

# Innovations

## Comparative Study on Natural Resources Management for Environmental Sustainability: India vs. Nigeria

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**Abstract:** *Natural Resource Management encompasses the strategic and sustainable utilization and preservation of natural assets, which include soil, water, land, forests, wildlife, and minerals. This approach aims to sustain ecosystem services, foster economic advancement, safeguard biodiversity, and guarantee the availability of resources for subsequent generations. The review conducted a comparative analysis of resource management strategies for environmental sustainability between India and Nigeria, drawing upon various reputable published works. The review findings revealed that India and Nigeria exhibit divergent methodologies influenced by their respective regulatory frameworks, environmental challenges, and economic contexts. It was determined that both nations are rich in natural resources yet encounter difficulties associated with governance, sustainable practices, and community participation. The results underscore that Nigeria exhibits a greater reliance on natural resources compared to India, whereas India demonstrates a more substantial investment in renewable energy and possesses a superior biodiversity index. Additional challenges faced by these nations include land degradation, water scarcity, deforestation, and energy inefficiencies. Nevertheless, India has achieved more significant advancements in sustainable resource management due to enhanced governance, improved policy frameworks, and considerable investments in renewable energy initiatives, conservation efforts, and a focus on technological advancements and a green economy. Conversely, Nigeria is actively pursuing diversification from its excessive dependence on oil, in contrast to India's commitment to self-sufficiency in minerals and sustainable mining practices. Both nations are striving to harmonize their resource management with economic growth and environmental conservation; however, the review*

*highlighted the necessity for increased investment in green technologies and the equitable distribution of natural resources to attain genuine environmental sustainability. Furthermore, efforts should be directed toward resource management practices and frameworks that promote fair resource utilization and conservation.*

**Keywords:** *Conservation, Management, Natural, Policies, Resources, Sustainability, Utilization*

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## **1. Introduction**

Natural Resource Management refers to the management of resources to improve the quality of life with a special focus on how they could be sustainably used for today and future generations (Kamalimeera, *et al.*, 2021). This discipline incorporates a range of methodologies and guidelines aimed at promoting ecological sustainability and economic efficiency. These approaches include ethical considerations, technological advancements, and policy-oriented initiatives (Hickey 2024). These principles advocate for the equitable and balanced utilization of resources to ensure their availability for future generations, aligning with global sustainability efforts (Efendiet *al.*, 2024). Natural resources are depleting daily because they are overused and polluted by anthropogenic activities such as modernization, deforestation, and global warming (Sarah, 2024). The diminishing supply of natural resources is impacting the way of life for countless individuals worldwide (Chaudhuri, 2001). Natural Resource Management, initiative, and governance are critical in protecting the environment, resource conflict, and community participation (Fasona, *et al.*, 2018). Effectively managing natural resources is crucial for conservation efforts, along with the implementation of environmentally sustainable energy solutions and economic growth, which are fundamental to environmental sustainability (Xu&Xu, 2024). Efficient resource management plays a vital role in promoting environmental sustainability, especially in resource-rich nations facing challenges related to over-exploitation and environmental degradation (Adebayo, *et al.*, 2013).

India and Nigeria, among the most populous countries in the world, present compelling case studies on Natural Resource Management. Despite the shared challenges in resource management, the contexts of their environmental issues, governance structures, economic priorities, and sustainability approaches differ significantly (Rajeswari, *et al.*, 2024). India has rivers, minerals, biodiversity, and a forest cover of around 21% with significant biodiversity hotspots, especially in the Western Ghats and Himalayas. Mondal *et al.*, (2022) India's management of natural resources is plagued by numerous obstacles, including institutional shortcomings, unlawful extraction, and excessive use. Despite the presence of regulatory frameworks, widespread illegal activities, orchestrated by corrupt political figures

and mining syndicates, pose threats to public well-being, environmental integrity, and the survival of indigenous populations. Nigeria is known for its oils, natural gases, and biodiversity, arable land forests cover about 10%. Despite the abundance of these endowed natural resources, it is facing deforestation and desertification. This comparative study analyses NRM in India and Nigeria, focusing on key areas such as forests, biodiversity, land, energy, and water. It highlights their approaches to environmental sustainability in terms of policies, strategies, and outcomes (Chopra *et al.*, 2014). The review underscores the differing approaches of the two countries in resource utilization and control, reflecting their developmental priorities.

