LEGAL GOVERNANCE OF HYDROPOWER DEVELOPMENT WITHIN THE WATER-ENERGY-FOOD NEXUS IN NIGERIA*

Abstract

Hydropower remains an important source of electricity in Nigeria and continues to contribute to national energy development. However, hydropower projects exist within the interconnected Water-Energy-Food (WEF) nexus, where energy production can affect water availability, agricultural activities, environmental sustainability, and community livelihoods. This paper examines the legal governance of hydropower development within the WEF nexus in Nigeria. It evaluates the extent to which existing legal frameworks promote sustainable resource management. The study adopts a doctrinal research methodology. It analyses relevant statutes, regulations, and institutional arrangements governing hydropower development in Nigeria. The paper is supported by case studies of the Kainji and Shiroro dams. These case studies highlight governance challenges associated with hydropower development, including environmental change, disruption of agricultural systems, flooding, community displacement, and emerging security concerns. The study finds that existing legal frameworks are largely sector-driven and insufficiently coordinated. This has resulted in fragmented governance, overlapping institutional responsibilities, weak inter-agency collaboration, and limited stakeholder participation. These shortcomings hinder the effective integration of water, energy, and food considerations in decision-making processes. The paper argues that a nexus-based governance approach is necessary to address the interconnected nature of resource management and promote policy coherence across relevant sectors. The paper concludes that Nigeria requires stronger legal coordination mechanisms, improved institutional collaboration, and more inclusive governance reforms. Such measures are necessary to ensure that hydropower development contributes to energy security, water sustainability, food security, environmental protection, and long-term community resilience.

Keywords: Energy, Environment, Food, Hydropower, Governance, Water.

* Olumide Opeyemi Toyinbo, Faculty of Law, Usmanu Danfodiyo University, Sokoto, Nigeria.
Email: olumideopeyemitoyinbo@gmail.com | Tel: +2348103240364.

1. Introduction

Access to sustainable energy, adequate food, and clean water is fundamental to human development. In Africa, the intersection of energy, food, and water systems has generated some sort of complexities that necessitate integrated legal and policy approaches.[1] The Water-Energy-Food (WEF) nexus has emerged as a conceptual framework for understanding these complexities and promoting coordinated governance.[2] Within this nexus, hydropower represents both an opportunity and a challenge. While it can contribute significantly to energy generation and water regulation, it also impacts agricultural productivity, community livelihoods, and environmental sustainability.[3]

Nigeria illustrates the trade-offs within the WEF nexus.[4] The nation continues to experience energy deficits, constrained agricultural productivity in several regions and significant challenges in water resource management.[5] Hydropower development has been prioritised as a solution to the energy crisis, yet many projects have been accompanied by adverse effects on food systems and water availability.[6] The legal frameworks governing hydropower, water, and agriculture remain largely fragmented. This paper seeks to evaluate these governance structures and suggest pathways for legal reform.

1 International Energy Agency, Africa Energy Outlook 2022 (IEA, 2022) <https://www.iea.org/reports/africa-energy-outlook-2022> accessed 12 June 2026.

2 H Hoff, *Understanding the Nexus: Background Paper for the Bonn 2011 Conference – The Water, Energy and Food Security Nexus* (Stockholm Environment Institute 2011).

3 G Rasul and B Sharma, 'The Nexus Approach to Water–Energy–Food Security: An Option for Adaptation to Climate Change' (2015) 16 Climate Policy 6, 682–702.

4 The WEF Nexus Index (2023), which is the latest available update on the portal at the time of writing this paper, shows that Nigeria has a composite score of 51.4, placing it 116th out of more than 180 countries assessed. It also records a score of 49.6 for water, 55.9 for energy, and 48.6 for food, reflecting relatively better performance in energy compared to water and food, but overall moderate and uneven progress across the three sectors. See 'WEF Nexus Index 2023: Nigeria' (WEF Nexus Index) <https://www.water-energy-food.org/nigeria> accessed 13 June 2026.

5 JA Adebiyi, LS Olabisi, L Liu and others, 'Water–food–energy–climate nexus and technology productivity: a Nigerian case study of organic leafy vegetable production' (2021) 23 *Environment, Development and Sustainability* 6128 <https://doi.org/10.1007/s10668-020-00865-0> accessed 13 June 2026.

6 I Dombrowsky and O Hensengerth, 'Governing the Water-Energy-Food Nexus Related to Hydropower on Shared Rivers—The Role of Regional Organizations' (2018) 6 *Frontiers in Environmental Science* <https://doi.org/10.3389/fenvs.2018.00153> accessed 14 June 2026.

