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Report No: PAD5613

INTERNATIONAL DEVELOPMENT ASSOCIATION

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED CREDIT

IN THE AMOUNT OF US$500 MILLION

TO THE

FEDERAL GOVERNMENT OF NIGERIA

FOR A

SUSTAINABLE POWER AND IRRIGATION FOR NIGERIA PROJECT

September 5, 2024

Water Global Practice

Western and Central Africa Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective July 31, 2024)

Currency Unit =	Nigerian Naira (NGN)
US$1 =	NGN 1,661

FISCAL YEAR

January 1 - December 31

Regional Vice President:	Ousmane Diagana
Country Director:	Ndiame Diop
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ABBREVIATIONS AND ACRONYMS

AAD	Annual Average Damages
AM	Accountability Mechanism
AWD	Alternate Watering and Drying
BCM	Billion Cubic Meters
BIS	Bakolori Irrigation Scheme
BPE	Bureau of Public Enterprises
CIC	Commitment, Integrity, and Capacity
CPF	Country Partnership Framework
DARES	Distributed Access through Renewable Energy Scale-up Project
DDRO	Department of Dams and Reservoir Operations
DID	Department of Irrigation and Drainage
DKIS	Dadin Kowa Irrigation Scheme
DRO	Dams and Reservoir Operations
DSRP	Dam Safety Review Panel
EAP	Emergency Action Plan
EFA	Economic and Financial Analysis
ERR	Economic Rate of Return
ESCP	Environmental and Social Commitment Plan
ESDD	Environmental and Social Due Diligence
ESF	Environmental and Social Framework
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plan
ESS	Environmental and Social Standards
EWS	Early Warning Systems
EX-ACT	Ex-Ante Carbon Balance Tool
FFWSDO	Flood Forecasting and Warning System for Dam Operations
FGN	Federal Government of Nigeria
FLID	Farmer-Led Irrigation Development
FLL	Field-Level Leadership
FM	Financial Management
FMAFS	Federal Ministry of Agriculture and Food Security
FMEnv	Federal Ministry of Environment
FMF	Federal Ministry of Finance
FMP	Federal Ministry of Power
FMWRS	Federal Ministry of Water Resources and Sanitation
FPFMD	Federal Project Financial Management Department
FPMU	Federal Project Management Unit
FRR	Financial Rate of Return
FTC	Federal Technical Committee
FX	Foreign Exchange
GBV	Gender-Based Violence
GDP	Gross Domestic Project
GHG	Greenhouse Gas

GIS	Geographic Information System
GRM	Grievance Redress Mechanism
GRS	Grievance Redress Service
HMP	Hydropower Master Plan
HPP	Hydropower Plant
HVIS	Hadejia Valley Irrigation Scheme
ICRC	Infrastructure Concession Regulatory Commission
ICT	Information and Communication Technology
IFC	International Finance Corporation
IFR	Interim Financial Report
IPF	Investment Project Financing
ISF	Irrigation Service Fee
IWRM	Integrated Water Resources Management
KRIS	Kano River Irrigation Scheme
LCBC	Lake Chad Basin Commission
LMP	Labor Management Procedures
M&E	Monitoring and Evaluation
MIGA	Multilateral Investment Guarantee Agency
MOM	Management, Operations, and Maintenance
MRVIS	Middle Rima Valley Irrigation Scheme
NBA	Niger Basin Authority
NDC	Nationally Determined Contribution
NESREA	National Environmental Standards and Regulations Enforcement Agency
NIDP	National Irrigation Development Program
NPV	Net Present Value
NWRI	National Water Resources Institute
O&M	Operation and Maintenance
OHS	Occupational Health and Safety
PAD	Project Appraisal Document
PBC	Performance-Based Condition
PDO	Project Development Objective
PFMU	Project Financial Management Unit
PIU	Project Implementation Unit
PMP	Pest Management Plan
PMU	Project Management Unit
POM	Project Operational Manual
PPP	Public-Private Partnership
PPSD	Project Procurement Strategy for Development
PSC	Project Steering Committee
RAP	Resettlement Action Plan
RBDA	River Basin Development Authority
RPF	Resettlement Policy Framework
SCF	Standard Conversion Factor
SEA	Sexual Exploitation and Abuse
SEP	Stakeholder Engagement Plan
SESA	Strategic Environmental and Social Assessment

SH	Sexual Harassment
SMWA	State Ministry of Women Affairs
SOP	Standard Operating Procedure
SPC	Shadow Price of Carbon
SPIN	Sustainable Power and Irrigation for Nigeria
SPIU	State Project Implementation Unit
SRI	System of Rice Intensification
STEP	Systematic Tracking and Exchanges in Procurement
TRIMING	Transforming Irrigation Management in Nigeria
TU	Technical Unit
VIDA	Village Data Analytics
WRM	Water Resources Management
WUA	Water User Association
WUG	Water User Group

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DATASHEET

BASIC INFORMATION

Project Beneficiary(ies)	Operation Name		
Nigeria	Sustainable Power and Irrigation for Nigeria Project		
Operation ID	Financing Instrument	Environmental and Social Risk Classification	
P179684	Investment Project Financing (IPF)	High	

Financing & Implementation Modalities

[ ] Multiphase Programmatic Approach (MPA)	[ ] Contingent Emergency Response Component (CERC)
[ ] Series of Projects (SOP)	[✓] Fragile State(s)
[✓] Performance-Based Conditions (PBCs)	[ ] Small State(s)
[ ] Financial Intermediaries (FI)	[ ] Fragile within a non-fragile Country
[ ] Project-Based Guarantee	[ ] Conflict
[ ] Deferred Drawdown	[ ] Responding to Natural or Man-made Disaster
[ ] Alternative Procurement Arrangements (APA)	[ ] Hands-on Expanded Implementation Support (HEIS)

Expected Approval Date	Expected Closing Date
26-Sep-2024	31-Dec-2029
Bank/IFC Collaboration	
No	

Proposed Development Objective(s)

The Project Development Objective is to strengthen dam safety and improve management of water resources for hydropower and irrigation in selected areas of Nigeria.

Components

Component Name	Cost (US$)
Institutional strengthening and capacity building for Water Resources Management	30.00
Irrigation Modernization	350.00
Improvements in dam operations and enhancing dam safety	100.00
Project Management	20.00

Organizations

Borrower:	FEDERAL GOVERNMENT OF NIGERIA
Implementing Agency:	Federal Ministry of Water Resources and Sanitation

PROJECT FINANCING DATA (US$, Millions)

Maximizing Finance for Development

Is this an MFD-Enabling Project (MFD-EP)? Yes

Is this project Private Capital Enabling (PCE)? Yes

SUMMARY

Total Operation Cost	**500.00**
Total Financing	**500.00**
of which IBRD/IDA	**500.00**
Financing Gap	**0.00**

DETAILS

World Bank Group Financing

International Development Association (IDA)	500.00
IDA Credit	500.00

IDA Resources (US$, Millions)

	Credit Amount	Grant Amount	SML Amount	Guarantee Amount	Total Amount
National Performance-Based Allocations (PBA)	500.00	0.00	0.00	0.00	500.00
Total	**500.00**	**0.00**	**0.00**	**0.00**	**500.00**

Expected Disbursements (US$, Millions)

WB Fiscal Year	2025	2026	2027	2028	2029	2030
Annual	15.00	40.00	90.00	135.00	155.00	65.00
Cumulative	15.00	55.00	145.00	280.00	435.00	500.00

PRACTICE AREA(S)

Practice Area (Lead)

Water

Contributing Practice Areas

Agriculture and Food; Energy & Extractives

CLIMATE

Climate Change and Disaster Screening

Yes, it has been screened and the results are discussed in the Operation Document

SYSTEMATIC OPERATIONS RISK- RATING TOOL (SORT)

Risk Category	Rating
1. Political and Governance	High
2. Macroeconomic	High

3. Sector Strategies and Policies	Substantial
4. Technical Design of Project or Program	Moderate
5. Institutional Capacity for Implementation and Sustainability	Moderate
6. Fiduciary	Substantial
7. Environment and Social	High
8. Stakeholders	Moderate
9. Overall	Substantial

POLICY COMPLIANCE

Policy

Does the project depart from the CPF in content or in other significant respects?

[ ] Yes [✓] No

Does the project require any waivers of Bank policies?

[ ] Yes [✓] No

ENVIRONMENTAL AND SOCIAL

Environmental and Social Standards Relevance Given its Context at the Time of Appraisal

E & S Standards	Relevance
ESS 1: Assessment and Management of Environmental and Social Risks and Impacts	Relevant
ESS 10: Stakeholder Engagement and Information Disclosure	Relevant
ESS 2: Labor and Working Conditions	Relevant
ESS 3: Resource Efficiency and Pollution Prevention and Management	Relevant
ESS 4: Community Health and Safety	Relevant
ESS 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	Relevant
ESS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	Relevant

ESS 7: Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities	Not Currently Relevant
ESS 8: Cultural Heritage	Relevant
ESS 9: Financial Intermediaries	Not Currently Relevant
NOTE: For further information regarding the World Bank's due diligence assessment of the Project's potential environmental and social risks and impacts, please refer to the Project's Appraisal Environmental and Social Review Summary (ESRS).	

LEGAL

Legal Covenants

Sections and Description
The Recipient shall, not later than three (3) months after the Effective Date, establish and thereafter maintain throughout the implementation of the Project, a Federal Technical Committee, with functions, composition, and resources satisfactory to the Association.
The Recipient shall, not later than three months (3) months after the Effective Date, establish and thereafter maintain throughout the implementation of the Project, three (3) Technical Units ("TUs") specializing in (i) irrigation; (ii) dam safety; and (iii) hydropower, each with functions, composition and resources satisfactory to the Association.
The Recipient shall (a) not later than thirty (30) days after the Effective Date, establish and thereafter maintain an independent dam safety review panel ("Dam Safety Review Panel") comprised of experts having the qualifications, experience and terms of reference acceptable to the Association.
The Recipient, through FMF-FMWRS, shall, not later than thirty (30) days after the Effective Date, prepare, in accordance with terms of reference acceptable to the Association, a Project implementation manual.
The Recipient shall, not later than six (6) months after the Effective Date, engage an independent verification agency, with qualifications and under terms of reference acceptable to the Association, ("Verification Agent").

Conditions

Type	Citation	Description	Financing Source
Effectiveness	Financing Agreement, Article 4.01	The Recipient has established the Project Steering Committee in accordance with the provisions of Section I.A.2 of Schedule 2 to the Financing Agreement, and the Project Steering Committee has held its inaugural meeting.	IBRD/IDA

Disbursement	Financing Agreement, Schedule 2, Section III. B.1 (b)	No withdrawal shall be made for payments to a Participating State under Category (2) until and unless the Recipient and such Participating State has executed the Subsidiary Agreement in accordance with the provisions of Section I.B of Schedule 2 to the Financing Agreement.	IBRD/IDA
Disbursement	Financing Agreement, Schedule 2, Section III. B.1 (c)	No withdrawal shall be made for payments under Category (3) to a Participating State, until and unless such Participating State has: (i) enacted a law establishing or supporting the establishment of WUAs; and (ii) approved an appropriation for the O&M requirements of WUAs.	IBRD/IDA

I. STRATEGIC CONTEXT

A. Country Context

1. **Nigeria, Africa's most populous country and home to the second-largest population living below US$2.15 per day, possesses substantial untapped economic potential yet is one of the least developed nations globally.** Nigeria is among the largest economies in Africa, with a gross domestic product (GDP) of approximately US$363 billion in 2023, but over 40 percent of its population live in poverty.[1] Economic growth over the past decade has not maintained pace with population growth: real income per capita in 2023 was US$2,455, lower than US$2,490 recorded in 2010. Nigeria's key development constraints include the high dependence on oil, insufficient economic diversification and inclusive growth, and a poor scorecard on good governance and service delivery including investments in human capital.[2] As a diverse federation of 36 autonomous states and 220 million people, federal-state coordination is a challenge.[3] Pathways for development include improving economic governance and generating more trust in State institutions, boosting government investments in human capital, expanding social assistance programs to sustain the move away from fuel subsidies, and improving opportunities for the young and entrepreneurial to diversify the economy and invest in inclusive economic growth.

2. **Elections in 2023 brought in a new President and administration committed to improving macroeconomic stability and addressing fiscal and debt vulnerabilities due to low revenues and a dependence on global oil prices.** Macroeconomic stability steadily deteriorated over the past decade leading to an increasing difference between official and parallel market exchange rates, a shortage of foreign exchange, and high inflation. Confronted with a fragile economic reality, the new administration that took office in May 2023 made two critical macro-fiscal reforms: the increase in the price of gasoline or premium motor spirit which was subsidized at a fiscal cost of 2.2 percent of GDP in 2022, and the liberalization of the exchange rate.[4] These policies are expected to help boost revenues from 6.7 percent of GDP in 2022 to 8.6 percent of GDP in 2024. Nonetheless, the fiscal deficit is projected to remain above 3 percent of GDP for 2024-2027. This fiscal outlook limits scope for essential public investments and services and highlights the urgent need to mobilize domestic revenues to shore-up fiscal sustainability and provide funding for government investments in inclusive and sustainable development.

3. **The economic and fiscal outlook continues to be vulnerable to shocks and oil-dependence and to the challenges associated with improving governance of the State.** In recent years, the economy has been hit by the COVID-19 pandemic, a fall in global oil prices, increasing insecurity, and weak domestic oil production. The post-COVID recovery was short-lived with real GDP growth dropping from 3.6 percent in 2021 to 3.1 percent in 2022-2023, due to low oil production, flood-related low agricultural output, and the disruptive currency demonetization policy instituted in Q1-2023. The fiscal space is limited by the need to service debts (101.5 percent of revenues in 2022) and vulnerable to fully realizing the fiscal transfers from the oil and gas sector, thus restricting public investments. Long-standing perceptions of corruption and other governance challenges such as weak institutions and limited transparency and accountability also dampen business sector confidence.

4. **Nigeria is considered as fragile and conflict affected, with most of its regions experiencing violence and disturbance.** The North-East faces insurgency and terrorism, primarily driven by Boko Haram and the Islamic State's West

1 World Bank. 2022. A Better Future for All Nigerians: Nigeria Poverty Assessment 2022. Washington, DC. World Bank. https://openknowledge.worldbank.org/handle/10986/37295
2 See World Bank Systematic Country Diagnostic 2020. https://elibrary.worldbank.org/doi/epdf/10.1596/33347
3 https://www.unfpa.org/data/world-population/NG
4 Subsidies were deducted from gross oil and gas revenues resulting in lower remittance of oil and gas revenues to the Federation.

Africa Province, resulting in the displacement of over two million people. The North-Central and North-West regions are plagued by banditry, identity clashes, communal conflicts, and herder-farmer disputes over land and cattle.

5. **Nigeria's vulnerability to climate shocks has increased due to a combination of political, geographic, and social factors and, specifically, the recent spike in insecurity in the country.** The country is highly prone to climate change-exacerbated river, urban, and coastal floodings; water scarcity; extreme heat; and wildfires. It ranks among the top 10 countries most susceptible to the detrimental effects of climate change and natural disasters.[5] Projected climate change impacts include increased average temperature and changes in precipitation patterns, leading to more frequent floods and droughts. These climate-related risks can have severe implications for livelihoods and result in increased food insecurity, famine, population displacement, conflicts, and biodiversity loss. Moreover, the country hydropower plants' potential can also be affected—both by lower- and higher-than-average river flows. Climate inaction could cost Nigeria between 6 and 30 percent of GDP by 2050, equivalent to a loss of US$100–460 billion.[6]

B. Sectoral and Institutional Context

6. Nigeria faces water security challenges, which affect water availability for drinking water, energy, and food production and are increasingly exacerbated by climate change, putting livelihoods and economic development at risk.

7. **Harnessing the water storage and dam safety is central to climate change adaptation and mitigation in Nigeria.** It is a prerequisite to improving water management for water supply, irrigation, and hydropower generation and offers protection from floods and droughts. Nigeria has over 400 dams and an estimated total combined storage of 59 billion cubic meter (BCM). About 46 percent of dams are federally owned and are managed by the Federal Ministry of Water Resources and Sanitation (FMWRS), through River Basin Development Authorities (RBDAs). About 48 percent of dams are state owned and are managed by a state ministry.[7] Many dams are incomplete, and more than 50 percent of the large dams which were built in the 1970s and 1980s require rehabilitation. This situation is due in part to institutions responsible for dam management, whether at the federal or state level, having inadequate budget, human resources, and capacity to ensure dam management, operation, and maintenance (MOM) and nonadherence to operational manuals, where they exist. As a result, structures and equipment in several instances broke down or functioned below the installed capacity, limiting the dams' potential to mitigate extreme weather events. The World Bank GRADE[8] analysis of the 2022 floods estimated the total direct economic damage to be around US$6.7 billion, equivalent to 1.6 percent of the estimated 2021 GDP. Combining addressing the root causes of poor dam operation and maintenance (O&M) and the rehabilitation and retrofitting of existing dams would offer substantial opportunities to promote and entrench integrated storage management and sustain the provision of productive and climate-resilient water services including mitigating water-related natural disasters including flooding events.[9]

8. **Agriculture remains key in Nigeria's economy, contributing an estimated 25.58 percent[10] of its GDP and employing over 36 percent of the workforce.** However, due to its heavy reliance on rain-fed agriculture, food production is highly vulnerable to climate change-exacerbated droughts and floods. Nigeria is endowed with 70.8 million ha of agricultural land area, broken down into eight agro-ecological zones capable of growing a variety of crops such as cassava, palm oil, cocoa, maize, yam, cowpea, groundnut, beans, potatoes, and rice. Most agricultural areas are rain-fed and

[5] Climate Scorecard 2019. https://www.climatescorecard.org/2018/11/nigeria-listed-as-one-of-the-10-most-climate-vulnerable-countries/.
[6] World Bank Group. 2020. *Country Partnership Framework for the Federal Republic of Nigeria for the Period FY21–FY25*. Report No. 153873-NG. November 16, 2020. *https://openknowledge.worldbank.org/handle/10986/35098.*
[7] Dams in Nigeria, Federal Ministry of Water Resources, 2020.
[8] GRADE = Global Rapid Post-Disaster Damage Estimation.
[9] In 2012 and 2022, devastating floods threatened lives, infrastructure, and livelihoods of people.
[10] Nigeria Bureau of Statistics, May 2023.

therefore exposed to water scarcity, which constrains agricultural production in many areas. Nigeria has a tropical climate, with historically longer rainy season in the south, receiving over 2,000 mm annual precipitation, and shorter rainy season in the north, with annual precipitation of below 1,000 mm. Despite having an estimated 375 BCM of surface water and 156 BCM per year of groundwater potential, water is unevenly distributed, and availability per capita is expected to decline. The yield of food-related crops has lagged population growth, leading to declining food self-sufficiency. This situation is worsened by a decline in seasonal water availability due to climate change. For this reason, agriculture production is increasingly dependent on the supplement water that irrigation provides. Otherwise, the overall crop production will not grow in par with the anticipated population growth to maintain food security at its current level. About 26.5 million Nigerians are projected to be food insecure in 2024.[11] The situation is expected to worsen with the population projected to reach 400 million by 2050.[12]

9. **Increase in food production is a must in Nigeria and can be achieved through improving the performance and management of existing irrigation and expansion of irrigation service area.** Nigeria has set a national target of 500,000 ha of irrigated area by 2030 with the objective of being able to feed the growing population. The country relies largely on federal and state Governments to continue developing large-scale irrigation development, which it sees as the fastest way to reach that target. Presently, out of the 350,000 ha equipped for irrigation, 260,000 ha are large-scale irrigation systems, the majority of which are owned by federal or state governments. The balance 90,000 ha are small-scale irrigation. The institution responsible for MOM of federal- or state-owned dams is also managing downstream irrigation schemes, which are both facing MOM limitations. The National Irrigation Development Program (NIDP), launched by the Federal Government in 2016 and supported by the World Bank-financed Transforming Irrigation Management in Nigeria (TRIMING) Project (P123112, 2014–2025, US$500 million), is part of Nigeria's recent efforts to reform the irrigation sector and improve its governance. The TRIMING Project, which was designed as a pilot under the NIDP, pioneered transformational management initiatives consisting of introducing, training and empowering water user associations (WUAs) as a new model for the MOM of secondary and tertiary irrigation canals in selected federally owned schemes, which were until then the responsibility of the RBDAs. However, RBDAs remain in charge of managing the primary irrigation canals. TRIMING successfully tested the MOM by WUAs as part of the rehabilitation of about 32,000 ha of large-scale irrigation. It led to improved production and positive impacts on the livelihood of farmers. However, more work is needed to further increase overall financial sustainability in the schemes.

10. **Reaching the NIDP target of 500,000 ha irrigation by 2030 will require enhanced cooperation between the Federal Government and all states.** Out of Nigeria's 36 states, 31 expressed interest in cooperating on irrigation development and management with the Federal Government within the Sustainable Power and Irrigation for Nigeria (SPIN Project). Irrigation development and management have historically been divided between federal-owned schemes (38.7 percent), state-owned schemes (42.1 percent), and small-scale schemes with other ownership arrangements (13.3 percent), with no financial or technical cooperation between the parties. In February 2024, the FMWRS invited the 36 state governments and the Federal Capital Territory to present its ambition to scale up and promote WUAs as a management model and the commitment, integrity, and capacity (CIC) related criteria to be supported and asked states to express interest in participating in this effort under the SPIN Project; 31 states expressed their interest. Stakeholders' engagement workshops were organized for each of the six geopolitical zones of Nigeria to explain what is expected of the participating states, including the selection criteria for states, and identify an initial list of possible investments and the time frame for next steps.

11. **Nigeria currently lacks an estimated 2,000 MW of capacity to cover current demand with acceptable reliability.** Hydropower development can play a significant role and can support economic growth and climate change mitigation.

[11] *Cadre Harmonisé analysis* 2023a.
[12] The Lancet Nigeria Commission 2022.

About 60 percent of the Nigerian population had access to electricity in 2021, excluding 85 million people.[13] The national average annual per capita electricity consumption is 147 kWh, which is one-fifth of the average lower-middle-income country consumption. Demand is projected to grow at 7–8 percent per year in the medium term. The total exploitable hydropower potential in Nigeria is estimated at 14,120 MW, of which 85 percent is yet to be developed. Currently, hydropower contributes up to 20 percent of Nigeria's energy mix, and its development would play a big role in the energy access and transition. As thermal plants in the country face gas supply shortages, Nigeria seeks to increase hydropower in its energy mix, along with variable renewable energy technologies such as solar and wind, to lower energy prices and replace or complement thermal plants as a base load power source. Hydropower is therefore a promising part of the country's energy transition journey.

12. **The currently compartmentalized efforts to increase food production through enhanced irrigation coverage and energy generation through hydropower make the attempts of the Government more disjointed highlighting the need for synergistic and holistic management of water resources.** This would require cross-sectoral convergence and interinstitutional collaboration to achieve a water-energy-food nexus.

13. **Relevant policy and institutional and regulatory frameworks exist in Nigeria for the governance of water resources, but they need strengthening.** The 2004 Water Resources Act (the Water Act) is the overarching law governing water resources in Nigeria. It vests in the FMWRS, at the Federal Government level, the responsibility to use and control both surface and groundwater in any water course affecting more than one state.[14] The Water Act confers to the federal minister extensive decision-making powers, which it exercises through 12 RBDAs and other parastatal institutions. The Integrated Water Resources Management (IWRM) Commission, which has the mandate for water resources regulation, exists based on a ministerial directive at the federal level but is not enacted by the Parliament. A comprehensive National Water Resource Bill, combining the Water Act, the RBDA Act, Nigeria Hydrological Services, and the National Water Resources Institute (NWRI), was presented to the Parliament in 2017 but has not been adopted. For dam safety, the National Environmental (Dams and Reservoirs) Regulations, 2014, establishes the National Environmental Standards and Regulations Enforcement Agency (NESREA) as the regulator to control the effects of dams and reservoirs on the environment and human health. However, the dam safety regulations need to be strengthened to increase focus on MOM, with complementary technical guidelines and protocols.

14. **Water resources and water infrastructure management in Nigeria is governed by the FMWRS and other parastatal entities.** The FMWRS is organized into several technical and non-technical departments including the Department of Dams and Reservoir Operations (DDRO), River Basin Operation and Inspectorate, and Department of Irrigation and Drainage (DID). The 12 RBDAs directly report to the FMWRS. Their role includes providing bulk water supply and extension and other support services to farmers in irrigation schemes. At the state level, Departments for Water Resources and/or Agriculture and State Water Agencies are responsible for sector management. In addition, there are state-owned dams being utilized for water supply, hydropower generation, and public irrigation. Some of the states[15] have enacted a legislation to establish irrigation development authorities to identify, plan, design, and construct irrigation schemes including regulation, supervision, operation, and maintenance of irrigation infrastructure for optimal performance and water efficiency. All the states acquired considerable experience by implementing a series of National

[13] About 11 percent of the urban and 74 percent of the rural populations have no electricity access, and 69 percent of those having no access to electricity belong to the lowest income segment of the population. https://trackingsdg7.esmap.org/.
[14] Other Federal legislations include the NWRI Act; River Basins Development Authorities Act, 1987; and Nigeria Hydrological Services Agency (Establishment) Act, 2010.
[15] Katsina State, for example.

Fadama Development Projects (1992–2019) in institutionalizing a bottom-up approach involving community-driven development and farmer-led irrigation development (FLID).

15. **The Federal Government of Nigeria (FGN), through the development of a Hydropower Master Plan (HMP), can increase collaboration between the FMWRS and the Federal Ministry of Power (FMP) and attract private investments and partnerships.** The governance and oversight responsibilities for water resources development and hydropower generation are split between the FMWRS and FMP. Past studies such as the 2013 National Water Resources Master Plan, 2019 Master Plan Study on National Power System Development, and 2016 Nigeria hydropower site screening do not reflect IWRM to optimize both energy and water. Nigeria would benefit from building on these to update its National Power System Development Plan and prepare a dedicated HMP, which could help (a) crowd in private financing to modernize deteriorating hydropower systems, including through public-private partnership (PPP) models; (b) identify and prioritize greenfield and brownfield hydropower investments across the country; and (c) improve coordination among the key stakeholders, including the FMWRS and FMP.

C. Relevance to Higher Level Objectives

16. **The proposed project is aligned with the World Bank Group Country Partnership Framework (CPF) for Nigeria for the period of FY21–FY25 (Report No. 153873-NG).** In particular, the proposed project is closely aligned to the CPF on the following objectives: Core Objective 8 - Increase access to reliable and sustainable power for households and firms; Core Objective 10 - Enhance climatic resilience; and Complementary Priority 6 - Modernize agriculture.

17. **The project is aligned with the Paris Agreement and Nigeria's objectives on climate change.** Nigeria's updated Nationally Determined Contribution (NDC) to the Paris Agreement commits to reduce greenhouse gas (GHG) emissions by 47 percent by 2030 from the 2018 business-as-usual projections, conditional on international support (20 percent reductions without such support).[16] The SPIN Project is consistent with national climate commitments and supports Nigeria's emission reduction and climate change mitigation goals by promoting a more efficient use of water in irrigation, thus reducing energy demand for pumping. It will also contribute to Nigeria's National Adaptation Plan Framework, as it prioritizes dam safety and climate-informed O&M in the rehabilitation of dams, making the communities living downstream of these dams less vulnerable to the risk of dam failures, floods, and water shortages. Moreover, increasing the irrigation sector's water efficiency will enhance the communities' resilience to droughts.

18. **The project is aligned with the FGN's objectives of achieving sustainable energy access for all by 2030.** This will be achieved by ensuring 30 GW of electricity is available by 2030; 30 percent of which is generated from renewable energy sources, with hydropower assisting as a base load to support penetration of other variable renewable energy. It will also help Nigeria meet its updated NDC to mitigate GHG emissions by unconditionally cutting its emissions by 2030 by 20 percent. The FGN aims to achieve 95 percent development of hydropower generation potential from the current 15 percent, leading to the production of up to 10,000 MW of electricity by 2030.