**2. Methods**

Various databases were sourced as part of the criteria for inclusion and reputable sources were used to search for literature, including Google Scholar, JSTOR, DOAJ, Microsoft Academic, Science Direct, Research Gate, Academia, etc. After identifying related works, the Researchers individually analyzed them and later related their findings for inclusion or exclusion in the review.

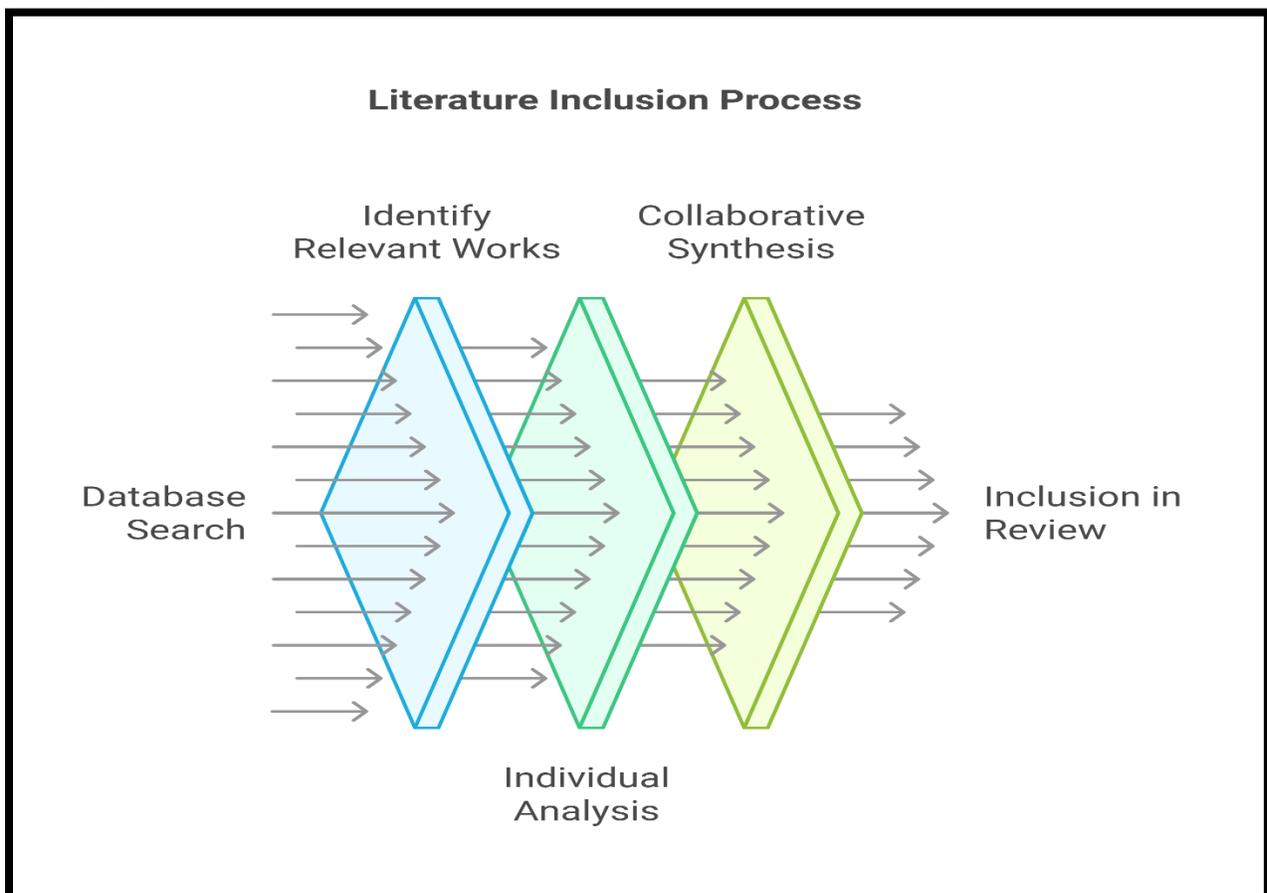


Figure 1: Review methods

### 3.0 Results and Analysis

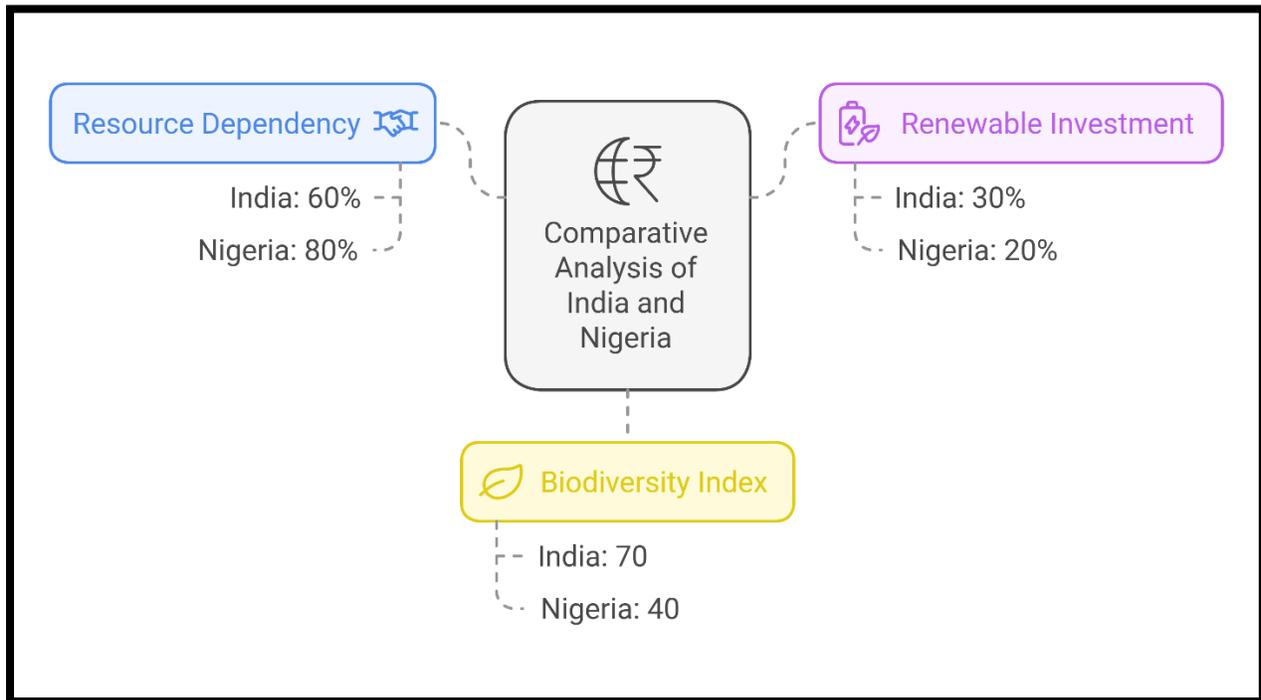


Figure 2: Natural Resource Management between India and Nigeria

The graphical illustration compares natural resource management between India and Nigeria across three key aspects: Resource Dependency, Renewable Investment, and Biodiversity Index.

#### Resource Dependency (%)

- India: Lower dependency at around 60%.
- Nigeria: Approximately 80% of the economy is dependent on natural resources.

#### Renewable Investment (%)

- India: Higher investment at approximately 30%
- Nigeria: Investment in renewable resources is about 20%.

#### Biodiversity Index

- India: Significantly higher biodiversity index of about 70.
- Nigeria: The Biodiversity index is around 40 (Rajeswari, et al.,2024).