2. Conceptualising the Water-Energy-Food Nexus

The WEF nexus approach highlights the interconnectedness of three critical systems that are traditionally managed in silos. As articulated by the Food and Agriculture Organization (FAO), the nexus approach seeks to enhance water, energy, and food security by reducing trade-offs, building synergies, and improving governance across sectors.[7] This integrated thinking has gained traction among policymakers, development institutions, and scholars as an innovative solution to sustainable resource management in the face of climate change and population growth.[8] Legal frameworks that fail to reflect these interconnections can lead to inefficiencies and exacerbate resource conflicts, particularly in water-scarce regions.

In the context of hydropower, the WEF nexus is particularly salient. Dams and hydroelectric projects directly affect water availability downstream, alter ecosystems, and influence agricultural outputs.[9] Conversely, agriculture consumes significant water resources and can affect the operational capacity of hydropower infrastructure through activities like irrigation and pollution. For instance, the FAO reports that irrigated agriculture accounts for more than 70% of global freshwater withdrawals, often resulting in competition with hydropower for water use.[10]

The integration of the nexus approach into legal systems can ensure that hydropower projects are subjected to cross-sectoral impact assessments, environmental and social safeguards, and inclusive stakeholder engagement. Legal instruments must address not only the technical dimensions of resource sharing but also the rights of affected communities. Notably, legal fragmentation can exacerbate policy incoherence, particularly where water, energy, and agriculture ministries operate in isolation. Effective governance of

7 FAO, Walking the Nexus Talk: Assessing the Water-Energy-Food Nexus in the Context of the Sustainable Energy for All Initiative (FAO, 2014).

8 A Kurian, 'The Water-Energy-Food Nexus: Trade-offs, Thresholds and Transdisciplinary Approaches to Sustainable Development' (2017) 68 Environmental Science & Policy 97-106.

9 M Howells, S Hermann, M Welsh, M Bazilian, R Segerstrom, T Alfstad, D Gielen, H Rogner, G Fischer, H Velthuizen, D Wiberg, C Young, R Roehrl, A Mueller, P Steduto and I Ramma, 'Integrated Analysis of Climate Change, Land-Use, Energy and Water Strategies' (2013) 3 Nature Climate Change 621–626.

10 FAO, *In Brief to The State of Food and Agriculture 2020: Overcoming Water Challenges in Agriculture* (FAO 2020) <https://doi.org/10.4060/cb1441e> accessed 15 June 2026.

hydropower within the nexus framework requires legal tools that promote coherence, equity, and environmental sustainability.[11]

Essentially, the WEF nexus expresses the urgency of rethinking legal governance to address the complex interdependencies in natural resource management. As climate variability intensifies and development pressures mount, Nigeria must adopt integrated legal and institutional frameworks that complement hydropower development with food and water security goals.

3. Hydropower Development in Nigeria

As of 2024, Nigeria's electricity supply remains heavily dependent on fossil fuels, particularly natural gas, which contributes roughly 79.5% of Nigeria's electricity mix.[12] It is followed by hydroelectric power, which accounts for about 20.4% of electricity generation, making it the leading renewable energy source.[13] The National Renewable Energy and Energy Efficiency Policy (NREEEP) of 2015 recognises hydropower as a key driver of clean energy growth.[14] Invariably, hydropower occupies a strategic position within Nigeria's energy transition goals.

Nigeria has over 14,120 megawatts (MW) of hydropower potential, but only 2,062 MW has been developed.[15] This means less than 15% of its hydropower resources are being used. The country's total installed electricity capacity is 12,522 MW, excluding off-grid sources.[16] This underuse is part of a wider problem across Africa, where only 11% of the continent's 340 gigawatts of

11 I Dombrowsky and O Hensengerth, 'Governing the Water-Energy-Food Nexus Related to Hydropower on Shared Rivers—The Role of Regional Organizations' (2018) 6 *Frontiers in Environmental Science* <https://doi.org/10.3389/fenvs.2018.00153> accessed 15 June 2026.

12 S Omakor, *Nigeria Electricity Generation 2021–2024* (unpublished manuscript, Scribd 2025) <https://www.scribd.com/document/861517241/Nigeria-Electricity-Generation-2021-2024-Alfred> accessed 16 June 2026.

13 K Osobase and O Sanni, Investing in Renewable Energy Development in Nigeria (Mondaq, February 2025) <https://www.mondaq.com/nigeria/renewables/1582138/investing-in-renewable-energy-development-in-nigeria> accessed 17 June 2026.