19. **Although public financing remains crucial for the dams and irrigation sectors that primarily serve public purposes, by preparing the master plan and studies, the project will support private capital enabling in hydropower investments.** It will also mobilize private capital through irrigation fees collected by WUAs. Irrigation fees collected from private farmers and WUAs are considered as private capital mobilization for the project to improve the financial sustainability of the sector. In Nigeria, hydropower development relies heavily on public funding due to perceived risks and the absence of a suitable risk-sharing mechanisms and enabling environment for private investors. Private sector participation is primarily limited to O&M through concession agreements, unlike in other countries where state utilities

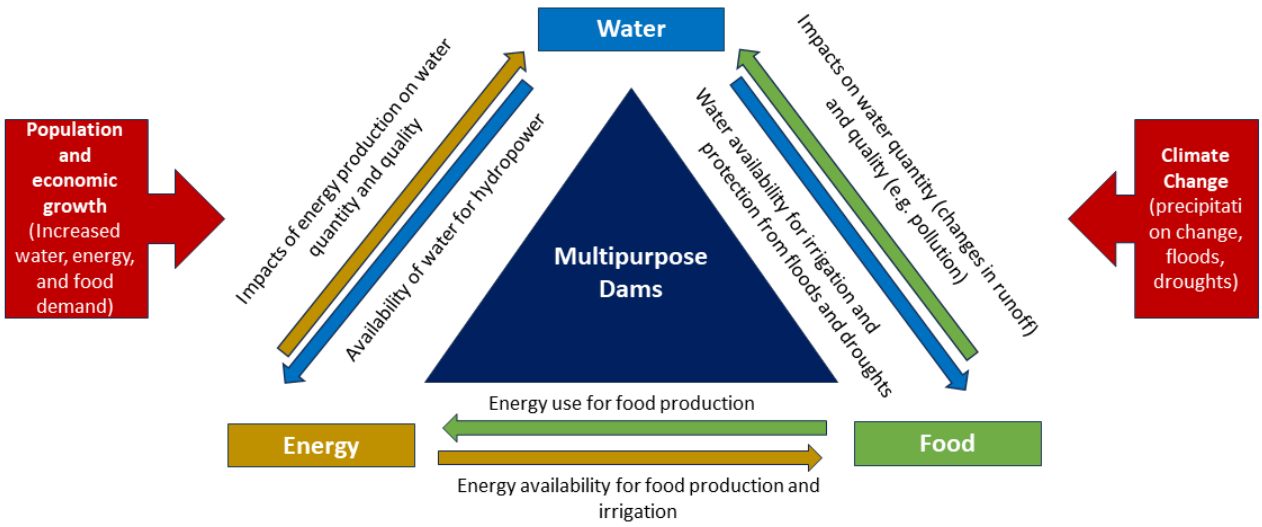
[16] https://unfccc.int/sites/default/files/NDC/2022-06/NDC_File%20Amended%20_11222.pdf.

are responsible for power generation. To attract private investors and reduce the financial burden on the public sector, the project's hydropower subcomponent will help prepare at least one large transformational project that will be identified through the master plan, considering implementation arrangement under PPP model while seeking to resolve some ecosystem challenges that will improve the enabling environment for private sector investment. It will offer transaction advisory services for a build-operate-transfer PPP model. World Bank is collaborating closely with the International Finance Corporation (IFC) with the objective to prepare potential PPPs for hydropower generation. World Bank will also work closely with the Multilateral Investment Guarantee Agency (MIGA).

Vision of the Project

20. Nigeria is on a mission to improve its food, water, and energy security by 2030 with the vision of achieving 500,000 ha of irrigated agriculture through the Irrigate Nigeria Project;[17] 30 GW of sustainable energy; and improved resilience to floods, droughts, and climate change. These objectives are independent and require strengthening the management of water resources and infrastructure across sectors and between levels of government. The vision of the SPIN Project is to make integrated management of water, energy, and food more effective and resilient in Nigeria. The SPIN Project will do this by investing in the management and resilience of multipurpose water infrastructure as well as strengthening the policies, institutions, capacities, and intergovernmental cooperation required. This vision builds on the results achieved under the TRIMING Project and relies on cross-cutting synergies, as shown in Figure 1. Through the above aims, the project will increase the country's resilience to climate change-exacerbated droughts and floods.

Figure 1. The Role of Multipurpose Dams and Irrigation in the Water-Energy-Food Nexus



[17] Irrigate Nigeria Project is a program of the Federal Government aimed at increasing food security through enhanced irrigation development and management to adapt the food production system to the impacts of climate change, for example, erratic rainfall resulting in floods and droughts.

II. PROJECT DESCRIPTION

A. Project Development Objective

PDO Statement

21. The Project Development Objective (PDO) is to strengthen dam safety and improve management of water resources for hydropower and irrigation in selected areas of Nigeria.

PDO Level Indicators

Strengthen dam safety

(a) People protected from floods and droughts through enhanced dam safety and operations (Number)

Improve management of water resources for hydropower and irrigation in selected areas of Nigeria

(b) Federal and state irrigation schemes under the Project managed by a functioning WUA[18] (Percentage)
(c) Area provided with new/improved irrigation or drainage services (Hectare)
(d) Hydropower master plan prepared, and a PPP transaction structured for a hydropower project jointly by FMWRS and FMP (Yes/No)

B. Project Components

Figure 2. Current challenge which SPIN is aiming to address

Present Challenge	SPIN Vision
Irrigation for food security	
Limited Federal-State cooperation for irrigation development and management to drive FGN target of 500k ha irrigation by 2030	**State-Federal cooperation** value demonstrated through development and management of **40,000 ha irrigation** across Nigeria **feeding 900,000 people**
Centralized, **inadequate** irrigation **O&M and cost-recovery** by RBDAs	**Participatory O&M, cost-recovery** through **WUA** establishment and **RBDA-State cooperation**
No WUA legal recognition Major policy bottleneck	**Water Law updated in all SPIN States**
Dam safety	
Absence of comprehensive dam safety protocols or guidelines Major policy bottleneck	**National dam safety protocols and guidelines** developed, adopted and implemented
Dams status unknown	Screening complete for all large dams and **people protected through prioritized rehabilitation**
Hydropower planning	
No strategy or systematic **FMWRS-FMP collaboration** for Hydropower development Major policy bottleneck	**National Hydropower Masterplan** jointly prepared and adopted
Lack of public or private investment in Hydropower	At least one priority **hydropower project prepared for PPP**

[18] A functioning WUA is defined as legally established, staffed, funded and operating irrigation services.

22. **SPIN is structured as an Investment Project Financing (IPF).** It includes two performance-based conditions (PBCs) to incentivize legislation of enabling policies and building of long-term capacity. The project has four components. Figure 2 presents the current challenges and the transformational changes which the project will promote.

Component 1: Institutional Strengthening and Capacity Building for Water Resources Management (US$30 million)

23. **This component supports policy, institutions, and regulation at the federal, state, and river basin levels and collaboration among irrigation, dam safety, and hydropower stakeholders to promote IWRM and help achieve the food-water-energy nexus in Nigeria.** The component will institutionalize and scale up the implementation structure, processes, and design standards successfully piloted by the TRIMING Project while integrating lessons learned. It will, among others, (a) strengthen regulation; (b) bundle irrigation rehabilitation and dam safety of related dams; (c) introduce criteria-based funding allocation and prioritize investments in bundled irrigation and dam safety under the project; (d) promote and institutionalize collaborative water resources management (WRM); and (e) strengthen integrated hydropower planning. The component will support three institutional reforms: (a) the FMWRS will develop and adopt national dam safety guidelines and protocols, which will be implemented in all SPIN target dams; (b) water laws will be developed or updated to legally recognize WUAs in all SPIN participating states; and (c) FMWRS and FMP will jointly develop the HMP and prepare at least one priority hydropower project. This component is structured into three subcomponents.

Subcomponent 1.1: Institutional Strengthening and Capacity Building for WRM and Hydropower Planning at Federal Level (US$24 million)

Activity 1.1.1: Strengthening of dam safety institutional structure, including development and adoption of improved dam safety technical guidelines and manuals (US$4 million)

24. **This activity will strengthen the capacity and improve the management framework for dam owners, operators, and agencies overseeing dam safety to help address dam safety risks** by (a) setting up a digital dam asset management system; (b) strengthening the dam safety institutional structure and developing improved national dam safety technical guidelines and manuals to complement NESREA's checklist; and (c) institutionalizing capacity assessment and delivering capacity building for the personnel involved in dam safety, including policy makers, owners, operators, and dam safety organizations at the Federal, RBDA, and at dam site levels. It will help the FMWRS deploy multidisciplinary specialists and purchase necessary equipment to perform dam safety mandates both at the federal and RBDA level, consistent with the legislation for dam safety requirements.

25. **The development and adoption of national dam safety technical guidelines and manuals by the FMWRS is designed as a PBC**. The allocation of US$50 million out of the US$100 million allocation for dam safety investments under Component 3 is linked to the achievement of the PBC. This will incentivize technical guidelines and manuals to be developed, adopted, and applied to the rehabilitated large dams under SPIN.

Activity 1.1.2: Capacity Building of and Support to Federal Institutions and Agencies on Water Resources and Irrigation Management (US$4 million)

26. **This activity will establish and operationalize a new framework for the co-management of federal irrigation and drainage schemes with the state governments and WUAs.** This activity sets the basis for the sustainability of the irrigation investments under Component 2. Currently, federal schemes are developed, managed, operated, and maintained entirely by RBDAs[19] and, similarly, state schemes are managed by state agencies. The new framework will empower the WUAs (to

[19] Except schemes under the TRIMING Project where WUAs have been established.

be established through Subcomponent 2.1) with MOM responsibility of secondary and tertiary irrigation canals. The MOM responsibility of primary canals will remain with federal and state governments owning the schemes. This framework requires a new collaboration between federal and state levels and with WUAs. The states enact legislation to establish WUAs for both federal and state schemes in the state, as piloted under TRIMING in Katsina and Gombe States. This framework also requires new partnerships between RBDAs and WUAs to optimize the use of irrigation infrastructure, ensure the sustainability of irrigation schemes, and make farmers more resilient to extreme weather events.

27. **This activity will also implement capacity building of federal agencies on irrigation modernization, water accounting and irrigation monitoring system,[20] and a nationwide review of the status of irrigation schemes.** Improved water monitoring and management systems support climate change adaptation by mitigating the impacts on agriculture and farmers' livelihoods of precipitation variability and water extremes, exacerbated by climate change.

Activity 1.1.3: Capacity Building of and Support to Federal Institutions and Agencies in Hydropower Development (US$16 million)

28. **This activity will support convergence between the FMP and FMWRS through a joint HMP, and feasibility study and relevant Environmental and Social (E&S) instruments for at least one prioritized project and ensure alignment with the water resources master plan**. This activity will (a) prepare an HMP and climate-smart hydropower investment planning; (b) explore PPP options and prepare at least one large transformative hydropower project; and (c) build the capacity of and support federal institutions in developing studies, strategies, and plans for improving hydropower planning and management. The activities contribute to both climate change adaptation (through improved inter-sectoral planning of water storage and management) and mitigation (through renewable energy).

29. **A PBC is linked to the adoption of the HMP by the Project Steering Committee (PSC) and the preparation of one priority hydropower project ready for PPP.** The eligibility of US$10 million out of the US$16 million of this subcomponent will be dependent on achievement of these (detailed in the Results Framework and Annex 4).

Subcomponent 1.2: Institutional Strengthening and National Knowledge Exchange on Water Resources Management at State Level (US$1 million)

30. **This subcomponent will support the participating states to develop and adopt legislation to establish WUAs for participatory irrigation management at the scheme level.** There are currently only two states[21] with legislation in place supporting the WUAs. To incentivize the states to adopt such provisions, the adoption of a legislation for WUAs and the provision of a dedicated state budget line to finance irrigation MOM through WUAs are the two eligibility criteria for a state to get financial support for irrigation rehabilitation under Component 2. To support this process, this subcomponent will provide technical support in the formulation of legislation to establish WUAs, based on experience from other countries, through development of models and organization of national workshops and establish a knowledge exchange and peer-to-peer learning platform between states on irrigation, the role of water infrastructure in climate change adaptation, and disaster risk reduction and WRM.

31. **The transfer of appropriate level of MOM of irrigation schemes from RBDA to WUAs is necessary to address the build, neglect, and rebuild cycle irrigation development is facing in Nigeria.** Over time, RBDAs lost both adequate budgetary provisions and human resources for irrigation MOM, leading to a growing number of schemes becoming dysfunctional. Federal subventions are not sufficient, and user contributions are almost nonexistent. TRIMING addressed

[20] In coordination with the Water Security and Governance Dialogue ASA (P178444).
[21] Gombe State and Katsina State.

this by introducing service agreements, whereby, in return for improved service, users pay a cost-reflective contribution called irrigation service fee (ISF) and organize themselves in WUAs to take up MOM of secondary and tertiary irrigation canals. The SPIN Project builds on early lessons from TRIMING.

Subcomponent 1.3: Improving WRM at River Basin Level (US$5 million)

32. **The SPIN Project will support RBDAs and state actors in refocusing their efforts on IWRM and resource planning at the river basin level and in enabling partnerships with WUAs for MOM of irrigation and drainage facilities.** This subcomponent will (a) improve MOM of water resources' infrastructural assets to increase the resilience to climate change of downstream communities, including climate change-exacerbated droughts and floods; (b) strengthen hydrological monitoring, water allocation, and WRM at the basin level through the installation of modern tools for the management of reservoirs; (c) strengthen capacity for bulk water supply planning and irrigation scheduling at the scheme level to ensure farmers receive water when and where needed; and (d) enhance cost recovery for MOM of assets through supply of bulk water for various socioeconomic sectors, in particular irrigation schemes. The strengthening of bulk water supply planning and monitoring, also prioritizes environmental flow, together with the enhanced cost recovery, promotes improved water conservation and resource sustainability. While Subcomponent 1.2 supports state water legislations, SPIN will also facilitate the revision of the RBDA Act to introduce legal recognition of WUAs and cooperation on WRM among states sharing a river basin.

33. **To support such a decentralized management model, a field-level leadership (FLL) program will be established by the federal government to support RBDAs, state governments, and WUAs,** for performance improvements. The FLL will include a leadership program for women focused on enhancing women's technical and leadership skills in irrigation management and preparing women for managerial roles, enabling them to make decisions that affect women farmers.

34. **The implementation of activities in support of RBDAs will be in close collaboration with the Department of River Basin Operations and Inspectorate of the FMWRS.** A technical working group will be established within the Department of River Basin Operations and Inspectorate, involving technical persons from RBDAs to support centralized activities. RBDAs will increase stakeholder participation in planning and complaint redress.

Component 2: Irrigation Modernization (US$350 million)

35. Component 2 will support the rehabilitation and revitalization of 40,000 ha of irrigated command area, through a comprehensive modernization program combining improving irrigation and drainage infrastructure while implementing the policy, institutional, and regulatory reforms presented in Component 1. While potential investments sites were pre-identified across all geopolitical zones (Figure 3), the federal and state schemes[22] which will be supported by the SPIN Project will be determined based on technical and implementation readiness criteria agreed with the FMWRS, as shown in Figure 4 (and detailed in Annex 2). Component 2 is structured into three subcomponents.

[22] Hereinafter, federal-financed schemes are referred as Model 1 and state-financed schemes are referred as Model 2.

Figure 3. Location of Potential Irrigation Schemes under SPIN and Irrigation Schemes Rehabilitated under the TRIMING Project

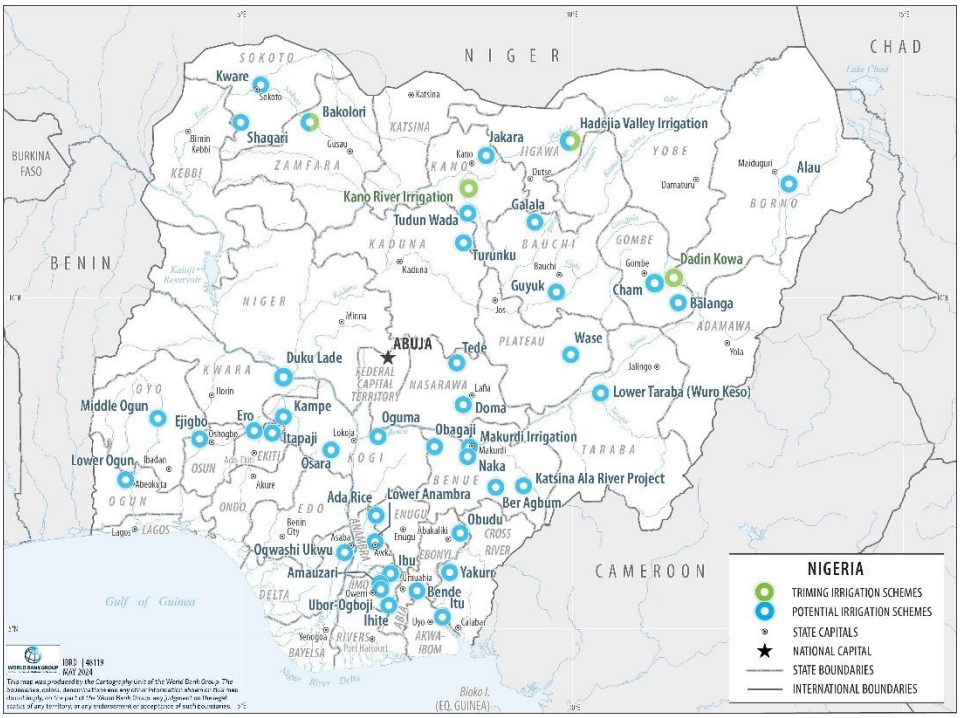


Figure 4. Selection Criteria for Irrigation Investments

DEMONSTRATED COMMITMENT CRITERIA

1. Availability of laws or Passage of legislation recognizing formation and functions of Water User Associations (WUAs) in the irrigation and drainage sub-sector

2. Commitment to support WUAs to maintain, operate and manage tertiary canals and other farm level infrastructures on both federal/RBDA and states schemes

3. Appropriation and release of counterpart funds as follows:

SPIN model 1 states minimum of NGN 200 mil

SPIN model 2 states minimum of NGN 500 mil

(The final amount of the CF is subject to review of scheme requirement)

TECHNICAL READINESS CRITERIA

1. Existing schemes requiring rehabilitation and potential for expansion for maximum leveraging of sunk cost;
2. Availability of feasibility study reports;
3. Availability of suitable land/soil;
4. Size 500 ha/scheme or above to avoid fragmentation;
5. Reliable water resources without creating major conflict to other users and uses;
6. Farmer occupier land tenure system preferred; and
7. Not involving significant resettlement, with no to only minor land acquisition in connection with irrigation infrastructure required;

IMPLEMENTATION & DISBURSEMENT READINESS CRITERIA

1. Commitment to Project Security
2. Competitive recruitment of qualified project staff
3. Institutional set up e.g. office accommodation
4. Authorized Signatories (ASL) and opening of Accounts
5. Signing of the Subsidiary Loan Agreement with FMoF
6. World Bank Assessment: E&S, Fiduciary Capacity
7. Any Demonstrated Commitment Criteria not already met at entry

Subcomponent 2.1: Mobilization and Development of Water User Associations (WUAs) (US$20 million)

36. **This subcomponent will support the creation of WUAs in all irrigation schemes under the project and will provide capacity building.** Building on the achievements of the TRIMING Project, it will focus on organizing farmers sharing

tertiary irrigation and drainage canals in water user groups (WUGs), which will constitute the building blocks for establishing WUAs to manage secondary and tertiary irrigation canals. The project will actively promote women's leadership and appointment at decision-making roles in WUAs by promoting inclusive internal operational procedures. The subcomponent will build the capacity of WUAs to undertake their primary responsibilities: maintaining the secondary- and field-level water conveyance system, facilitating crop planning, estimating water requirements, ensuring equitable and sustainable irrigation scheduling and delivering irrigation services to members, and fixing and collecting irrigation and drainage service fees from members to recover the MOM costs to help them sustainably manage the water conveyance system. The WUA establishment and their capacity building on WRM will enable farmers to have direct responsibility of the MOM and improve their adaptive capacity to water variability and climate change impacts. Moreover, well-maintained irrigation and drainage systems contribute to mitigating the effects of both floods and droughts. The implementation of Subcomponent 2.1 will be done by the Federal Project Management Unit (FPMU) in close collaboration with RBDAs and states. The daily coordination of WUA activities and oversight will be taken up by the state governments through the desk offices of the RBDAs reporting to the national desk office of the FMWRS The FPMU, RBDAs and States will set up a dedicated WUA unit leveraging the existing national RBDA desk offices, as part of the bulk water supply to provide facilitation support to WUAs at all levels. The activities of this subcomponent are further detailed in Annex 2.

Subcomponent 2.2: Irrigation and Drainage Infrastructure Investments (US$320 million)

37. **This subcomponent will support the rehabilitation and upgrading of water distribution and conveyance systems aimed at increasing the irrigation command area, strengthening farmers' resilience to climate hazards such as droughts (through delivery of stored water) and floods (through drainage), minimizing conveyance losses, and improving the reliability and timely delivery of irrigation and drainage services.** The urgency of these upgrades is significantly affected by the impacts of climate change on the assets' economic lifetimes. This subcomponent will finance (a) studies and/or design reviews of irrigation schemes; (b) based on approved technical design, preparation of relevant Environmental and Social Framework (ESF) instruments, including Environmental and Social Impact Assessments (ESIAs), Environmental and Social Management Plans (ESMPs), and Resettlement Action Plans (RAPs) as required, and monitoring of their implementation; (c) rehabilitation of irrigation and drainage civil works; (d) associated engineering supervision; and (e) installation of critical canal monitoring system. Water resources for majority of schemes to be rehabilitated would be supplied by existing dams. Rehabilitation of these existing dams are covered under Component 3.

Subcomponent 2.3: Irrigation Management Modernization (US$10 million)

38. **The aim of the subcomponent is to operationalize energy efficient management tools, information and communication technology (ICT) equipment, and management information systems to make the irrigation infrastructure deliver reliable, accountable, and sustainable irrigation and drainage services.** This subcomponent will (a) develop a comprehensive irrigation management system to track the condition of canal assets for optimizing maintenance and investment planning; (b) establish water accounting systems, incorporating enhanced use of climate-related data to monitor water availability, formulation of service delivery standards, and establishment of service regulations; and (c) establish benchmarking systems of service delivery and performance assessment of the participating irrigation systems. Such activities pertain to basin/sub-basin planning, water accounting, and data-driven allocation decisions across multiple uses and multiple schemes. Energy efficiency design of such systems will be promoted, and the procured ICT equipment will be aligned with the international standards on energy efficiency, such as Energy Star certification, with improvement compared to the country benchmark. These activities will be implemented in parallel and in correspondence with the construction works (rehabilitation or expansion) financed under Subcomponent 2.2 so that the rehabilitated or newly constructed infrastructure is handed over to the WUAs and scheme operator from the contractor in a progressive manner.

39. **This subcomponent will also promote climate-resilient water management strategies and change irrigation management strategies to reduce climate vulnerabilities (for example, irrigation schedules) and improve water and energy efficiency of the rehabilitated systems.** The energy efficiency of the irrigation schemes will be ensured as investments will be on gravity irrigation, and when pumps are necessary, solar pumps will be installed. The resilience of the communities to water-related disasters such as drought and flood will also be strengthened through the operationalization of the irrigation monitoring systems. Moreover, the irrigation management modernization will improve the quality of service provided by the operator. Key performance indicators will be defined among RBDAs and WUAs on the performance satisfaction of the service provided against the water delivery plan.

Component 3: Improvements in dam operations and enhancing dam safety (US$100 million)

40. **This component will strengthen the dam safety management system in the country and will rehabilitate and improve the safety of prioritized dams and associated appurtenances.** The project will not finance the construction of any new dam. Planned activities are not intended to alter the original schemes, change their nature, or expand dam extents to make them appear as new or different schemes. Priority will be given to select dams that provide downstream irrigation services to the schemes which will be identified under Component 2. The safety of dams is key to climate adaptation by ensuring water delivery for water supply, hydropower, ecosystem conservation, and irrigation to mitigate droughts; protecting against dam break flooding; and storing excess water to mitigate floods following high precipitation.

41. This component will (a) conduct a Dam Safety Portfolio Risk Assessment Exercise including establishing and implementing a risk indexing screening method for dams in Nigeria and selecting dams for rehabilitation works; (b) prepare an Emergency Action Plan (EAP) and an O&M manual, including operational protocols, dam health monitoring and reporting protocols, and an instrumentation plan for dam safety—the EAP will include safety protocols that address safety concerns specific to women and persons with disabilities; (c) perform rehabilitation works including measures for seepage reduction, hydrological and structural safety measures, strengthening of main dam body and foundation, and improvement and operationalization of basic dam facilities and dam safety instruments; (d) prepare and implement sediment management plans, through bathymetric surveys and feasibility studies, piloting of institutional models, and plans for treatment of upstream drainage catchments with construction of sediment-retaining check dams and river bank protection structures; and (e) apply nature-based solutions to dam/reservoir operation and management such as the use of natural flood plains for flood risk reduction, and improved sedimentation management practices through improved operation and mitigation of adverse land use practices within the catchment. Details on the activities are in Annex 3.

Component 4: Project Management (US$20 million)

42. **The main objective of this component is to effectively implement, monitor, and evaluate project activities.** It involves establishing the FPMU and Technical Units (TUs) at the federal level and State Project Implementing Units for the state irrigation schemes to oversee and coordinate project implementation, as well as setting up a monitoring and evaluation (M&E) system to assess the project activities and their impact. Component 4 will also support the establishment of the PSC and Technical Steering Committee for the project, with ministerial representations from the FMWRS, FMP, and other relevant agencies. The component includes financing for consultancies, trainings, materials, office equipment, and operating costs.

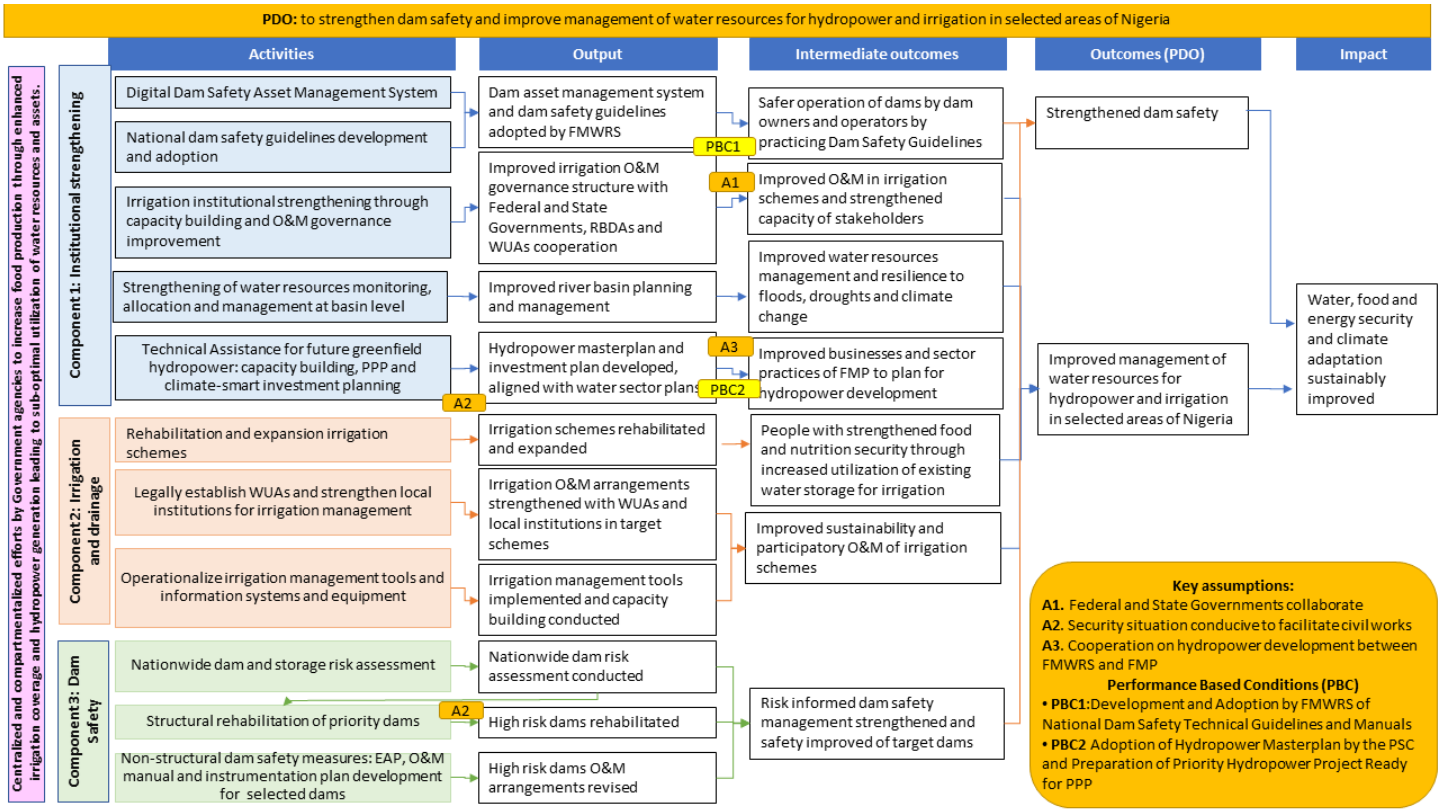
C. Project Beneficiaries

43. **Around 950,000 Nigerians will directly benefit from more reliable, climate-resilient, and efficient irrigation water supply and increased agricultural productivity through improved irrigation water management.** Direct beneficiaries (950,000) will include (a) consumers getting more food as a result of the improved irrigation system; (b)

households, farmers, and livestock breeders, benefiting from improved water storage, supply, and irrigation services; and (c) all institutional staff who will be directly involved in project activities and/or who will benefit from training. Thousands of farmers will have access to rehabilitated irrigation and drainage services in the zones of command of rehabilitated dams. Institutional beneficiaries include government agencies (FMWRS, FMP, RBDAs, and state agencies) and WUAs. Additional indirect beneficiaries will include (a) downstream households protected by improvement of dam safety; (b) the population involved in agricultural and pastoral value chains; (c) personnel of the institutions involved in project activities; and (d) consultants and employees of the companies involved in project construction and consultancy activities.