### 3.1 Forest Management and Biodiversity Conservation

Sustainable forest resources are fundamental to the sustenance of life on Earth, providing essential food and habitat for both human and animal populations (FAO, 2017). Sinha *et al.* (2015) identified that India has achieved a significant reduction in its rates of deforestation through an array of conservation initiatives. Nonetheless, challenges such as illegal logging and land encroachment persist, particularly in the northeastern and central regions of India. India is recognized as one of the world's

17 mega-diverse nations, hosting an overabundance of endemic species. Numerous national parks and wildlife sanctuaries have been instituted as part of the Project Tiger initiative and various conservation endeavors. The Forest Conservation Act of India (1980) and the National Biodiversity Act (2002) are designed to safeguard forest ecosystems and biodiversity (National Biodiversity Authority of India, 2019). The Green India Mission, which operates under the National Action Plan on Climate Change, advocates for afforestation and reforestation efforts.

Nigeria boasts a wealth of biodiversity, encompassing species within the Niger Delta and the forests of the Cross River region. However, this diversity is at risk due to habitat destruction and poaching activities. The rapid decline of Nigeria's forests is primarily attributed to logging, agricultural expansion, and urbanization (Pelletier *et al.*, 2016). Annually, over three million hectares of forest are lost, resulting in a significant reduction in biodiversity and carbon sequestration potential (Akinyemiet *et al.*, 2014). The Nigerian government has devised the National Biodiversity Strategy and Action Plan (NBSAP) and is actively implementing reforestation programs. However, the enforcement of these measures is inadequate, and illegal logging continues to be a pervasive challenge (Nigerian Biodiversity Strategy and Action Plan, 2016). In contrast, India has developed more sophisticated and effective forest conservation policies, allocating greater resources towards the preservation of biodiversity and reforestation initiatives. Nigeria, while endeavoring to make progress, grapples with the challenges posed by insufficient enforcement of conservation regulations and ongoing habitat degradation.

### **3.2 Land Management and Agricultural Practices**

Fasonaet *et al.*, (2018) observed that effective land management and agricultural practices significantly enhance ecosystem services and the availability of freshwater for both domestic and agricultural purposes. Globally, approximately 73% of deforestation can be attributed to agricultural activities (Hosonumaet *et al.*, 2012). India is experiencing extensive land degradation due to factors such as soil erosion, deforestation, and water scarcity. The semi-arid areas of Rajasthan and certain regions of Gujarat are particularly susceptible to desertification, while the fertile Indo-Gangetic plains are encountering soil degradation as a result of overly intensive agricultural practices (Ministry of Agriculture and Farmers' Welfare, India, 2014). Myllemngapet *et al.*, (2021) noted that while agriculture in India is diverse, it often lacks sustainability, being characterized by excessive use of chemical fertilizers, reliance on water-intensive crops such as rice and wheat, and minimal crop rotation practices. India has made considerable progress in promoting organic farming and Zero-Budget Natural Farming (ZBNF). Initiatives such as the National Mission for Sustainable Agriculture (NMSA) and Soil Health Management (SHM) aim to foster soil conservation, enhance water efficiency, and implement sustainable agricultural techniques. Additionally, India is advocating for Integrated Watershed

Management to combat land degradation and restore soil fertility (Sharma *et al.*, 2013).

In Nigeria, land degradation represents a critical challenge exacerbated by desertification in the northern regions and pervasive deforestation throughout the country. The overgrazing of livestock, combined with suboptimal agricultural practices, has led to a decline in available arable land. Agriculture plays a pivotal role in Nigeria's economy, particularly in the northern and central belt regions, and employs a substantial segment of the population.

However, Nigeria's agricultural practices often involve shifting cultivation, over-reliance on monocultures (such as cocoa, palm oil, and maize), and the use of harmful chemicals, leading to soil degradation and low productivity (Oyebo, *et al.*, 2010). Programs such as the National Programme on Climate Change and the Green Climate Fund are designed to enhance sustainable land utilization, conservation agriculture, and soil rehabilitation (National Programme on Climate Change, 2023). Both nations are confronted with issues of land degradation and non-sustainable agricultural methodologies. Nevertheless, India exhibits a more comprehensive framework for fostering sustainable agriculture, bolstered by numerous governmental initiatives aimed at enhancing soil health and optimizing water-use efficiency (Sharma *et al.*, 2013). Despite its potential, Nigeria's policy environment frequently suffers from insufficient funding and lackluster enforcement mechanisms (Adedayo *et al.*, 2016).