14 Federal Executive Council (FEC), *National Renewable Energy and Energy Efficiency Policy (NREEEP)* (Federal Ministry of Power, Nigeria, April 2015) <https://admin.theiguides.org/Media/Documents/NREEE%20POLICY%202015-%20FEC%20APPROVED%20COPY.pdf> accessed 17 June 2026.

15 Kingsley Jeremiah, 'Nigeria's Hydropower Untapped Despite 14,120 MW Exploitable Capacity' Guardian Nigeria https://guardian.ng/business-services/nigerias-hydropower-untapped-despite-14120mw-exploitable-capacity/> accessed 17 June 2026.

16 Ibid.

hydropower potential has been tapped.[17] Several factors constrain progress in this sector, including aging infrastructure, poor maintenance, inadequate transmission networks, policy inconsistency, and weak regulatory enforcement.[18]

Environmental and social concerns are central to the discourse on hydropower development in Nigeria. Several large-scale projects have been implemented with insufficient Environmental Impact Assessments (EIAs), leading to severe consequences such as the displacement of indigenous and farming communities, loss of livelihoods, and the flooding of fertile agricultural land.[19] The World Commission on Dams emphasises that such projects must prioritise participatory decision-making and equitable benefit-sharing, principles often absent in Nigerian practice.[20] The displacement caused by the Kainji and Shiroro dams, for example, resulted in the forced relocation of tens of thousands of people with inadequate compensation or resettlement planning.[21]

The effects of uncoordinated hydropower development extend to Nigeria's agricultural sector. Dams have altered natural river flows, disrupted seasonal flooding cycles, and reduced access to irrigation water downstream, thus impacting food production.[22] This has significant implications for rural economies and national food security, particularly in the North Central and

17 Ibid.

18 Kingsley Jeremiah, '62% of electricity capacity idle last year as grid collapsed 26 times' *Guardian Nigeria* <https://guardian.ng/energy/62-of-electricity-capacity-idle-last-year-as-grid-collapsed-26-times/> accessed 17 June 2026.

19 A T Ajobe, 'INVESTIGATION: Damned by dams: How hydro-dams affect Niger communities' *Daily Trust* (Minna, 2018) <https://dailytrust.com/damned-by-dams-how-hydro-dams-affect-niger-communities-266310-2/> accessed 17 June 2026.

20 L Scodanibbio and G Mañez, 'The World Commission on Dams: A Fundamental Step Towards Integrated Water Resources Management and Poverty Reduction? A Pilot Case in the Lower Zambezi, Mozambique' (2005) 30(11–16) *Physics and Chemistry of the Earth, Parts A/B/C* 976.

21 R S Gyuse and T T Gyuse, 'Kainji Resettlement Housing: 40 years later' (2008) 1(2) Journal of Urbanism 247 <https://www.researchgate.net/publication/240955403_Kainji_resettlement_housing_40_years_later> accessed 17 June 2026.

22 Omotunde Ojugbele (ed), *Special Report: Why Dams in Nigeria Fails to Support Irrigation Farming* <https://naturenews.africa/special-report-why-dams-in-nigeria-fails-to-support-irrigation-farming/> accessed 17 June 2026.

North West regions, where subsistence farming is prevalent.[23] The interactions between water flow regulation for electricity and agricultural water demand highlight the need for a nexus-based legal approach to hydropower governance.

Realising the full potential of hydropower in Nigeria demands a reformed legal and policy landscape that embeds sustainability, equity, and stakeholder participation at its core. Learning from global best practices, such as the Hydropower Sustainability Guidelines on Good International Industry Practice (HGIIP), Nigeria can establish regulatory frameworks that align infrastructure development with environmental integrity and human rights protections.[24] This is especially crucial in the context of climate change, where water scarcity, energy insecurity, and food production risks are increasingly interlinked.

4. Legal and Institutional Framework for Hydropower Governance in Nigeria

Hydropower development in Nigeria operates within a fragmented and multi-layered legal and institutional framework that governs water use, environmental protection, and electricity generation. The principal legislations include the Electricity Act 2023, the Water Resources Act 1993, the River Basins Development Authorities Act 1987, the National Water Resources Institute Act 1985, and the Environmental Impact Assessment Act 1992.[25]

The *Electricity Act 2023*, which repealed the *Electric Power Sector Reform Act 2005*, now serves as the overarching legal instrument for electricity governance in Nigeria. It consolidates and restructures the functions of several institutions that play critical roles in energy development, particularly in promoting decentralised, sustainable, and renewable electricity generation

23 H Takeshima, A Adeoti and O A Popoola, *Effects of Irrigation Infrastructure Development in Nigeria: The Case of the Bakolori Irrigation Project* (International Food Policy Research Institute 2016) <http://www.ifpri.org/cdmref/p15738coll2/id/130731/filename/130942.pdf> accessed 17 June 2026.

