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Sustainable Management of Critical Resources In Nigeria: Balancing Technological Advancement, Economic Growth, And National Security

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Abstract: This study investigates the sustainable management of Nigeria's critical resources, focusing on the integration of technological advancements, economic growth, and national security. Given Nigeria's heavy reliance on oil, the study addresses the challenges of resource management, including corruption, environmental degradation, and economic diversification. The aim is to propose strategies that balance these factors, ensuring long-term stability and prosperity. Methodologically, the study employs a comparative literature review as well as analysis of resource management practices in Nigeria and other resource-rich nations such as Angola, Ghana, South Africa, Norway, Canada, and Australia. This approach allows for the identification of best practices and lessons applicable to Nigeria. The results reveal that while modern technologies like remote sensing and blockchain can enhance efficiency and transparency in resource management, their implementation is hindered by infrastructural and financial challenges. Moreover, the study highlights the necessity of economic diversification and robust environmental governance to reduce Nigeria's dependency on oil and mitigate associated social inequalities. The study recommends adopting governance reforms, strengthening environmental regulations, and

enhancing local content policies to ensure equitable resource distribution and sustainable development. These strategies, if implemented, will align technological advancements with economic growth and national security objectives.

Keywords: Sustainable resource management, technological advancements, economic growth, national security, resources.

Introduction: The sustainable management of essential resources is a significant challenge for countries around the world, particularly those with abundant natural resources such as Nigeria. Nigeria, also known as the "Giant of Africa," is the most densely populated country in Africa and one of the largest economies on the continent. Nigeria possesses huge deposits of crude oil, natural gas, and diverse minerals, which have played a pivotal role in its economic progress. Nevertheless, the utilization and administration of these resources have presented notable obstacles to the country's economic stability, technical advancement, and national security (Eboh & Uduma, 2022). The pursuit of sustainable management of these resources is additionally complicated by the necessity to harmonize economic growth, technological progress, and the imperatives of national security, a delicate equilibrium that has proven challenging to attain due to Nigeria's intricate socio-political environment (Adeola & Boso, 2021).

The consequences of unsustainable resource management are extensive and diverse, impacting not just the economic prosperity of the nation but also its security and technological development. The Nigerian government's dependence on oil revenue has resulted in a limited economic foundation, rendering the economy susceptible to global oil price volatility (Olujobi et al., 2023). Moreover, the absence of efficient managerial strategies has led to the deterioration of the environment, social turmoil, and a notable security risk, especially in locations abundant in resources such as the Niger Delta. These difficulties highlight the immediate requirement for a comprehensive strategy for managing resources that can align Nigeria's economic goals with the concepts of sustainability and national security. This paper investigates the interaction between these aspects and seeks to offer a full comprehension of how Nigeria might attain a sustainable management structure that effectively tackles these complex challenges.

Statement of the Problem

Despite Nigeria's abundance of natural resources, the government nevertheless faces substantial difficulties in managing these resources, achieving economic growth, and ensuring national security. The excessive dependence on crude oil as the main source of income has not only hindered the expansion of the economy's variety but has also intensified problems associated with the exhaustion of resources, environmental deterioration, and socio-political instability

(Ikelegbe, 2022). The economy's reliance on a solitary commodity has rendered it susceptible to external forces, such as variations in global oil prices, which have traditionally resulted in economic recession and heightened levels of poverty within the nation (Adewuyi & Awodumi, 2020). In addition, the ineffective and frequently corrupt management of these crucial resources has played a role in extensive environmental deterioration, especially in the areas where oil is produced. The Niger Delta region has experienced significant environmental degradation as a result of oil spills, gas flaring, and other unsustainable activities. This has resulted in the loss of livelihoods, health problems, and ongoing conflicts (Onuoha, 2023). The lack of a viable and enduring management structure has not only endangered Nigeria's economic and security interests in the long run but has also prolonged patterns of poverty and violence in regions abundant in resources.

The issue is exacerbated by the requirement to include technological developments into the resource management procedure. Nigeria has faced challenges in efficiently adopting and implementing technological innovations that could enhance the efficiency and sustainability of resource exploitation (Nwosu & Ndubuisi, 2022). The country's inability to harness technology for sustainable development has been impeded by insufficient infrastructure, qualified workforce, and regulatory frameworks. The disparity in technology, combined with the urgent economic incentives to quickly utilize resources, has frequently resulted in short-term benefits at the cost of long-term sustainability and national security. It is of utmost importance to tackle these concerns in order to ensure Nigeria's progress and stability in the upcoming decades. It is crucial to have a strong framework that guarantees the sustainable use of resources and incorporates technical progress, economic development, and national security. Implementing such a structure would allow Nigeria to efficiently utilize its resources, guaranteeing that they contribute to the country's economy while also safeguarding the ability of future generations to satisfy their own requirements (Oludare & Agunbiade, 2023).

Aim of Study

The aim of this research is to examine and propose sustainable management strategies for Nigeria's critical resources that successfully integrate technological advancements, economic growth, and national security.