### **3.3 Water Resources Management**

India is currently experiencing considerable water stress, with numerous regions grappling with severe water scarcity, particularly within the northern and western states. The rampant over-extraction of groundwater, coupled with the contamination of rivers, lakes, and other aquatic ecosystems, poses significant challenges. The nation's water management framework is hindered by inadequate infrastructure, excessive dependence on groundwater, and ineffective irrigation methodologies (e.g., flood irrigation). The pollution of river water, particularly in the Ganga and Yamuna rivers, remains a pressing issue (Rathore *et al.*, 2021). The National Water Policy of 2012 underscores the necessity for sustainable water management practices, water conservation initiatives, and advancements in irrigation techniques. Furthermore, India has embarked on extensive river rejuvenation initiatives, such as the Namami Gange Mission, which aims to cleanse and revitalize its principal rivers (Central Water Commission India, 2019).

Nigeria, while endowed with substantial water resources, encounters challenges related to uneven distribution, resulting in water scarcity in numerous regions. The northern regions of Nigeria, in particular, endure prolonged dry periods and lack adequate access to potable water. Water contamination stemming from oil spills, industrial effluents, and inadequate sanitation practices exacerbates the scarcity of

water (Adekola *et al.*, 2020). The nation's water infrastructure is antiquated, and inefficient irrigation practices are prevalent across the agricultural sector. The National Water Resources Policy and the River Basin Development Authorities (RBDA) serve as the principal frameworks for the management of water resources. These policies prioritize the enhancement of access to clean water, the promotion of efficient irrigation practices, and the implementation of flood control measures (Federal Ministry of Water Resources Nigeria, 2022).

While both India and Nigeria contend with issues of water scarcity and pollution, India has established more sophisticated policies and extensive water management initiatives, particularly in the realm of river rejuvenation. Conversely, Nigeria's water policies, although existent, frequently encounter implementation obstacles stemming from inadequate infrastructure and governance challenges (World Bank, 2022).

### **3.4 Energy Resources and Renewable Energy**

India demonstrates a pronounced reliance on coal for its energy requirements but has made considerable investments in renewable energy sources, particularly solar and wind power. The nation aspires to derive 50% of its energy from renewable sources by the year 2030. Substantial investments are being directed towards renewable energy and green financing to realize net zero emissions by 2070. India has emerged as a global frontrunner in the renewable energy sector, characterized by extensive investments in solar power parks, wind energy, and hydroelectric initiatives (International Energy Agency, 2020). The country also benefits from participation in the International Solar Alliance (ISA), which advocates for solar energy adoption in the developing global south. Notwithstanding this progress, the transition to renewable energy faces significant challenges related to grid integration, energy storage solutions, and the financial viability of renewable projects (Ministry of New and Renewable Energy India, 2021).