24 International Hydropower Association, *Hydropower Sustainability Guidelines on Good International Industry Practice* <https://www.hydropower.org/publications/hydropower-sustainability-guidelines> accessed 17 June 2026.

25 See generally Electricity Act 2023; Water Resources Act, 1993, Cap W2 LFN 2004; River Basins Development Authorities Act, 1987, No. 35 Cap R9 LFN 2004; National Water Resources Institute Act, 1985 Cap N83 LFN 2004; Environmental Impact Assessment Act, 1992 Cap E12 LFN 2004.

such as hydropower.[26] The Act is aligned with Nigeria's climate commitments and promotes clean energy technologies through a more liberalised and state-inclusive power sector model.[27] Major institutions under the Electricity Act 2023 include Nigerian Electricity Regulatory Commission (NERC), National Hydroelectric Power Producing Areas Development Commission (N-HYPPADEC), Rural Electrification Agency (REA), Nigerian Electricity Management Services Agency (NEMSA), and National Power Training Institute of Nigeria (NAPTIN).

NERC remains the central regulatory body for electricity licensing, consumer protection, tariff setting, and ensuring market competition and transparency. It is empowered to oversee the electricity markets, and to set Renewable Energy Purchase Obligations which indirectly impact hydropower promotion.[28] N-HYPPADEC is tasked with managing the ecological and socio-economic effects of hydroelectric dams on host communities. It funds community development, resettlement schemes, and environmental restoration projects in areas affected by hydropower infrastructure such as Kainji and Jebba.[29]

The REA facilitates off-grid electrification initiatives, including small and medium-scale hydropower plants, especially in rural and underserved communities. It also manages the Nigeria Electrification Project, which provides blended finance and technical assistance for mini-hydro developers.[30] NEMSA ensures that electrical installations and networks meet safety and technical standards. It plays a regulatory inspection role critical to the certification of hydropower infrastructure, including turbines, switchgears, and transmission equipment.[31]

NAPTIN provides capacity building for professionals and technicians in the power sector, including hydropower engineers. It is instrumental in advancing technical expertise needed for local hydropower design, construction, and

26 See generally Preamble and Section 1 of the Electricity Act, 2023.
27 See generally Sections 2 and 63 of the Electricity Act, 2023.
28 Electricity Act, 2023, Part V.
29 Ibid., Part VIII.
30 Ibid., Part XVI.
31 Ibid., Part XVIII.

maintenance.[32] These institutions as created by the Electricity Act, 2023 work in tandem with other sectoral actors, but there is often a lack of synergy between energy, water, and environmental regulators, leading to a disjointed approach to hydropower development.

The Water Resources Act[33] vests control over all surface and groundwater resources affecting more than one state in the federal government.[34] It authorises the issuance of water use licences by the Minister charged with responsibility for matters relating to water resources.[35] However, the Act omits explicit provisions for environmental protection or community water rights and it raises concerns about resource overuse and ecological degradation.

Efforts to replace the Act with the National Water Resources Bill were met with resistance. The Bill, which sought to unify existing water-related statutes under a centralised framework, was eventually thrown out.[36] Although it aimed to enhance coordination, critics argued it would erode state and community control, entrench federal dominance, and was introduced without sufficient public consultation.[37] The Bill also reignited constitutional debates regarding the extent of federal powers over natural resources.[38] It is hoped that future legislative reforms will strike a balance between national coordination and inclusive, sustainable water governance.

The Environmental Impact Assessment Act[39] sets out the general principles, procedures, and methods for the prior consideration of environmental impacts associated with certain categories of public and private projects, including

32 Ibid, Part XIX.
33 Cap W2, Laws of the Federation of Nigeria 2004.
34 Section 1 of the Water Resources Act.
35 Sections 9, 10, 11 and 13 of the Water Resources Act.
36 ThisdayLive, 'At Last, National Assembly Throws out Controversial Water Resources Bill' <https://www.thisdaylive.com/2023/06/07/at-last-national-assembly-throws-out-controversial-water-resources-bill/> accessed 17 June 2026.
37 Ibid.
38 Corporate Accountability & Public Participation Africa (CAPPA), '*Analysis: Why Nigerians Must Reject the Latest Water Resources Bill*' <https://cappaafrica.org/2022/08/01/analysis-why-nigerians-must-resist-the-latest-water-resources-bill/> accessed 17 June 2026.
39 Cap E12, LFN 2004.

dams, hydroelectric power schemes, and hydropower generation.[40] This legislative framework aims to ensure that environmental consequences are duly assessed before project implementation. To enhance enforcement, the National Environmental Standards and Regulations Enforcement Agency (NESREA) was established under the NESREA (Establishment) Act, 2007.[41] Specifically, Section 1(2) (a) of the Act provides that the Agency shall serve as the body responsible for environmental standards, regulations, rules, laws, policies, and guidelines in Nigeria. Collectively, the Environmental Impact Assessment Act and the NESREA Act constitute the core legal framework for regulating and managing the environmental implications of hydropower development in the country.