Significance of Study

This study holds great significance as it centers on the pivotal issue of resource management in Nigeria, a nation heavily dependent on the efficient utilization of its natural resources for both its economic functioning and security. The results of this study are anticipated to enhance the current understanding of resource management and provide practical suggestions for attaining a harmonious equilibrium between economic advancement, technical progress, and national defense. This study will be specifically pertinent to policymakers, industry stakeholders, and researchers who are interested in the sustainable governance of natural resources in Nigeria and other emerging nations that possess abundant resources.

Scope of Study

This study specifically focuses on the sustainable management of Nigeria's essential resources, particularly in the oil and gas sector and renewable energy sources. The study will employ a combination of literature review and case studies to analyze the management practices of these resources, with a specific focus on locations like the Niger Delta. This region is significant due to its role in resource extraction and the resulting conflicts, which have implications for national security. Although the study primarily focuses on Nigeria, its conclusions are anticipated to have wider implications for other countries with abundant resources that also grapple with the delicate balance between economic growth, technical progress, and national security.

Literature Review

Nigeria's Resource Endowment and Economic Development

Nigeria has crude oil, natural gas, solid minerals, and agricultural resources. Since the 1970s, the nation's oil reserves have driven economic growth and contributed significantly to government revenue and foreign exchange (Eboh & Uduma, 2022). However, the Nigerian economy's strong reliance on oil makes it vulnerable to global oil price changes, causing economic instability and crises (Olujobi et al., 2023). Studies on Nigeria's resource management have found inefficiencies in oil income administration, environmental degradation, and socioeconomic inequities. Ikelegbe's (2022) research examines Nigeria's political economics of resource governance, specifically how oil mismanagement has caused Niger Delta conflicts. Apart from oil, Nigeria

has large natural gas and solid mineral deposits. These reserves can boost economic diversification and sustainability. However, regulatory issues, infrastructure issues, and security concerns have prevented their use (Nwosu & Ndubuisi, 2022). Research shows that addressing these issues requires legislative reforms, institutional strengthening, and funding for infrastructure and technology (Oludare & Agunbiade, 2023).

Resource Dependence and National Security

Foreign disruptions and geopolitical pressures threaten Nigeria's security due to its heavy reliance on oil and minerals. Oil is the nation's main source of income, making it vulnerable to global oil price movements (Aliyev, 2023). These oscillations may destabilize the economy, threatening the government's security. Nigeria is vulnerable to geopolitical pressures due to its oil and other resource dependence. Foreign companies with a stake in a nation's resources can influence local policy and exploit it. Although Nigeria has abundant resources, its underdevelopment, especially in the Niger Delta, worsens the problem. The Niger Delta, rich in oil, has seen unequal economic growth, which has led to isolation and military rebellion (Aliyev, 2023). The resource gap and lack of local development increase internal tensions and instability, threatening national security. The illegal production and selling of oil threatens Nigeria's security by funding insurgency factions and criminal syndicates, perpetuating regional instability.

Sustainable Resource Management

Sustainable resource management encourages the fair and appropriate use of natural resources to meet current needs without compromising future needs. Sustainability principles emphasize long-term environmental, economic, and social factors (Manresa & Rivera 2021). Sustainable development principles promote environmental preservation, social fairness, and economic feasibility, aiming for a harmonious balance between human activities and the natural environment (Gołębiewska et al., 2020). Studies imply that sustainable development requires a holistic strategy that considers economic, environmental, and social aspects (Nuttman et al., 2019; Rendtorff, 2020). These principles guide decision-making to sustain natural resource use and preserve their integrity (Axon, 2024). Sustainable resource management in Nigeria requires balancing resource exploitation, environmental protection, economic diversification, and social justice (Eboh & Uduma, 2022). Nigeria's vast crude oil, natural

gas, and solid mineral reserves provide sustainable development but also present challenges. Our dependency on oil money has driven economic growth, but it has also generated environmental degradation, social inequality, and economic susceptibility to volatile global oil prices (Adewuyi & Awodumi, 2020). Therefore, sustainable resource management in Nigeria should avoid these negative effects while using resource availability to boost economic growth and social welfare.

National Security and Resource Management

Effective resource allocation and control are crucial to national security. Nigeria's natural resources have often caused violence, especially in the Niger Delta. Environmental destruction, poverty, and political marginalization have caused violent upheavals (Ikelegbe, 2022). Maintaining national stability requires protecting resource-rich regions and addressing resource disputes at their source. Multiple research shed light on Nigerian resource management. Shahbaz et al. (2018) and Redmond & Nasir (2020) examine how rich natural resources boost economic growth, emphasizing the requirement for effective financial development and global commerce. Shobande and Enemona (2021) stress the importance of sustainable financing in natural resource management, while Chanchangi et al. (2022) suggest that solar energy can boost energy security. Banso (2023) for water and Egu et al. (2021) for forest resources emphasize the need for integrated methods for sustainable resource management. Okolie (2023) and Udo et al. (2023) also discuss the importance of human resource management in firms and public expenditure on economic growth, which are important for sustainable development. As Akonji et al. (2022) found, foreign direct investment is vital to economic growth. Sustainable resource management can boost national security by reducing the environmental and social impacts of resource exploitation, promoting equitable profit distribution, and boosting economic growth. Allocating resources to sustainable energy sources like solar and wind power can improve energy stability, reduce dependence on foreign fuels, and reduce global energy market volatility (Onuoha, 2023).