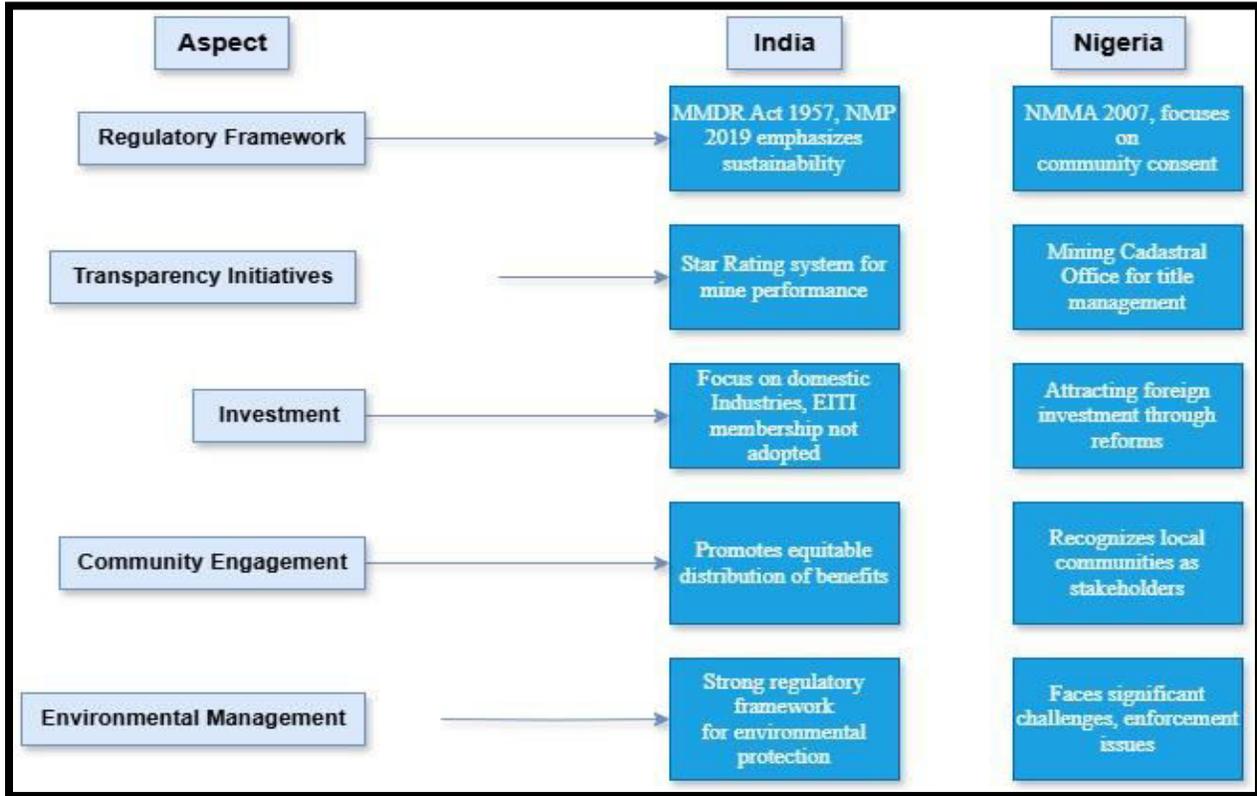
As one of the world's major oil producers, Nigeria's energy sector is primarily based on oil and gas. However, the country possesses considerable potential for solar, hydro, and wind energy. Nigeria has initiated investments in renewable energy, including the Solar Power Naija program, which aims to expand electricity access in remote areas. Nevertheless, the adoption of renewable energy faces obstacles such as political instability, financial constraints, and corruption (Ogwueleka, *et al.*, 2020). The Nigerian energy sector suffers from inefficiencies, outdated infrastructure, and gas flaring, contributing to environmental degradation and greenhouse gas emissions. In contrast to Nigeria's nascent renewable energy projects and high fossil fuel dependence, India has implemented a more ambitious and successful approach to renewable energy adoption (Solar Power Naija Program, 2022).

### 3.5 Mineral Resources Management

India and Nigeria exhibit distinct resource profiles and varied approaches to mineral resource management. India, with limited oil reserves compared to Nigeria, relies heavily on coal for energy production but also possesses other minerals such as limestone, iron ore, bauxite, mica, zinc, and manganese (Ministry of Mines, 2021). Thriving industries in India include cement, steel, and energy, with efforts to diversify the energy sector to reduce import dependence (Chandra, 2019). Despite numerous environmental laws for sustainable mining, coal, and other mining activities continue to impact air and water quality (Bhanumati, 2018). The regulatory framework, governed by the Ministry of Mines and the Indian Bureau of Mines under the Mines and Minerals Act, implements e-auctions for mining leases to ensure transparency and reduce illegal mining (Ministry of Mine, 2021).

Nigeria's vast crude oil reserves form the backbone of its revenue generation, accounting for 80% of the country's income. This overreliance on oil revenue has led to economic instability (Yusuf, *et al.*, 2020). Other mineral resources in Nigeria include limestone, natural gas, coal, tin, iron ore, and gold (Edeme, *et al.*, 2019). However, most of these minerals remain underutilized due to insufficient investment in the sector (Federal Republic of Nigeria, 2008). The country has prioritized oil extraction while neglecting mineral resource extraction and management (Nigerian Mining and Minerals Act, 2007). Environmental degradation continues due to gas flaring, oil spillage, and illegal mining (Ugwuanyi *et al.*, 2021). The Ministry of Mines and Steel Development oversees mineral resources, with the Minerals and Mining Act aimed at monitoring and diversifying mining activities (Federal of Nigeria, 2008). (Federal of Nigeria, 2008).