D. Results Chain

Figure 5. Theory of Change



E. Rationale for World Bank Involvement and Role of Partners

44. **The Government of Nigeria is in the middle of implementing the flagship NIDP (2016–2030),** with an ambitious target of developing 500,000 ha of land under irrigation by 2030. So far, the achievements stand at 350,000 ha (2023) equipped, many of which became dysfunctional due to lack of means for MOM. The World Bank has demonstrated experience in supporting the establishment of irrigation management models, which, combined with rehabilitation funds, allow bringing irrigation schemes back to their full production potential. TRIMING has demonstrated the proof of concept of WUAs in Nigeria, which the SPIN Project is bringing to the next level. The World Bank's worldwide experience and convening power allows facilitating greater coordination, institutionalization of the financing framework, oversight, and monitoring, as well as tackling the challenges of adaptations to climate risks and mitigating vulnerabilities due to climate change. The ongoing excellent partnership between the Government of Nigeria and the World Bank ensures high-impact interventions in the sector.

45. **The World Bank is recognized for supporting dam safety and management improvement, including in federal states**, for instance, it supported the Dam Rehabilitation and Improvement Projects in India. It also had valuable expertise and experience supporting client countries improve IWRM and optimize water resource allocation for climate resilience and economic and environmental benefits.

46. **The World Bank brings experience and lessons learned from hydropower projects both in and outside West Africa.** Most notably within West Africa is the recent Nachtigal Hydropower Project in Cameroon, which was developed on a PPP model with World Bank Group support. The World Bank has extensive experience of partnerships with technical and financial institutions, including on complex dam construction and safety aspects, and in structuring complex and innovative PPPs, building on a one World Bank Group approach that combines private investments with IFC support and risks mitigation guarantees and products proposed by MIGA.

F. Lessons Learned and Reflected in the Project Design

47. The preparation and design of the SPIN Project drew on international, regional, and in-country experiences of similar irrigation programs using participatory irrigation management, by the World Bank and other development partners. The main lessons and experiences that have been incorporated in the design of the SPIN Project include the following:

(a) **State governments.** As the second tier of the Nigerian Government, state governments need to be incorporated in the implementation arrangement. State governments have considerable experience in FLID and livelihood support for irrigated agriculture in Nigeria, as implemented by Agro-Climatic Resilience in Semi-Arid Landscapes Project. They have a direct interest in ensuring that irrigation schemes perform to their full potential and are best placed to support WUAs and apex WUAs during and after the project period.

(b) **The farmer institution model of WUA and Apex WUA to be scaled up.** One of the key lessons emerging from the TRIMING project is the need for WUAs to be strengthened as inclusive, self-managed, and accountable institutions of farmers. The TRIMING Project showcased a successful three-tier farmer institution model—WUGs, WUAs, and Apex WUA—registered under state/federal law, taking over from RBDAs the MOM of secondary and tertiary level canals, thereby institutionalizing participatory irrigation and drainage management. The SPIN Project will adapt the WUA knowledge package/`WUA tool kit' to scale up and strengthen the model.

(c) **Water conveyance improvements in formal irrigation schemes can catalyze substantial FLID activities leading to additional beneficiaries**. In TRIMING, around 10,000 ha was estimated as additional areas brought under production by farmers who invested private capital on land preparation and to abstract water from rehabilitated canals using pumps for upland farming. The SPIN Project will consider -where potential exists- increasing carrying capacity of irrigation and drainage facilities to accommodate potential FLID to avoid conflicts between irrigators in formal schemes and FLID farmers.

(d) **RBDA institutional capacity to undertake mandated roles to be enhanced.** RBDAs need organizational development and human resource capacity support to perform their mandated institutional functions of improving the O&M of head works and bulk water supply in federal schemes. RBDAs are also required to support state governments in the technical and oversight roles of state irrigation assets.

(e) **Internalizing systems, procedures, and processes within the FMWRS and FMP a prerequisite for sustainability.** It is important to internalize and institutionalize capacities within the Directorates of FMWRS and Directorates of FMP to sustain development efforts, process improvements, and performance of

investments initiated under World Bank-supported projects. The SPIN Project design incorporates setting up project management teams within the top management structure and technical facilitation arrangements embedded within the technical departments of the FMWRS and FMP.

III. IMPLEMENTATION ARRANGEMENTS

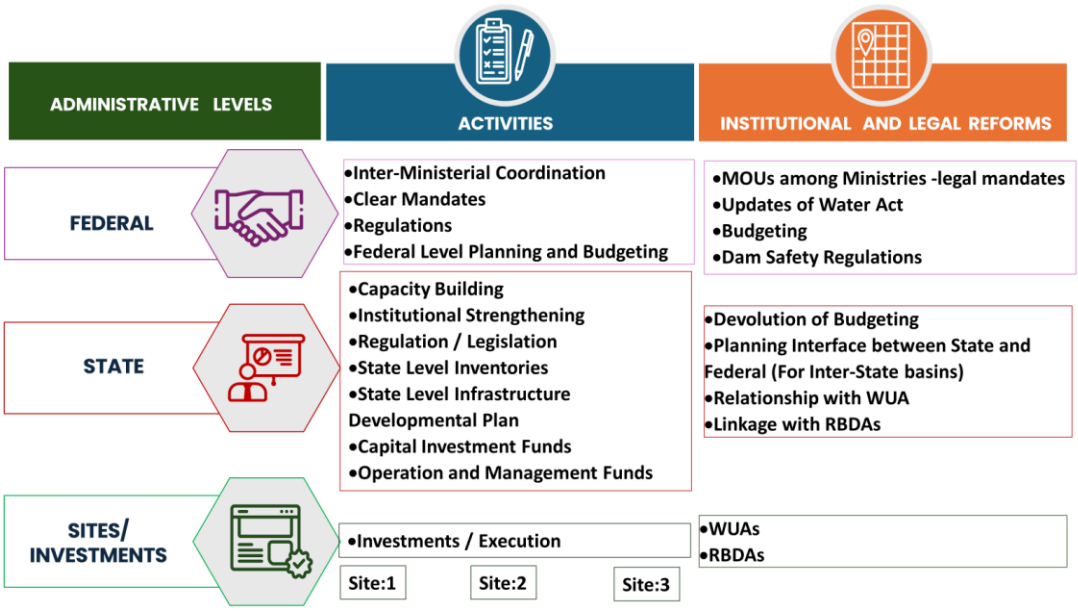
A. Institutional and Implementation Arrangements

48. **The FMWRS is the lead implementing ministry for the project, in collaboration with the FMP and participating state government.** Given the administrative structure, as defined by the constitution of Nigeria, the project will be executed through the federal and state governments. The project implementation arrangements are to strengthen the roles, responsibilities, and accountabilities of the administrative structure of the country and aim to reform the devolution and institutionalization of the water sector architecture. An interministerial PSC will be set up with the mandate of discussing the overall project direction, and concurring on project outputs for World Bank's no objection. The PSC will consist of the FMWRS, FMP, Federal Ministry of Finance (FMF), Federal Ministry of Agriculture and Food Security (FMAFS), Federal Ministry of Environment (FMEnv), Federal Ministry of Budget and Economic Planning, and commissioners of water resources and agriculture in participating states, and any other relevant ministries, departments, and agencies, as further detailed in the Project Implementation Manual**.** The PSC will be mandated to meet at least once every six months and will be chaired by the Minister of FMWRS and co-chaired by the Minister of FMP. The Permanent Secretary of the FMWRS will be the Secretary of the PSC. Establishment of the PSC and holding the first meeting will be an effectiveness condition for the project. The Federal Technical Committee (FTC) will provide overall technical guidance. The FTC will be chaired by the Permanent Secretary of the FMWRS and will include Directors of Irrigation and Drainage, Dams and Reservoir Operations (DRO), River Basin Operations and Inspectorate of the FMWRS, Director of Renewable and Rural Power Access of the FMP, relevant Directors from FMAFS and FMEnv, and FMF, and Managing Directors from participating RBDAs. The National Project Coordinator for the project will be the secretary of the FTC. The mapping of project activities and institutional reforms across the administrative structure of Nigeria is shown in Figure 6 and is consistent with the WRM responsibilities mandated to them.

49. **The FMWRS will set up an FPMU staffed with competent multi-disciplinary experts from both the FMWRS and FMP fully dedicated to managing the project.** The FPMU will be lean, with only responsibility for coordination, fiduciary, that is, procurement and financial management (FM), M&E, and environmental and social management. For Model 1[23], State Focal teams appointed by State Governments will be part of the Project Management Unit (PMU). The technical arm of the FPMU will be handled by Technical Units (TUs) hosted in the Departments of Irrigation and Drainage and DRO of the FMWRS and the Department of Renewable and Rural Power Access of the FMP. The appointed experts from the Infrastructure Concession Regulatory Commission (ICRC) and the Bureau of Public Enterprises (BPEs) will be part of the Hydropower TU in the Department of Renewable and Rural Power Access of the FMP to support operationalization of the PPP action plan and other activities around private sector participation in hydropower development. The TUs will be responsible for preparing terms of reference for technical consultants, specifications, lead evaluations of technical proposals, and other technical documents required for the project's implementation.

[23] See Annex 2 paragraph 2 for details on Model 1 and 2 design.

Figure 6. Mapping of Project Activities and Reforms across Administrative Levels



50. The FPMU, with expert staff from the FMWRS and FMP, shall be the principal implementing and coordination agency for the project, and a single Designated (Special) Account under the administrative management of the FPMU will therefore be established there. The FPMU will be responsible for putting in place the required FM infrastructure with adequate staff to manage the Designated (Special) Account and withdraw funds from the Credit through replenishment of the account and through direct payments. The project-established implementation units correspond to the administrative levels and are shown in Figure 1.2 in Annex 1.

51. **Project components, subcomponents, and activities will be implemented through relevant departments of the FMWRS and FMP, RBDAs and participating states.** SPIN Model 1 states will sign a memorandum of understanding with respective RBDAs in their states, while subsidiary agreements will be signed with states implementing SPIN Model 2. A robust annual joint work programming process will be facilitated by the FPMU and State Project Implementation Unit (SPIU).

52. **State selection, prioritization, and staging criteria.** The Project's geographic coverage will be nationwide; however, states' participation is subject to expression of interest and compliance with the eligibility and readiness criteria agreed for the project. To date, 31 states drawn from all the six geopolitical zones of Nigeria have submitted documentation expressing interest to participate in the project. The FMWRS and World Bank will use the documentation to jointly assess interested states and group them into Category 1 and Category 2 states[24]. For both categories, states would be assessed against a set of demonstrated CIC criteria as described in Annex 2. This is to inform transparent decisions on state selection. Only states that have met the demonstrated commitment criteria will progress for assessment of technical readiness. Passing both the demonstrated commitment and technical readiness criteria is mandatory for admission into the SPIN Project. The number of states to be admitted into this phase of SPIN would depend on the availability of funds.

[24] Category 1 states would represent all states opting for SPIN Model 1 and Category 2 states represent states opting for SPIN Model 2. See Annex 2 paragraph 2 for details on Model 1 and Model 2.

B. Results Monitoring and Evaluation Arrangements

53. **The FMWRS/FPMU will monitor all component activities and send progress reports in a form and substance satisfactory to the World Bank.** As needed, to review progress and address issues that may arise, the FMWRS/FPMU will convene meetings with relevant stakeholders, including the FMF, FMP, RBDAs, and participating state governments. Following the project Results Framework, monitoring results and outcomes will be reported in the project progress reports. The in-house M&E capacity of the FMWRS/FPMU will be developed for data collection and processing, integration of M&E data and findings, and coordination with the private sector. Participating companies will have their own environmental and social management systems per the specifications set in the Project Implementation Manual.

54. **The World Bank will provide implementation support to the project over its lifetime and regularly monitor its results and outcomes to evaluate achievement of the PDO and implementation performance.** Also, a midterm review will be conducted within two years after the start of project implementation to assess project performance and ensure that lessons learned are considered in implementation over the remaining period.

C. Sustainability

55. **The project builds on the lessons of the NIDP of the Federal Government and the World Bank-financed TRIMING Project, reflecting in the project design concerted activities that focus on sustainability of institutions and investments in public irrigation assets.** The project will focus on institutional and financial sustainability at the WUA level by (a) building the capacity and skills of user/farmer members to manage their own institutions and graduate to higher-level federated arrangements; (b) managing O&M of assets devolved to them through the recovery of user fees and building systems for demanding collection and accounting of member dues; and (c) ensuring legal recognition, oversight, and provision of organization umbrella through legislation and anchorage by the state governments including assured supply of bulk water and technical assistance from RBDAs. The sustainability of the implementation model will be ensured through reliance on existing government structures at the federal level through convergence among the FMWRS, FMP, and other relevant ministries as well as involvement of ministries, departments, and agencies at the state level for implementation. The project design consists of PBCs with clearly defined results including co-funding and budget provisions both at the federal and state levels including system building and human resource provisions for technical support. The investments at the public water resource assets level for rehabilitation of irrigation assets and hydropower assets will be triggered through PBCs. The investments for dam safety have been coupled with dam safety guidelines, international standards, operational protocols, and so on for ensuring sustainability of public assets rehabilitated. Sustainability of public investments are ensured through optimal utilization of the storage available and safety and security of the structures. Overall, the existing institutional structures will be organizationally supported at the federal and state levels to ensure the continuation of the processes and institutional reform put in place by the project focusing on building partnership among farmers and the public and private sector to synergize the development outcomes in both the irrigation and hydropower sub-sectors.

IV. PROJECT APPRAISAL SUMMARY

A. Technical, Economic and Financial Analysis

Economic and Financial Analysis

56. The project will produce economic benefits for existing and new water users by providing a new or improved service. This service will be made available through the proposed investments in irrigation rehabilitation and upgrading

(Component 2) and rehabilitation of existing dam structures and related facilities (Component 3). The detailed economic and financial analysis (EFA), including sensitivity analyses, are provided in Annex 5.

57. An economic analysis based on avoided costs carried out to assess the project's economic viability shows that the project is economically viable even without any consideration of environmental externalities. The project's economic internal rate of return and net present value (NPV) are calculated using a standard cost-benefit methodology. The economic evaluation is confined to the project activities for which an economic value can be identified and measured. The overall preliminary result obtained from the three analyzed schemes being implemented under the TRIMING Project would justify the proposed SPIN Project investment, as it shows an economic rate of return (ERR) of 16.7 percent and an NPV of US$ 488.4 million (with 6 percent as discount rate). The Standard Conversion Factor (SCF) used for valuing the shadow value of costs and benefits for the economic analysis was 0.815, while 0.7 was used for the shadow cost of labor.

Technical Analysis

58. **The project has been technically designed to address the most pressing challenges in the safety and maintenance of dams in Nigeria,** including rehabilitation of priority assets and strengthening of MOM and surveillance. Proposed interventions for each dam under Component 3 will be based on the results of a sound and resilient design in line with international good practices, and the execution of works will be supervised by qualified engineers, supported by the consulting service. A total of 15 priority dams have been identified by the DDRO of the FMWRS. Three of these dams have been reviewed by the dam safety review panel (DSRP). Their comments are being integrated in their Report and Project Screening Template.

59. **As per World Bank Dam Safety Good Practice Notes guidelines, Construction Supervision and Quality Assurance Plans will be prepared before tender processes for rehabilitation works.** The MOM, Emergency Preparedness Plans and other relevant E&S instruments will be prepared before starting the rehabilitation works (including a specific section for dam operation and flood management during the works). Instrumentation plans will be integrated into the MOM plan. Dam break analysis will be performed for all selected dams under the project, to prepare associated dam safety plans commensurate with the risk and as per the World Bank Dam Safety Good Practice Notes and Templates.

60. **The project will strengthen the risk management process for the whole national dam portfolio.** Dam owners in the nation, led by the FMWRS DDRO, have commenced preparation of assessment tools for the dam safety portfolio risk management exercise to prioritize rehabilitation works of the 180 large dams in the nation. The activity will be completed as part of the dam safety rehabilitation exercise under Component 3. Moreover, the FMWRS DDRO has started to consider a list of guidelines required for dam safety. The FMWRS DDRO will commence drafting these guidelines and will complete them as part of the activities under Component 1.

61. **To address the institutional aspects, the project will support the DDRO and RBDAs of the FMWRS and state governments to be selected by enhancing their managerial and operational skills for dam safety.** The maturity matrices will be conducted for agencies to be selected for dam safety. The maturity matrices exercise will cover different elements of the project in terms of dam safety such as governance, training, surveillance, dam maintenance, and emergency preparedness. The exercise will be prepared for the dam owners and operators in Nigeria to provide a structured approach to (a) assess the effectiveness of the dam safety project activities against the program of the DDRO/RBDAs; (b) identify and prioritize areas for improvement based on the portfolio risk management exercise discussed above; (c) compare the performance of the project activities over time; (d) inform the prioritization of resources for dam safety improvement; and (e) communicate the effectiveness of the dam safety program to wider audiences. Progress for each dam, depending on its risk category, will be tracked regularly with updated matrices.

62. **The irrigation infrastructures to be rehabilitated or extended are irrigation perimeters with total water control, mainly gravity fed.** As presented in Annex 2, the irrigation schemes will be selected through a selection process. Feasibility studies and some detailed designs are available for 16 irrigation schemes with the total irrigation area of 53,550 ha. Review of the design and preparation of tender documents will start soon after the scheme selection is completed and relevant E&S instruments are prepared.

63. **To further strengthen policy dialogue and joint planning of WRM among major stakeholders, the project will ensure joint implementation of project activities**. At the federal government level, HMP and feasibility study of priority hydropower projects by FMP will be coordinated to ensure its harmonization with existing water resources master plan of FMWRS. At the basin level, RBDA's bulk water allocation exercise will ensure periodic dialogue among RBDA, WUAs and state government to ensure accountability and improvement of monitoring of service performance at basin level.

64. **The operation is aligned with the goals of the Paris Agreement and presents climate-co-benefits** on both mitigation and adaptation.

65. **Assessment and reduction of adaptation risks.** The main climate risks likely to have a material impact on the operation (including assets and services) and its PDO are extreme heat, droughts, and floods. The project design considers these climate risks and aims to mitigate them through (a) integration of climate change considerations in HMP to determine requirements at the national scale to adopt to it in the sector; (b) rehabilitation of priority dams selected through the Dam Safety Portfolio Risk Assessment Exercise under Component 3, including installing instruments for monitoring the status of dams, measuring the quantity and quality of water resources (on-site and upstream), and/or supporting early warning systems to improve the dam's capacity to reduce flood risks and provide water storage during droughts; and (c) reinforcing of dams to protect infrastructure and beneficiaries downstream during flood events, including through the improved EAPs for each of the target dams. The project will rehabilitate irrigated perimeters for agriculture to enhance resilience to climate change-exacerbated droughts/water shortages and floods/waterlogging to improve food security. Further, the development of upstream and downstream services around the rehabilitated dams will bolster farmers' and other users' resilience to extreme water-related weather events, improving water availability and promoting efficient water use. All infrastructure activities will follow the guidelines of dam safety developed under Subcomponent 1.1. These will be aligned with the Resilient Water Infrastructure Design Brief[25] to ensure that the infrastructure itself is able to withstand climate change-exacerbated floods, and droughts. With these risk mitigation efforts in place, the residual risk of climate hazards having a material impact on the project is Low.

66. **Assessment and reduction of mitigation risks.** All project activities are universally aligned, and the project is at 'Low Risk' of having a negative impact on the country's low GHG emissions development pathways. There is no lock-in risk, as the hydropower dams to be rehabilitated/restored were impounded a long time ago (and therefore will have relatively low GHG emission now). Moreover, the project will support gravity-fed irrigation and replace diesel pumps with solar-powered pumps, leading to emissions reductions. No additional water storage will be created, as the activities focus on the rehabilitation and restoration of priority dams and will not include new impoundments. Fish production/value chain activities are outside the project's scope, so the associated mitigation risks have not been included in the project assessment. SPIN will not promote expansion into areas of high carbon stocks, areas of high biodiversity, lead to significant conversion of natural habitat, or involve land use change that is likely to reduce carbon stocks. The Food and Agriculture Organization's Ex-Ante Carbon Balance Tool (EX-ACT) was used to estimate the project's net GHG emissions. The project's net GHG emissions[26] over its economic lifetime (5 years of implementation and 15 years for capitalization) are estimated to be 1,167,470 tCO_2eq, translating to average annual emissions reduction of 58,374 tCO_2eq. Total emissions under the

[25] https://documents1.worldbank.org/curated/en/868981599035366969/pdf/Resilient-Water-Infrastructure-Design-Brief.pdf.
[26] Ex ante GHG accounting carried out using EX-ACT, quantifying the net carbon balance as tCO_2eq.

'with project' scenario are 3,267,284 tCO_2eq while in the 'without project' scenario they are 4,434,755 tCO_2eq. Reduction in emissions resulted from changes in land use/farmland expansion, higher irrigation water use efficiency, and increase in rice yields per ha, with the only increase in emission emanating from more urea use in one of the subprojects. Overall, there is a net reduction of emissions by about 25 percent relative to a business-as-usual scenario. These results will be updated once the subproject details are finalized with the appropriate agencies.

67. **Climate Change Adaptation and Mitigation.** The project has a strong focus on promoting climate change adaptation and mitigation. Component 1 supports (a) the strengthening of dam institutional structure and dam safety guidelines and manuals integrating the risks of climate change-exacerbated weather events; (b) the strengthening of government agencies to monitor and manage irrigation systems to provide reliable water services to farmers; and (c) the development of HMP and of at least one priority hydropower project. Component 2 supports investments in irrigation rehabilitation and the establishment of WUAs and will contribute to protect farmers against climate change-exacerbated water extreme events, as well as mitigate GHG emission by implementing gravity schemes and solar-powered pumps. Component 3 will support investments in essential river channel works and maintenance in the abovementioned basins to (a) protect communities against damages from flooding caused by high dam spillway discharges; (b) mitigate the impacts of droughts on farmers and agriculture through improved water storage management; (c) support ecosystem protection by ensuring environmental flows and sustainable reservoir management; and (d) mitigate impacts on downstream riparian communities due to the reduction of dry season river flows from water abstraction for existing irrigation schemes served by the dams with improved reservoir capacity to the original level. Moreover, procurement of ICT equipment within the project will be aligned with the international standards such as Energy Star certification on energy efficiency, with substantial improvement compared to the country benchmark.

B. Fiduciary

(i) Financial Management

68. **The FM arrangement of the FMWRS under the existing TRIMING Project was assessed to determine its acceptability and provide reasonable assurance that project funds will be used economically and efficiently for the intended purposes.** The FM arrangement for the FMWRS under the SPIN Project will model the same arrangements of the TRIMING Project, which strongly rely on the country systems and are highly homogenous with several other projects within the Nigeria portfolio. However, adequate mitigating measures will be applied to ensure that risks are lowered, and FM performance is strengthened. The Federal Project Financial Management Department (FPFMD) at the federal level and Project Financial Management Unit (PFMU) at the state level are responsible for providing FM functions and Designated Account management for all World Bank-financed projects implemented at the federal and state ministries, departments, and agencies. The FPFMD and PFMUs shall be responsible for deploying FM staff to the FPMU and Project Implementation Units (PIUs), oversight of the project's financial and reporting arrangements, and the funds management in all project management and implementing units. The FPMU will have FM staff from the FPFMD and shall be the principal implementing unit for the project. The SPIU will have FM staff from PFMU.

69. **The overall FM risk for the SPIN Project is assessed as Substantial**. The assessment of the control risks reveals that the FMWRS needs to strengthen its internal control systems and employ timely resolution of key issues arising from fiduciary reviews. To mitigate these risks, the FMWRS must review and update its Financial Procedure Manuals to ensure that control mechanisms put in place are suitable for the SPIN Project, while FM implementation support will be consistent with a risk-based approach to promptly address issues that may arise during project implementation. In addition, due to the current macroeconomic condition of the operating environment, the project work plans and budgets may be exposed to transactional risks arising from persistent and sizeable Foreign Exchange (FX) rate premiums, which could lead to

significant cost variations during project implementation. To mitigate possible insufficiency of annual budgets resulting from cost variation, the annual work plans and budgets will be reviewed and updated quarterly by the budget committee of the FPMU to ensure timely identification of cost variances.

70. With respect to project implementation at the state level, government agencies operating manual systems of accounting have the risk of reporting financial transactions inadequately and generating financial reports that may not be of acceptable quality. To mitigate this, the agencies must ensure that computerized accounting systems are introduced, and participating states will be provided adequate training in World Bank fund flow and disbursement procedures for their designated project FM staff.

(ii) Procurement

71. **Procurement for the federal-level interventions (including the irrigation schemes following the SPIN Model 1) will be conducted by the SPIN FPMU to be constituted for the implementation, leveraging the already existing capacity from the TRIMING Project**, with the technical inputs and support from the TUs, that is, DID, DDRO, RBDA of the FMWRS, and Department of Renewable and Rural Power Access under the FMP. The FPMU will have two procurement officers headed by qualified government procurement officers. However, where needed, an individual procurement consultant may be engaged. The procurements for the state-level interventions (including the irrigation schemes following the SPIN Model 2) will be conducted by the SPIUs to be established under the State Ministry of Water Resources or Agriculture. The FPMU has extensive experience in conducting World Bank-financed procurements, and it is fully staffed in procurement. Procurement for the project will be carried out following: (a) the World Bank Procurement Regulations for IPF Borrowers, dated September 2023; (b) Guidelines on Preventing and Combating Fraud and Corruption in Projects Financed by IBRD Loans and IDA Credits and Grants, dated October 15, 2006, and revised in January 2011 and as of July 2016; and (c) other provisions stipulated in the Financing Agreements.

72. **The procurement risk of the project has been assessed as Substantial.** This is mainly based on not knowing the participating states at this stage of the project, their procurement scope under the project, and the procurement and contract management capacity of the state-level PIUs. Other identified risks are delay in procurement and contract implementation; vulnerability of the implementing agencies to effectively manage the fraud and corruption issues; poor procurement record management; capacity constraint in some of the states in conducting the procurement and contract management effectively following the World Bank Procurement Regulations; difficulty in monitoring large number of civil works across different geographic locations resulting delay in contract implementation, safeguard issues, and poor quality of works; and shortage of service providers/contractors/suppliers in some of the States due to the fragility, conflict, and violence situation. Procurement risks will be mitigated by engaging skilled procurement staff/specialist in each of the SPIUs; starting the identified procurement activities (advance procurement) early; providing hands-on expanded implementation support by the World Bank to the low-capacity states to conduct their major procurement activities; closely monitoring progress through the Procurement Plan and contract implementation plan; providing extensive procurement and contract management training in the initial phase of the project[27]; using the World Bank's online procurement planning and management portal, Systematic Tracking of Exchanges in Procurement (STEP), to manage procurement activities and store important procurement documents; conducting awareness training to combat fraud and corruption; increasing the use of electronic procurement systems and data disclosure such as beneficial ownership information; using an experienced supervision consulting firm to supervise implementation of the major civil works across the country; conducting early market sounding to encourage bidders to participate in the procurement process; identifying fit-for-purpose procurement approach based on the situation on the ground; and so on. For the state participation,

[27] Subject to the request from the Borrower and approval from the World Bank

assessment of the procurement capacity and risk of the SPIUs will be carried out as and when the states are selected, and appropriate procurement risk mitigation measures and fit-for-purpose procurement approaches will be incorporated in the project.

C. Legal Operational Policies

Legal Operational Policies	Triggered?
Projects on International Waterways OP 7.50	Yes
Projects in Disputed Area OP 7.60	No

73. The Government of Nigeria has sent a notification to all riparian countries through the Niger Basin Authority (NBA) and the Lake Chad Basin Commission (LCBC). Both the NBA and LCBC have replied with 'No Objection' authorizing the SPIN Project to proceed.