Mismanagement of natural resources has caused violence and instability in Nigeria, making resource management and national security crucial. The Niger Delta, noted for its oil wealth, has seen violent confrontations due to environmental degradation, poverty, and political marginalization (Ikelegbe, 2022). These wars have threatened regional security, national stability, and economic growth. Nigerian resource management security studies have stressed the need for a more comprehensive and fair resource governance system. Onuoha (2023) and other researchers argue that resource-related issues can be resolved by improving resource distribution, environmental justice, and local participation in decision-making. The research also suggests that investing in renewable energy and diversifying into non-oil businesses will reduce the country's oil dependence and reduce security risks (Akinwale, 2020).

Impact of Current Resource Management Practices on Nigeria's National Security and Economic Development

Ineffective resource management increases security challenges and slows economic growth in Nigeria. Strong institutions are needed to efficiently manage resources and extend the economy beyond natural resources (Elisha, 2023). Poor resource management sometimes leads to economic inequity and security problems as the privileged class exploits the government for personal gain, ignoring the population's socio-economic needs (Samuel, 2024). Insurgencies, kidnappings, and banditry have spread due to mismanagement. These dangers damage lives and deter domestic and international investment, slowing economic growth (David & Binatari, 2024). The lack of security creates an uncertainty that hinders firm operations and economic growth, as businesses need a stable environment (Agogbua et al., 2022). Lack of security reduces institutional confidence and foreign direct investment, slowing economic growth (Opuala–Charles & Oshilike, 2022).

The Impact of Resource Mismanagement on Ethnic Tensions and Security in Nigeria

In Nigeria, poor resource management has caused ethnic conflicts and security issues. Mismanagement has caused resource inequality, worsening ethnic and geographical disparities (Anowai, & Okebuinor). A prime example is the Niger Delta, rich in oil, where local development has lagged behind money extraction, marginalizing the indigenous populace. Uneven resource distribution has intensified disagreements and separatist movements, such as Fulani herder-non-Fulani farmer land disputes. This shows how resource mismanagement can increase security vulnerabilities.

Corruption exacerbates these divisions by consolidating money and power in a few, undermining political institutions and sustaining social instability. Corruption in resource management undermines governance and the state's ability to resolve conflicts and maintain order, compromising national security. Research shows that corruption hinders economic growth and development, preventing the country from achieving sustainable prosperity (Rotimi et al., 2023; Babasanya, 2020). Nigeria is one of Africa's most corrupt nations, making anti-corruption efforts difficult (Matthew et al.,

2020; Amadi, 2021). Lack of political will and anti-corruption policies have slowed corruption fights, perpetuating mismanagement and wrongdoing (Omotehinse et al., 2023; Sandabe, 2021). Corruption in Nigeria is widespread and inhibits growth in all industries (Namo, 2024). Failure to fight corruption hurts economic productivity, democratic institutions, and social cohesion (Igiebor, 2019).

Impact of Critical Infrastructure Protection on Nigeria's Security Landscape

Nigeria needs security critical resource infrastructure to bolster its security framework. This precaution ensures a steady flow of money for the economy and prevents the illicit use of resources that could fund insurgencies (Asuquo et al., 2021). Protecting infrastructure is crucial to stabilizing conflict-prone areas. This reduces militant activity and boosts economic growth. Effective efforts to protect these resources ensure the availability of key energy supplies for internal use and export, sustaining national stability. Asuquo et al. (2021) noted that this enhances Nigeria's economic resilience. Nigeria's infrastructure growth depends on government investment on capital projects, which account for a large portion of its revenue. The strong correlation between revenue and infrastructure procurement spending emphasises the importance of financial commitment to infrastructure projects (Asuquo et al., 2021). However, research has shown that Nigeria's transportation and healthcare infrastructure needs further investment (Olaoye, 2023).

Nigerians depend on infrastructure including transportation, healthcare, and other essentials, underscoring the importance of strong infrastructure systems. Studies show that public funding for infrastructure development boosts Nigeria's economy (Anderu, 2023). Madaki et al. (2022) found that infrastructural upgrades like airports boost economic growth. Government infrastructure spending boosts economic growth, but some studies show that it may not be used efficiently, raising concerns about resource waste (Ahamba, 2024). Nigeria must prioritise resource allocation and exploitation to maximise infrastructure investment benefits (Azolibe et al., 2020). Transportation and communication networks are essential for economic growth in various industries, including agriculture (Utuk, 2024). Infrastructure and institutional assistance affect Nigeria's agricultural industry, which is vital to the economy (Effiom & Ebi, 2020).

Infrastructure investments, mainly from Chinese companies, have helped Nigeria build power plants, airports, railroads, and roads (Eyitope, 2020). Infrastructure's impact on economic productivity, especially for SMEs, is crucial. Small and medium-sized enterprises (SMEs) need water and transportation facilities to operate efficiently and boost the economy (Akor & Bamiduro 2019). Electricity, government restrictions, and financial services accessibility help Nigerian SMEs grow and survive (Usman et al., 2019). Studies have indicated that infrastructure investment drives economic growth in Nigeria (Abur, 2019). The findings highlight the importance of infrastructure investment for economic growth and people well-being (Abur, 2019). Additionally, infrastructure investments help manage disaster risks. Flood risk infrastructure investments improve resilience and reduce disaster damage (Ikiriko, 2024).

