evident in global emissions data, which show that greenhouse gas emissions reached 59 gigatons of CO_2 -equivalent in 2019 (IPCC, 2022), while atmospheric CO_2 concentrations surpassed 420 ppm in 2022 (WMO, 2023). Such statistics confirm that technological progress, when divorced from ethical responsibility, accelerates ecological degradation.

African philosophy offers an important corrective to these reductionist paradigms by emphasizing interconnectedness and communal coexistence. Ubuntu philosophy expands moral responsibility beyond individual interests and promotes collective

well-being. When extended ecologically, this insight suggests that environmental destruction ultimately threatens communal existence itself (Ramose, 1999; Tutu, 2008).

The study, therefore, argues that contemporary ecological crises are fundamentally crises of broken relationality between humanity and nature. Sustainable development consequently requires the restoration of relational harmony through ethical technological practices grounded in complementarity, solidarity, communal responsibility, and ecological consciousness. The findings further indicate that sustainable technological development requires ethical transformation in addition to scientific innovation. Environmental stewardship cannot succeed solely through policy mechanisms or technological regulation unless supported by moral values emphasizing ecological responsibility and intergenerational justice (UNEP, 2021; Maathai, 2003).

Overall, the discussion demonstrates that the environmental crisis associated with contemporary technological civilization is not merely scientific or economic but fundamentally ontological and ethical. African relational philosophies such as *Igwebuike* and *Ibuanyidanda* reveal that human existence, technological systems, and ecological reality are inseparably interconnected. Consequently, sustainable technological development requires not only scientific innovation but also philosophical reorientation toward relational coexistence, ecological responsibility, and intergenerational justice.

Conclusion

This study has demonstrated that technological progress, while offering undeniable developmental benefits, also generates profound ecological consequences when guided by anthropocentric and mechanistic paradigms. As Heidegger warned, modern technology risks reducing nature to a mere

standing reserve, fostering exploitative attitudes that undermine ecological sustainability. Similarly, Jonas insists that technological power must be restrained by responsibility.

These philosophical insights are confirmed by empirical evidence: technological advancement has intensified ecological degradation through pollution, deforestation, climate change, biodiversity loss, and unsustainable resource exploitation (IPCC, 2022; UNEP, 2021; WMO, 2023). The environmental crisis is, therefore, not merely a technical or economic issue but a deeper ontological and ethical rupture in humanity's relationship with nature. Against this backdrop, African relational philosophies provide distinctive ethical resources for rethinking the relationship between humanity, technology, and nature. The findings confirm that African relational philosophies not only critique exploitative technological paradigms but also provide constructive frameworks for harmonizing innovation with ecological responsibility. By situating technological progress within communal ontology, solidarity, and complementarity, these philosophies extend ecological responsibility beyond individual stewardship to collective and intergenerational justice. Ubuntu, *Igwebuike*, and *Ibuanyidanda* emphasize interconnectedness, complementarity, and communal responsibility, offering ethical foundations for sustainable technological development (Asouzu, 2007, 2016; Kanu, 2015, 2020, 2024; Ramose, 1999, 2003).

The conclusion affirms that sustainable technological development requires both scientific innovation and ethical transformation. African philosophy contributes a unique framework for reimagining technology as a partner in sustaining life, community, and the planet. Ultimately, ecological responsibility and intergenerational justice must guide technological progress if humanity is to achieve authentic development. By grounding sustainability in African relational ontology, this study contributes

to environmental ethics by proposing a distinctly African framework for responsible technological progress, one that harmonizes innovation with ecological stewardship, communal solidarity, and intergenerational justice.

Recommendations

From the foregoing insights, this paper recommends the following:

a. Governments and policymakers should strengthen environmental regulations guiding industrial and technological activities to reduce greenhouse gas emissions, ecological degradation, and unsustainable resource exploitation.
b. Educational institutions should integrate environmental ethics, sustainability studies, and African relational philosophies into curricula for science, engineering, technology, and the humanities.
c. Technology industries and innovators should move beyond purely anthropocentric and mechanistic models of development by adopting ethical frameworks that balance technological progress with ecological sustainability.
d. Governments, communities, and cultural institutions should revive and adapt traditional African ecological practices, including communal resource management, sacred ecological spaces, and respect for natural systems.
e. Scholars and researchers should encourage comparative philosophical engagement between African thought and Western ecological theories to enrich global environmental ethics through diverse intellectual perspectives.