D. Environmental and Social

74. **The project involves the rehabilitation of existing dams and their associated structures, technical studies (including Environmental and Social Assessments) for potential hydropower investments, sedimentation management, rehabilitation of underutilized irrigation schemes, and expansion to irrigable areas within the existing schemes.** The project spans various states with varying geographical conditions and environmental and social sensitivities, making environmental and social considerations a high risk. The FMWRS has proposed about 10 to 20 dams (categorized as medium to large dams, earth-filled with multipurpose use) that will potentially be rehabilitated, but the exact dams and their safety status are not yet known. The SPIN Project will strengthen the capacity and improve the management framework for dam owners, operators, and agencies overseeing dam safety to help address dam safety risks of selected project dams. The project will help develop comprehensive dam safety guidelines consisting of standards, operational manuals, and rules to help dam owners and operators to improve their capacity of dam operation and maintenance and emergency preparedness and comply with dam safety requirements of the World Bank. Other interventions will include measures for seepage reduction, hydrological and structural safety, strengthening of the main dam body and foundation, and improving of basic dam facilities and safety instruments for storing water for potable supply, irrigation, and power generation. The project will also involve rehabilitation and expansion of around 15 existing irrigation schemes with the total irrigation service area of 40,000 ha. Works would include designing and retrofitting infrastructure for efficient water use, modernizing gravity systems, installing canal monitoring tools, and developing new conveyance infrastructures. In addition, the project will prepare hydropower master plan and feasibility study and ESIA of one prioritized yet unidentified hydropower project.

75. **Potential environmental and social risks associated with the rehabilitation of dam and irrigation schemes** include dam failure; issues related to mainly construction-related activities, which include dust due to earth movement and construction debris/waste; wastewater discharges including stormwater runoff from disturbed areas; siltation in the dam without effective sediment management resulting in the issue of dam safety; flooding; and thus, impacts at the downstream population. Other risks are occupational health and safety (OHS) of workers which include physical hazards, slips and falls, work at height and moving machinery, community health and safety issues, grievance because of poor implementation of the interventions, compensation (where it becomes relevant), inadequate dam O&M, emergency preparedness, and potential dam failure. Poor stakeholder engagements can also affect the project if stakeholders are not

adequately consulted. The project is implemented in fragile, conflict-affected, and volatile settings, making security risk level equally high. The capacity of staff to implement environmental and social measures at the state levels varies across states and will be strengthened through the ESF technical support that will be provided under Component 4.

76. **Other social issues may include minor land acquisition and temporary loss of livelihood during the rehabilitation of the existing irrigation schemes.** Minor land take may also be required during civil works to provide campsites, construction yards and working areas. However, upon completion of the rehabilitation, the land will need to be redistributed among the original farmers who were affected. Experience from the TRIMING Project indicates that the land tenure system differs from scheme to scheme. Land ownership in the scheme is acquired through several approaches, including the farmer occupier system, the family inheritance system, the purchase of land, the user allocation system, the sharecropping system, the re-leasing of leased land (commercial farms), gifts, and loan arrangements. During implementation, detailed stakeholder engagement is critical, specifically on the land tenure/ownership structures at each scheme/project site to understand the land relations and ownership in and around the scheme. The specific subprojects are not yet selected, at this stage of project preparation. Therefore, the Client prepared a Resettlement Policy Framework, which spells out the key objectives and principles of the policy and will give guidance for the preparation of subsequent RAPs. It will be important, therefore, that site-special RAPs and feasibility study that will be prepared for the hydropower investment also provide information on the legal status of farmers' rights, the typology of land tenure arrangements that exist, any discernable trends in land markets and values, landlessness, and any potential concerns relating to tenure insecurity or conflict over land that may result from or pose a risk for project implementation. Specific attention will be given to payment of appropriate compensation to affected persons that will be indicated in the RAPs and the development of grievance redress mechanism (GRM) at the community level that will be accessible to all stakeholders as well as arrangements for monitoring the implementation of RAPs. In addition, robust assessments of other potential social impacts related to land tenure and use will be conducted as part of the ESIA process at each of the project sites.

77. **To understand the potential environmental and social risks and impacts of the potential subprojects for dam and irrigation rehabilitation, the client undertook initial due diligence assessments (ESDDs[28]) of three potential sites.[29]** These ESDDs reviewed the level of proposed work to be carried out and the impact on environmental and social sensitivities. For the three reviewed sites, environmental and social impactswere determined to be mainly localized and mostly related to OHS and community health and safety and, in one case, potential livelihood and legacy issues. For all irrigation and dam sites selected under the SPIN Project, environmental and social assessments and plans will be carried out through dam safety review panel visits. Thereafter, ESDDs or environmental and social audit for all subproject dams will be conducted to identify any liability, legacy issues, how cumulative impacts were considered for the dam construction and operation model, environmental flow, and the risk category. ESDDs or environmental and social audit will also include dam safety assessments, site-specific environmental and social assessments, environmental and social specific plans, including resettlement and livelihood restoration plans where needed, and adequate consultations will be undertaken (including for downstream communities). The World Bank will clear all ESDDs and the assessment of the risk profile. Where it has been described as low to moderate risks, a standard ESMP with relevant guidelines will be prepared and implemented. All subprojects categorized as Substantial to High risk will undergo a detailed ESIA.

78. **During the implementation of the project, dam rehabilitation plans will be developed to include structural and nonstructural measures identified through investigative studies, including systematic hydrological assessment, stability analysis, geotechnical studies, and geophysical and bathymetric surveys.** The dam safety plans will also include dam

[28] Environmental and Social Due Diligence

[29] Doma Irrigation/Dam (large) in Nasarawa State, Naka Irrigation/Dam in Benue State, and Wuro Keso retention pond (also known as Gassol) for Lower Taraba Irrigation in Taraba State.

safety instrumentation plans, emergency action plans, a Flood Forecasting and Warning System for Dam Operations (FFWSDO), and integrated reservoir operations, including streamflow forecasting for climate-resilient dam management, as well as an O&M plan. The dam sites will ensure the security and safety of personnel.

79. **As the precise scope and design of proposed activities are not yet selected at appraisal, the project employed a framework approach and has prepared an Environmental and Social Management Framework (ESMF) that provides, among others, the detailed procedures for environmental and social screening of proposed activities/ subprojects and suggests generic mitigation measures**. The ESMF, which was disclosed in-country on July 30, 2024 and on the World Bank's external website on August 1, 2024, further lays down the procedures for screening that will lead to the preparation of further environmental and social instruments for addressing the identified impacts and risks. TheESMF also includes preparation, approval, and monitoring protocols to track ESMPs and provides institutional capacity-building approaches for the project staff to effectively manage the requirements of environmental and social implementation as set out in the ESMF/ESMPs.

80. **Other documents have also been prepared by the Borrower, including the Resettlement Policy Framework, Labor Management Procedures (LMP), and Pest Management Plan (PMP), which will guide the preparation of site-specific documents**. The prepared Stakeholder Engagement Plan (SEP) will support and guide effective stakeholder engagement. The strategy outlines systems and processes to ensure stakeholders and the public participate actively in all project design and implementation aspects. All ESF documents have been disclosed in-country and on the World Bank's external website. The Resettlement Policy Framework (RPF), LMP, SEP, PMP and the Environmental and Social Commitment Plan (ESCP) were disclosed in-country on July 30, 2024, and on the World Bank's external website (July 26, 2024, for the ESCP and SEP, August 1, 2024, for the ESMF, August 19, 2024, for the PMP and RPF and August 20,2024 for the LMP).

81. **The ESMPs/ESIAs will specify the types of plans that need to be prepared as required under each applicable ESS**. These may include Biodiversity Management Plans, Waste Management Plans, Cultural Heritage Management Plans, Labor Management Procedures, Dam Safety Management Plan, and OHS Plans. In addition to these plans, Environmental, Social, Health and Safety and Sexual Exploitation and Abuse/Sexual Harassment (SEA/SH)-related provisions will be included in the bid documents. The ESCP, Security Management Plans and SEA/SH Action Plans will also be prepared.

82. **For the HMP that will be financed by the project, the client will prepare due diligence assessments** including a Strategic Environmental and Social Assessment (SESA) during the implementation phase to systematically examine the environmental and social risks/impacts and issues associated with the Government's policies, plans, or programs in the water resources and power sector for now and in the future. At later stages, individual projects identified under the master plan would be subject to site-specific full assessments such as ESIAs or RAPs (where relevant). The ESIA will be used to address impacts associated with the HMP such as downstream water quality, biodiversity loss, and fish migrations.

83. **Implementation of environmental and social requirements.** The ESCP prepared by the Borrower and the World Bank covers the material measures and actions required for the project to achieve compliance with the Environmental and Social Standards (ESSs) over a specified time frame and responsibilities. The SPIN Project will be implemented through two models, with Model 1 implemented by the FPMU in federal-financed schemes that are under the RBDAs, and Model 2 implemented by the states through the SPIUs. Regardless of the model employed, all SPIUs and RBDAs will engage qualified environmental, social, and gender/gender-based violence (GBV) officer, and security focal points. SPIUs will require qualified environmental/OHS officers from the State Ministry of Environment, social officers from the Department of Lands and gender/GBV officers from the State Ministry of Women Affairs (SMWA) to be deployed as PIU officers no later than one month after effectiveness. Security focal points shall be appointed by state security advisers across the

participating states no later than three months after effectiveness. Through its Component 4, the project will provide ESF training to officers, including leveraging training provided under existing projects.

84. **Gender social inclusion and citizen engagement.** The project is aligned with the World Bank Group's Gender Strategy and commitments in terms of citizen engagement and disability inclusion. Women's role is increasingly being recognized globally as crucial to sustainable water management. At the local or informal level in Nigeria, the contribution of women to water resources development, management, and use, as well as the need for their involvement, has also long been recognized. Nigeria signed the United Nations 2030 Agenda for Sustainable Development (A/RES/70/1) and its Sustainable Development Goals in 2017 and its targets related to gender and water.[30] The project aims to empower women in water management through various activities such as strengthening their representation and leadership in water institutions, supporting female farmer organizations, and promoting women's entrepreneurship and ensuring gender-equitable disaster risk management. The project will prioritize and support the representation of women in key decision-making roles in water management, strengthening the results and efforts made under the TRIMING Project. It will thereby focus on expanding women's decision-making role in WUAs beyond just membership by supporting women's promotion to managerial positions. The irrigation schemes often do not have established WUAs, and thus no women in decision-making position on water resources management. SPIN will scale-up to other irrigation schemes the effort conducted in TRIMING schemes, where female WUA members accounted for around 6 percent of the total, and women representation in WUA executive roles was promoted and achieved around 14 percent representation. Through Component 1, the project will provide an FLL program targeted at women to enhance their technical and leadership skills to prepare them for decision-making roles in government agencies and formally established WUAs. Through Component 2, the project will actively promote women's leadership and appointment at decision-making managerial roles in WUAs by developing internal operational procedures that remove barriers for women, such as gender-equitable promotion policies, women quotas, and flexible work hours for women to accommodate their needs associated with their domestic tasks.

85. **Citizen engagement is integrated into the project design through various citizen engagement mechanisms, including consultations with project beneficiaries and satisfaction surveys.** An SEP has been prepared and disclosed which provides procedures and plans for engaging with the multiple stakeholders under this Project. It also informs the consultation processes throughout project implementation to ensure high participation. As part of the preparation of the SESA, high-level stakeholders across the regulatory and sector-specific Government institutions, Non-Governmental Organizations, Civil Society Organizations, Private Sector organizations will be consulted. This approach in consultations will also be employed throughout project implementation to discuss project implementation issues and provide a platform to articulate and address concerns about the Project. Beneficiaries' feedback, specifically on the rehabilitation of the irrigation services, functionality of the WUAs, implementing agencies' performance will be collected through focus group discussions, surveys, and citizen report cards (leveraging on the experience from the TRIMING Project) and used to inform the implementation of project interventions and will thereby allow for any needed course correction and include a process to close the feedback loop with project stakeholders. Moreover, a project-specific GRM will be designed to allow affected stakeholders to submit grievances and seek redress when they perceive that a negative impact has arisen from the project interventions. The GRM will be designed in consultation with relevant government and nongovernment stakeholders. It will establish accessible processes to submit complaints and clear procedures from investigation to resolution and feedback. The GRM will include the provision for appeal if aggrieved parties are dissatisfied with the outcome. A

[30] Target 5.5 of Goal 5 specifically requested member countries to realize women's active participation in decision-making at all levels of economic, political, and public areas; strengthen sound policies and legislations to encourage gender parity; and empower girls and women (Target 5.c). Target 6.4 of Goal 6 directed member countries to improve water-use efficiency and significantly decrease the number of people (including women) affected by water scarcity. Target 6.b on the other hand mandated member states to progress water and sanitation management by strengthening the participation of local communities (including women) (United Nations 2016).

communication campaign will be implemented aiming at raising awareness and informing stakeholders on how to use the GRM and explaining the investigation and resolution sequential process, timeline, and procedures. The GRM will include GBV redress procedures to ensure that any allegations of SEA/SH in the project-financed activities are handled safely and ethically. The project will also develop a plan to facilitate accessibility for persons with disabilities. Targeted outreach and communication campaigns will be conducted to sensitize the community on project activities and timelines, emergency plans and early warning systems, GRM channels for effective complaint resolution, and to encourage participation in project activities.

V. GRIEVANCE REDRESS SERVICES

86. **Grievance redress.** Communities and individuals who believe that they are adversely affected by a project supported by the World Bank may submit complaints to existing project-level grievance mechanisms or the World Bank's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address project-related concerns. Project affected communities and individuals may submit their complaint to the World Bank's independent Accountability Mechanism (AM). The AM houses the Inspection Panel, which determines whether harm occurred, or could occur, as a result of World Bank non-compliance with its policies and procedures, and the Dispute Resolution Service, which provides communities and borrowers with the opportunity to address complaints through dispute resolution. Complaints may be submitted to the AM at any time after concerns have been brought directly to the attention of World Bank Management and after Management has been given an opportunity to respond. For information on how to submit complaints to the World Bank's GRS, please visit http://www.worldbank.org/GRS. For information on how to submit complaints to the World Bank's AM, please visit https://accountability.worldbank.org.

VI. KEY RISKS

87. **Overall risk rating of the project is rated Substantial,** due to high Political and Governance, Macroeconomics, and Environmental and Social risks, as well as substantial Sector Strategies and Policies and Fiduciary risks.

88. **Political and Governance risk is rated High.** The political and governance risks are high given the nature of Nigerian federalism, with high levels of state autonomy. The recent Supreme Court of Nigeria decision emphasized the political and financial autonomy of local governments. This is not expected to impact the project and the respective roles and commitment of the state and local governments as the water resources management is conducted along the hydrological boundaries and not political ones. Security concerns in northern Nigeria, such as banditry and kidnapping, further affect foreign investment and is closely monitored. Access to irrigation, water, and hydropower is a political issue with broad support and extensive stakeholder engagement, including citizen representatives, ensures buy-in at all levels, with ongoing engagement throughout project preparation.

89. **Macroeconomic risk is rated High.** The outlook for Nigeria's growth is uncertain and dependent on external factors and the government's policy response to longstanding issues which could affect the project. Though the government has made some key policy response that could impact the outlook, the impact of these reforms is yet to be seen. The World Bank will continue to monitor the macro-economic outlook and support the government through other interventions. The reforms that are supported under the Reforms for Economic Stabilization to Enable Transformation Development Policy Financing and the Accelerating Revenue Mobilization Reforms Program are designed strengthen Nigeria's macro-economic policy framework and to increase revenue, which should mitigate fiscal pressures over the medium-term

90. **Sector Strategies and Policy risk is rated Substantial.** Although these strategies and policies generally meet adequate standards and undergo regular reviews, further strengthening is necessary to ensure close alignment with parallel policies in agriculture, bulk water supply, hydropower generation, and irrigation use. The National Water Policy and Nigeria's National Renewable Energy and Energy Efficiency Policy serve as pivotal frameworks for coordinating and implementing various policies and legislation in the sector. However, effective coordination between the FMP and FMWRS is crucial, especially when addressing challenges related to large water infrastructures, such as hydropower generation and dam safety. Strengthening coordination, integrating policies across sectors, and adhering to international best practices will drive comprehensive implementation of these policies and strategies, leading to the maximization of multiple benefits derived from water utilization in the country.

91. **Fiduciary risk is rated Substantial.** Key risks in FM for the SPIN intervention include potential misuse of funds, fraud, political interference, high personnel turnover, delayed financial reporting, and noncompliance with fiduciary requirements. To address these risks, a robust action plan and implementation support will be put in place. The project will build on the existing FM arrangements managed by the FPFMD at the Federal level, which have been deemed adequate. These arrangements ensure efficient fund utilization, accurate reporting, asset safeguarding, and independent audits. The FPFMD, under the Office of Accountant General of the FGN, has a proven track record in managing World Bank-financed projects. Additionally, the SPIN Project will leverage key elements of FM arrangements, including a comprehensive Financial Procedures Manual, computerized accounting system, trained staff, segregation of duties, robust control environment, independent internal auditors, alignment with the Government's FM system, and lessons learned from previous implementations.

92. **Environmental and Social risk is rated High.** Potential key risks include issues associated with community health and safety, particularly in the event of dam failure, labor-related risks encompassing OHS issues and SEA/SH issues, security risks that can be exacerbated by project activities pollution of water resources and the ecology, air quality impact, land use impacts, including issues related to land acquisition; temporary loss of livelihood for farmers and water users during rehabilitation works; and inadequate compensation, complaints and grievances, poor stakeholder engagements, and the possibility of displacements. To effectively manage and address these risks, the project will undertake comprehensive assessments and align its frameworks with the ESF to ensure compliance with international standards.

VII. RESULTS FRAMEWORK AND MONITORING

PDO Indicators by PDO Outcomes

Baseline	Period 1	Period 2	Period 3	Period 4	Closing Period
Strengthen Dam Safety					
People protected from floods and droughts through enhanced dam safety and operations (Number)					
Jan/2025	Dec/2025	Dec/2026	Dec/2027	Dec/2028	Dec/2029
0	0	20,000	50,000	100,000	150,000
Improved Management of Water Resources for Hydropower and Irrigation in selected areas of Nigeria					
Share of Federal and State irrigation schemes under the Project managed by a functioning WUA (Percentage)					
Jan/2025	Dec/2025	Dec/2026	Dec/2027	Dec/2028	Dec/2029
0	0	10	20	40	60
Hydropower master plan prepared, and a PPP transaction structured for a hydropower project jointly by FMWRS and FMP (Yes/No)					
Jan/2025	Dec/2025	Dec/2026	Dec/2027	Dec/2028	Dec/2029
0	0	0	0	0	1
Area provided with new/improved irrigation or drainage services (Hectare(Ha))					
Jan/2025	Dec/2025	Dec/2026	Dec/2027	Dec/2028	Dec/2029
0	2,000	5,000	10,000	20,000	40,000
Number of people with enhanced resilience to climate shocks (including floods and droughts) (Number)					
Jan/2025	Dec/2025	Dec/2026	Dec/2027	Dec/2028	Dec/2029
0	0	20,000	50,000	100,000	150,000

Intermediate Indicators by Components

Baseline	Period 1	Period 2	Period 3	Period 4	Closing Period
Institutional strengthening and capacity building for Water Resources Management					
Digital Dam Asset Management System established (Yes/No)					
Dec/2024					Nov/2026
No					Yes

Improved businesses and sector practices of FMP to plan for hydropower development, project modelling and financing strategies (Text) [PBC]					
Jan/2025	Dec/2027				Dec/2028
No systematic masterplans, financing strategies for hydropower sub-sector in congruence with water resources sector plans.	Hydropower master plan is prepared and a priority project is prepared for financing with full Feasibility Study and ESIA completed.				PPP guidelines for preparation of the selected HPP are prepared so that private sector can take on the project.
States legislation and state budget line adoption for Water User Association Support. (Number)					
Jan/2025	Dec/2025	Dec/2026	Dec/2027	Dec/2028	Dec/2029
0	3	7	10	12	15
Safer operation of dams by dam owners and operators by practicing Dam Safety Guidelines approved and adopted by Project Steering Committee. Guidelines are thereafter implemented by the project. (Text) [PBC]					
Jan/2025	Dec/2025	Dec/2027			Dec/2029
No customized dam safety guidelines adopted by Government of Nigeria	Dam safety standards, practices and procedures prepared and adopted by the Government. The guidelines to contain i) Standard dam design code; ii) Guidelines for hydrologic review; iii) Guidelines of dam safety; and vi) Manual for assessing structural safety of existing dams and v) Guidelines for preparation and installation of dam safety instruments (Yes/No)	Dam safety guidelines are implemented by 30% of dam operators under SPIN project (Yes/No)			Dam safety guidelines are implemented by 50% of dam operators under SPIN project (Yes/No)
Basins utilizing hydrological information generated by the hydro- Meteorological stations and irrigation management systems under the project for water allocation (Number)					
Jan/2025	Dec/2025	Dec/2026	Dec/2027	Dec/2028	Dec/2029

0	1	3	5	7	8
Irrigation Modernization					
Irrigation fee recovery rate by WUAs (Percentage)					
Jan/2025	Dec/2025	Dec/2026	Dec/2027	Dec/2028	Dec/2029
0	0	10	20	40	60
WUA/Farmer contributions towards O&M of irrigation infrastructure rehabilitated through project interventions (Amount(USD))					
Jan/2025	Dec/2025	Dec/2026	Dec/2027	Dec/2028	Dec/2029
0	0	100,000	300,000	400,000	500,000
Women managers in formally established WUA governing bodies (Percentage)					
Jan/2025	Dec/2025	Dec/2026	Dec/2027	Dec/2028	Dec/2029
0	0	5	10	15	20
People fed as a result of increased agricultural/food production (Number of people) CRI					
Jan/2025	Dec/2025	Dec/2026	Dec/2027	Dec/2028	Dec/2029
0	0	200,000	500,000	700,000	950,000
➢People fed as a result of increased agricultural/food production - Female (Number of people) CRI					
Jan/2025	Dec/2025	Dec/2026	Dec/2027	Dec/2028	Dec/2029
0	0	100,000	250,000	350,000	475,000
➢People fed as a result of increased agricultural/food production - Youth (Number of people) CRI					
Jan/2025	Dec/2025	Dec/2026	Dec/2027	Dec/2028	Dec/2029
0	0	60,000	150,000	210,000	270,000
Cropping intensity (by scheme) (Percentage)					
Jan/2025	Dec/2025	Dec/2026	Dec/2027	Dec/2028	Dec/2029
115	115	130	150	170	180
Improvements in dam operations and enhancing dam safety					
Dams with improved and climate-resilient operational procedures and dam safety measures under the Project (Number)					
Jan/2025	Dec/2025	Dec/2026	Dec/2027	Dec/2028	Dec/2029
0	0	2	5	10	15
Dam rehabilitation priorities analysis completed based on Dam Safety Portfolio Risk Management Analysis results (Text)					
Dec/2024	Dec/2025	Dec/2026			Nov/2027

No risk management analysis conducted yet	Risk prioritization index tool is adopted	Dam safety portfolio risk management analysis is completed for all large dams			Detailed risk assessment is carreid out for high-risk dams defined by the Analysis
People benefiting from climate resilient infrastructure (Number of people) CRI					
Jan/2025	Dec/2025	Dec/2026	Dec/2027	Dec/2028	Dec/2029
0	0	20,000	50,000	100,000	150,000
➢People benefiting from climate resilient infrastructure - Female (Number of people) CRI					
Jan/2025	Dec/2025	Dec/2026	Dec/2027	Dec/2028	Dec/2029
0	0	10,000	25,000	50,000	75,000
➢People benefiting from climate resilient infrastructure - Youth (Number of people) CRI					
Jan/2025	Dec/2025	Dec/2026	Dec/2027	Dec/2028	Dec/2029
0	0	6,000	15,000	30,000	45,000
Project Management					
Grievances registered and addressed within the GRM timeframe (Percentage)					
Dec/2024	Nov/2025	Nov/2026	Nov/2027	Nov/2028	Nov/2029
0	60	70	80	90	90
Farmer beneficiaries satisfied with the irrigation services received (Percentage)					
Jan/2025	Dec/2025	Dec/2026	Dec/2027	Dec/2028	Dec/2029
0	0	10	20	30	40

Performance-based Conditions (PBC)

Period	Period Definition
Period 1	year 1
Period 2	year 2
Period 3	year 3
Period 4	year 4
Period 5	year 5

Baseline	Period 1	Period 2	Period 3	Period 4	Period 5
1:Safer operation of dams by dam owners and operators by practicing Dam Safety Guidelines approved and adopted by Project Steering Committee. Guidelines are thereafter implemented by the project. (Text)					
No customized dam safety guidelines adopted by Government of Nigeria	FMWRS prepared and adopted safety standards and guidelines of dam safety customized for dams in Nigeria. The guidelines to contain i) Standard dam design code; (ii) Guidelines for hydrologic review; iii) Guidelines of dam safety; and vi) Manual for assessing structural safety of existing dams and v) preparation and installation of dam safety instruments (Yes/No).		Guidelines are implemented by 30% of the project dams.		Guidelines are implemented by 50% of the project dams.
0.00	30,000,000.00	0.00	10,000,000.00	0.00	10,000,000.00
PBC allocation		50,000,000.00	As a % of Total PBC Allocation		83.33%
2:Improved businesses and sector practices of FMP to plan for hydropower development, project modelling and financing strategies (Text)					
No systematic masterplans, financing strategies for hydropower sub-sector in congruence with water resources sector plans.		Hydropower master plan is prepared and one project prepared for financing with full Feasibility Study and ESIA completed (Yes/No).		PPP guidelines for the selected HPP are prepared in consultation with key stakeholders including private sector.	
0.00	0.00	5,000,000.00	0.00	5,000,000.00	0.00
PBC allocation		10,000,000.00	As a % of Total PBC Allocation		16.67%

Monitoring & Evaluation Plan: PDO Indicators					
Indicator Name	**Definition/Description**	**Frequency**	**Datasource**	**Methodology for Data Collection**	**Responsibility for Data Collection**
People protected from floods and droughts through enhanced dam safety and operations (number)	The indicator measures people in the downstream protected from climate shocks because of the safe and secure operations of the dams owing to adoption of dam safety guidelines, practice of safety standards and the dam safety rehabilitation investments.	Annual	Progress Reports	The number of populations residing in the downstream flood plain areas of the dams with improved operations with enhanced safety as identified by the dam break analysis.	FPMU
Federal and State irrigation schemes under the Project managed by a functioning WUA (Percentage)	This indicator measures the share of irrigation schemes under federal and state governments. A functioning WUA is defined as legally established, staffed, funded and operating irrigation services.	Annual	Reports	Project M&E system	FMPU
Area provided with new/improved irrigation or drainage services (Hectare(Ha))	This indicator measures the total area of land provided with irrigation and drainage services under the project, including in (i) the area provided with new irrigation and drainage services, and (ii) the area	Annual	Progress report	Project M&E system	FPMU

	provided with improved irrigation and drainage services, expressed in hectare (ha).				
Hydropower master plan prepared and a PPP transaction structured for a hydropower project jointly by FMWRS and FMP (Yes/No)	This indicator measures joint and collaborative consultation and decision making between FMWRS and FMP, wherein the hydropower master plan is in congruence and informed by the water resources master plan. The Project Steering Committee co-chaired by ministers of FMWRS and FMP become the platform for consultation and decision-making.	Annual	Reports	Project M&E system	FPMU

Monitoring & Evaluation Plan: Intermediate Results Indicators					
Indicator Name	**Definition/Description**	**Frequency**	**Datasource**	**Methodology for Data Collection**	**Responsibility for Data Collection**
Digital Dam Asset Management System established (Yes/No)	The indicator measures: (i) improvements to the asset management system and	Annual	Progress report	Project M&E system	FPMU

	the digital dam depository as a comprehensive digital application for safe and efficient utilization of dam, irrigation and hydropower assets including access to information in real time;and (ii) provide comprehensive estimation of funds for regular MoM and rehabilitation requirements.				
Adoption of Hydropower Masterplan by the PSC and Preparation of Priority Hydropower Project Ready for PPP (Text) PBC	The indicator measures the preparation of a comprehensive hydropower masterplan showcasing potential climate smart hydropower investments which is complemented and informed by the water resources master plan also detailing a priority project readied for financing with full feasibility study, completed ESIA and PPP guidelines for the HPP to be implemented by private sector.	As and when PBRs achieved	FMP report on achievement of PBRs	Confirmation of achievement of PBRs by FMP and approved by Project Steering Committee	FPMU