Security Implications of Reliance on Foreign Expertise and Technology

Nigeria relies on foreign expertise and technology for resource extraction and management, which has pros and cons for national security. Foreign intervention can improve resource extraction efficiency with advanced technologies and skilled workers (Wachtmeister et al., 2021). However, this dependence creates vulnerabilities that foreign forces can exploit, threatening a nation's autonomy (Zhang, 2024). Foreign companies and workers in sensitive areas can increase local tensions, especially if resource extraction benefits are unequally allocated (Chanie, 2024). Foreign entities controlling critical technologies and withholding or manipulating them during geopolitical crises pose additional risks (Nwankwo et al., 2023). Nigeria should prioritize worker skills to reduce these dangers and boost national security. By promoting local technical development and citizen training and education, Nigeria can reduce its dependence on foreign knowledge and technology and gain control over key resources (Azu et al., 2021).

To protect the nation's resource control and ownership, agreements with international partners must be made to gain better terms. According to the National Development Plan, Nigeria must expand its industrial sector and minimize its reliance on foreign investment (Ogbonna et al., 2023). Nigeria's situation is complicated by its agricultural dependence before crude oil became a major foreign currency source in the 1970s. To improve national security, Nigeria must diversify its economy and reduce its dependence on a single resource. Nigeria's heavy imports highlight the need to address resource exploitation and distribution

inequities in industries. Nigeria struggles with border governance, migratory securitization, and foreign security threats (Agwu, 2024). These issues emphasize the need to strengthen internal security and reduce foreign security involvement. Increased foreign direct

investment (FDI) in Nigeria can reveal vulnerabilities that external organizations can exploit (Shi & Li, 2022). To avoid risks, foreign direct investment (FDI) and national security must be carefully managed. International assistance distribution in Nigeria is vital to poverty reduction and economic progress (Obiora et al., 2021). To maximize their benefits and prevent national security threats, transparency, accountability, and appropriate management of these aids are essential. Energy security can be improved by reducing fossil fuel and imported energy use with geothermal power generation (Shi et al., 2022). Renewable energy sources like geothermal electricity may improve Nigeria's energy security and lessen traditional energy hazards. Financial development's role in regulating tax income and economic development emphasizes the necessity of domestic financial competence in national security (Upreti, 2024).

Leveraging Critical Resources for Resource Diplomacy and National Security

By using its rich resources in international negotiations, Nigeria can secure favorable trade accords, foreign investments, and strategic alliances (Bovan et al., 2020). This approach involves using its oil and gas assets to boost its economy and international influence (Eseosa, 2023). Resource diplomacy requires effective and transparent resource management to avoid corruption's negative consequences on Nigeria's negotiating abilities (Bovan et al., 2020). Foreign policy's resource diplomacy affects a nation's international relations and security strategy. Nigeria, with large oil and gas deposits, needs energy diplomacy to protect its economic interests. International energy diplomacy is intricately tied to foreign policy and national security. Energy resources and geopolitics are interdependent (Bovan et al., 2020). Energy diplomacy can affect Nigeria's economy and security.

China's oil-related economic policies towards Nigeria demonstrate resource diplomacy. China's involvement in Nigeria's oil business shows the importance of strategic partnerships in resource- rich countries (Minardi & Lestari, 2019). The complex economic, political, and diplomatic issues that underpin resource diplomacy are highlighted by these interactions. China's energy-related CO2 emissions and their global implications show how energy policies affect international relations (Zheng et al., 2019). The transition to renewable energy and carbon neutrality is changing energy diplomacy globally. Countries' efforts to reduce their carbon footprint are changing the energy landscape and diplomatic contacts, emphasizing renewable energy (Yang & Lo, 2023).

Nigeria's international standing could improve if it expands its energy portfolio and integrates renewables. Energy policy alignment with global environmental goals could boost Nigeria's stature in international coalitions (Yang & Lo, 2023). Energy sector studies investigate legislative frameworks and policy developments in Nigeria, revealing the regulatory context that promotes resource diplomacy. Nigeria must comprehend the complicated legal and regulatory issues of the energy sector to use its resources in diplomatic negotiations (Otu, 2024). Transparent and solid legal frameworks boost investor trust and indicate Nigeria's commitment to ethical resource management, essential to resource diplomacy. Iran's energy diplomacy in the oil and gas sector shows how wealthy nations protect their interests abroad. Iran's energy diplomacy strategies can help resource-rich nations like Nigeria maximize their diplomatic advantages. Iran's resource diplomacy can teach Nigeria and help it avoid mistakes (Baskakov, 2023).