River Basin Development Authorities (RBDAs) and the National Water Resources Institute (NWRI) are additional institutional actors in hydropower governance. RBDAs are mandated to manage river basins for agricultural and infrastructural development.[42] NWRI focuses on water-related research, including hydrology, water conservation, and climate forecasting.[43] However, despite their respective mandates, there is often poor coordination between RBDAs and energy-sector institutions, and the research outputs of NWRI are seldom incorporated into hydropower or broader energy planning frameworks.

In practice, institutional fragmentation and regulatory overlaps impede integrated planning and resource optimisation. The absence of a centralised data-sharing platform and inter-agency communication channels often leads to contradictory policies. For example, while energy policy may prioritise hydropower expansion, water allocation frameworks may not adequately reflect seasonal flow changes or agricultural needs. This disconnect undermines the WEF nexus approach, which requires a shift from traditional sectoral thinking towards integrated approaches to resource management and

40 Section 12 and Schedule of the Environmental Impact Assessment Act.

41 Section 1 of the NESREA (Establishment) Act.

42 River Basin Development Authorities (RBDAs), Bureau of Public Enterprises (BPE) (12 August 2021) <https://www.bpe.gov.ng/river-basin-development-authorities-rbdas/> accessed 17 June 2026.

43 NWRI Act, Section 1.

also an understanding of the inextricable connections between the three resource sectors.[44]

Therefore, despite notable legal reforms such as the *Electricity Act 2023*, Nigeria's hydropower governance framework still lacks the inter-institutional coherence necessary for sustainable, inclusive, and efficient hydropower development.

5. Case Studies of Kainji and Shiroro Dams

This section examines the Kainji and Shiroro dams as key case studies in Nigeria's hydropower development, with emphasis on their governance implications and relevance to the WEF nexus. The two dams are considered due to the enduring challenges associated with their development and operation, as well as the legal lessons they provide for sustainable hydropower governance in Nigeria.

Commissioned in 1968, the Kainji Dam was Nigeria's first major hydropower project and was designed to generate 760 MW of electricity on the River Niger.[45] While the project significantly contributed to electricity generation and national development, studies have documented substantial environmental and socio-economic impacts associated with its construction. The creation of the reservoir resulted in the inundation of large areas of land and the displacement of thousands of residents from affected communities.[46]

Contemporary literature indicates that some displaced persons experienced disruptions to their traditional livelihoods, particularly farming and fishing, due to changes in land use patterns and access to natural resources at the time

44 G B Simpson, G P W Jewitt, T Mabhaudhi, C Taguta and J Badenhorst, 'An African Perspective on the Water-Energy-Food Nexus' (2023) 13 *Scientific Reports* 16842 <https://doi.org/10.1038/s41598-023-43606-9> accessed 17 June 2026.

45 I K Okakwu, A S Alayande and O E Olabode, 'Performance and Economic Analysis of Kainji Hydropower Plant in Nigeria' (2019) 15(2) *Arid Zone Journal of Engineering, Technology and Environment* 461 <https://www.azojete.com.ng/index.php/azojete/article/view/338> accessed 17 June 2026.

46 R S Gyuse and T T Gyuse, 'Kainji Resettlement Housing: 40 Years Later' (2008) 1(3) *Journal of Urbanism: International Research on Placemaking and Urban Sustainability* 247 <https://doi.org/10.1080/17549170802532062> accessed 17 June 2026.

of resettlement.[47] These experiences continue to serve as important reference points in discussions on environmental sustainability, community welfare, and resettlement practices in the planning and implementation of large-scale hydropower projects in Nigeria.

Ecologically, the Kainji Dam has altered floodplain dynamics, reduced seasonal flood pulses essential for wetland agriculture, and affected downstream fisheries.[48] Studies have also linked the displacement and resettlement associated with the project to long-term livelihood challenges among affected communities.[49] Although the dam has contributed significantly to national electricity generation, its development occurred before the establishment of a comprehensive environmental regulatory framework for dam operations in Nigeria.