States legislation and state budget line adoption for Water User Association Support. (Number)	The indicator measures the number of states demonstrating readiness and commitment to legally recognize and support Water User Associations.	Annual	State Legislation and approved budget	The states will submit legislative orders and approved budget to FMWRS	FPMU
Development and Adoption by FMWRS of National Dam Safety Technical Guidelines and Manuals(Text) PBC	The indicator measures whether dam safety standards, practices and procedures prepared and adopted by the Government. The guidelines to contain i) Standard dam design code; ii) Guidelines for hydrologic review; iii) Guidelines of dam safety; and vi) Manual for assessing structural safety of existing dams and v) Guidelines for preparation and installation of dam safety instruments (Yes/No)	Annual	FMWRS report on completion of the PBRs	The claim report for the PBRs will be technically verified and clearedy by the DDRO	FPMU
Basins utilizing hydrological information generated by the hydro- Meteorological stations and irrigation management systems under the project for water allocation (Number)	The indicator measures the improvements in water allocation by RBDAs among irrigation, hydropower, and other uses of water by utilizing hydro-met data as generated, stored and	Annual	Progress Report	Project M&E system	FPMU

	shared by the hydro-Meteorological stations on inflows into the storage as well as downstream water allocation volume confirmed by irrigation management system				
People fed as a result of increased agricultural/food production (Number of people) CRI	The indicator measures people fed as a result of increased agricultural production owing to the improved irrigation and drainage services provided by the project including (i) the area provided with new irrigation and drainage services, and (ii) the area provided with improved irrigation and drainage services. This includes increased production from 40,000 ha of irrigated area under Component 2.The indicator will be further disagregated for Sex (Female) and youth.	Annual	Progress Report	The actual production figures for the increase in production of main crops due to enhanced access to irrigation and drainage services will be directly collected. The sum of the increased production of food commodity (rice paddy, maize, tomato etc) from the area provided with new/ improved irrigation and drainage services adjusted for the 10% post-harvest losses, multiplied with unit calorie contained in these food commodities, is then divided by 365 times	FPMU

				the minimum daily calorie requirement (2000 Kcal) to arrive at the number of people with strengthened food and nutrition security.	
Irrigation fee recovery rate by WUAs (Percentage)	The indicator measures the efficiency of recovery of operation and maintenance cost by collecting irrigation fees from its members.	Annual	Progress Report	Project M&E system	FPMU
WUA/Farmer contributions towards O&M of irrigation infrastructure rehabilitation through project interventions (amount USD)	The indicator measures the amount of contribution towards O&M expenses of the irrigation infrastructure operationalized. The amount collected include the contribution towards bulk water fees and fees paid by individual farmers towards irrigation and drainage services fee	Annual	Progress Report	Project M&E system	FPMU
Women managers in formally established WUA governing bodies (Percentage)	The indicator measures women's representation in the leadership positions of the various governance and operational committees of WUAs.	Annual	Progress Report	Project M&E system	FPMU

Cropping intensity (by scheme) (Percentage)	The ratio of the harvested irrigated areas over the area equipped for full control irrigation actually irrigated (times 100 to give it in percentage).	Annual	Progress report	Project M&E system	FPMU
People benefiting from climate resilient infrastructure (Number of people) CRI	The indicator measures people in the downstream protected from climate shocks because of the safe and secure operations of the dams owing to adoption of dam safety guidelines, practice of safety standards and the dam safety rehabilitation investments. The indicator will be further disagregated for Sex (Female) and youth.	Annual	Progress Reports	The number of populations residing in the downstream flood plain areas of the dams with improved operations with enhanced safety as identified by the dam break analysis.	FPMU
Dams with improved and climate-resilient operational procedures and dam safety measures under the Project (Number)	The indicator measures number of dams where safety guidelines elaborating principles, practices, protocols and tools covering structural and non-structural measures of dam safety are utilized by owners, operators and dam safety institutions. In	Annual	Progress Report	Project M&E system	FPMU

	addition, more reliable climate resilient and stable dam operations are ensured through dam safety rehabilitation works under component 3 following the dam safety design standards				
Dam rehabilitation priorities analysis completed based on Dam Safety Portfolio Risk Management Analysis results (text)	This indicator measures completion of the results of Dam Safety Portfolio Risk Management (DSPRM) Analysis conducted by Government. During the first year the risk prioritization index tool is to be customized and adopted. During the second year, DSPRM analysis will be completed for all large dams. By project closure DSPRM will be carried out for all high risk dams defined by the analysis.	Annual	Progress report	Project M&E system	FPMU
Grievances registered and addressed within the GRM timeframe (Percentage)	Grievances registered and addressed within the GRM framework established for the project within the agreed time limits service standards	Annual	Progress report	Project M&E system	FPMU

Farmer beneficiaries satisfied with the irrigation services received (Percentage)	Using publicly disseminated scorecards (suitably adapted from TRIMING experience) for each scheme are debated annually, drawing on an information system which facilitate farmer satisfaction scores reflecting information on reform progress, results achieved, and access to services	Annual	Assessment	Project M&E system	FPMU

Verification Protocol Table: Performance-Based Conditions

PBC 1: Development and Adoption by FMWRS of National Dam Safety Technical Guidelines and Manuals (Text)	
Formula	The total value of the PBC is US$50 million. Achievement of the PBC will enable reimbursement of funds for the dam safety rehabilitation works under component 3.
Description	PBC 1 will involve one PBC mainly consisting of preparation and approval of dam safety guidelines. PBC 1 is text and non-scalable. The dam safety guidelines have to elaborate principles, practices, protocols, and tools covering structural and nonstructural measures of dam safety to be utilized by owners, operators, and dam safety institutions. The guidelines will include (a) standard dam design code, (b) guidelines for hydrologic review, (c) guidelines of dam safety, (d) manual for assessing structural safety of existing dams, and (e) guidelines for preparation and installation of dam safety instruments. The achievement of the PBC in full will enable reimbursement of the US$50 million allocated for the rehabilitation works identified under Component 3. Funds releases will be made for the rehabilitation works ready to be awarded. The eligible expenses include all items of all services, goods, and works in the approved contracts for rehabilitation.
Data Source/Agency	DDRO of FMWRS - dam safety guidelines
Verification Entity	Technical clearance of DDRO of FMWRS.
Procedure	The DDRO will submit a report on completion of actions and showcasing the results achieved to the FPMU. The FPMU will assess the performance and will submit its report and recommendation to the World Bank and PSC. The PSC will approve the report with ‘no objection’ from the World Bank.
PBC2: Adoption of Hydropower Masterplan by the PSC and Preparation of Priority Hydropower Project Ready for PPP (Text)	
Formula	A total of US$10 million is allocated.
Description	PBC 2 consists of PBR 2.1. and 2.2, which are text and non-scalable.

	• PBR 2.1. The master plan for hydropower development consisting of identified and ranked hydropower projects as showcased opportunities for potential developers/investors. One feasibility study and ESIA for a prioritized project from master plan will also be prepared. • PBR 2.2 Guidelines for PPP consisting of (a) selection of PPP projects; (b) institutional, legal, and administrative framework and policy support; (c) Identification of private sector financing; (d) public sector involvement; (e) options of PPP model; and (f) preparation of tender process and documents.
Data Source/Agency	FMP, ICRC and BPE
Verification Entity	Independent verification entity consisting of a team of international and local panel of experts to be engaged by the Hydropower TU with FPMU
Procedure	The FMP will submit its claims for project support with detailed activities undertaken and results achieved to the FPMU. The FPMU will engage the independent verification entity who will submit the report and recommendation to the World Bank. The PSC will approve the report and payments with 'no objection' from the World Bank.

ANNEX 1: Implementation Arrangements and Support Plan

Implementation Arrangement

1. **The Government of Nigeria intends to mainstream the key implementation models, processes, and tools piloted through TRIMING within the existing organizational structure of the FMWRS for ensuring sustainability of the investments and improvements in the service delivery.** The project implementation arrangement aims at developing the human resource capacity of the FMWRS and addressing the organization development aspects of the different institutional entities within the FMWRS. The arrangement also reflects the recommendations and outcomes of various consultations, studies, and assessments carried out as part of the preparation. The implementation arrangement summarizes the key structure, overall composition, main roles, and accountabilities. The elaboration of the implementation arrangements including detailed composition, process steps, and procedures for implementing the project are in the Project Operational Manual (POM).

2. **The main features of the implementation arrangement include** (a) the FMWRS continuing to be the main implementing agency for most of the components, while the FMP implements the improvements envisaged in the hydropower sector with support from the ICRC and BPE on aspects around the PPP framework and action plan; (b) evaluating and adopting appropriate areas of reforms as part of institutionalization and policy support initiatives; and (c) implementing appropriate organizational development activities including systems improvement to mitigate the risks and uncertainties emanating from the challenges of climate change.

Overall Institutional Model and Implementation Arrangement

3. **The overall implementation arrangement is multilayered to cover Federal-, river basin-, state-, and scheme-level arrangements.** The project implementation will be the primary responsibility of the FMWRS at the Federal level, RBDAs at the basin level, the designated departments at the state level, and WUAs at the scheme and farm levels. To strengthen the capacity for coordinating and implementing the project, a lean and efficient FPMU will be set up within the Office of the Permanent Secretary, FMWRS. Also, to augment skill gaps and have a dedicated technical backstopping support for project implementation, three TUs will be set up within the DID, DRO, and Department of Renewable and Rural Power Access at the FMP. In the long run, these skills and competencies will also be internalized within the FMWRS and FMP. The arrangement is also structured thematically mapping the main roles of (a) project governance and oversight; (b) coordination and operations management; and (c) technical partnerships and collaborations. The SPIUs will be established in those states that will be implementing activities on state-owned irrigation and dams. The overall institutional model is summarized in Table 1.1.

Table 1.1. Overall Institutional Model for the SPIN Project

Implementation Level	Project Governance and Oversight	Project Coordination and Operations Management	Technical Partnerships and Collaborations
Federal	• FMWRS, FMP • PSC • Federal Technical Committee	• PMU within the Office of the Permanent Secretary, FMWRS • TUs of the PMU within the Departments of Irrigation and Drainage; DRO; and Department of Renewable and Rural Power Access, FMP, and designated staff from the ICRC and BPE	• FMF • FMEnv • Federal Ministry of Agriculture and Rural Development • NWRI, Kaduna • Nigeria Hydrological Services Agency • NESREA

Implementation Level	Project Governance and Oversight	Project Coordination and Operations Management	Technical Partnerships and Collaborations
River basin	• RBDA	• Dam safety unit of RBDA • Irrigation unit of RBDA	• Relevant state ministries (water resources or agriculture)
State	• State Ministry of Water Resources • State Ministry of Agriculture • State Technical Committee	• SPIU	• RBDA
Scheme	• RBDA • State	• WUA (Apex and Sector)	• Producer organizations (cooperatives), private service providers), and agribusinesses

Federal-Level Implementation Arrangement

4. **In addition to the existing government structures, the project will establish dedicated special purpose implementation and coordination arrangements at the Federal level.** The project-related special purpose arrangements are only transitionary and to be internalized within the FMWRS in the long run. The Federal-level implementation arrangement is summarized in Table 1.2.

5. **The FMWRS will be the implementing agency for most of the components of the project, while the FMP with support from ICRC and BPE will be the agency responsible for implementing the Subcomponent 1.3 (Hydropower Institutional Strengthening and Capacity Building).** The FMWRS remains the government vehicle for delivering water resources infrastructure and irrigation and drainage services to farmers in the country. The project will strengthen the FMWRS to function as the guardian of rules for the sustainable development and use of water resources in the country. In addition to upgrading the skills and competencies of the department, the FMWRS will be strengthened with systems, equipment, and tools such as operating standards and design standards to function as the agency to mitigate the risk and uncertainty emanating from the challenges of climate change and extreme events such as floods and droughts. In the long run, the FMWRS will be able to successfully showcase IWRM and realize the government's vision.

6. **The PSC is the principal apex governance body having senior management representation of all ministries and institutions mandated with project implementation responsibilities.**

7. **The FTC provides technical backstopping, collaborations, and partnerships for ensuring feasibility, viability, and sustainability of interventions and investments at the national level**.

8. **The FPMU is established within the office of Permanent Secretary, FMWRS, to coordinate overall project implementation, monitoring, and reporting.** The PMU will also function as Secretariat of the Steering Committee and will be responsible for all reporting requirements to the World Bank.

9. **TUs will be established within the Departments of Irrigation and Drainage, Dam and Reservoir Operations, and Department of Renewable and Rural Power Access at FMP.** They will be strengthened with technical oversight and technical efficiency capacities for enhancing the effectiveness of the investments and implementation processes.

State-Level Implementation Arrangement

10. **The State Technical Committees provide technical backstopping, collaborations, and partnerships for ensuring feasibility, viability, and sustainability of interventions and investments in the participating states.**

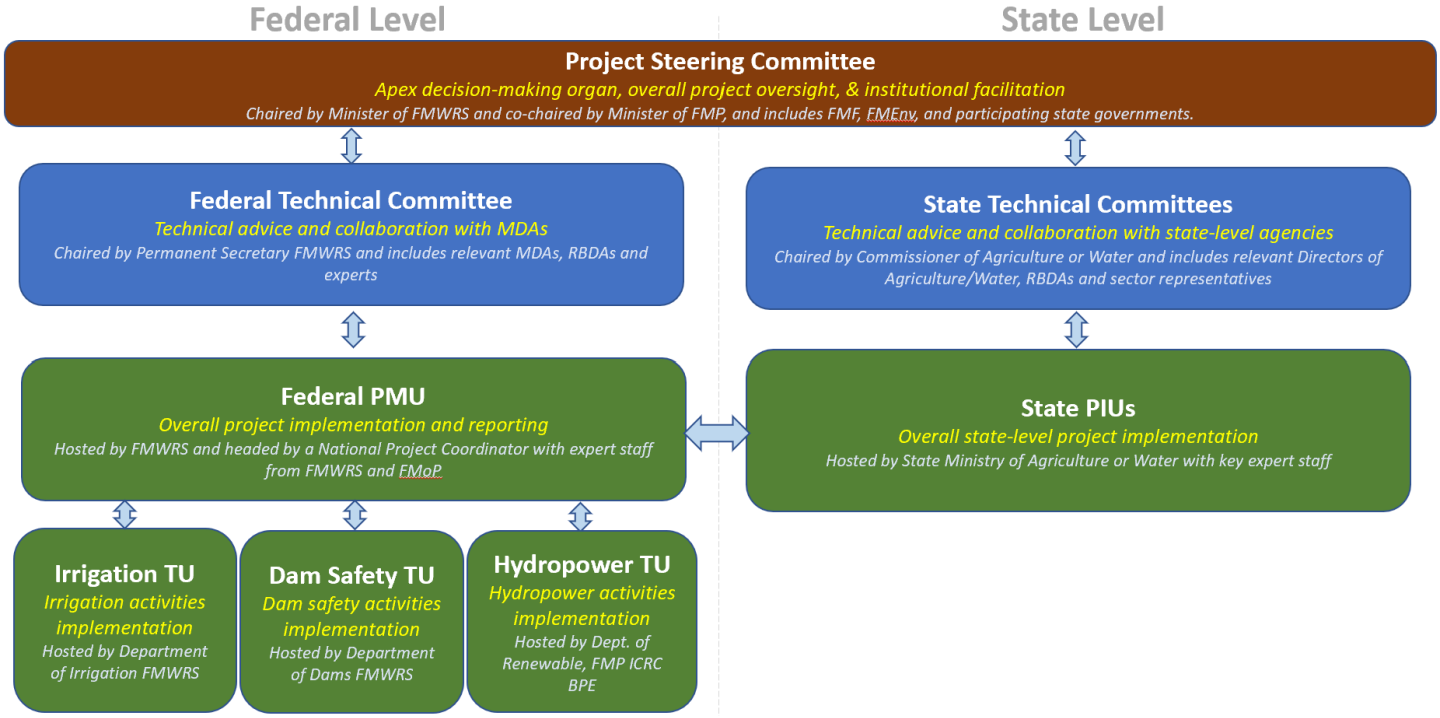
11. **The SPIU** will be established within the Office of the Commissioner, Department of Irrigation/Water Resources of each participating state to coordinate overall project implementation, monitoring, and reporting of the state-financed project. The SPIU will also function as the Secretariat of the State Technical Committee and will be responsible for all reporting requirements to the World Bank.

Table 1.2. Implementation Arrangements

Responsible Entity	Composition	Roles and Responsibilities	Accountabilities
FMWRS/FMP	• Headed by minister/Permanent Secretary • Organized into departments	• Guardian of rules • Adoption of sector policies • Setting and achieving of reforms agenda	• Realization of sector vision of the Government of Nigeria
Project Steering Committee	• Chaired by Minister of FMWRS and co-chaired by Minister of FMP • The members of the Steering Committee include FMF, FMP, FMEnv, FMAFS, NWRI, representatives from the states and RBDAs. • Meets biannually (twice a year)	• Approving policy briefs to be recommended to the minister/Council of Ministers for approval • The POM including Standard Operating Procedures (SOPs) on irrigation, dam safety and other operational aspects, and financial and accounting manuals for approval by ministers/Council of Ministers • Approving and recommending to the FMF, the annual budget for project implementation and the required allocations in the Federal budget • Administrative approval of proposals for investment under the project	• The investments and other project programs conform to national priorities and state's demands
Federal Technical Committee	• Chaired by Permanent Secretary, FMWRS • Technical experts from relevant departments • Technical experts from collaborating institutions • Technical experts from RBDAs • Meets at least quarterly	• Phasing and technical prioritization of investments • Assessing technical feasibilities of investment proposals • Technical approval	• Ensuring that the investments conform to national standards
FPMU	• Headed by the national project coordinator • Reporting to Permanent Secretary, FMWRS	• Day-to-day operations and overall coordination of the project • Planning, budgeting, procurement, and reporting	• Attaining the PDO-level and intermediate-level indicators • Attaining the PBCs

Responsible Entity	Composition	Roles and Responsibilities	Accountabilities
TUs	• Headed by team leader • Dedicated technical experts from the departments • Three TUs for (a) DRO, (b) irrigation and drainage, and (c) hydropower	• Day-to-day responsibilities of technical aspects of the project, for example, technical evaluation of proposals, design reviews, and construction supervision	• All technical interventions are feasible, functional, and conform to national priorities.
State Technical Committee	• Chaired by the Permanent Secretary of Agriculture/Water Resources • Technical experts from relevant state departments • Technical experts from RBDAs • Meets at least quarterly	• Coordination between state government and PSC • Technical approval	• Ensuring that the investments conform to national standards
State Project Implementation Unit	• Headed by the state project coordinator • Reporting to Commissioner of Irrigation/Water Resources Department	• Day-to-day operations and overall coordination of the project • Planning, budgeting, procurement, and reporting	• M&E of project indicators

Figure 1.2. Institutional and Implementation Arrangements



12. **Institutional reforms and PBCs.** SPIN will support three institutional reforms: (a) the FMWRS will develop national dam safety guidelines and protocols, and the PSC will adopt them to be implemented in all SPIN target dams; (b) water laws will be developed or updated to legally recognize WUAs in all SPIN participating states; and (c) the FMWRS and FMP will jointly develop the HMP and prepare at least one priority hydropower project based on it. To incentivize such reforms, SPIN includes the following provisions: (a) the development and adoption of the national dam safety guidelines and

protocols is a PBC for the amount of US$50 million of Component 3; (b) as part of the selection criteria for irrigation investments, each state needs to have the legal establishment of WUAs (detailed in Annex 2); and (c) the joint development and adoption of the HMP by the FMWRS and FMP and the joint preparation of at least one hydropower project is a PBC for the amount of US$10 million. Two PBCs are included in the project to incentivize the institutional and policy reforms. They are the development and adoption of the dam safety guidelines by the FMWRS, which is designed as one PBC to incentivize the critical objective for national dam safety, and the preparation of the HMP, one feasibility, study and ESIA and PPP guidelines for hydropower project.

Procurement

13. Procurement for the project will be carried out following the World Bank procedures: (a) the World Bank Procurement Regulations for IPF Borrowers, dated September 2023; (b) Guidelines on Preventing and Combating Fraud and Corruption in Projects Financed by IBRD Loans and IDA Credits and Grants, dated October 15, 2006 and revised in January 2011 and as of July 1, 2016; and (c) other provisions stipulated in the Financing Agreements. Procurements under the fund allocated for PBC shall also follow the above procedures and will be subject to World Bank's prior/post review.

14. Procurement for the federal-level interventions (including the irrigation schemes following the SPIN Model 1) will be conducted by the SPIN FPMU to be constituted for the implementation, leveraging the already existing capacity from the TRIMING Project, with the technical inputs and support from the TUs, that is, DID, DDRO, RBDA of the FMWRS, and Department of Renewable and Rural Power Access under the FMP. The procurements for the state-level interventions (including the irrigation schemes following the SPIN Model 2) will be conducted by the SPIUs to be established under the State Ministry of Water Resources or Agriculture. The FPMU has a procurement team consisting of a senior procurement specialist and an assistant procurement specialist with considerable experiences in procuring high-value irrigation and dam safety contracts (such as rehabilitation of existing dams and its associated structures, rehabilitation of irrigation and drainage works, and consultancy services for the preparation of hydropower development master plan.

15. The SPIN Interim Project Preparatory Team has already prepared a Project Procurement Strategy for Development (PPSD) and Procurement Plan for the first 18 months of the project. PPSD notes that FPMU of FMWRS has gained significant experience through the implementation of World Bank-financed projects, particularly TRIMING while assessment of the procurement capacity and risk of the State PIUs will be carried out as and when the States are selected. The Procurement Plan identified activities with a total of US$91 million estimated cost covering mostly the consultancy services (US$19 million) and civil works (US$72 million) of which, the major two procurement packages are construction/rehabilitation of irrigation and drainage works (US$32 million) and rehabilitation of the existing dams and their associated structures (US$32 million). The PPSD and the Procurement Plan will be updated as and when necessary. Details of the procurement packages with related procurement method and arrangement with specific market approach are stated in the PPSD and Procurement Plan.

16. The appropriate World Bank Standard Procurement Documents will be used for all international competitive procurement. For national competitive procurement, the Federal Government standard bidding documents including the amendments incorporated in line with the paragraphs 5.2 and 5.3 of the World Bank Procurement Regulations will be used. The latest versions of Standard Procurement Documents as published on the World Bank's external website shall be used for all international competitive procurements.

17. There is a state procurement agency in each of the states of Nigeria with trained procurement staff that could be deployed to support the SPIN Project's SPIUs. However, the engagement of such procurement staff shall be subject to World Bank clearance based on qualifications and experiences in managing development partner-supported projects. The procurement specialist at the FPMU would also provide fiduciary support to the state teams to ensure timely

implementation of procurement activities. Training on the World Bank's Procurement Regulations and the online STEP would be provided to the SPIN procurement team within 30 days of the project signing, and refreshment training will be organized from time to time.

Financial Management

18. The FPFMD and PFMUs are departments/units in the Office of Accountant General of the Federation/States responsible for providing FM functions and Designated Account management for all World Bank-financed projects implemented at the federal and state ministries, departments, and agencies. The FPFMD and PFMUs shall be responsible for deploying FM staff to the FPMU and SPIUs, oversight of the project's financial and reporting arrangements, and the funds management in all project management and implementing units. The FPMU will be established at the FMWRS headed by a national project coordinator and financial management staff from FPFMD and shall be the principal implementing unit for the project. The SPIU will be established within the Ministries of Irrigation/Water Resources of each participating state and shall be headed by a project coordinator supported by experts from the Ministries of Irrigation/Water Resources along with FM staff from the PFMU.

19. **Planning and budgeting.** To prepare annual work plans and budgets under the SPIN Project, heads of sections within the FPMU/PIUs shall prepare work plans derived from the project's components; these will be consolidated by the project coordinator into the FPMU/SPIU's annual work plans and forwarded to the World Bank for review and concurrence. The approved annual work plan shall be the basis for developing the annual budget. The project accountant shall prepare the draft annual budget after consultations with the heads of sections and project coordinator in the FPMU/SPIUs. The FPMU/SPIU's budget committee chaired by the project coordinator, shall review the draft annual budget and forward the same to the steering committee for final approval. The project coordinator shall send a copy of the annual budget to the World Bank at least two months before the beginning of the applicable budget year, and the budget should be cleared by the World Bank at least one month before commencement of the applicable budget year. The project coordinator shall ensure the final budget is circulated to the concerned project staff.

20. **Accounting.** The project accountants at the FPMU and each SPIU shall be primarily responsible for ensuring adequate record keeping and financial reporting of the project funds. At the FPMU and each SPIU, project funds will be accounted on a cash basis in accordance with the International Public Sector Accounting Standards; the books of account shall preferably be automated and maintained using accounting software; and the chart of accounts will be structured to reflects all project activities, financing, and expenditures as described in the Project Appraisal Document (PAD) and Financing Agreement. The project accountants at the FPMU and each SPIU shall ensure that interim financial reports (IFRs) and audit reports are submitted to the World Bank at the times specified in the Disbursement and Financial Information Letter and Financing Agreement, as all IFRs and audit reports will be prepared separately by the FPMU and each SPIU. The 'Generic Project Financial Manual for Donor Funded Projects in Nigeria' issued by the FPFMD shall be adopted by the FPMU/SPIUs as the Financial Procedures Manual for the SPIN Project.

21. **Financial reporting.** The FPMU and each SPIU shall prepare and submit separate IFRs to the World Bank biannually which shall be due 45 days after the end of each semester. The IFRs shall include, at minimum, (a) sources and uses of funds; (b) uses of funds by project components; (c) US dollar Designated Account activity statements; and (d) reconciliation statement for the Designated Account, drawdown accounts, any other project account, and their relative bank statements. The IFRs shall encompass the total project activities at the FPMU and PIUs as described in the PAD and legal agreements. They should reflect all financing and expenditures from government contributions (if received). They will be subject to limited reviews by the FPMU's and each PIU's external auditor/internal auditors, as agreed with the World Bank, before submission.

22. **Internal control.** The internal controls of the project shall include a framework of the Financial Manual for Donor Funded Projects in Nigeria issued by the FPFMD and adopted by the FPMU/SPIUs, segregation of functions/duties, experienced and qualified project FM staff who are well trained in World Bank procedures and disbursement requirements, and independent and well-trained internal auditors. The FM staff will be appointed by the Accountant General for the Federation, and states, subject to clearance by the World Bank. The FPFMD and SPIUs will be responsible for internal audit functions in the project. The Internal Audit Units will carry out a risk-based internal audit review in addition to the traditional compliance audit and nonfinancial or operational internal audit. Biannual internal audit reports will be prepared by the internal auditors and shared with the World Bank for review.

23. **External auditing.** The FPMU and each SPIU shall prepare separate annual project financial statements, covering project activities at the FPMU and SPIUs. The annual financial statements will be prepared in accordance with the International Public Sector Accounting Standards. They shall be audited by an independent external auditor appointed by the FPMU and each SPIU. The external auditor's appointment shall be based on terms of reference acceptable to the World Bank. The auditor shall express an opinion on the annual financial statements in compliance with International Standards on Auditing. In addition to the audit report, the external auditors will prepare a management letter. The project accountants at the FPMU and each SPIU shall submit a copy of the audited financial statements along with the management letter to the World Bank not later than six months after the end of each financial year.

24. **Funds flow.** The FPMU at the FMWRS shall maintain one Designated Account in US dollar at the Central Bank of Nigeria, along with one drawdown account denominated in Nigerian naira. Funds from the Designated Account will be credited to the drawdown account to finance eligible expenditures. The FMP will also be required to maintain and operate one drawdown account in Nigerian naira at the FPMU. For the states having subsidiary loan agreement with the FMF, each state's PIU shall maintain one Designated Account in US dollars along with one drawdown account denominated in Nigerian naira at a commercial bank acceptable to the World Bank. Funds from the Designated Accounts will be credited to the drawdown accounts to finance eligible expenditures. Based on request from the FPMU or the SPIU, the World Bank will advance financing proceeds into their respective designated accounts. Advances into the Designated Accounts shall be made in the currency of the Designated Accounts, and the FMPU/SPIU shall draw down funds from their respective Designated Accounts into their drawdown accounts on a need basis to finance eligible project expenditures.

25. **Disbursement.** After initial advance to the Designated Accounts, replenishment will be done against withdrawal applications supported by the Statements of Expenditures. Authorized account signatories for the federal and state FPMU and SPIUs will be as listed in panels (A and B) in Table 1.3. One signatory from each panel will jointly sign the project financial documents/instruments.