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THE POLITICS OF BIODIVERSITY AND PUBLIC HEALTH IN AFRICA: A PHILOSOPHICAL INQUIRY INTO THE NATURE OF POLICIES AND THEIR IMPLICATIONS

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Abstract

The relationship between biodiversity and public health in Africa has become increasingly important in the context of environmental degradation, climate change, ecological insecurity and persistent health challenges. Yet policies relating to land use, forestry, mining, agriculture, urbanisation, waste management and disease prevention are often formulated within separate institutional structures, with insufficient attention to their ecological interdependence. This paper examines the political and philosophical assumptions underlying biodiversity and public health policies in Africa, with particular attention to Nigeria. It argues that the problem is not merely administrative or technical but also ethical and philosophical, because policy decisions reflect particular conceptions of nature, development, justice, responsibility and the common good. The study employs conceptual analysis and hermeneutics. Conceptual analysis clarifies the relationships among politics, biodiversity, public

health, policy and justice, while hermeneutics facilitates the interpretation of the socio-cultural and philosophical assumptions embedded in environmental governance. The paper further brings African philosophical perspectives into conversation with environmental ethics through the ideas of Kwame Gyekye, Kwasi Wiredu, Ikechukwu Anthony Kanu and Pantaleon Iroegbu. Their emphasis on community, responsibility, consensus, complementarity and relationality provides resources for rethinking biodiversity governance beyond purely instrumental approaches to nature. The Nigerian experience demonstrates that weak implementation, institutional fragmentation and unequal distribution of environmental burdens can undermine both ecological integrity and public health. The paper concludes that effective biodiversity governance in Africa requires an integrated ethical framework that combines ecological responsibility, environmental justice, community participation, indigenous ecological knowledge and human well-being.

Keywords: Biodiversity Politics, Public Health Policy, Environmental Justice, African Philosophy, Ecological Justice, Nigeria.

Introduction

Africa possesses exceptional biological diversity, including tropical forests, savannahs, wetlands, mangroves, freshwater ecosystems and diverse plant and animal species. These ecosystems sustain agriculture, fisheries, traditional medicine, water security, climate regulation and cultural life. Biodiversity is therefore not merely an environmental resource; it is part of the material foundation of human well-being. Its degradation through deforestation, pollution, mining, inappropriate agricultural practices, urban expansion and climate change consequently has implications for both ecological stability and public health.[1] The relationship between ecological degradation and health is

increasingly recognised. Changes in land use and ecosystem disturbance can alter interactions among humans, wildlife, livestock and disease vectors, thereby increasing opportunities for infectious disease transmission. The World Health Organization (WHO) and the Convention on Biological Diversity (CBD) have consequently emphasised the interdependence of healthy ecosystems, food security, clean water, disease regulation and human health.[2]

Despite this interdependence, environmental and health governance in many African states remains institutionally fragmented. Ministries and agencies responsible for health, environment, agriculture, forestry, mining and urban planning frequently operate according to separate mandates. Such fragmentation can produce contradictory policy outcomes: a policy intended to stimulate economic activity may simultaneously damage ecosystems that communities depend upon for food, water and health. Biodiversity governance is therefore inherently political because it concerns the allocation of natural resources, environmental benefits and environmental burdens.

The philosophical significance of the problem lies in the values underlying these political choices. If nature is regarded principally as an economic instrument, policies are likely to favour extraction whenever immediate economic benefits appear to outweigh ecological costs. If, however, nature is understood as having moral significance and as constituting the ecological basis of communal existence, political responsibility takes a different form. Environmental policy then becomes a question of justice, responsibility and the common good.

This question has particular significance in Africa because indigenous societies developed diverse institutions for regulating relationships with land, forests, rivers, animals and other natural resources. Sacred forests, customary restrictions, protected species, seasonal prohibitions and communal forms of resource management were among the mechanisms through which ecological resources were socially regulated. These practices should not be romanticised or treated as uniformly successful, but neither should they be dismissed as irrelevant to contemporary environmental governance. Recent research on African sacred forests, including studies in Nigeria, indicates that such sites can function as important reservoirs of biodiversity and ecosystem services.[3] Nigeria provides a useful case for examining these issues. Oil pollution in the Niger Delta, deforestation, illegal mining, poor waste management and expanding urbanisation have produced significant environmental pressures. The UNEP assessment of Ogoniland, for example, documented extensive contamination of land, water and ecosystems after decades of petroleum operations.[4] The Nigerian experience demonstrates that environmental degradation cannot be understood independently of questions concerning political authority, economic priorities, institutional responsibility and the distribution of environmental risks.