**Figure3: Analysis of Mineral Resource Management between India and Nigeria**



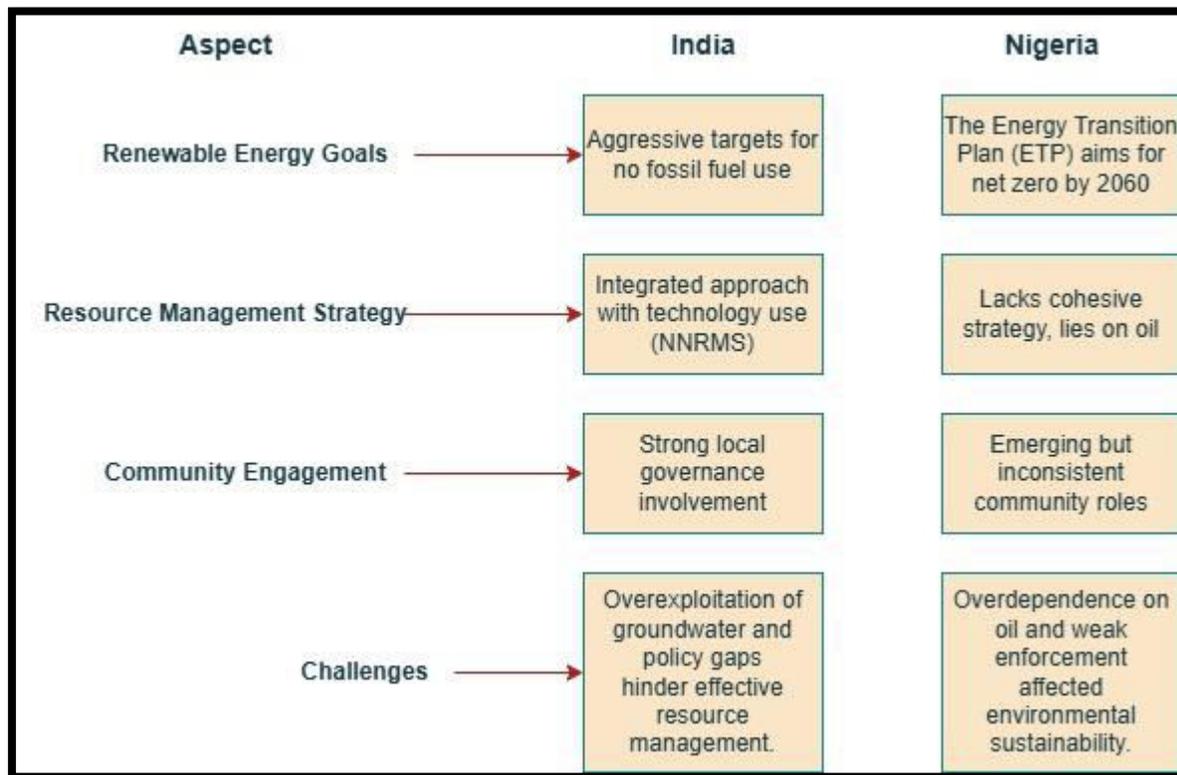
**4. Governance and Policy Framework**

According to Chopra *et al.*, (2014), India possesses more advanced environmental institutions and demonstrates greater political determination to tackle ecological issues. The MoEFCC and NGT are crucial in overseeing environmental impacts, with the latter serving as a judicial body for environmental matters. India actively engages in global climate agreements and has made substantial commitments under the Paris Agreement. Additionally, India promotes south-south collaboration for sustainable growth (National Green Tribunal India, 2019). The Forest Conservation Act of 1980 safeguards forest resources, while the NAPCC concentrates on managing ecosystems, harnessing solar energy, conserving water, and promoting sustainable agriculture. The NNMRS employs remote sensing to monitor and map various natural resources. India also participates in international environmental conventions such as the CBD and the Paris Agreement. In the mining sector, the Mines and Minerals (Development and Regulation) Act of 1957 governs mineral resources, and the NMP 2019 aims to ensure sustainable mining practices, support domestic industries, and decrease reliance on mineral imports (Government of India, Ministry of Mines, 2019). The MCDR is established to enforce environmental compliance and reduce mining-related pollution (Press Information Bureau, Government of India, 2019).