Security Risks in Regional and International Resource Competition

Nigeria's regional and worldwide resource competitiveness complicates security. Conflicts over valuable assets are more likely as global demand for oil, gas, and minerals rises. These disputes may involve geographical boundaries and resource ownership (Abdulrasheed, 2022). Since global corporations may prioritize profits over local stability, their presence complicates the situation. This could lead to national security disputes (Xiang, 2023). Nigeria's economy and security are vulnerable to global price shifts due to its reliance on international resource markets. Nigeria needs aggressive diplomacy, active engagement in regional security frameworks, and a commitment to peacefully resolving boundary conflicts to address these issues and lessen the associated risks (Sobseh, 2023).

Nigeria can use diplomatic techniques to form alliances with neighbouring nations and global partners to promote peaceful resource management and avoid conflicts (Boamah, 2021). Regional security arrangements can foster cooperation and dispute resolution, fostering regional stability (Bamidele & Idowu, 2023). To maintain good ties with neighbours and ensure long- term security, boundary conflicts must be resolved peacefully (Ukpong-Umo et al., 2019). Mediation and arbitration are flexible and effective ways to resolve resource conflicts and stabilize Nigeria's competitive resource landscape. These approaches have shown effective in settling conflicts like cross-border land disputes by providing quick and cost-effective solutions (Kadagi et al., 2020). In addition, research on the Bakassi Peninsula crisis shows that international law is used to resolve boundary disputes.

Nigeria can handle border disputes and reduce security threats by obeying international law and engaging in arbitration (Abdulrasheed, 2022). Cooperative solutions for managing shared resources, like those found in maritime border disputes between Kenya and Somalia, can help resolve resource problems and promote peaceful coexistence.

Technological Advancement and Sustainable Resource Management

Modern technology is needed to manage resources in Nigeria, where inefficiency, corruption, and environmental harm are common. Technology can improve resource exploitation, environmental impact, and monitoring and governance. Recent studies have revealed that numerous technologies can improve Nigerian resource management. Remote sensing and GIS have successfully monitored environmental impacts and identified criminal behavior in natural resource-rich regions. The above technologies provide valuable data that can be used to protect natural resources and ensure environmental compliance (Oludare & Agunbiade, 2023). Blockchain technology may increase resource governance transparency and accountability. By keeping unchangeable records of transactions and resource transfers, it can reduce corruption and ensure resource allocation (Onuoha, 2023).

Nigeria needs a broad technological approach to ensure long-term resource management. Advanced ICTs can improve environmental monitoring and resource management, making exploitation more efficient and less harmful. Vocational training and local expertise help workers run and maintain modern technologies, increasing productivity and adopting sustainable industrial practises (Oghuvbu et al., 2022). Although these technologies have great potential, the literature indicates significant barriers to their use in Nigeria. Lack of infrastructure, technical skills, and funding are major obstacles. According to Akinwale (2020), Nigeria needs government infrastructure and human capital investments to improve technological innovation and resource management. Legal frameworks protect future generations by preventing economic growth from harming the environment (Emelie, 2019).

Case Studies

Environmental Degradation and Conflict in Nigeria's Niger Delta

The oil-rich Niger Delta has undergone severe environmental degradation due to widespread oil exploitation, causing major ecological and socioeconomic repercussions. Oil spills, gas flaring, and deforestation have destroyed local ecosystems, diminishing biodiversity and poisoning agricultural and fishery water sources, wiping out local livelihoods. Studies show that multinational oil companies, particularly Shell Petroleum, have failed to address pollution and implement proper remediation, fueling social unrest and the rise of militant groups like the Movement for the Emancipation of the Niger Delta (Okringbo, et al 2022). This unrest is caused by grievances about oil income inequality, bad infrastructure, and government and company neglect, which perpetuates poverty, violence, and environmental damage (Bamidele & Erameh, 2023). Oil theft, bunkering, and pipeline damage linked to organized crime have caused considerable economic losses and worsened the region's instability (Offiong et al., 2018). Due to corruption, lack of transparency, and insufficient funding, military interventions and the Niger Delta Development Commission have failed to address the region's environmental and socio- economic issues (Nwozor, 2020).

Economic, Diplomatic, and Security Impacts of the NLNG Project on Nigeria

The Nigeria Liquefied Natural Gas (NLNG) project has played a pivotal role in Nigeria's economic growth, contributing significantly to the nation's GDP, foreign exchange reserves, and government revenue. By providing an alternative revenue stream through the export of liquefied natural gas, the NLNG project has helped diversify Nigeria's economy, reducing its dependency on crude oil and mitigating the risks associated with global oil price fluctuations. Furthermore, the project has facilitated job creation and stimulated local economies, particularly in the Niger Delta region, where it is based (Gbakon & Ojaraida, 2020). On the international front, the success of the NLNG project has enhanced Nigeria's standing as a key player in the global LNG market, attracting substantial foreign direct investment (FDI) and fostering stronger ties with international markets by bolstering Nigeria's competitiveness in the energy sector. Moreover, the project has significantly influenced Nigeria's foreign policy, allowing the country to leverage its role as a reliable LNG supplier to strengthen diplomatic relations and strategic alliances globally (Adekoya,et al 2024). However, the NLNG project is not without challenges, particularly regarding security in the volatile Niger Delta region.