This paper therefore argues that biodiversity and public health policy in Africa requires philosophical reconsideration. Using conceptual analysis and hermeneutics, it examines the relationship between politics, biodiversity, public health and justice; evaluates relevant environmental and political theories; deepens the analysis through African philosophical perspectives; and applies the resulting framework to Nigeria.

Conceptual Clarification and Philosophical Framework

Politics may broadly be understood as the organisation and

exercise of power in the making of collective decisions. Harold Lasswell famously characterised politics in terms of "who gets what, when, and how," thereby drawing attention to the distributive dimension of political decision-making.[5] Public policy is similarly concerned with governmental choices and non-choices concerning matters of collective importance. Thomas Dye's formulation of policy as what governments choose to do or not to do is especially relevant to environmental governance because regulatory inaction may itself have significant ecological consequences.

Biodiversity, according to the Convention on Biological Diversity, encompasses variability among living organisms, including diversity within species, between species and of ecosystems.[6] Its significance extends beyond the number of species present in an ecosystem. Biodiversity contributes to food production, pollination, soil fertility, water regulation, medicinal resources and ecological resilience. The degradation of biodiversity can therefore affect the material conditions necessary for human health.

Public health, likewise, should not be reduced to medical treatment. It involves organised social efforts to prevent disease and promote conditions conducive to healthy living. The WHO's broader conception of health as physical, mental and social well-being reinforces the importance of environmental conditions in understanding health. The WHO-CBD assessment consequently treats biodiversity and ecosystem integrity as important determinants of human well-being.[7]

These concepts converge around the question of justice. Environmental justice asks who receives environmental benefits, who bears environmental burdens, and who participates in decisions concerning environmental resources. In many African

contexts, communities that depend most directly on forests, agricultural land, rivers and coastal ecosystems can be particularly exposed to pollution and ecological degradation while having limited influence over decisions concerning resource extraction. Environmental ethics adds a further dimension by questioning the assumption that nature has value only insofar as it serves human economic interests. Aldo Leopold's Land Ethic expands moral consideration to the wider biotic community and proposes ecological integrity as a criterion for evaluating human conduct.[8] Holmes Rolston III similarly argues for recognising value in the natural world beyond its immediate usefulness to human beings.[9] These positions challenge policy approaches that treat ecosystems primarily as inventories of exploitable resources. Hans Jonas provides an additional ethical principle through his philosophy of responsibility. Modern technological and economic activity has acquired the power to produce environmental consequences extending across generations. Jonas therefore argues for an ethic capable of taking responsibility for the long-term conditions of human existence.[10] Applied to biodiversity governance, this means that present governments have responsibilities extending beyond immediate economic returns to the ecological conditions inherited by future generations. John Rawls' theory of justice also offers a useful, though indirect, framework. His concern with fairness in the distribution of social benefits and burdens can be extended to environmental governance.[11] If environmental risks are systematically concentrated among poor or politically marginalised populations while economic benefits are disproportionately enjoyed elsewhere, questions of distributive justice arise. Amartya Sen's capability approach reinforces this concern by understanding development in terms of people's substantive opportunities to live lives they have reason to value.[12] Environmental degradation can reduce such capabilities by undermining health, food security, access to water, livelihoods and participation in social life.

These theories establish an important normative foundation, but an analysis of Africa's biodiversity politics should not depend exclusively on Western philosophical categories. African philosophy provides concepts capable of illuminating the relationship among person, community, nature and the common good.