In response to the environmental and social concerns associated with dam and reservoir projects, the National Environmental (Dams and Reservoirs) Regulations 2014 introduced legally enforceable environmental management obligations. The Regulations require measures relating to environmental management planning, pollution prevention, environmental monitoring, and the protection of water resources, aquatic ecosystems, and public health.[50] Nevertheless, the Kainji Dam experience continues to exhibit the importance of integrating environmental protection and sustainable resource management into hydropower development in Nigeria.

The Shiroro Dam on the Kaduna River, commissioned in 1990, was developed to address Nigeria's growing electricity demand and has an installed capacity of 600 MW. [51] Like the Kainji Dam, studies indicate that downstream farmers have experienced disruptions arising from water-release patterns, including flooding and periods of reduced water availability that

47 M Maiyaki, 'Social Impacts of Hydroelectric Dams on the Livelihoods of Select Communities in Kainji and Jebba, Niger State, Nigeria' (2026) 4(1) *International Journal of Sub-Saharan African Research* 324.

48 M I Adeoba, O J Ogunniyi, D R Oladejo and I B Feyijin, 'Water–Energy Nexus and Sustainability Issues' in M I Adeoba, S A Aransiola, O Ololade and O P Abioye (eds), *Water Resources Management in Nigeria* (Springer Nature Switzerland 2026) 47; Gyuse and Gyuse n(44) 247.

49 Ibid.

50 The National Environmental (Dams and Reservoirs) Regulations 2014, specifically Regulations 1, 5, 8 and 13.

51 S L Gbadamosi, O O Adedayo and L Nnaa, 'Evaluation of Operational Efficiency of Shiroro Hydro-Electric Plant in Nigeria' (2015) 4(42) *International Journal of Science and Engineering Investigations* 14.

affect farming activities and crop production. [52] These challenges have prompted calls for improved irrigation infrastructure and water management measures to support agricultural productivity and livelihood security in affected communities. [53]

The Shiroro experience also highlights the importance of integrated water-energy governance. In response to developmental concerns in hydropower-producing areas, the National Hydroelectric Power Producing Areas Development Commission (N-HYPADEC) was established to promote infrastructure development and socio-economic advancement in affected communities.[54] Its establishment reflects efforts to address some of the challenges associated with hydropower development and expresses the need to balance electricity generation with environmental sustainability and community welfare.

6. Legal and Governance Challenges

One of the major governance challenges affecting hydropower development within Nigeria's Water-Energy-Food (WEF) nexus is the difficulty of coordinating institutions responsible for water resources, energy regulation, environmental protection, and agricultural development.[55] Hydropower projects have implications that cut across these sectors, yet decision-making is often undertaken through separate institutional frameworks. [56] This can hinder

---

52 U Sanusi, C A Odiji, B K Nwadike, D D Hamza, S T Baba and S K Salis, 'Flood Vulnerability Analysis in the Down Stream of Shiroro Dam and Environs' (2023) 3(4) *Water and Environmental Sustainability* 41–49 <https://www.journalwes.com/article_172692.html> accessed 17 June 2026.; Y J Alhassan, S Umar and G Ayuba, 'Analysis of the Constraints Influencing Artisanal Fisheries along Shiroro and Kainji Dams, Nigeria' (2023) 10(9) *Scholars Journal of Agriculture and Veterinary Sciences* 121.

53 Y U Oladimeji, *Effect of Shiroro Dam Project on Sustainable Livelihood and Poverty Status of Farmers in Niger State, Nigeria* (2020) *Zaria Geographer* 27(1) 111 <https://physicalsciences.abu.edu.ng/department/geography/public/journal/2020/files/08.pdf> accessed 17 June 2026.

54 F O Yusufu, A Y Adeku, U S Abdulazeez and A O Eneyamire, 'Role of Hydroelectric Power Producing Areas Development Commission (HYPPADEC) in Sustainable Development of Hydro Electric Communities in Nigeria' (2025) 2(2) International Journal of Public Administration and Development Studies 57.

55 Federal Government of Nigeria, *Environmental and Social Management Framework (Draft Final) for the Sustainable Power and Irrigation in Nigeria (SPIN) Project* (World Bank, July 2024) <https://documents1.worldbank.org/curated/en/099080723195021838/P1796840129df10e09f9e08494f3d4e4d1.docx> accessed 17 June 2026.

56 A Scott, *Making Governance Work for Water-Energy-Food Nexus Approaches* (CDKN, 2017) <https://cdkn.org/sites/default/files/files/Working-paper_CDKN_Making-governance-work-for-water-energy-food-nexus-approaches.pdf> accessed 17 June 2026.

the integration of competing interests relating to electricity generation, water allocation, environmental sustainability, and food production, thereby affecting the effectiveness of hydropower governance.