Security and Environmental Implications of Oil Theft and Pipeline Vandalism in Nigeria

Nigeria's economy, environment, and security all threatened by oil theft and pipeline damage. The Niger Delta's unlawful actions cost the government billions of

dollars annually, lowering foreign exchange and government revenue needed for national development. Oil firms may lose investment and growth due to expensive repair and security costs (Henry & Mohammed, 2023). Regular oil spills pollute land, water, and air, degrading local ecosystems. This contamination affects wildlife, degrades vegetation, and pollutes drinking, fishing, and agricultural water bodies, causing health problems and economic challenges for local residents. Organized crime networks are actively involved in oil theft, worsening regional security. These networks support violent groups, disrupting the Niger Delta and threatening national security (Akpomera, 2024). The Nigerian government and oil firms have used surveillance technologies and community participation, but the problem remains massive. Corruption and the Niger Delta's difficult terrain make it harder to tackle these criminal activities, resulting in uneven results in security and environmental protection (Olujobi et al., 2022).

Security Challenges and Opportunities in Nigeria's Solid Mineral Sector

Nigeria's solid mineral sector, rich in resources such as gold, limestone, and tin, offers significant economic diversification opportunities, yet it is hindered by security challenges, inadequate infrastructure, and regulatory issues. The potential for economic growth through mining is substantial, but the sector's development is hampered by illegal mining activities, which are often linked to organized crime (Otoijamun et al., 2021). These activities not only divert revenue from the government but also exacerbate security concerns, particularly in remote mining areas. Illegal miners exploit valuable resources, funding criminal activities and armed groups that destabilize regions, further complicating efforts to secure these areas. Moreover, illegal mining contributes to severe environmental degradation, including deforestation and water contamination, which have long-term impacts on local ecosystems and public health (Godwin & Umaru, 2018). The economic losses from illegal mining are compounded by the deterrence of legitimate investment, as the risky environment discourages both domestic and foreign investors.

Water Resources and Conflict

In dry and semi-arid regions like the North-East, water scarcity in Nigeria threatens unrest and national security. Water disputes between farmers, herders, and urbanites often turn violent (Kamta et al., 2021). Water inequality causes water conflicts as people or areas compete for scarce resources (Eryani, 2024). Climate change, population increase, and poor water management intensify these problems. Big dams are necessary for water management, agriculture, and power generation, but they often displace local residents, causing social instability and violence (Kamta et al., 2020). Dams displace populations and generate infrastructure security problems. Dam sabotage could destroy downstream towns, highlighting the need for protection. Poorly managed relocation initiatives raise population grievances and instability. Dam construction benefits must be balanced with community rights and needs to maintain social harmony and national security (Kamta et al., 2020). Developing solutions to water scarcity and violent conflicts requires understanding their links (Nkiaka, 2024).

Technological Advancement and Security

Cyberattacks on pipelines, refineries, and communication systems endanger national security, oil production, financial losses, and environmental calamities as Nigeria's oil and gas industry digitizes (Hugyik, 2020). Data theft may undermine Nigerian companies' global competitiveness. Critical infrastructure needs advanced defenses, risk assessments, and government-industry cooperation. Remote sensing technology for resource monitoring addresses environmental and resource issues to improve national security (Hugyik, 2020). Protection of critical infrastructure requires cyber disaster survival, response, and recovery (Czuryk, 2023). To defend vital and non- critical infrastructure from cyberattacks, all security levels must be reinforced (Toapanta et al., 2020). Machine learning in IoT threat avoidance can boost cybersecurity in oil and gas (Kumar et al., 2021). Critical infrastructure cybersecurity requires innovative sensing and security technologies (Kim et al., 2021). Industrial Control Systems (ICS) provide remote infrastructure management but are subject to cyberattacks, requiring risk assessments and anomaly detection (Gómez et al., 2019; Kim et al., 2022). Unsupervised learning can detect and mitigate critical infrastructure IoT cyberattacks. Cryptography strengthens Critical Infrastructure Protection (CIP) systems, which defend energy, transportation, and communication infrastructure and national security (Iqbal, 2024). Better cybersecurity is needed because deep generative models can detect and prevent critical infrastructure attacks (Chandy et al., 2019). Modern warfare emphasizes cybersecurity's role in national security and key infrastructure (Korda, 2023).

Comparative Case Studies

Comparative Case Studies of African Countries: Nigeria vs. Angola, Ghana, and South Africa Nigeria and Angola, major African oil producers, struggle to manage their resources sustainably. Both countries face corruption,

environmental degradation, and economic diversification. They address these difficulties differently, revealing how resource-rich nations might balance technical innovation, economic prosperity, and national security. Angola's National Agency for Oil, Gas, and Biofuels (ANPG) has improved oil industry governance through openness and accountability (Morais & Cardoso, 2023). Nigeria, however, struggles to manage resources due to oil industry corruption and inefficiency. Governance improvements affect resource management, with Angola's approach yielding better results. Nigeria and Angola recognize economic diversification as a sustainable resource management strategy. By investing in agriculture and infrastructure, Angola has made more progress. Inconsistent policies and security concerns limit Nigeria's non-oil sectors' growth. Angola's policy stability has promoted technical improvements and long-term economic planning, unlike Nigeria's uneven diversification. Environmental management is another difference between the nations. Both nations risk oil spills and gas flaring. Nigeria struggles to reduce gas flaring and environmental destruction, while Angola uses reinjection. This comparison shows how environmental initiatives affect national security and sustainability.