African Philosophical Perspectives on Nature, Community and the Common Good

A deeper African philosophical dimension begins with the recognition that African thought is internally diverse. There is no single African philosophy or uniform African conception of nature. Nevertheless, a number of African philosophers have identified relational, communal and participatory dimensions of African moral and political thought that can contribute to contemporary environmental philosophy. Kwame Gyekye's moderate communitarianism is particularly relevant. Gyekye argues that the individual and community possess moral significance and that neither should be reduced to the other. Community is necessary for the realisation of human capacities, while individual rights and responsibilities remain important.[13] This provides a philosophical basis for understanding environmental resources as common goods without treating individual interests as irrelevant. Forests, rivers and agricultural lands may be communally significant, yet responsible governance must also recognise the rights and legitimate interests of individuals and particular communities.

The implications for biodiversity governance are substantial. Environmental policy should not be designed merely as a technical process administered from the centre. Communities affected by environmental decisions have moral and political standing. Their

participation is justified not only by practical considerations but by a conception of political life in which the common good emerges through relationships among persons and communities. Kwasi Wiredu's reflections on consensus provide a complementary political dimension. Wiredu examines consensus as an African mode of collective decision-making and contrasts it with adversarial forms of political competition.[14] His argument does not imply that every traditional African political institution should simply be reproduced in modern states. Rather, it highlights the philosophical value of dialogue, participation and the accommodation of interests in decisions affecting the community. Applied to biodiversity governance, meaningful consultation with local communities should precede major decisions concerning land use, extractive industries and ecological resources. Ikechukwu Anthony Kanu's philosophy of *Igwebuike* adds another important dimension. Kanu presents *Igwebuike* as a philosophy of complementarity, relationality, solidarity and communality.[15] Its relevance to environmental governance lies in its rejection of isolated and absolutised conceptions of reality. Environmental problems themselves demonstrate this interdependence: human health depends upon ecosystems; ecosystems are affected by economic activity; economic activity is regulated through political institutions; and political decisions affect both present communities and future generations.

The philosophical significance of *Igwebuike* therefore extends beyond the simple claim that "community matters." It provides a relational framework for interpreting biodiversity governance. Forest, river, human community, animal life and political institution should not be regarded as unrelated entities. They participate in a network of relationships in which harm to one dimension may produce consequences for others. Kanu's interpretation of *Igwebuike* as an ethical orientation grounded in

complementarity and solidarity is consequently relevant to a policy framework that seeks to integrate environmental protection, public health and communal welfare.[16] Pantaleon Iroegbu's *Uwa* ontology provides another promising African philosophical resource. The idea of *uwa* as a reality of belonging and relational existence has recently been interpreted as providing a possible basis for an ecocentric environmental philosophy. Jonathan O. Chimakonam and L. Uchenna Ogbonnaya argue that Iroegbu's ontology can support an understanding of ecosystems as interconnected networks of biotic and abiotic realities rather than as collections of isolated objects.[17] This is particularly significant for biodiversity because the loss of one component of an ecosystem can affect the functioning of the whole.

These African philosophical perspectives also encourage a critical reassessment of indigenous ecological knowledge. Indigenous practices should neither be idealised nor accepted uncritically. Some traditional practices may have become inadequate under contemporary population, technological and economic conditions. Nevertheless, sacred groves, customary restrictions and community-based resource institutions demonstrate that ecological regulation has historically been embedded within African social and moral structures. Recent research on sacred forests in Africa confirms their continuing importance for local biodiversity conservation, while research on sacred groves in southwestern Nigeria has documented their ecological and cultural significance.[18]

The philosophical lesson is therefore not that Africa should reject modern science in favour of tradition. Rather, contemporary environmental policy can benefit from a dialogue between scientific knowledge and indigenous ecological knowledge.

Wiredu's critical approach to tradition is important here: African traditions can constitute resources for philosophical reflection without being exempted from critical examination.[19] Such an approach avoids both uncritical traditionalism and the assumption that useful knowledge can only come from modern scientific institutions. The African philosophical contribution to biodiversity governance can consequently be summarised around four interconnected principles: community, participation, relationality and responsibility. These principles complement environmental ethics and political theories of justice by providing culturally grounded ways of thinking about the common good and the human relationship with the natural world.

The Politics of Biodiversity and Public Health in Africa

The biodiversity crisis in Africa is fundamentally political because access to ecological resources and exposure to ecological risks are shaped by political decisions. Governments determine the legal status of forests, mining areas, wetlands and protected lands; approve or reject development projects; regulate extractive industries; and determine the institutional resources available for environmental protection.