Another challenge relates to the implementation and enforcement of environmental and social safeguards. The Environmental Impact Assessment Act requires environmental assessments for major projects.[57] Also, the National Environmental (Dams and Reservoirs) Regulations 2014 establish a regulatory framework for managing the environmental and public health impacts associated with dam and reservoir operations.[58] Despite the existence of these legal instruments, concerns remain regarding the consistency of compliance monitoring and enforcement, particularly in ensuring that environmental and social impacts are adequately addressed throughout the operational life of hydropower projects.

Stakeholder participation also remains an important governance concern. Although mechanisms such as the National Hydroelectric Power Producing Areas Development Commission (N-HYPPADEC) have been established to promote development and improve the welfare of communities affected by hydropower projects, effective participation by local communities in project planning, implementation, and monitoring is still necessary. Meaningful stakeholder engagement promotes transparency, enhances public trust, and contributes to the sustainable management of water, energy, and food resources.[59]

---

57 Federal Republic of Nigeria, *Nigeria Environmental and Social Country System Assessment Report (Draft)* (Environmental Assessment Department, Federal Ministry of Environment 2025) <https://ead.gov.ng/wp-content/uploads/2025/06/Nigeria_ES-Country-System-Assessment-Report_DRAFT_.pdf> accessed 17 June 2026; P Esor, Comprehensive review of the Environmental Impact Assessment Act <https://community.youth4climate.info/topic/comprehensive-review-environmental-impact-assessment-act-praise-esor> accessed 17 June 2026.

58 Ibid, n(48).

59 OECD, *Stakeholder Engagement for Inclusive Water Governance* (OECD Publishing, 2015) <https://www.oecd.org/content/dam/oecd/en/publications/reports/2015/04/stakeholder-engagement-for-inclusive-water-governance_g1g51d25/9789264231122-en.pdf> accessed 17 June 2026; Andrew Scott, *Making Governance Work for Water-Energy-Food Nexus Approaches* (CDKN, 2017) <https://cdkn.org/sites/default/files/files/Working-paper_CDKN_Making-governance-work-for-water-energy-food-nexus-approaches.pdf> accessed 17 June 2026.

Furthermore, the legal framework governing hydropower development is dispersed across several sector-specific laws relating to water resources, electricity regulation, environmental protection, agriculture, and land administration.[60] The challenge is therefore not the absence of regulation but the limited integration of these legal regimes in addressing the interconnected concerns of the WEF nexus. Strengthening coordination among existing laws and institutions would enhance policy coherence and improve the capacity of the regulatory system to respond to cross-sectoral challenges associated with hydropower development.

In Nigeria, effective governance is also constrained by weaknesses in data collection, monitoring, and information sharing.[61] Reliable hydrological, environmental, agricultural, and energy data are essential for informed decision-making and regulatory oversight. Where data are fragmented, outdated, or inaccessible, the ability of institutions to undertake integrated planning and assess the cumulative impacts of hydropower projects within the WEF nexus becomes significantly limited.

A further legal and governance challenge relates to the capacity of existing institutional frameworks to address evolving risks within hydropower-producing communities. The Kainji and Shiroro dam corridors remain important centres of agricultural and fisheries production, contributing significantly to local livelihoods and regional food systems.[62] However, recent experiences of flooding and insecurity in these areas have exposed the

60 J C Sanchez Ramirez, A Nicol and F Eldabbagh, *Policy Coherence in Food, Land, and Water Systems: A Comparative Analysis of Policy Flagship Reports for Nigeria, Egypt, Colombia, India, Kenya, and Laos* (International Water Management Institute (IWMI), 2024) 55.

61 S Ojo, H Mensah, E Albrecht and B Ibrahim, 'Adaptation to Climate Change Effects on Water Resources: Understanding Institutional Barriers in Nigeria' (2020) 8(11) *Climate* 134 <https://doi.org/10.3390/cli8110134> accessed 17 June 2026.

62 Y J Alhassan, S Umar and G Ayuba, 'Analysis of the Constraints Influencing Artisanal Fisheries along Shiroro and Kainji Dams, Nigeria' (2023) 10(9) *Scholars Journal of Agriculture and Veterinary Sciences* 121.; Y J Alhassan and T A Manga, 'Exploring how the Livelihood Prospects of the Fishing Communities around Nigeria's Shiroro and Kainji Dams are Correlated with Artisanal Fishing Activities' (2024) 12(2) *Direct Research Journal of Agriculture and Food Science* 173.

vulnerability of communities whose economic activities depend on stable environmental and social conditions.[63]

These developments raise important questions regarding the adequacy of current governance arrangements in safeguarding both infrastructure and livelihoods within the Water-Energy-Food nexus. Beyond regulating electricity generation and environmental compliance, the legal framework must also support risk mitigation, resilience planning, and the protection of communities affected by hydropower operations.