When comparing Nigeria's resource management with Ghana's, significant differences emerge. Ghana's Public Interest and Accountability Committee (PIAC) has successfully built public trust and reduced corruption within the oil industry (Ablo & Otchere-Darko, 2022). Additionally, Ghana's local content development strategy has retained oil sector gains domestically, increasing employment and local industry participation. Nigeria's local content policies, in contrast, have not achieved the same level of effectiveness in promoting economic stability. Ghana also demonstrates a proactive approach to environmental management, led by its Environmental Protection Agency (EPA), which contrasts with Nigeria's more reactive strategies. Ghana's commitment to comprehensive environmental impact assessments further distinguishes its approach from Nigeria's, reflecting differences in regulatory strength and environmental stewardship.

In comparing Nigeria's mining sector with South Africa's, notable contrasts can be observed in their approaches to environmental and labor regulations. South Africa's stringent regulations have effectively mitigated environmental degradation and social unrest, issues that continue to plague Nigeria due to a lack of rigorous enforcement. South Africa's Broad-Based Black Economic Empowerment (BBBEE) strategy also stands out as a model for promoting equitable wealth distribution in the mining industry, a challenge that Nigeria's local content policies have yet to fully address (Kilambo, 2021).

Comparative Case Studies of Resource-Rich Countries: Nigeria vs. Norway, Canada, and Australia

Norway provides an exemplary model for the long-term management of oil wealth. The Government Pension Fund Global (GPFG), one of the largest and most transparent sovereign wealth funds globally, underscores Norway's commitment to ensuring that oil profits benefit future generations (Hong et al., 2021). In comparison, Nigeria's sovereign wealth fund, the Nigeria Sovereign Investment Authority (NSIA), faces challenges related to political involvement and inconsistent contributions, which hinder its potential impact. Norway's strict emission reduction policies and offshore drilling risk management further highlight differences in sustainable resource extraction. While Norway has successfully minimized environmental impacts, Nigeria continues to struggle with issues like gas flaring and oil spills, underscoring the disparities in environmental governance (Gasparini, 2023).

Canada's federal structure, which grants provinces significant authority over natural resources, offers insights into sustainable resource management. Alberta, for instance, has balanced economic development with environmental protection, illustrating how decentralization can enhance resource management. In contrast, Nigeria's centralized approach often leads to challenges in personalized management and local accountability. Additionally, Canada's inclusive approach to involving indigenous populations in resource extraction decisions contrasts with Nigeria's ongoing land and resource conflicts, highlighting different approaches to community relations and resource management (Shaw et al., 2021).

Australia's mining sector presents another point of comparison, particularly regarding regulatory frameworks and economic diversification. Australia's stringent mining regulations have ensured environmentally responsible mining practices, which contrast sharply with the issues of illegal mining and environmental degradation in Nigeria. Moreover, Australia's success in diversifying its economy beyond mining, through sectors like agriculture, education, and services, stands in contrast to Nigeria's continued reliance on oil. This comparison underscores the differences in economic strategies and their implications for technological growth, economic stability, and national security (Weldegiorgis et al., 2024).

DISCUSSION

This study emphasizes the importance of modern technology in Nigeria's sustainable resource management. Remote sensing, GIS, and blockchain have improved resource management efficiency, transparency, and sustainability. These technologies address Nigeria's resource management system's inefficiency, corruption, and environmental degradation. Infrastructure, technical skills, and finances prevent widespread use of these technologies. These issues must be addressed to use technology for sustainable resource management. Nigeria's oil and resource dependence has pros and cons. This dependency has boosted economic growth but made the country vulnerable to global market and geopolitical crises, causing instability and diversification issues. The paper examines how this dependency affects resource revenue administration inefficiencies and social inequality in the Niger Delta. Due to oil profits, local development has been neglected, causing social instability and strife. The findings emphasize the need for a more diverse economy that minimizes resource dependence and boosts other industries.

Resource management affects national security. The study blames poor resource management for violence, insurgency, and instability in resource-rich regions like the Niger Delta. Illegal oil extraction and trafficking have supported criminal syndicates and insurgency groups, causing regional instability and national security problems. Foreign expertise and technology on Nigerian resource development could affect local policy and resource access, especially during geopolitical crises. This raises security issues. The study stresses the necessity of developing domestic technology capabilities to boost national security and reduce dependence on foreign corporations. Economic progress and national security depend on resource management. The study emphasizes environmental protection, social equity, and economic diversification to counteract resource exploitation's negative effects. It also shows that solar and wind power may reduce Nigeria's fossil fuel dependence, improve energy security, and boost economic growth. Through renewable energy and sustainability, Nigeria may improve its security and lessen its energy market volatility.