African states have adopted important environmental laws and international commitments, including the Convention on Biological Diversity and the Kunming-Montreal Global Biodiversity Framework.[20] Yet formal commitments do not automatically produce effective conservation. Where environmental regulations are weakly enforced, environmental impact assessments are inadequate, or institutional responsibilities overlap, economic activities may continue to generate ecological damage.

The consequences extend to public health. The WHO-CBD assessment identifies connections between biodiversity, infectious diseases, nutrition, medicines, water, climate regulation and other determinants of health.[21] Ecosystem degradation may increase exposure to pollutants, reduce food diversity, undermine water security and alter relationships between humans and disease vectors. Biodiversity policy should therefore be considered part of preventive public health rather than a separate environmental concern. Fragmented governance remains a major obstacle. When environmental, agricultural, health, water and mining policies are formulated independently, one institution may inadvertently undermine the objectives of another. The appropriate response is not simply the creation of more agencies but stronger coordination around shared ecological and health objectives. The problem is particularly serious for rural communities. Forests, wetlands, rivers and coastal ecosystems often provide food, fuel, medicinal resources, employment and water. When such ecosystems deteriorate, the consequences can appear simultaneously as environmental degradation, loss of livelihood, food insecurity and declining health. The politics of biodiversity is therefore also the politics of social vulnerability.

Environmental justice further reveals that ecological burdens are rarely distributed equally. Communities located close to extractive activities may experience pollution and loss of livelihood while economic benefits are distributed through wider national or international markets. Such situations raise questions of participation, compensation, accountability and distributive justice. An integrated approach should therefore connect biodiversity conservation with public health, poverty reduction and community participation. Conservation that excludes communities from legitimate decision-making can generate conflict, while development that disregards ecological limits can

create long-term health and economic costs. The philosophical challenge is to establish institutions capable of balancing these interests without reducing nature to a commodity or communities to passive beneficiaries.

The Nigerian Experience

Nigeria illustrates the political and ethical difficulties involved in biodiversity governance. Its ecological diversity ranges from mangrove and freshwater ecosystems in the Niger Delta to forests, savannahs and semi-arid environments in other regions. These ecosystems support agriculture, fisheries, forestry, traditional medicine and numerous rural livelihoods.[22] Yet oil pollution, deforestation, mining, waste generation, urban expansion and other pressures have degraded important ecosystems. The UNEP assessment of Ogoniland provides particularly strong evidence. Its investigation examined more than 200 locations and found extensive contamination associated with decades of petroleum operations, with implications for land, water, ecosystems and human health.[23]

The Nigerian problem is therefore not simply the absence of environmental legislation. Institutions such as the Federal Ministry of Environment and environmental regulatory agencies exist, and Nigeria has adopted biodiversity strategies and international commitments. The persistent difficulty lies in implementation, coordination, monitoring and enforcement. This distinction is philosophically important. A state may possess formally adequate laws while failing to realise the values those laws are intended to protect. The resulting gap between normative commitment and practical governance becomes a problem of political responsibility. Where environmental rules exist but are systematically ignored, the problem cannot be solved through legislation alone. The

Nigerian experience can also be interpreted through the African philosophical framework developed above. From a communitarian perspective, environmental resources are connected with communal welfare. Pollution of a river is not simply damage to an abstract environmental object; it can affect the health, livelihood and social continuity of a community. From an *Igwebuike* perspective, environmental governance requires attention to the relationships among ecological systems, communities, institutions and economic activity. From the perspective of *Uwa*, ecological realities can be understood through belonging and interdependence rather than isolation.

These perspectives also modify the meaning of environmental justice. Justice requires more than distributing financial benefits from natural resources. It requires ensuring that communities have meaningful participation in decisions affecting their ecological conditions and that they are not disproportionately exposed to environmental hazards. The common good must therefore include the ecological conditions necessary for communal life. Nigeria's environmental challenge consequently calls for an ethical reorientation of governance. Political leadership must treat biodiversity conservation and public health as interconnected responsibilities rather than separate administrative concerns. Economic development remains legitimate and necessary, but its legitimacy is weakened when the ecological foundations of human well-being are destroyed.