Table 1.3. Authorized Account Signatories for the Federal and State Project Financial Management

	Panel A	Panel B
Main	The project coordinator	Director FPFMD (Federal)/Head of PFMU (State)
Alternate	A director in the implementing department	Project accountant

Table 1.4. Categories of Eligible Expenditure

Category	Amount of the Financing Allocated (expressed in USD)	Percentage of Expenditures to be Financed (inclusive of Taxes)
(1) Goods, works, non-consulting services, consulting services, Training, and Operating Costs for	115,000,000	100%

Category	Amount of the Financing Allocated (expressed in USD)	Percentage of Expenditures to be Financed (inclusive of Taxes)
Parts 1.1.1, 1.1.2, 1.1.3, 1.3, 2 (except 2.2), 3, and 4 of the Project		
(2) Goods, works, non-consulting services, consulting services, Training, and Operating Costs for Parts 1.2 and 4 of the Project	5,000,000	100%
(3) Goods, works, non-consulting services, consulting services, Training, and Operating Costs for Part 2.2	320,000,000	100%
(4) Eligible PBC Expenditures for Parts 1.1.3 and 3 of the Project	60,000,000	100%
TOTAL AMOUNT	**500,000,000**	

26. **FM implementation support mission arrangement.** FM implementation support will be consistent with a risk-based approach. The implementation support frequency will be based initially on the assessed FM risk rating and subsequently on the updated FM risk rating during implementation. On-site review will cover all aspects of FM, including internal control systems, the overall fiduciary control environment, and tracing transactions from the bidding process to disbursements, as well as Statement of Expenditures review. Additional implementation support activities will include desk review of periodic IFRs, quarterly internal audit reports, audited annual financial statements, and management letters, as well as timely follow-up of issues that arise and updating of the FM rating of the project as appropriate.

Table 1.5. FM Action Plan

No.	Action Plan	Timeline	Responsible Entity
1	Appointment of project FM staff by the Office of Accountant General subject to clearance by the World Bank	Within 30 days after effectiveness	FPFMD/FMWRS and SMWR/PFMU
2	Update/create chart of accounts in new or existing computerized accounting system for the SPIN Project activities	Within 30 days after effectiveness	FPFMD/FMWRS and SMWR/PFMU

Note: SMWR = State Ministry of Water Resources.

Environmental and Social

27. **The project will be implemented using the guidelines provided in the ESF documents.** Site-specific instruments will be prepared for each dam and irrigation scheme, following the steps articulated in the ESMP, RPF, and ESCP. When the dams and irrigation schemes are identified, the client will be required to screen each subproject. Based on the screening, the recommended instruments (ESIAs/ESMPs/RAPs/site-specific plans, including biodiversity and OHS plans) will be prepared.

28. **Project implementation will require each SPIU/RBDA to engage an environmental/OHS and social officer, including a gender officer.** SPIUs will require qualified environmental/OHS officers from the State Ministry of Environment and social officers from the Department of Lands and Gender/GBV officers from the SMWA to be deployed as PIU officers before project effectiveness. A Security Adviser will be hired no later than three months after effectiveness. The Project Implementation Manual will include detailed tasks and responsibilities of the officers. The FPMU shall set up an E&S unit, leveraging the experience available from the TRIMING Project. The environmental and social officers will work closely with the dam safety experts engaged by the SPIUs/FPMU.

29. Although the project will not construct a hydropower dam, the preparation of the HMP will necessitate the preparation of environmental and social instruments. The client will prepare a SESA and site-specific full assessments such as ESIAs.

30. Per the ESCP's requirements, quarterly reports will be submitted to the World Bank, while the contractors will submit monthly reports to the SPIUs/RBDAs. The FPMU/SPIU/RBDA shall operationalize a GRM with committees established at the FPMU, SPIU, RBDA, and dam scheme levels. The roles and responsibilities of the GRM committee will be indicated in the GRM Manual, which will be developed by the FPMU, including alternative channels for grievance. The project shall also operationalize a GBV-sensitive GRM and a labor GRM for contractors and their workers.

31. **Land acquisition, restrictions on land use, and involuntary resettlement.** The activities under the project, especially those related to the expansion of irrigation, may likely result in land acquisition/displacement or disruption of income or livelihood sources. Given that the locations of subprojects are not yet known at this stage of the project preparation, the project prepared and disclosed an RPF. The RPF aims to clarify resettlement principles, organizational arrangements, and design criteria to be applied to subprojects or project components to be prepared during project implementation. When specific subproject locations are identified, an RAP or Livelihood Restoration Plan proportionate to the potential risks and impacts of the project will be prepared. While the project is not expected to entail significant land acquisition and displacement, its activities may cause temporary loss of livelihood during the rehabilitation of the irrigation schemes and physical and economic displacements. Moreover, the project activities will not commence until such specific plans have been finalized and approved by the World Bank and prompt compensation and resettlement assistance payments are made to project-affected persons. For the Model 2 participating states, costs associated with compensation and resettlement assistance will be provided through the state counterpart funds, while for Model 1 arrangement, the FPMU will cover the cost for compensation and resettlement assistance similar to the TRIMING Project. Specific attention will be given to payment of appropriate compensation to affected persons as indicated in the RAPs and the development of GRM at the community level that will be accessible to all stakeholders as well as arrangements for the monitoring the implementation of RAPs.

Overall Implementation Support Needs

32. The World Bank team will comprise members with different skills and required experience for successful project implementation. Tables 1.6 and 1.7 outline the expected staff/weeks and travel needed to ensure the actions and schedules are appropriately resourced.

Table 1.6. World Bank Implementation Support

Time	Focus	Skills Needed from Task Team	Resource Estimate (US$)
First 12 months	• Pipeline project readiness • Procurement preparation pre-award • Capacity building	Irrigation, dam safety, WRM, water institutions, hydropower experts, procurement, FM, environmental, social, and gender/GBV	500,000
12–48 months	• Review of progress in tender process and construction • M&E, ESF and FM • Capacity building	Irrigation, dam safety, WRM, water institutions, hydropower experts, procurement, FM	1,500,000
48–60 months	• Closing out open contracts • New pipeline development • M&E, ESF, and FM	Irrigation, dam safety, WRM, and hydropower experts	600,000

Table 1.7. Required Support Skills

Skills Needed	Number of Staff Weeks	Number of Trips per Year	Comments
Team leaders (water/irrigation specialist)	20	3–4	Task Team Leader and co-Task Team Leader based in Abuja
Hydropower specialists	24–30	3–4	One based in Abuja/Washington, DC
Energy specialist	10–15	n.a.	Based in Abuja
Water specialist	10–15	n.a.	Based in Abuja/Washington DC
Dam safety specialist	5-6	1-2	Based in Washington DC
Procurement specialists	10–15	n.a.	Based in Abuja
FM specialist	6	n.a.	Based in Abuja
Environmental specialists	5–6	n.a.	Based in Abuja
Social specialists	5–6	n.a.	Based in Abuja
GBV specialists	2–3	n.a.	Based in Abuja
Gender specialists	1–2	n.a.	—
Operational support	5–10	2	—
Specialized technical experts	5–10	3–5	Initially 5, reduced to 3 later
Administrative support	5-10	n.a.	Based in Abuja

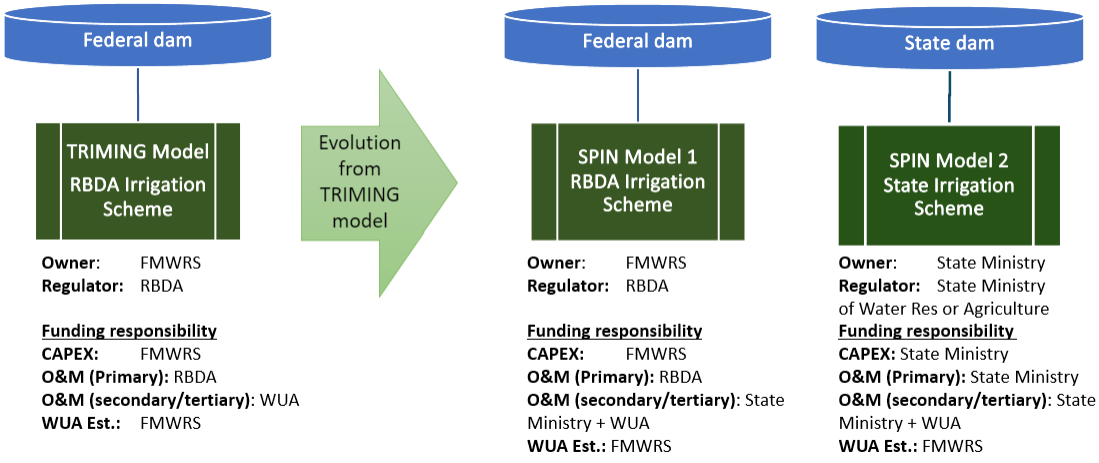
ANNEX 2: Irrigation Investment - State Selection and Investment Staging

1. This annex describes the process for selection of states and subprojects on irrigation that would be financed under the project, based on transparent prioritization and performance criteria. It also describes in detail the activities to be undertaken under Subcomponent 2.1 on WUAs.

I. State Selection and Investment Staging

2. The Federal Government has a vision to achieve 500,000 ha of irrigated land by 2030. This vision cannot be achieved by the Federal Government alone; partnership between the Federal Government and states to achieve the target has become imperative, as highlighted during the National Council on Water Resources meeting of 2018. The SPIN Project provides a good platform to pilot a Federal Government-State partnership model on irrigation and drainage development. SPIN aims to support the national and state irrigation and drainage development programs over a five-year period (2025–2031). The project would promote two distinct irrigation and drainage management models, which is an improvement on the TRIMING model, as outlined in Figure 2.1.

Figure 2.1. Evolution of Irrigation Management Models from TRIMING to SPIN



State Selection

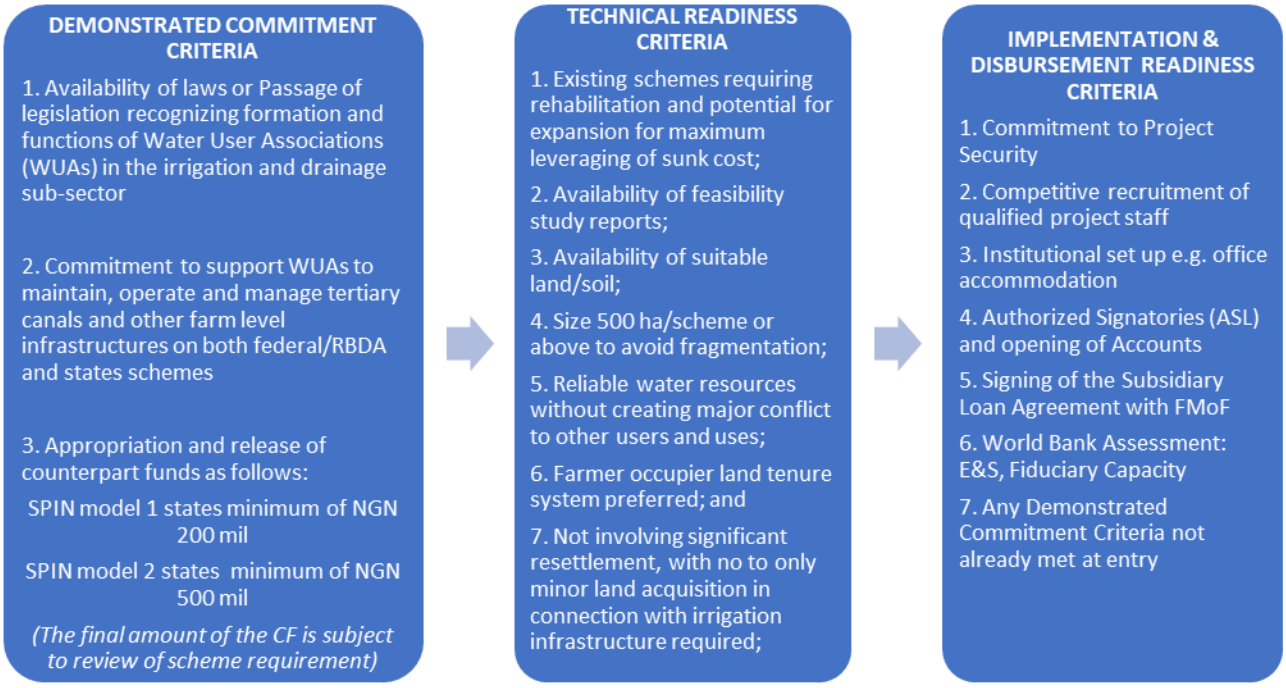
3. **Eligibility criteria.** The geographic coverage of the program is nationwide; however, states' participation would be subject to compliance with the eligibility and readiness criteria agreed for this project. The project will strengthen the institutional and technical aspects of irrigation and drainage management in Nigeria. The number of state schemes to be included in the project will be subject to availability of project funds.

4. To be considered, interested states must do the following:

- Submit in writing, expression of interest to implement either SPIN Model 1 or SPIN Model 2 (Figure 2.1). Table 2.4 provides the tentative list of investments for Models 1 and 2. In both cases, the states must demonstrate readiness for project implementation and readiness to allocate counterpart funds.
- For SPIN Model 1, the expression of interest must state the Federal (RBDA) scheme on which the state is willing to partner with the Federal Government.

- For both SPIN Models 1 and 2, the state must submit documentation demonstrating the state's CIC (Figure 2.2). The project will implement only rehabilitation and expansion of existing schemes and not development of new schemes.

Figure 2.2. Prioritization and State Staging Process



5. **To date, 31 states have expressed interest in SPIN** and were subsequently invited to document and submit their compliance with both the demonstrated commitment and technical readiness criteria during the stakeholders' engagement workshops organized at the six geopolitical zones of Nigeria. The responses submitted by the states to document the criteria were assessed in the plenary during the workshops held between May 12 and 15, 2024, for South-East, South-West, and North-East zones and May 19 and 22, 2024, for North-Central, North-West, and South-South. The outcome of the state selection process and prioritization criteria would also be presented to the Nigeria Governors' Forum. Table 2.1 presents the list of interested states.

Table 2.1. States that Expressed Interest in SPIN

Model 1					
North-Central	**North-East**	**North-West**	**South-East**	**South-West**	**South-South**
Benue	Borno	Jigawa	Abia	Lagos	Akwa Ibom
Kogi	Taraba	Katsina	Anambra	Osun	Cross River
Kwara	Yobe	Kebbi	Enugu	Ekiti	Delta
Nasarawa		Sokoto	Imo		Edo
Plateau		Zamfara			
Niger					

Model 2					
North-Central	**North-East**	**North-West**	**South-East**	**South-West**	**South-South**
	Adamawa	Kano	Ebonyi	Ekiti	Cross River
	Bauchi				
	Borno	Katsina			
	Gombe	Kebbi			

6. **Prioritization and state staging criteria.** The FMWRS and the World Bank will use the documentations to jointly assess interested states and group them into Category 1 and Category 2 states. Category 1 states would represent all states opting for SPIN Model 1 and Category 2 represents states opting for SPIN Model 2. The ability to participate in SPIN from among eligible states depends upon the demonstrated commitment and implementation readiness based on a set of prioritization criteria. Eligible states must submit to the FMWRS a detailed proposal demonstrating their commitment and readiness, which will be assessed, and states will be selected based on the criteria. The prioritization criteria include three minimum conditions, which need to be compulsorily complied by the states before submitting their proposal.

7. **The minimum conditions for prioritization** are (a) availability of/willingness to pass necessary legislation to create public irrigation units/entities, adopt participatory irrigation methodology, and provide corporate body status to WUAs/Apex WUAs; (b) resolution to participate in the SPIN program and avail loan from the World Bank by signing subsidiary financing agreement; and (c) budget provision committing capital and operation maintenance expenses of existing state public irrigation assets and committing co-financing requirements. To help the FMWRS verify the minimum conditions, states must include documents for verifications, which may include (a) existing state policies, state enactments, investment plans, and annual and master plans; (b) statements of the state/resolutions; and (c) passed budgets, audited financial statements, procurement committee minutes, and so on.

8. Both Category 1 and Category 2 states would be assessed against the demonstrated commitment criteria and technical readiness criteria, as presented in figure 2.2, to inform transparent decisions on state selection. Only states that have met the demonstrated commitment criteria will be progressed for assessment of technical readiness. Passing both the demonstrated commitment and technical readiness criteria is mandatory for admission into the SPIN program. In addition, Category 1 states would have to sign a memorandum of understanding with the RBDA overseeing the federal irrigation scheme which the state is interested in. Compliance with the criteria would have to be achieved no later than 12 months after project effectiveness.

9. **With the minimum conditions as the primary filter, the FMWRS will evaluate the states self-proposing for inclusion under SPIN for their commitment and readiness objectively using prioritization criteria.** The FMWRS, in collaboration with RBDAs, will sensitize the commissioners of all eligible states to the prioritization criteria, steps for evolution, means of verification, and so on, which are further elaborated in the Project Implementation Manual. The prioritization criteria for identifying states to participate in the project are included in Table 2.2.

Table 2.2. Prioritization Criteria

Sl. No.	Prioritization Criteria	Means of Verification
1	**Primary feasibility.** Existence of a dam with adequate filled water storage/adequate catchment area of reliable water source, which can feasibly be rehabilitated to harness adequate storage with potential to irrigate at least 500 ha	Feasibility study reports
2	**Asset management.** Assessed technical feasibility for the rehabilitation and development of both storage and conveyance structures optimally leveraging the sunk cost for achieving the potential	Project feasibility reports

Sl. No.	Prioritization Criteria	Means of Verification
3	**Potential for irrigated agriculture.** Proposed command area has prevalence of suitable agro-climatic-, land-, and soil-related factors conducive for crop husbandry, with a potential to achieve cropping intensity and crop diversification.	Study reports documenting the agro-climatic and soil descriptions cultivation practices and such other status reports
4	**Conflicting uses**. No pronounced externalities with other uses of water and no conflict with other users including interstate water issues	Detailed description of externalities if any.
5	**Social relevance.** The existence of majority small farmers and sharecroppers including women farmers expected to be benefiting from irrigation	Detailed statics of type of farmers with classification criteria
6	**Financial capacity.** Commitment for counterpart funding including cost of setting up initial readiness aspects until project funds are available including awareness campaigns, setting up the state PMU, and so on.	Statement of the state committing budget allocation/budget statement
7	**Human resource capacity.** Especially related to technical personnel and social, environmental, and financial management	Existing organogram showing filled in positions
8	**Environmental factors.** No adverse environmental impacts both from storage and conveyance rehabilitation and proven capacity to implement environmental safeguards.	Environmental assessment by the World Bank
9	**Social aspects.** No adverse social impacts including major rehabilitation and resettlement issues. Adequate capacity to implement social safeguards aspects	Social assessment by World Bank
10	**Institutional assessment.** Proven fiduciary capacity for both FM and procurement functions	Fiduciary assessment by the FM and procurement teams of the World Bank
11	**Convergence and coordination.** The state department/units responsible for environment, agriculture, finance, procurement, planning, and women development are working in close coordination and are committed to converge their activities at the scheme level involving WUAs and Apex WUA including commitment of sub-sectoral budgets and ongoing programs.	Statement of the state with directive to the sub-sector agencies

10. **The participating states will be allocated project funds based on graduating stages, but the actual release will depend upon assessment of performance.** The state staging consists of readiness condition and milestones to be achieved to access funds capped at each stage. The entry-level stage mainly consists of funding for planning studies, activities to satisfy achievement of minimum capacity, system establishment, technical assistance, and so on. Stage 2 consists of tasks that are based on agreed work plans covering the devolved activities. The work plans will clearly specify the milestones and deliverables. Stage 3 consists of larger allocation to continue with the updated work plans. The stage-wise allocation is predetermined, increasing by stages but incentivized based on assessed performance. The stage-wise readiness criteria, allocation, potential activities for each stage, assessment methodology, and the basis for dynamic allocation for financing, and so on are further described in the Project Implementation Manual.

11. A further criterion on implementation and disbursement readiness will apply to Category 2 states only, as they are expected to have state-level implementation units. Implementation in Category 1 states will be managed at the Federal-level PMU.

12. The managed allocation of project funds to participating states is intended to promote implementation performance. States will access growing levels of funding based on their compliance with readiness and performance conditions. At entry, states will benefit from federally implemented technical assistance and planning studies, toward satisfying commitment and readiness conditions (Stage 1). The states having satisfied capacity and readiness conditions will have access to an initial capped amount of investment funding to start implementing an agreed work plan on their

preferred scheme identified during the states' engagement held between May 12 and 15, 2024, for South-East, South-West, and North-East zones and May 19 and 22, 2024, for North-Central, North-West, and South-South (Stage 2). Each state will have the opportunity to subsequently access larger capped tranches of funding to scale up scope of their approved investments (Stage 3), based on their performance in Stage 1. In all stages, state performance will consider the timeliness and compliance of consultancies, design, procurement, and implementation tasks. Excessive delays or compliance deviations in procurement or in implementation will be factors in potential decisions for reduced or deferred allocation of new funding or even for a reallocation of noncommitted funding. The proposed starting and fund allocation mechanisms are further discussed in Table 2.3.

Table 2.3. State Staging Process

<table>
<tr><th></th><th>Stage 1</th><th>Stage 2</th><th>Stage 3</th></tr>
<tr><td>Overall Commitment</td><td>• Expressed interest
• Commitment to support WUAs and budget line</td><td colspan="2">• Available legislation for establishment of WUAs in the irrigation and drainage sector
• Available budget line for WUAs O&M needs
• Counterpart financing commitment released to Designated Account
• Project security
• Compliance with ESDD</td></tr>
<tr><td>Component 1</td><td>• Technical assistance support to eligible states at entry to meet overall commitment criteria to unlock Stage 2 investments</td><td colspan="2">• Establishment of WUAs across all eligible schemes</td></tr>
<tr><td>Component 2</td><td rowspan="2">• Rapid review of feasibility, design, and bidding documents
• Initiate procurement process up to award stage only</td><td>• Initial investment package approved for preferred scheme up to US$5 million</td><td>• Additional investment package for scale-up approved up to US$10 million</td></tr>
<tr><td>Component 3</td><td>• Investment package approved for water source (dam) connected to the preferred schemes
• Investment package approved for dams identified via Risk Analysis Assessment and selected for rehabilitation</td><td></td></tr>
</table>

13. **States are expected to progress through the various stages toward full implementation of the planned project activities.** This will be based on regular reviews of state performance every six months, based on the recommendation of the National Project Management Unit and concurrence of the World Bank. In addition, the annual performance of states will be assessed to determine whether the state should continue at that stage or be dropped. The implementation performance criteria will include SPIU performance (related to overall project activity facilitation, technical, fiduciary, and ESF) and state investment implementation performance including scheme completion, WUA establishment, and O&M budget provision or other sustainability conditions.

II. Mobilization and Development of WUAs

14. **The homegrown model of WUAs initiated under the TRIMING Project will be replicated and scaled up in project areas.** Subcomponent 2.1 will focus on mobilizing WUGs of farmers around 'secondary' irrigation and drainage canals as building blocks for establishing WUAs as legally registered entities taking over fully the O&M at scheme levels built/rehabilitated under the project. WUAs will be strengthened as inclusive, self-managed and accountable institutions of farmers. WUAs are primarily responsible for maintaining the secondary- and field-level water conveyance system, facilitating crop planning, estimating water requirements, ensuring equitable and sustainable irrigation scheduling, delivering irrigation services to members, and fixing and collecting irrigation and drainage service fees from members to recover the O&M cost to help them sustainably manage the 'last mile' water conveyance system. The main aim of Subcomponent 2.1 is to reverse the management of public irrigation from 'top down' to 'bottom-up' and enhance the level of ownership and acceptance by member farmers irrigation and drainage services.

15. **The management and running of the WUAs shall ensure social, economic, environmental, and institutional sustainability.** WUAs must follow good governance procedures, implement social accountability mechanisms, and optimize water resources utilization. Special attention shall be given to vulnerable sections of the membership such as small farmers, sharecroppers, and women-headed farm holds so that they are meaningfully included in WUA leadership and membership and benefits. The management of infrastructure and planning for resource utilization shall be climate smart to ensure resilience from extreme climate events.

16. **WUAs have to function in a gender-sensitive manner.** The key principles to be followed in developing WUAs include participation of women members of the farm families in the membership and activities, ensuring systematic engagement of women as participants and decision-makers in WUAs. In addition, targeted leadership development for women members should include structured consultations with women on key decisions to be made, women-friendly training and learning events, and so on.

17. **The timing for initiating and developing of WUAs must start sufficiently early to ensure that the users are engaged up front.** The initiation of WUAs must synchronize with the physical development of the irrigation system. By the time the schemes are developed and ready for handing over, WUAs should have been established and initial capacity building completed. WUAs must be readied to take over and operate the schemes as soon as the facilities are handed over including engagement of technical staff for operation, decision-making on ISFs, and systems for collecting receivables from the members.

18. **To mobilize, empower, and build the institutional capacity of farmer organizations and WUAs and help them graduate into higher-level federated arrangements, Apex WUAs will be formed.** Organically aggregating and functionally networking WUAs into an Apex WUA as a federation will help maximize the performance and results of member WUAs. The Apex WUAs will help enable greater bargaining power to farmers, broad-based representation, and aggregation of demands and services for achieving economies of scale, thereby deepening transformation of the irrigation sector.

19. **In partnership and collaboration with RBDAs and state governments, WUAs are expected to ensure not only critical irrigation to agriculture but also sustainable and resilient management of the public irrigation system.** The activities include enhancing organizational and human resource capacity of WUAs and formalizing the interrelationship with state governments and RBDAs. In geographic areas where state governments are not coming forward to partner with the FMWRS to take up implementation of SPIN Model 1, RBDAs will continue to provide support to WUAs.

20. **WUAs will be established in all irrigation schemes under the project and capacity building will be provided.** Main activities to be carried out and to be financed under the project will include

(a) Sensitizing, mobilizing, and establishing the organizational structure, processes, and functions of WUAs through the provision of technical assistance including adapting, updating, and/or customizing model bylaws, rules of business, and SOPs to guide management of WUAs;

(b) Building awareness and developing a shared understanding among members of WUAs on key principles and rules of participatory irrigation model, including member's rights and duties;

(c) Building the skills and competencies of WUA leadership and committee members, including staff of WUAs, to plan MOM, continued management and operation of irrigation services, transparent fiduciary management (including fixing of service charges, recovery of MOM expenses, and transparent accounting and reporting), accountable decision-making, and so on;

(d) Facilitating cross learning from well-performing WUAs and organizing peer-to-peer learning and sharing from implementation champions—both farmer members and WUA staff.;

(e) Installing simple user-friendly software systems for billing and collection of user fees and other payments from members, including easy-to-use member database to help crop planning and irrigation scheduling including training of user farmers/staff;

(f) Implementing a performance tracking and grading mechanism as a tool to implement organization development activities to address performance challenges and ensure sustainability of WUAs;

(g) Providing support to establish offices, computers, and operating systems and other initial investments required for smoother functioning of WUAs;

(h) Providing transitional contributions to MOM costs of irrigation schemes on a declining basis as block grants;[31]

(i) Formalizing the devolved co-management arrangement for the O&M of the irrigation schemes through the signing of a tripartite memorandum of understanding among WUAs/Apex WUAs with state governments and RBDAs, detailing the roles and accountabilities of each of the parties including the consensus on assured bulk water supply, bulk water pricing, major periodic maintenance of the system, basis of measurement, and so on;

(j) Facilitating link-up and collaboration with agriculture production enhancing and marketing/processing initiatives and agencies, both public and private sector;

(k) Establishing Apex WUAs and supporting the setting up of their offices and minimum administrative and technical staff; and

(l) Training dedicated WUA facilitators at the state level and within RBDAs where states opt out of MOM responsibilities.

21. As already showcased by the TRIMING Project, women will play a critical role as members of WUAs to deliver and manage water resources effectively. The outcome will be assessed by an appropriate indicator measuring the number of women decision-makers in WUAs. Implementation of Subcomponent 2.1 will be done by the FPMU in close collaboration

[31] WUAs are expected to prepare a business plan covering four years of activities and the project will support block grants to the tune of 80 percent in year 1, 60 percent in year 2, and tapering to 20 percent in year 4. The steps and formats for preparing the business plans will be elaborated in the knowledge package for WUAs and the POM.

with RBDAs and states. The coordination of activities and oversight will be taken up by the state governments. RBDAs will set up a dedicated WUA unit as part of the bulk water supply to provide facilitation support to WUAs and the states.

Potential List of Model 1 Irrigation Schemes

22. Devolution of scheme-level irrigation systems from the federal scheme to state governments (Public Irrigation Devolution Model 1) has been discussed in the main text. Table 2.4 provides the potential list of Model 1 schemes, which have been identified by the FMWRS based on the selection criteria discussed above. The final list will be confirmed as soon as the state selection processes are completed before the project effectiveness.