In contrast, Nigeria's environmental policies are often undermined by weak institutions, corruption, and inadequate enforcement. Environmental agencies like NESREA lack funding and struggle to implement laws effectively (National Environmental Standards and Regulations Enforcement Agency, 2022). The National Policy on the Environment 1989 emphasizes sustainable development. The Great Green Wall Initiative addresses desertification in northern Nigeria through tree planting and land restoration, while the NDDC focuses on managing the environmental impact of oil exploration. Although Nigeria participates in global environmental initiatives like the Paris Agreement and UNFCCC, it faces challenges in implementing climate action plans due to governance issues (Umeh, *et al.*, 2018). In the mining sector, the NMMA aims to reduce conflicts in mining communities by treating them as stakeholders and ensuring they benefit from mining proceeds. A Mining Cadastral office has been established to oversee mineral titles, enhance transparency, attract foreign investment, and improve industry standards (Nigerian Mining and Minerals Act, 2007).

Both nations are committed to the United Nations Sustainable Development Goals, with India prioritizing renewable energy promotion, clean energy, and sustainable cities to combat climate change, while Nigeria focuses on poverty reduction and improving environmental management. India's stronger governance and institutional frameworks for environmental sustainability contrast with Nigeria's challenges, where economic dependence on oil, corruption, and weak enforcement hinder progress.

**Figure 4: Comparative Analysis between India and Nigeria in Terms of NRM**



## Enforcement

## 5. Conclusion

The statistics reveal that Nigeria relies more heavily on natural resources compared to India, while India demonstrates greater commitment to renewable energy and biodiversity preservation. This underscores the contrasting approaches and obstacles in resource management between the two nations. Both countries encounter similar issues, such as soil erosion, water shortages, forest loss, and energy inefficiency. However, India has made more significant strides towards sustainable management due to more robust governance, improved policy frameworks, and substantial investments in renewable energy initiatives, conservation efforts, and a focus on technology and green economic practices. Despite its abundant natural resources, Nigeria continues to grapple with inadequate enforcement of environmental regulations, political unrest, and excessive dependence on oil revenues, leading to environmental degradation. Nevertheless, Nigeria has the potential to thrive through policy reforms, community-based initiatives, and international assistance. Nigeria's efforts to diversify its economy away from oil dependence contrast with India's emphasis on mineral self-sufficiency and sustainable mining practices. Both nations are striving to balance

resource management, economic development, and environmental protection, but must improve governance, increase investment in green technologies, and ensure fair distribution of natural resources to achieve true environmental sustainability. There is a necessity for unique and sustainable strategies in resource management and resource profiles to ensure equitable utilization and conservation. Resource-rich communities should be involved in management processes and provided with alternatives to reduce over-reliance on natural resources, particularly in the realm of renewable energy, by addressing energy supply needs and decreasing fossil fuel consumption. These communities should be educated about sustainable resource use. Research should focus on developing methods to enhance resource utilization and technologies, making them accessible and affordable to the general population. Governments and non-governmental organizations should strictly adhere to their environmental protection and resource management policies.

### 6. Suggested Actions

**Enhancing Policy Enforcement:** India and Nigeria should improve the execution of their resource management strategies, emphasizing openness and responsibility.

**Advancing Clean Energy:** Although India has progressed in sustainable power sources, Nigeria ought to tap into its sun-based and wind energy potential to decrease its dependence on non-renewable energy sources.

**Scientific Exploration:** Joint research endeavors can tackle common issues like forest loss, water conservation, and soil erosion.

**Global Collaboration:** Both nations should participate in information exchange and alliances, utilizing worldwide funding sources such as the Green Climate Fund.



Figure 5: Collaboration for Sustainable Resource Management

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