Conclusion and Recommendations

This study has examined the politics of biodiversity and public health in Africa from a philosophical perspective. It has shown that biodiversity is not merely a biological or technical concern but a political and ethical issue involving power, justice, responsibility,

participation and the common good. The analysis also demonstrates that environmental degradation can undermine public health through effects on water, food systems, pollution, disease regulation, livelihoods and ecological resilience.

The philosophical analysis of Leopold, Rolston, Jonas, Rawls and Sen provides important resources for understanding ecological value, responsibility, justice and human capabilities. However, the African philosophical perspectives of Gyekye, Wiredu, Kanu and Iroegbu deepen the argument by drawing attention to community, participation, relationality, complementarity and belonging. These perspectives suggest that biodiversity governance in Africa should not be constructed exclusively through externally derived conceptual frameworks.

Five recommendations follow: First, African governments should develop integrated biodiversity–public health policies that bring environmental, health, agricultural, water, forestry, mining and climate institutions into effective coordination. Second, environmental regulatory institutions should be strengthened through adequate funding, technical capacity, transparent environmental impact assessment, monitoring and enforcement. Environmental laws are meaningful only when institutions possess the capacity and independence to implement them. Third, communities should have meaningful participation in environmental decision-making. Indigenous ecological knowledge should be documented, critically assessed and incorporated where appropriate into contemporary conservation strategies. Community participation should be understood as a matter of political responsibility rather than merely administrative consultation. Fourth, environmental protection should be treated as preventive public health. Clean water, sanitation, pollution control,

ecosystem restoration, sustainable agriculture and climate resilience should form part of public health planning, particularly in vulnerable rural and peri-urban communities. Finally, environmental ethics and ecological justice should receive greater attention in education and public policy. The objective should be an ethical conception of development in which economic progress is evaluated alongside ecological integrity, human dignity, communal welfare and intergenerational responsibility.

The central conclusion of the study is therefore that Africa's biodiversity and public health challenges cannot be adequately addressed by technical interventions alone. What is required is a political philosophy of ecological responsibility: one that recognises the intrinsic and instrumental significance of nature, protects the capabilities and health of human communities, gives affected populations a meaningful voice in environmental decisions, and understands present political authority as carrying responsibilities to future generations. Such an approach provides a philosophical basis for reconciling environmental protection with sustainable human development.

Endnotes

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12. Amartya Sen, *Development as Freedom* (New York: Alfred A. Knopf, 1999), 3–11, 87–110.

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17. Jonathan O. Chimakonam and L. Uchenna Ogbonnaya, "Iroegbu's Uwa Ontology as a Framework for an Ecocentric Philosophy," *Ethics, Policy & Environment* 28, no. 3 (2025): 407–422.

18. Sinthumule, "Sacred Forests as Repositories of Local Biodiversity in Africa," 337–348. Recent research on sacred groves in southeastern Nigeria similarly documents the relationship between indigenous cultural practices and biodiversity conservation.

19. Kwasi Wiredu, *Cultural Universals and Particulars: An African Perspective* (Bloomington: Indiana University Press, 1996). Wiredu's position is especially useful because he treats indigenous traditions as resources for critical philosophical reflection rather than as bodies of belief beyond rational examination.

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The Book

It is with great pleasure and a profound sense of scholarly commitment that I present this third volume of the proceedings of the 10th International Conference of the Association for the Promotion of African Studies (APAS), titled Governance, Education and Sustainable Development in Africa: Policy and Institutional Pathways for Biodiversity Conservation and Public Health. The volume is part of a three-volume scholarly publication from the APAS international conference held at Veritas University, Abuja, from Tuesday, 26 May to Friday, 29 May 2026, on the theme, "Biodiversity, Conservation and Public Health in Africa: Challenges and Prospects." … The central concern of this volume is therefore not merely what Africa knows about biodiversity, environmental degradation and public health, but what Africa does with that knowledge. Knowledge must ultimately find expression in policies, institutions, educational systems, leadership practices, economic decisions, legislation and responsible civic action. Without appropriate institutional structures and effective implementation mechanisms, even the most compelling environmental ideals may remain largely aspirational … I commend this book to the scholarly community, policy-makers, educators, institutional leaders, development practitioners, business leaders, students and all who are committed to building a sustainable and flourishing Africa. May the scholarship contained in this volume move us from knowledge to consciousness, from consciousness to responsibility, and from responsibility to transformative action.

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ISBN: 978-2981-35-15