Table 2.4. List of Potential Irrigation Schemes under Component 2

No.	Scheme	State	RBDA	Service Area (ha)
1	Kampe	Kogi	Lower Niger	3,000
2	Middle Ogun	Ogun	Ogun-Oshun	3,000
3	Ada Rice	Enugu	Anambra Imo	3,000
4	Turunku	Kaduna	Upper Niger	1,250
5	Duke Lade	Kwara	Lower Niger	3,000
6	Lower Ogun	Ogun	Ogun-Oshun	3,500
7	Guyuk	Adamawa, Gombe, and Borno	Lower Benue	17,000
8	Lower Taraba (Wuro Keso)	Taraba	Upper Benue	5,000
9	Cham Dam	Gombe	Upper Benue	3,000
10	Balanga[32]	Gombe	Upper Benue	2,800
11	Doma	Nasarawa	Lower Benue	2,000
12	Naka	Benue	Lower Benue	1,000
13	Obagaji	Benue	Lower Benue	1,000
14	Tede	Nasarawa	Lower Benue	3,000
15	Oguma	Kogi	Lower Niger	1,000
16	Wase	Plateau	Lower Benue	1,000
	Subtotal			53,550

[32] Balanga Irrigation scheme under Gombe State government and is considered as a candidate for Model 2. All other schemes are under the Federal Government (Model 1).

ANNEX 3: Technical Note on Dam Safety

I. Detailed Project Description

Activity 1.1.1: Strengthening of dam safety institutional structure, including development and adoption of improved dam safety technical guidelines and manuals (US$4 million)

1. **This activity will strengthen the capacity and improve the management framework for dam owners, operators, and agencies overseeing dam safety to help address dam safety risks in line with the ESF** including those from climate change-exacerbated floods and droughts[33] by (a) setting up a digital dam asset management system; (b) strengthening the dam safety institutional structure and developing improved dam safety technical guidelines and manuals to complement NESREA's checklist; and (c) institutionalizing capacity assessment and delivering capacity building for the personnel involved in dam safety. It will help the FMWRS deploy multidisciplinary specialists and purchase necessary equipment to perform dam safety mandates both at the federal and RBDA levels, consistent with the legislation for dam safety requirements.

2. **Nigeria's digital dam asset management system will be built on and complement the existing Digital Dam Repository Application developed under the TRIMING Project.** It will estimate the funds required to meet the regular MOM and rehabilitation requirements of dams over a multiyear period. It will also monitor the utilization of the investments and allow dam owners, operators, and dam safety staff to access and update transactions information in real time.

3. **The project will help develop comprehensive dam safety guidelines consisting of standards, operational manuals, and rules to help dam owners and operators comply with dam safety requirements.** The guidelines will cover structural and nonstructural dam safety measures and will include operating standards, reservoir operation manual, reporting requirements, MOM planning and budgeting, emergency action planning, warning system, information to prepare public awareness campaigns, and strategies to tackle climate change. The guidelines will also contain the oversight and monitoring mechanism including formats for reporting on dam safety aspects. By reducing the risk of dam breaches and failures—through the development and adoption of safety standards and regulations—and ensuring staff are properly trained to adjust operations under low- and high-water conditions, the resilience of the project area residents to extreme water-related weather events will increase.

4. **The development and adoption of the dam safety guidelines by the FMWRS is designed as a PBC to incentivize this critical objective for national dam safety.** Upon completion of the PBC, US$50 million out of the US$100 million allocation for dam safety investments under Component 3 will become eligible for disbursement.

5. **The component will also implement dam safety capacity building for policy makers, owners, operators, and dam safety organizations** at the federal, RBDA, and dam levels, including the DDRO and IWRM Commission under FMWRS, RBDAs, state agencies, and NESREA. It will disseminate the dam safety guidelines and have a particular focus on emergency action planning for all disaster management agencies and rescue agencies including awareness raising of the public.

[33] Low water levels can change the load distribution on dam structures, which can result in stress and structural integrity issues. In addition, reduced inflows can lead to increased sedimentation in reservoirs, which can reduce storage capacity and affect dam operation. In a drought situation, extremely low water levels may limit the electricity generation potential. Prolonged low water levels can expose parts of the dam and intake structures to the air, leading to corrosion and other maintenance challenges.

II. Dam safety portfolio risk analysis

6. Nigeria has over 400 dams that were constructed for irrigation and for hydropower production. To ensure the safety of these important infrastructure, a dam safety management framework needs to be in place to ensure that the structures are maintained in a way that minimizes the threat to life safety, economic risks, and environmental risks. As one of the first initiatives, Nigeria intends to rehabilitate 180 large hydropower and irrigation dams located in various river basins across the country. A first step in this program will be to develop the risk profile of the portfolio. This will involve the development and application of a qualitative risk-informed tool that will rank the dams according to the dam safety risks they impose to the public and the environment. Thereafter, the tool developed will identify and prioritize the preliminary order of the rehabilitation program, accounting for the dams that present the greatest dam safety risks.

7. In January 2024, the FMWRS conducted, with technical assistance of the World Bank, a series of workshops to introduce the proposed tool. Over the course of two days, the theory and application of the tool was presented to a group of Nigerian dam safety stakeholders. During the discussions, changes to the proposed tool that would allow for a better reflection of conditions in Nigeria were identified, and the tool was modified to reflect these recommendations.

8. The FMWRS thereafter created, within its DDRO, a team of dam experts to oversee the application of the tool and provide training for dam owners/operators in the use of the tool. In May 2024, another workshop was conducted with the tool applied to 30 large dams. The FMWRS will continue to lead discussions and application of tools, summarizing the exercise results to achieve the goal of obtaining a risk-informed prioritization of identified dams needing rehabilitation by the end of 2025, which is one of the initial outputs envisaged under Component 3.

III. Representative Dams for Assessment

9. Within the portfolio of proposed dams to be supported under the SPIN Project, Dam Safety Assessments have been carried out for three dams, through field visits conducted by DSRP for the preparation of the SPIN Project. The assessment results are reflected in the DSRP report and Project Screening Template report. These field visits include dam safety assessments to (a) inspect and evaluate the safety status of the dams, their appurtenances, and performance history; (b) review and evaluate the O&M procedures; and (c) update the quality control checklist for 'Case 2 - Existing Dams and dams under construction - project finances rehabilitation or upgrading of existing dams', supplied by the Global Solution Group on dam safety team. The dam rehabilitation plan will include structural and nonstructural measures identified through investigative studies including systematic hydrological assessment, stability analysis, geotechnical studies, and geophysical and bathymetric surveys. Based on the DSRP and Project Screening Template reports, the ESDD report is prepared and will determine the level of environmental and social impact. If the level of environmental and social impact is determined as 'low' or 'medium', the ESMP will be prepared. If the level is determined as 'Substantial' or 'High', a detailed ESIA will be conducted. The prioritized dams for the first phase include the following:

- **Naka Dam**, under the responsibility of Lower Benue RBDA, situated in Benue State, is a multipurpose dam serving 1,000 ha of irrigation area and providing 0.2 million m^3 of water to 10,000 habitants downstream. The dam has a height of 8.5 m and a length of 500 m. Rehabilitation measures recommended are (a) clearing of site and dam toe; (b) treatment of upstream and downstream slopes; and (c) grading and surfacing of the dam crest. The total cost of rehabilitation is estimated at US$1 million.
- **Doma Dam**, under the responsibility of Lower Benue RBDA, situated in Nasarawa State, is a 27 m high earth-fill dam with a crest length of 500 m and a central clay core built in 1988. Doma Dam is the water source of the Doma Irrigation System that serves 2,000 ha of irrigation service area. The field visit found that severe

erosion on the downstream surface of the main dam body, which requires immediate rehabilitation. Dam crest settlement was also observed during the visit.

- **Wuro Keso Dam (weir)** under the responsibility of Upper Benue RBDA, situated in Taraba State, is an intake weir comprising a homogeneous embankment of about 3.5 m high constructed to create a reservoir for a diversion channel from Taraba River. The DSRP report recommended required works in site clearing, reservoir area clearing, and construction of living quarters for dam operators.

IV. Other Technical Details

10. **Dam safety instrumentation** will be considered an essential requirement to improve the basic safety of dams and appurtenant structures. Based on an assessment carried out during preparation of the project and feedback from the DRO staff, it was recognized that there is a major lack or shortage of dam safety instrumentation, for example, (a) day-to-day access and mobility at sites; (b) communication facilities; (c) basic equipment needs for surveillance and monitoring,; (d) safety equipment for inspections and emergency repair works; (e) standby power supply; and (f) reservoir transportation facilities (boats) and so on. In general, the supply and/or installation of the minimum package of dam safety instruments will be considered during the early stage of project implementation. The experience with procurement and installation of the basic dam safety instrumentation during the TRIMING Project's dam safety activities points to a number of important lessons. The approach to be adopted under the SPIN Project will explore service contract provisions to sustain the provision of basic spares and maintenance measures, as well as sustained capacity building and support during the project period. This will be provided on a decreasing basis to correspond with increasing capacity within the FMWRS and RBDAs to assume longer-term sustainable operations.

11. **EAP** is an operational tool to reduce the likelihood of failure and potential impacts caused by dam failure. The contents of the plan will include preventive actions to be undertaken to avoid failure; a flow chart listing authorities involved in the notification process, ranging from dam operator to local emergency authorities; and inundation maps delineating the area that will be flooded in the event of a dam failure and identified evacuation procedures. Till date, the FMWRS and RBDAs have conducted dam break analysis,[34] which will lead to development of EAPs for about five dams, of which all have been financed by the TRIMING Project. During preparation, the downstream communities that would be affected by dam failure and the provincial and local authorities responsible for early warning, evacuation, and post-flood assistance, are required to be consulted.

12. **FFWSDO and integrated reservoir operations including streamflow forecasting for climate-resilient dam management.** The preparation and operationalization of a flood forecasting and warning system is the most effective method for reducing the risk of loss of life and economic losses. The study[35] conducted under the TRIMING Project revealed that cascade operation of reservoirs under the 2022 flood conditions would have reduced the peak in Benue River basin by 30 percent. The SPIN Project will support a comprehensive program to enhance capacity with respect to flood forecasting for dam operations. This will include telemetry to facilitate real-time data for each dam and a relay station to the office on site, RBDA offices, and Central Dam Safety Office under the DRO of the FMWRS. Nature based solutions will also be promoted, such as improved sedimentation management practices through improved operation and mitigation of adverse land use practices within the catchment.

13. **Hydroclimatic stress testing.** To assess the potential impact of climate change on dam safety and operations, the Tiga Dam was chosen as the sample dam in Nigeria and was subjected to a comprehensive stress test to evaluate its

[34] Consulting service for dam break flood inundation hazard and exposure assessment for supporting the storage agenda for a More Resilient Development in Nigeria.
[35] Automated Detection and Estimation of Dam Volume of Reservoirs and Dam Bodies Using Satellite Images in Nigeria.

response under a wide range of hydroclimatic changes driven by climate change. This assessment utilized the Water GP's Hydroclimatic Stress Testing Tool. The tool synthetically generates time series of precipitation and temperature which are then translated into terrestrial river flow and hydrological conditions via water system model. The generation of these series used historical climatological conditions, with adjusted parameters informed by the outputs of projections.[36] The findings indicate that the Tiga Dam performs adequately under future changes in annual mean daily discharge by the mid of the century. Most climate scenarios suggest that the baseline (current) inflow to the dam will be sustained or in fact increase. However, this apparent robustness may be compromised under extreme conditions. The analysis highlights that the Tiga Dam faces a substantial risk of increased flooding, as indicated by the annual maximum daily discharge. Although the risk of water scarcity is not currently estimated to be very high, further analysis is necessary, as the minimum flow upstream of the dam may not be met, even with low future increases in temperature and slight decreases in precipitation. This analysis identifies how climate change may affect the operational activities, expected outcomes, and benefits of the Tiga Dam. The tool will be expanded to assess hydroclimatic risks to other dams and relevant infrastructure within the SPIN Project. These analyses will be conducted throughout the project's execution and will inform the design of climate-robust and resilient strategies.

[36] Global climate models (GCMs) from the sixth Coupled Model Intercomparison Project Phases (CMIP6)

ANNEX 4: Technical Description of the Hydropower Component

I. Project Activity Details

Activity 1.1.3: Capacity Building of and Support to Federal Institutions and Agencies in Hydropower Development (US$16 million)

1. **The objective is to support the Federal Government in (a) preparation of an HMP and climate-smart hydropower investment planning; (b) PPP options for a large transformative project for Nigeria; and (c) capacity building of and support to federal institutions and agencies in hydropower planning and management.** The activities contribute to both climate change adaptation (through improved inter-sectoral planning of water storage and management as well as improved dam and reservoir O&M, including emergency procedures during floods and droughts) and mitigation (through the generation of renewable energy and avoided GHG emissions associated with fossil fuels).

2. **Preparation of an HMP and climate-smart hydropower investment plans.** Consistent with the mandated accountabilities of the FMWRS, FMP, and its agencies coordinating large investments in hydropower projects and tasks of flood control, navigation, and water supply and providing power across Nigeria, this component will provide strategic support to prepare a master plan and select optimized hydropower projects through cooperation between the FMWRS and FMP. SPIN will support the preparation of a hydropower development master plan, which would include better synergies with existing water resources master plan and serve as input for Nigeria's Integrated Energy Resource Plan and broader least-cost power development plan considering the role of hydropower in integrating other renewable energy sources. It will also support the establishment of a screening criteria agreed by both the FMWRS and FMP and developed through a stakeholder process for the selection of transformative and climate-resilient projects from the master plan. The selection criteria can then be applied to candidate projects proposed by the ministries. For this, the SPIN Project will finance a qualified international transaction adviser who will be assisted by local consultants. The master plan is expected to include stakeholder engagement; characterization of the water resource, environmental and social conditions in the watersheds being considered for development; and identification of a portfolio of hydropower projects including multipurpose projects. The HMP would also analyze the hydropower capacity and energy capabilities for a series of development scenarios, including the potential for hybrid operation of solar energy resources with hydropower that can increase the total dispatchable energy yield of the combined systems. For one selected project from the HMP, a feasibility study and ESIA will be conducted, and SPIN will assist in development planning to identify a program for PPP procurement, project design, construction tendering, construction, and operation. This would include the development of a project development agreement and so on. Optimizing the development of hydropower in Niger River sub-basins and its gradual integration with solar power and the national energy grid will make the hydropower sector more resilient to climate change-exacerbated precipitation and river flow variability.

3. **PPP options for large transformative projects for Nigeria.** The support will cover, among others, the following: (a) reviewing an investment program; (b) defining the PPP procurement process; (c) gaining clarity on the legislative processes; (d) defining the role of the implementing agency; and (e) updating the ICRC Swiss Challenge. The ICRC and BPE will be supported to operationalize the PPP action plan, aimed at leveraging private sector participation in the power sector along with reform and liberalization of hydropower projects. This will help develop the right PPP processes to support some of the transformative projects identified through the HMP for investments.

4. **A PBC is linked to the adoption of the HMP by the PSC and the preparation of priority hydropower projects ready for PPP.** The eligibility of US$10 million out of US$16 million of this subcomponent will be dependent on the achievement of these objectives (detailed in the Results Framework).

5. **Capacity building of and support to federal institutions and agencies in hydropower development.** This subcomponent aims at building human resources and institutional capacity for hydropower development in the federal institutions and its agencies. This includes developing studies, strategies, and plans for improving hydropower planning and management. Activities under this subcomponent are (a) studies and policies for benefit sharing among stakeholders for hydropower development; (b) studies and action plans for asset development, ownership, and operation (including potential interprovincial assets, PPPs, and so on); and (c) strategy for integrating variable renewable energy including solar-hydro hybridization into the national grid.

II. Hydropower (Rural Electrification Rehabilitation Analysis)

6. As part of the SPIN Project preparation, the team assessed the hydropower potential in Nigeria and observed that there were several greenfield and brownfield opportunities across Nigeria, estimated at 14 GW. From the list of brownfield projects in the country, it was seen that there were three categories of possible hydropower projects.

- **The first category comprised purely rehabilitation projects** that already had provision for hydropower but needed rehabilitation of electro-mechanical equipment and possibly repairs to civil works. There are two projects totaling 13 MW in this category: Oyan in Oyo State (10 MW) and Bakalori in Zamfara State (3 MW).
- **The second category includes partially built projects that have provisions for hydropower.** There are eight projects totaling 78 MW. The smallest is Galma in Kaduna State (2 MW) and the largest is Kiri in Adamawa State (40 MW).
- **The last category of brownfield projects comprises existing dams that may have the potential to incorporate the hydropower component.** There are 36 projects totaling 105 MW in this category. The largest is Gubi in Bauchi (40 MW) and the smallest is the Nkari in Akwa Ibom (2 KW). All these multipurpose dams belong to either the FMWRS, FMP, or the state government.

7. Most of these brownfield projects may not be large enough for utility-scale electrification projects. However, their impact can be transformational at the national level, from an aggregated standpoint, and make a significant dent in the energy access and energy transition agenda of the FGN. The small to medium hydropower projects could be used to power unelectrified rural communities and augment power from the grid to underserved rural/peri-urban communities near these hydro dam locations. Further, the evolving role of state governments, driven by the Electricity Act 2023, presents an opportunity for subnational entities to leverage the potential of small to medium hydro dams to define the electrification pathways for the states, which are backed by an enabling policy and regulatory framework.

8. To investigate these opportunities, the World Bank engaged the services of Village Data Analytics (VIDA), a consulting firm to support due diligence of the rural electrification potential of small to medium hydro dams across Nigeria, leveraging VIDA's geospatial-based software platform. VIDA analyzed 46 potential brownfield sites for their viability for off-grid electrification. Based on the assessment carried out by VIDA on the 46 dams, it was discovered that 3 dams may have the potential to provide electricity for the off-grid market, 9 dams may be good candidates for a hybrid solution (combination of on-grid and off-grid), and 34 dams located next to the grid are most likely already connected.

9. The Federal Government currently retains the ownership of the transmission assets through the FMF Incorporated (management under concession), with the generation assets concessioned and distribution sectors fully privatized. A generation license authorizes the licensee to construct, own, operate, and maintain a generation station for generation and supply of electricity in accordance with the Electric Power Sector Reform Act, 2005. Subject to this act, the holder of a generation license may sell power or ancillary services to any of the classes of persons specified in the license. An electricity generation license is needed for any power generation activity beyond 1 MW. As the generation and distribution

sectors are managed by the private sector, there is no business case for the Government of Nigeria to lend money to the ministries or states to develop these projects in the public domain. Hence, under SPIN, unless the Ministry of Finance borrows IDA resources and lends to the private sector to develop the brownfield hydropower project, financing of brownfield hydropower projects has not been considered. There are other hydropower projects that may be considered in the future for a subsequent SPIN program. These would be priority government projects that may not meet the return expectations of the private sector. The structure for this intervention cannot be determined at this stage of this Government's administration. Moreover, beyond the upstream ecosystem support needed to design a process and framework, including standard contractual templates to guide the tendering of hydropower sites to the private sector with key institutional roles clearly defined, the US$750 million Nigeria Distributed Access to Renewable Energy Scale-up (DARES) Project, approved by the World Bank Board in December 2023, is a private sector-led results-based financing program, which is agnostic to renewable energy technology types and could accommodate the few dams suited for off-grid and hybrid electrification.

PPP Options for Large Transformative Projects for Nigeria

10. The SPIN Project will cover, among others, the following:

(a) **Review of an investment program** and identification of a financing strategy for projects identified in the master plan and screened for potential interest to private sector for projects considered for a PPP structure.

(b) **Defining of the PPP procurement process for the SPIN Project.** It is important to have a well-defined process for PPP procurement. While such a process already exists in Nigeria, it is important to refine it in light of the SPIN program and gain clarity on the parts where there are ambiguities or foreseeable problems.

(c) **Gaining of clarity on the duality of legislative regimes (hydro resources and power)**. Develop a clear methodology for determining whether the FMWRS or FMP (or both through joint representation) should have responsibility for any particular hydropower project, especially in the SPIN program.

(d) **Nomination of BPE as the implementing agency.** Even though the ministers, departments, and agencies can legally implement the projects on their own, it is recommended to include BPE as the implementing agency to gain the benefits of their specialization in PPP procurement.

(e) **Inclusion of relevant states due to duality of legislative regimes (PPP).** In addition to the ICRC Act and ICRC Regulations, federating states are not prohibited from passing laws in relation to the implementation of PPP projects within the relevant states. Therefore, it important to include the relevant states in the stakeholder discussions.

(f) **Removal or modification of the ICRC Swiss Challenge.** The ICRC Swiss Challenge is acting as a deterrent to international sponsors from developing PPP projects in Nigeria. In case of an unsolicited proposal, it is recommended to either completely remove the ICRC Swiss Challenge from the SPIN process or modify it to include a shareholding in the project or cash payout to the original proponent equivalent to the amount invested by them on relevant studies, instead of the right to match the best offer.

11. The ICRC and BPE will be supported to operationalize the PPP action plan, aimed at leveraging private sector participation in the power sector along with reforms and liberalization of hydropower projects.

ANNEX 5: Economic and Financial Analysis

I. Introduction

1. The EFA is necessary for verifying if the US$500 million proposed investment for improving the utilization and safety of existing water storage facilities for irrigation and other uses, and strengthening institutional arrangements for IWRM in Nigeria is justified, both from the point of view of the beneficiaries and the Nigerian economy. The project aims to secure and maximize the socioeconomic value of existing water storage to develop the untapped potential of irrigation (agriculture production), protect people from floods and droughts in face of climate change (mitigating loss and damage), and add to energy security through hydropower development.

II. Methodology for the EFA

2. This annex presents the EFA of the investments for irrigation development, dam safety, and flood protection in Nigeria. The rationale for verifying the joint justification of the proposed investment is that, without a reliable flood protection system in place, irrigation investment would not be feasible due to the increasing frequency of floods affecting the downstream areas. During the rainy seasons, the river basins experience heavy rainfall, and these areas suffer floods leading to massive displacement, loss of life and property, disease outbreaks (mainly waterborne and water related), and agricultural crops and fields being washed away. Two of the main quantifiable benefits to be obtained through the proposed SPIN investments are (a) increased agricultural production and (b) reduced costs and damages from drought and flood events.

3. This EFA was prepared based on relevant data collected from the impact of the predecessor TRIMING Project[37] likely to be closed in January 2025. The EFA methodology was based on building 'with' and 'without project' scenarios quantifying the incremental benefits to be attained with the proposed investments. The scenarios and results from irrigation (US$350,000) are presented in section III.[38] Section IV presents the estimation of additional benefits to be obtained from Component 3 'Improvements in Dam Operations and Enhancing Dam Safety' (US$100 million) aiming to increase the safety of selected dams and strengthen dam safety management in the country. Dam safety will reduce flood risks, considerably mitigating material and nonmaterial damages from the flood hazards. Flood risk benefits were assessed based on the expected value of the annual average damages (AAD) to be avoided grounded on the spatial analysis, flood maps, and results of the Flood Exposure of Population and Agricultural Fields reported by the Fukushima University consultants.[39]

4. The indicators for the study include (a) the financial impact of investments at the level of the irrigation beneficiaries (family net income increases) using 2023 market prices; (b) the economic impact from dam safety; and (c) the aggregate irrigation and dam safety investments for the Nigerian economy. The last two economic indicators used are the ERR and the economic NPV of the project's incremental costs and benefits. Relevant conversion factors were used to estimate the shadow values of costs and benefits for the country, net of market imperfections (taxes and subsidies). A sensitivity analysis was also prepared to verify the effect of major risks on the proposed interventions.

[37] Financial and Economic Analysis, Final Report 2023, Matrix Universal Services Ltd. November 2023; and other sources.
[38] FARMOD software was used for the construction and analysis of the alternative scenarios. Tables are available in the project files.
[39] *Dam Break Flood Hazard and Impact Assessment to Support Data Storage Program for More Sustainable Development in Nigeria*.

III. Irrigated Agricultural Production

5. Nigeria is the largest producer of rice in Africa, producing about 8.4 million tons annually. However, Nigeria is also the third highest importer of milled rice in the world, importing about two million metric tons of rice. Rice is and will continue to be the primary and most important production activity in the irrigated areas. Developing an efficient rice production value chain should be crucial and necessary for justification of the proposed investment. One of the major hindrances to produce local rice for small farmers has been the lack of appropriate technologies.[40] Other higher-value crops and activities (tomato, onions, fruits, aquaculture, and so on) could offer even higher potential returns, but developing adapted production technologies, adequate value chains, and market links are difficult and will take some years.

6. Considering the nature of the proposed investments and that the specific irrigation schemes to be supported under SPIN are still in the process of being selected, this EFA is based on the performance of three of the five TRIMING irrigation schemes under implementation[41] involving 25,652 ha already improved and handed over under (a) the Kano River Irrigation Scheme (KRIS); (b) the Bakolori Irrigation Scheme (BIS); and (c) the Hadejia Valley Irrigation Scheme (HVIS).[42] The other two TRIMING subprojects, the Middle Rima Valley Irrigation Scheme (MRVIS) and the Dadin Kowa Irrigation Scheme (DKIS), are still to fly with the major improvements: the MRVIS due to refusal of irrigators to pay and remit irrigation fees, while in DKIS, irrigation is still on hold to allow for the rehabilitation works.

7. **EFA scenarios.** The development of the 'with' and 'without project' scenarios started with the preparation of representative crop and activity budget models. Crop yields, relevant prices, input and labor use, family on-farm consumption, production costs, and resulting revenues were averaged for the main crops and activities to quantify benefits obtained before the project improvements and the changes that are being detected after project interventions at the farm level. Support activities including infrastructure improvements, technical assistance, and other backing services for enhancing productivity and value chain developments were also modeled. The second assessment level was the preparation of farm and agri-business models: crop and activities are combined under the dominant production systems for quantifying beneficiaries' income changes. This allows checking if farmers will be willing to take the risk of changing their traditional production practices. The third level is the aggregation of farmers´ activities within each scheme to quantify the benefits and costs involved for the development of each subproject, and finally, for the overall project from the country's economy point of view.

8. **Crop and activity models.** On average, farmers cultivate less than 0.5 ha of land with irrigation, planting mainly rice and eventually other market-oriented crops in two main seasons every year: in the dry season and in the wet season. Farmers usually also cultivate some land outside the irrigated perimeter for growing traditional food crops for self-consumption under rain-fed conditions (mainly millet during the wet season and sorghum in the dry season).

[40] Nigeria's rice consumption per capita is about 32 kg, which is lower than the global rice consumption (53.9 kg). Locally produced rice accounts for about 57 percent of the rice consumed in Nigeria, while the deficit is smuggled or imported into the country illegally.
[41] The original objective of the TRIMING Project was to support performance improvement of about 50,000 ha through rehabilitation and new development in five schemes downstream of existing storage reservoirs. Implementation delays and challenges led to project restructuring during the midterm review, and the target was reduced to about 36,700 ha.
[42] The KRIS planned area to be rehabilitated was about 15,000 ha. About 14,444 ha was completed and commissioned by May 2023. The BIS plan was to rehabilitate 8,000 ha of a gravity system (Lot 1) and gravitate about 13,000 ha of an abandoned sprinkler area (Lot 2). The construction contract for Lot 1 was able to rehabilitate only 4,578 ha before stopping works due to insecurity in the area. The designers of the conversion works under Lot 2 reduced the area to be developed to about 5,556 ha due to significant siltation of the dam reservoir, leading to reduction of its capacity, cost considerations, and sustainability. The contractor was only able to deliver about 970 ha before construction work was also stopped due to insecurity. The planned intervention at HVIS was to develop about 6,000 ha. A net area of about 5,750 ha was completed, commissioned, and handed over to the farmers in January 2023.

9. The crop budget 'with' and 'without' project was calculated, including input and output 2023 prices. The calculations cover crop budgets per hectare for wet season and dry season rice, maize, tomato , and onion. Production parameters, costs, and resulting revenues are accounted as the new technologies are adopted, following what is being attained under the TRIMING Project, with new practices such as the Urea Deep Placement and the System of Rice Intensification (SRI) package[43] being adopted and improving efficiency. The SRI includes the use of laser land leveling and alternate watering and drying (AWD)[44] irrigation method, which reduce the amount of water and other inputs used, thereby lowering production costs. Induced changes include a slow mechanization process of several activities (laser land leveling, land preparation, transplanting, harvesting, and so on) and improved post-harvesting handling (rice milling, onion dying, and so on) with project support.