Unsustainable resource extraction, especially in the oil sector, harms the Niger Delta ecology. Multinational firms and the government's inaction on pollution have caused environmental degradation and social unrest. Conflict prevention and sustainable development require strong environmental governance and fair resource distribution. The NLNG project showed how resource management may boost Nigeria's economy and energy sector. However, the Niger Delta security challenges show how vulnerable natural resource-based economies are. Oil theft and pipeline vandalism in Nigeria pose serious threats to the economy, ecology, and security. Organized crime threatens regional stability and economic prosperity. Corruption and complexity make Niger Delta security and environmental protection difficult.

Furthermore, illegal mining and security concerns limit solid mineral economic potential. Comparisons with other resource-rich nations show that effective resource management requires strict laws and equal wealth distribution. Unregulated activities and environmental damage might reduce resource extraction's economic benefits if not addressed and supervised. Water scarcity, especially in Nigeria's North-East, threatens national security. Fighting over scarce water supplies exacerbates regional instability. Dams are necessary to water management, but they must be carefully planned and implemented to avoid social displacement and conflict. Technological advances and community requirements must be balanced for effective water management and social cohesion.

Nigeria's oil and gas business is digitizing, raising cyber security worries. Secure key infrastructure and boost industry growth with a strong cybersecurity framework. Advanced technologies like machine learning and remote sensing improve security and resource management. However, these technologies must be integrated into a complete strategic framework that addresses current and future risks. Technology is essential for security and sustainability. However, strong governance and international cooperation are needed to maximize its potential. Studying resource-rich countries like Angola, Ghana, South Africa, Norway, Canada, and Australia helps explain sustainable resource management. These countries have successfully implemented governance changes, diversified their economies, and used advanced environmental and technology strategies to manage their resources. These analogies emphasize the need to adopt foreign resource management strategies to address Nigeria's particular difficulties.

CONCLUSION

This study emphasizes the balance between technical innovation, economic growth, and national security in Nigeria's resource sector and the necessity for sustainable management. Modern technologies like remote sensing, GIS, and blockchain can improve resource management efficiency and transparency. They must overcome infrastructural, technical, and financial obstacles to succeed. Nigeria's significant reliance on oil has fueled economic growth but made it

subject to global market volatility and geopolitical crises, causing economic instability and hindering diversification efforts. Social inequities, especially in the Niger Delta, highlight the need to diversify the economy to limit resource exploitation and boost sectoral growth. Poor resource management causes violence and instability in resource-rich regions. The paper warns against unlawful oil activities and stresses the need to limit foreign expertise to improve local policy autonomy and security. Domestic technology development boosts national security and reduces foreign dependence. Environmental protection, social equality, and economic diversification must be integrated into resource management to mitigate the negative effects of resource exploitation. The study also shows that renewable energy can cut fossil fuel use and boost energy security. For long-term security and sustainability in the sector, a strong cybersecurity framework and smart integration of innovative technologies are needed.

RECOMMENDATIONS

1. Governance Reforms and Transparency: Nigeria should adopt governance reforms akin to Angola's efforts to enhance transparency and accountability in the oil sector. By reducing political interference and improving regulatory oversight, these reforms can mitigate corruption and inefficiencies, fostering economic growth and strengthening national security. Additionally, Nigeria should depoliticize its Sovereign Investment Authority (NSIA) and ensure consistent contributions to build a robust and transparent sovereign wealth fund, drawing inspiration from Norway's Government Pension Fund Global (GPFG). This would safeguard oil revenues for future generations, contributing to long-term economic stability.

2. Economic Diversification: Nigeria must intensify efforts to diversify its economy, reducing its reliance on oil by promoting sectors such as agriculture, infrastructure, education, and renewable energy. Drawing on Angola's and Australia's experiences, economic diversification can mitigate the impact of global market fluctuations and create a more resilient economy that supports sustainable growth and national security.

3. Enhanced Environmental Management: Nigeria should strengthen its environmental governance by adopting best practices from Angola, Ghana, and Norway. This includes implementing gas reinjection techniques to reduce flaring and emissions, enforcing stricter environmental regulations, and proactively managing environmental impacts. Such measures would ensure that technological advancements in resource extraction do not compromise environmental sustainability or national security.

4. Social Equity and Community Engagement: To address social inequalities exacerbated by resource extraction, particularly in the Niger Delta, Nigeria should strengthen local content policies and involve communities more effectively in resource management decisions. Learning from Ghana, Canada, and South Africa, Nigeria can promote social equity by ensuring that resource revenues are widely distributed and that local communities benefit from resource extraction, reducing conflicts and supporting sustainable development.

5. Technological Innovation and Cybersecurity: Nigeria should foster a stable policy environment that encourages technological innovation and long-term economic planning, as seen in Angola. Investing in research and innovation, particularly in minimizing the environmental impact of resource extraction and enhancing cybersecurity, is essential. Adopting best practices in mining regulation and enforcement from Australia would further ensure that Nigeria's resource management strategies are sustainable and aligned with national security objectives.

6. Decentralization and Local Accountability: Nigeria should consider devolving more control over natural resources to its states, similar to Canada's federal structure. Decentralization would enable more tailored resource management strategies, improving local accountability and contributing to national security by addressing region-specific challenges more effectively.

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