7. Recommendations for Legal Reform

To address the legal and governance challenges within the Water-Energy-Food (WEF) nexus, Nigeria should prioritise the harmonisation of existing laws and policies relating to water resources, energy, agriculture, environmental protection, and land use.[64] Rather than creating a single omnibus statute, legal reforms should establish clearer coordination mechanisms among relevant institutions and promote integrated planning across sectors. Statutory provisions that encourage inter-agency collaboration and policy coherence would strengthen the governance of hydropower projects and their impacts on water and food systems.

Strengthening the implementation and enforcement of environmental and social safeguards is equally important. Although the Environmental Impact Assessment Act and the National Environmental (Dams and Reservoirs)

63 Niger communities deserted as bandits turn Kainji Park into terrorists' haven' (The Punch, 2 July 2024) <https://punchng.com/niger-communities-deserted-as-bandits-turn-kainji-park-into-terrorists-haven/> accessed 17 June 2026.; 'North-Central: Anxiety lingers over insecurity, fate of displaced persons' (The Guardian, 8 October 2025) https://guardian.ng/news/north-central-anxiety-lingers-over-insecurity-fate-of-displaced-persons/ accessed 17 June 2026.; 'Catastrophic flooding looms as Kainji, Jebba, Shiroro, Zungeru dams discharge excess water' (Vanguard, 3 October 2025) https://www.vanguardngr.com/2025/10/catastrophic-flooding-looms-as-kainji-jebba-shiroro-zungeru-dams-discharge-excess-water/ accessed 17 June 2026.; 'Kainji, Jebba, Shiroro, Zungeru dams to discharge excess water' (ThisDay, 3 October 2025) https://www.thisdaylive.com/2025/10/03/kainji-jebba-shiroro-zungeru-dams-to-discharge-excess-water/ accessed 17 June 2026.; 'Significant flood events that occurred downstream of Shiroro Dam on the Kaduna River' (ResearchGate, n.d.) https://www.researchgate.net/figure/Significant-flood-events-that-occurred-down-the-Shiroro-dam-on-the-Kaduna-River_tbl2_328309896 accessed 17 June 2026.

64 Andrew Scott, *Making Governance Work for Water-Energy-Food Nexus Approaches* (CDKN, 2017) <https://cdkn.org/sites/default/files/files/Working-paper_CDKN_Making-governance-work-for-water-energy-food-nexus-approaches.pdf> accessed 17 June 2026.

Regulations 2014 provide a legal basis for environmental oversight, greater attention should be given to compliance monitoring, periodic audits, public disclosure of relevant information, and effective sanctions for regulatory breaches. Improved enforcement would help ensure that the environmental and social consequences of hydropower projects are properly assessed and managed throughout their operational lifespan.

Legal reforms should also enhance stakeholder participation and community protection within hydropower-producing areas. Existing institutions such as the National Hydroelectric Power Producing Areas Development Commission (N-HYPPADEC) should be further strengthened to promote community development and facilitate engagement with affected populations. In addition, legal frameworks should guarantee meaningful consultation, access to information, and appropriate mechanisms for addressing grievances arising from hydropower development.

Nigeria should also establish a coordinated framework for data collection, monitoring, and information sharing across the WEF sectors. Reliable hydrological, environmental, agricultural, and energy data are essential for evidence-based policymaking and integrated resource management. Legal provisions requiring inter-agency data sharing, periodic reporting, and the use of digital monitoring systems would improve regulatory oversight and support more informed decision-making.

Legal and policy frameworks governing hydropower development should also incorporate measures aimed at addressing emerging risks affecting host communities. This includes strengthening flood-risk management, emergency preparedness, and resilience planning in hydropower-producing areas. Greater coordination among water resource authorities, environmental regulators, emergency management agencies, security institutions, and local communities would help safeguard livelihoods, protect critical infrastructure, and promote the long-term sustainability of hydropower development within the WEF nexus.

8. Conclusion

Hydropower remains an important component of Nigeria's energy mix, but its development inevitably affects water resources, food production, and

community welfare. This paper has shown that achieving the objectives of the Water-Energy-Food nexus requires effective legal and institutional coordination, strong environmental governance, and meaningful stakeholder engagement. A more integrated and responsive governance approach is therefore necessary to ensure that hydropower development supports sustainable development and delivers benefits across the Water-Energy-Food nexus.