10. Based on the results being attained from the TRIMING Project—through enhanced infrastructure, adoption of improved technologies, better post-harvest handling of products—it can be reasonably expected that outcomes would result in (a) more than 100 percent average increase in rice yields, from 2.2 metric tons per hectare in the wet season and 3.2 metric tons in the dry season to 5.5 metric tons and 7.4 metric tons, respectively; (b) a 20 to 30 percent reduction in the use and cost of irrigation water, seeds, fertilizers and pesticides washed away with the excess water; and (c) a reduction in the use of labor (by using small equipment including harvesting machines). The resulting net revenues per hectare of rice before family labor would increase significantly, from NGN 111,500 to NGN 871,650 in the wet season, and from NGN 343,950 to NGN 1.31 million in the dry season.

11. Other crops also show similar higher returns due to project improvements. Table 5.1 shows the summary costs and revenues being achieved from cropping in the KRIS according to the TRIMING M&E system field observations. Budgets were also prepared for the BIS and HVIS. Many other higher-value crops with reliable irrigation offer relevant diversification options in the project areas. Fruits (papaya, banana, passion fruit, pineapple, mango, guava, and so on) and vegetables (tomato, capsicum, eggplant, watermelon, melon, and so on) could also provide significant contributions to further improve production for the irrigated areas, if adequate value chain support is provided.

Table 5.1. Crop Models 'Without' (before) and 'With' (after) the Project (in NGN, thousands per hectare)

		Gross Revenue		Input Costs		Income Before Labor		Labor Costs		Net Revenue		Increments
Table	Crop Budget	WoP	WP	WoP	WP	WoP	WP	WoP	WP	WoP	WP	(before labor)
A6-Ap2	Rice Wet Season	580.0	1,441.0	468.5	569.4	111.5	871.7	136.5	177.0	-25.0	694.7	782%
A6-Ap3	Rice Dry Season	830.0	1,916.0	486.1	605.8	343.9	1,310.2	142.5	186.0	201.4	1,124.2	381%
A6-Ap4	Maize Wet Season	302.0	640.0	86.2	196.9	215.8	443.1	39.0	63.0	176.8	380.1	205%
A6-Ap5	Maize Dry Season	424.4	838.0	115.1	231.6	309.3	606.5	39.0	63.0	270.3	543.5	196%
A6-Ap6	Tomate	5,320.0	8,176.0	582.5	884.0	4,737.5	7,292.0	136.5	201.0	4,601.0	7,091.0	154%
A6-Ap7	Onions	2,880.0	5,580.0	473.0	841.5	2,407.0	4,738.5	157.5	240.0	2,249.5	4,498.5	197%

12. As can be seen in Table 5.1, the main crops would significantly increase the current revenues before labor costs, making this the most relevant indicator for beneficiaries' financial results from the project improvements. Most farming activities are done with family labor, which has few job opportunities in the project areas. Tomato and onion provide

[43] The SRI is an innovative agro-ecological climate-smart technology that aims to increase yields and farmers' profits by creating the most suitable environment for the rice plants to grow stronger and produce higher yields.

[44] AWD is a water management system that reduces the water use in irrigated rice fields without lowering productivity. Under AWD, rice fields are alternately flooded and un-flooded rather than kept continuously submerged as under conventional rice farming. By reducing the plant density per hectare, the roots can better develop, reaching more nutrients and oxygen, resulting in bigger and healthier plants with more and heavier grains. Besides water use is reduced, allowing for the expansion of the irrigation area.

notably higher returns than rice (even applying improved SRI technology), provided that adequate post-harvesting and storage facilities are in place, and proper market links are developed. Other higher-value crops such as other fruits and vegetables, or activities such as aquaculture (tilapia and catfish) could also offer higher returns but require adequate technical support for production and marketing.

13. **Farm models.** Three farm models based on what is being done and achieved on the average farms in KRIS, BIS, and HVIS are shown in Table 5.2 to represent the beneficiaries' typical farming systems and the expected benefits in the SPIN Project areas. These models allow quantification of the family income changes that could be attained from the proposed project. The assumed cropping pattern was defined following the average crops being grown in each of the three scheme areas on which this assessment is based, with rice occupying 70, 80, and 95 percent of the cropped areas, respectively. In addition to the 0.5 ha of irrigated crops, the models include another 0.5 ha with millet (dry season) and sorghum (wet season) under rain-fed situations for self-consumption.

Table 5.2. Farm Models for Phase I for Existing Farmers

Table number in the Appendix	Typical Farm Beneficiary (0.5ha irrigated plus 0.5ha with rain fed millet & sorghum)	Main Irrigated Crops 1/		Gross Value Production		Net Value Production		Family labor use in farming		Returns per family day work		Income increase
				(in '000 Naira)		(in '000 Naira)		(person days/year)		(in Naira)		
		Without Project	With Project	Without Project	With Project	Without Project	With Project	Without Project	With Project	Without Project	With Project	
A6-Ap8	FM 1 based on KRIS	R,M,T & O	R,M,T & O	1,427	3,705	938	2,621	110	191	8,527	13,723	179%
A6-Ap9	FM 2 based on BIS	R,SP,T & O	R,SP,T & O	1,253	3,336	759	2,286	118	194	6,432	11,784	201%
A6-Ap10	FM 3 based on HVIS	R,M,T & O	R,M,T & O	1,095	2,959	471	1,817	135	195	3,489	9,318	286%
	1/ R: rice, M: maize, T: tomato, O: onion, SP: sweet potato											

14. **Production services and post-harvest agribusiness models.** The financial and economic impact from development of the irrigation infrastructure costing US$350 million (Component 2) also depends on (a) adopting improved technologies allowing significant land and water productivity increases;[45] (b) enhancing the value chains adding worth to their main products; and (c) linking the more efficient and increased production in the field with the access to higher market niches offering higher prices. These targets must be developed together to create the benefits required for justifying the large investment, needing the 'software' support interventions for ensuring adequate support services, including training and capacity building.

15. Some production service models were prepared as viable examples for the promotion of operators to offer soil preparation and leveling services with small equipment, as well as for planting and harvesting of rice. Models for post-harvest handling and processing of rice, onions, and tomato were also prepared. As field production grows, these services need to be developed by individuals or groups of farmers with adequate project support.[46] As examples of machinery services providers, two cases are considered, the first for a small land monoculture equipment and the second, for the operation of a small harvesting and threshing equipment for servicing about 60 ha (120 to 150 small farms). In both cases, the service provider could need to be supported with a small US$5,000 to US$10,000 soft loan (or grant) covering 80–90

[45] Poor land levelling and preparation is identified as the single most limiting factor in the irrigation perimeters resulting in efficiency losses of 30 percent or more in water use, nitrogen leakage, soil compaction, and ultimately poor production. The adoption of SRI technologies requires adequate land levelling to ensure proper water distribution in the rice fields.

[46] Similar business plans after the necessary feasibility studies, detailed designs, and selection processes could be supported and co-financed with small loans and/or other projects' matching grants covering about 30 to 80 percent of the investment with SPIN's technical support to develop adequate productive alliances among farmers, marketing agents, and financial institutions.

percent of the investment. The financial rate of return (FRR) in these two cases would be 49.2 percent and 56.6 percent even if developed with soft loans to be fully repaid in three years.

16. Three post-harvesting and processing models are considered. The first one involving rice milling for removing hulls and brans from paddy grains to produce polished rice with a mini rice mill unit (capacity of 360 metric tons of paddy per year) costing NGN 4.5 million (US$6,300)[47] including the required installations. About 80 percent of the investment (US$5,000) could be covered with a soft loan (or a grant). In addition, about NGN 9.5 million would be needed as working capital that could be financed by the benefited farmers or the entrepreneur. With this small plant, paddy from 30 ha (wet season and dry season) could be handled, adding value to the rice. Polished bagged rice (40 percent of polished rice from paddy plus 20 percent of broken rice) was assumed to be sold at NGN 700 per kg. With an FRR of 45 percent, the group of farmers or individual implementing this unit would significantly help improve the farm gate prices.

17. The onion drying and storage model was assumed having a capacity for storing 20 metric tons of onions at harvest time. After two to four months, about 16 metric tons of dry onions off-season could be sold at about NGN 330 per kg instead of NGN 180 per kg if sold during the harvesting season. Three cycles could be stored per year. The investment required was estimated at NGN 7 million (US$15,185)[48] for the required cool, dry, dark, and ventilated, rustic warehouse. In this case, it was assumed that 90 percent of the investment (US$13,666) would be financed and repaid in three years. With an FRR of 14.7 percent, the operator or group of farmers implementing this unit could also promote production and improve the onion price being paid in the area. Similarly, the case for a tomato packing facility with an investment of NGN 36 million (US$78,000), with a loan covering 90 percent of the investment, shows an FRR of 34.7 percent.

18. **Irrigation modernization and support results.** Table 5.3 shows the aggregation of farm and activity models within the supported irrigation schemes. The aggregation allows estimating the benefits of irrigation modernization to the Nigerian society. It also helps assessing the expected volumes of production and the inputs and labor expected to be mobilized in this enhanced activity. As mentioned before, the three TRIMING schemes assessed as representative of the investment to be carried out under the new project were (a) KRIS with 14,444 ha modernized, and about 45,000 small farmers planting rice in about 70 percent of the area, and other crops (tomato in 13 percent of the area, maize in 8 percent, onion in 5 percent, and other crops); (b) BIS with 5,750 ha rehabilitated (80 percent with rice, 9 percent with sweet potato, and 8 percent with tomato) involving more than 24,000 farmers; and (c) HVIS with 5,448 ha rehabilitated (95 percent of rice) and benefiting about 20,000 farmers.

Table 5.3. Main Results Indicators per Scheme and for Component 2

	Number of Farms	Area Total (ha)	Investment (USD Mill)	Production at Maturity		Internal Rate of Return (%)		Net Present Value (6% discount rate)	
				Gross (USD Mill)	Net (USD Mill)	Financial	Economic	Financial (USD Mill)	Economic (USD Mill)
KRIS	45,000	14,444	109.1	114.5	76.0	22.1	23.0	175.5	190.6
BIS	24,000	5,750	82.3	36.5	21.9	10.0	10.9	24.7	30.3
HVIS	20,000	5,448	63.9	35.8	20.4	17.7	18.7	53.1	58.8
Total Irrigation Modernization	**89,000**	**25,642**	**255.3**	**186.8**	**118.3**	**17.5**	**18.5**	**253.3**	**279.7**

[47] Exchange rate used for the study conducted in July 2023 was 1 USD = 714 NGN

[48] Exchange rate used for the study conducted in March 2023 was 1 USD = 461 NGN

19. The total TRIMING investments involved in the still ongoing three assessed schemes was estimated at about US$255.3 million including about 73 percent of the total IDA disbursed amount.[49] Table 5.3 summarizes the main parameters and results indicators for the three schemes and their aggregation. Considering that these are representative of those to be supported under the SPIN Project, the proposed new investment for improving irrigation would be justified, as it would have an ERR of 18.5 percent and an NPV of US$279 million. This result excludes the corresponding share of the project management Component 4 costs that are included in the overall analysis in section V. The SCF used for valuing the shadow value of costs and benefits for the economic analysis was 0.815, while 0.7 was used for the shadow cost of labor.

IV. Avoided Damages from Dam Safety Investments

20. The project will play a primary role in reducing the frequency and severity of flooding. Floods are the most common natural hazards in Nigeria, with severe consequences on life and property. Lower basin states throughout southern Nigeria have experienced a 20 percent increase in volumes of torrential rains over the past decades, accelerating gully erosion in areas where many riverbanks have collapsed. Flooding degrades the environment and destroys crops, farm settlements, livestock, and grain store facilities. These events reduce harvest and affect the next planting season, resulting in food shortage crisis. Livestock are killed or lose pastures, and many times inundated farmlands become unsuitable for cultivation.

21. Nigeria is now experiencing floods every year and food insecurity is a growing problem. In 2012, flooding affected almost every Nigerian state damaging or destroying 600,000 houses, displacing over two million people, and causing the death of 363 people. Floods in 2018 resulted in 301 new deaths. In 2021, 7 out of 10 Nigerians did not have enough to eat. The 2022 floods affected 3.2 million people, displaced 1.4 million, destroyed over half a million hectares of farmland and resulted in the deaths of more than 600 people. The magnitude and impact of the 2022 events have surpassed the 2012 damage. Again, in October 2023, general disruptions due to flooding took place across Adamawa State, especially following the release of water into the Niger and Benue River basins from the Lagdo Dam in neighboring Cameroon, displacing more than 57,000 people.

22. The Nigeria Post-Disaster Needs Assessment of the 2012 floods estimated that about US$7.1 billion would be required to cover the flood damage.[50] Of this amount, about US$5.5 billion would finance disaster-resilient reconstruction of assets that were destroyed and US$1.6 billion would be allocated for ensuring economic recovery. About US$4.2 billion (59 percent of the needs) would cover reconstruction and recovery of housing (about 1,377,450 affected houses), with an average cost per house estimated at US$3,050. Adding other reconstruction and recovery needs (41 percent of needs for health, education, productive assets, and infrastructure), the average needs per affected house added to US$5,170.

23. The FGN with the World Bank support assessed the damage and loss derived from the 2022 devastating floods. The total direct economic damages were in the range of US$3.79 billion to US$9.12 billion, with a median estimate at US$6.68 billion including impacts on livelihood, damages to residential and nonresidential buildings, infrastructure, productive sectors, and agriculture.[51] Overall, 64 percent of households in the most damaged states were affected. Monetary cost of damage to houses was estimated by the affected people at an average cost of US$4,246. The average cost for the 2012 and 2022 hazards per house damaged was US$3,648.

[49] IDA funds disbursements up to the end of 2023 were US$ 350.3 million: (a) US$53.6 million under Component 1 for WRM and dam operations improvement; (b) US$246.7 under Components 2 and 3 (including other irrigation schemes) for improving irrigation and enhancing agricultural production; and (c) US$50.1 million under Component 4 for institutional development and project management.

[50] Nigeria Post Disaster Needs Assessment. 2012 Floods, Federal Government of Nigeria with support of World Bank, United Nations, Global Facility for Disaster Reduction and Recovery, the European Union, and Japanese International Cooperation Agency.

[51] Nigeria Flood Impact, Recovery and Mitigation Assessment Report 2022–2023, Nigeria Bureau of Statistics, National Emergency Management Agency, and United Nations Development Programme.

24. The objective of Component 3 'Improvements in Dam operations and Enhancing Dam Safety' (US$100 million) is to increase the safety of selected dams and strengthen the dam safety management system in the country. The target is to improve safety of 10 to 20 prioritized dams and associated structures that provide downstream irrigation to schemes to be identified under Component 2. The benefits of the enhanced dam safety including planning, management and rehabilitation, preventive measures, and development of FFWSDO and early warning systems (EWS) are to reduce the likelihood and costs of dam failure and reduce material and nonmaterial damages from flood hazards, inducing economic activities and increasing agricultural output.

25. Valuing the expected avoided damages is challenging. It needs to establish the likely annual flood damages in the future and compare its value with the annual cost of preventing those damages from occurring. Measuring risks and avoided damages with the project-proposed dam safety investments mainly comprise three steps: (a) identification of hazard that is likely to result in disaster in both scenarios ('with' and 'without' the project); (b) estimation of the risk of such event in each scenario; and (c) evaluation of the post-disaster economic and social costs of the expected risk in both cases. The concept of risk therefore considers flooding as a hazard that requires application of adequate investment and measures for flooding to be prevented and for mitigating its impact. Hazards associated with flooding can be addressed saving time, cost, and energy while preserving life and properties that are at risk under probable flooding events.

26. Benefits of dam safety investments are usually quantified based on the expected value of AAD avoided. These are estimated through the integration of a series of single event damages for a sequence of flood events with gradually infrequent return periods. Maps of flooded areas need to be drawn for each flood risk area with an assigned value of the likelihood of occurrence, that is, (a) areas where the flooding likelihood is low (once in 1,000 years, 0.1 percent chance); (b) areas where the probability is medium (once in 100 years, 1 percent chance); and (c) areas where the chance is high (every 10 years, 10 percent). With three flood scenarios, the curves showing average value of damages[52] under different chance of occurrence need to be valued. The avoided AAD benefit is then obtained by deducting the area under the loss probability curve for the 'with project' scenario from the area under the curve for the 'without project' scenario.

27. In Nigeria, there is little or no data for drawing flood maps after dam break hazards with different probability of occurrence, including the location and value of the exposed elements. However, based on the consultancy report 'Dam Break Flood Hazard and Impact Assessment to Support Data Storage Program for More Sustainable Development in Nigeria'[53] and on the impact assessment reports of the 2012 and the 2022/23 flood events, an estimation of avoided AAD was done for this EFA, with a representative dam safety investment case. The Fukushima University study identified two-dimensional modeling dams breach under the TRIMING Project: the Tiga Dam breach flooding modeling and Zobe and Goronyo Dam breach flooding. Based on these models, and the existing information about dams/reservoirs bathymetry, digital elevation model, land use cover, population, and other data for the dam areas, Fukushima University developed the flood maps for the three dams.

28. The case of the Tiga Dam overflow in September 2022 was used by the Fukushima University study, after relevant data collection about the discharge through the dam and the exposed areas, for testing the model and downstream flooding. The results of the modeling were considered for the hydrological scenarios of the flood discharge with the exceedance probability at 10.0 percent, 1.0 percent, and 0.1 percent. The flooding and depth maps for the mentioned events were processed with the Geographic Information System (GIS) data on affected (a) population and (b) type of

[52] Data about the population, infrastructure, industrial facilities, and agricultural fields are required for flood risk and exposure of the population and other elements (land use and land cover and soil maps) in vulnerable areas. Exposure data include information on the location and estimated value of the exposed elements. Exposure data are vital for quantifying the potential losses and damages.

[53] Final report prepared by Dr. Maksym Gusyev, and Dr. Kenji Nanba, Institute of Environmental Radioactivity, Fukushima University, and by Dr. Mark Zheleznyak, Nichiu Svit LLC. The consultancy aimed to increase knowledge on the flood hazard and exposure due to the break of large dams for improving flood risk preparedness and contingency planning in Nigeria.

agricultural fields. The resulting maps in Argis format provided mapping of the risk exposure only for these two elements.[54] The Tiga Dam overflow maps at the three exceedance probability flooding levels were compared with the real flooding zones downstream of the Tiga Dam, which were identified from the satellite images.

29. As a good match between the 1 percent flood map case and the satellite images was confirmed, the modeled exposure for population and agriculture fields was validated as a good indicator for valuing the damage of the dam overflow with 10.0 percent, 1.0 percent, and 0.1 percent likelihoods. The maps with flooding depth drawn for the three hazard events with the GIS data on population and agricultural fields and the maps in Argis format were then used to present the mapping of the risk exposure for the mentioned elements. Results are shown in Table 5.4.

Table 5.4. Results of Spatial Analysis: Population and Agricultural Fields Flood Exposure for Tiga Dam

Concept	Total	Category of Flood Hazard[a]			
Population in flood zone (thousands)		**Low**	**Moderate**	**High**	**Very High**
10 percent flood	138.2	66.3	41.5	26.7	3.7
1% flood	189.7	84.7	48.9	48.3	7.8
0.1% flood	224.2	85.1	72.1	52.8	14.2
Exposed agricultural areas (km^2)		**Low**	**Moderate**	**High**	**Very High**
10% flood	688.3	227.6	263.6	161.3	35.8
1% flood	845.0	254.5	285.5	245.8	59.2
0.1% flood	945.3	256.7	300.1	298.1	90.4

Source: Dam Break Flood Hazard and Impact Assessment to Support Data Storage Program for More Sustainable Development in Nigeria.

Note: a. Hazard categories depend on depth of flooding: Low < 0.5 m (Caution, it is possible to walk through the water); Moderate 0.5–1.2 m (Danger, the ground floor of buildings and houses is flooded); High 1.2–2.5 m (Extreme danger, ground floor flooded up to the roof); Very High > 2.5 m.

30. The affected population of the Tiga Dam overflow modeled events was taken as the main indicator for estimating the avoided AAD with the typical dam safety investments under the SPIN Project. Assuming an average of six people per house, about 23,033,31,616 and 37,367 households would be affected with the exceedance probability of 10.0 percent, 1.0 percent, and 0.1 percent, respectively. Taking an average reconstruction cost of US$3,648 per house (the abovementioned average reconstruction cost for the 2012 and 2022 events) and adding other needs costs (41 percent of total needs for covering health, education, productive assets, and infrastructure damages), the average needs per affected household becomes US$6,183. Hence, the expected value of the damages from 10.0 percent, 1.0 percent, and 0.1 percent flood events probability for the typical dam case 'without project' would be US$142.4 million, US$195.5 million, and US$231 million, respectively, as shown in Column D of Table 5.5. The estimated AAD for the 'without project' scenario was estimated at US$35.18 million, as explained in Table 5.5.

[54] Risk assessment is an accurate way for assessment of floods affecting population and damages to agriculture but needs more data about settlements, infrastructure, agricultural areas, and land use elements' location, which was not intended to be done within the Fukushima University study.

Table 5.5. AAD Computation for the 'Without Project' Scenario

Return Interval (A)	Probability (B)	Probability Interval (C)	Damages $ Million (D)	Interval Avge Dge ($ Mill) (E)	Interval Dge. Calcul. ($ Mill (F)	Expected Anual Damage (G)
2 YR	0.5		15.8			
		0.3		31.6	9.49	9.49
5 YR	0.2		47.5			
		0.1		94.9	9.49	18.99
10 YR	0.1		142.4			
		0.08		155.7	12.45	31.44
50 YR	0.02		169.0			
		0.01		182.2	1.82	33.27
100 YR	0.01		195.5			
		0.009		213.3	1.92	**35.18**
1000 YR	0.001		231.0			
Column C: Interval probability computed as difference of probabilities (i.e. 0.5 - 0.2 = 0.3)						
Column D: Estimated damages from overflow modeling at 10%, 1% and 0.1% exceedance probab						
Column E:Average damages for the interval, i.e. (2yr damages + 5yr damages)/2						
Column F: Probability within interval (Col C) * Interval Average Damages (Col E)						
Column G: Cumulative of Col F (Note: last item is the Average Annual Damages)						

31. The benefits of dam safety investments comprise the flood damage averted in the future because of the project interventions to reduce the frequency of flooding and mitigate the impact of flooding on properties and economic activities, or a combination of both. The proposed typical investment for improving safety of a representative dam (including planning, management, rehabilitation, and operation of EWS preventing and reducing downstream risks) was assumed at US$20 million. This investment would result in a reduction of at least 15 percent on the expected value of AAD in the face of an approaching catastrophe as proper action to protect life and property damage is taken.[55] The benefit 'with the project' was estimated at US$5.28 million per year. With the abovementioned assumptions, the ERR of a typical dam safety intervention was estimated at 21.9 percent, and the economic NPV at NGN 11,851 million (US$25.7 million). Table 5.6 shows the dam safety EFA.

Table 5.6. Dam Safety, Flood Protection and EWS (Tiga Dam)

ECONOMIC BUDGET (In Naira Million) /a	With Project			
	1	**2**	**3**	**4 to 15**
Main Benefits				
Average Annual Damages (AAD) Avoided	-	730.1	1,460.2	2,190.3
Maintenance of Dam Safety				
Management and O&M of Dam & EWS	-	37.2	74.4	111.6
Investments in Dam Safety				
Dam Operations and Enhancing Dam Safety	3,073.3	3,073.3	3,073.3	-
OUTFLOWS	3,073.3	3,110.5	3,147.7	111.6
Cash Flow	-3,073.3	-2,380.4	-1,687.5	2,078.7

IRR = 21.9%, NPV = 11,851

\a The estimated AAD **without dam safety investments** would be equivalent to US$35.18 million.
With project investing US$20 million the AAD could be reduced by 15% (US$5.28 million) as the value of avoided AAD.

[55] The study conducted under the TRIMING Project revealed that cascade operation of reservoirs under 2022 flood condition would have reduced the peak in Benue River basin by 30 percent.

V. Overall SPIN Economic and Financial Analysis

32. Table 5.7 shows the SPIN Project's overall EFA including all project costs and the expected benefits from (a) increased irrigated production and (b) avoided AAD. The net value of production per year from the supported schemes would grow from US$131.6 million to US$332.4 million and the NPV after all production and project costs (cash flow) would be tripled at project maturity from US$72.7 million to US$221 million. Labor occupied would be increased by more than 4.4 times from 4.6 million person-days to 20.3 million per year, and its productivity would increase by 65 percent from US$15.8 of net revenue generated per day to US$26.1. The estimated ERR would be 16.7 percent and the economic NPV US$488.4 million (NGN 225.2 billion).

Table 5.7. Overall EFA Summary

ECONOMIC BUDGET (AGGREGATED) (In Naira Million)	Without Project	With Project								
	1 to 20	1	2	3	4	5	6	7	8	9 to 20
Main Production										
Maize	642	642	642	303	303	415	613	1,194	1,435	1,435
Rice Paddy	19,614	19,614	19,614	8,769	8,769	14,623	30,951	47,260	59,307	59,307
Milled Rice	-	-	-	1,376	4,335	9,255	10,890	11,870	11,870	11,870
Broken Rice & Husk	-	-	-	516	1,626	3,471	4,084	4,451	4,451	4,451
Tomato	21,278	21,278	21,278	10,543	10,543	14,297	20,663	32,257	36,649	36,649
Tomato in 25 kg Crates	-	-	-	700	2,945	7,490	13,050	15,570	16,830	16,830
Onions at Farm	5,546	5,546	5,546	2,747	2,747	5,045	7,294	9,681	11,495	11,495
Onion Off Season	-	-	-	169	660	1,626	2,424	2,899	2,899	2,899
Sweet Potatoes	1,230	1,230	1,230	630	630	750	1,580	1,796	2,025	2,025
Crop Residues	1,089	1,089	1,089	496	496	785	1,561	2,272	2,776	2,776
Livestock Products	12,500	12,500	12,500	12,500	12,500	12,500	12,500	14,939	17,613	20,500
Small Machinery Service Providers	-	-	-	48	189	430	635	692	692	692
Average Annual Damages (AAD) Avoided	-	-	-	730	2,920	5,841	8,031	8,761	8,761	8,761
Sub-total Main Production	61,899	61,899	61,899	39,528	48,664	76,528	114,273	153,643	176,803	179,690
On-Farm Use or Local Processing										
Rice Paddy	-	-	-	1,229	3,871	8,264	9,723	10,598	10,598	10,598
Tomato	-	-	-	490	2,047	5,172	8,946	10,559	11,365	11,365
Onions at Farm	-	-	-	115	450	1,109	1,652	1,976	1,976	1,976
Livestock Products	1,250	1,250	1,250	852	852	1,220	1,250	1,628	2,052	2,500
Sub-Total On-Farm Use	1,250	1,250	1,250	2,686	7,220	15,764	21,571	24,761	25,992	26,440
Net Value Of Production	60,649	60,649	60,649	36,842	41,444	60,764	92,702	128,881	150,811	153,250
Production Cost										
Investment										
Rice Processing Equipment	-	-	87	166	249	-	-	-	-	-
Onions Warehouse (60 m2 - 20 tons cap	-	-	217	414	611	-	-	-	-	-
Tomato Packing and Cold Storage Faciliti	-	-	244	698	1,257	1,257	-	-	-	-
Harvesting and Threshing Machines	-	-	138	247	386	87	-	-	-	-
Monoculture Equipment	-	-	45	98	164	105	-	-	-	-
Other Inputs	-	-	295	628	1,004	373	-	-	-	-
Sub-total Investment Costs	-	-	1,028	2,252	3,670	1,822	-	-	-	-
Operating										
Management and O&M of Dam & EWS	-	-	-	37	149	297	409	446	446	446
Inputs (Seeds, Agrochemicals, etc.)	22,026	22,026	22,026	13,507	14,726	21,331	29,451	36,261	39,952	41,306
Irrigation Fees	395	395	395	181	181	289	465	610	686	686
Family Labor	4,396	4,396	4,396	2,492	2,823	4,441	6,339	7,665	8,294	8,409
Sub-total Operating Costs	26,817	26,817	26,817	16,219	17,879	26,355	36,664	44,983	49,377	50,848
Sub-Total Production Cost	26,817	26,817	27,845	18,471	21,549	28,177	36,664	44,983	49,377	50,848
SPIN Project Costs										
Management and O&M of the I&D Systems	320	516	516	516	516	516	516	516	516	516
Dam Safety Investments and EWS	-	-	2,981	8,943	11,925	8,943	2,981	-	-	-
KRIS Investment	-	2,672	1,493	10,058	4,243	9,823	23,653	21,767	4,951	-
BIS Investment	-	2,175	11,844	8,702	4,593	6,647	15,954	8,762	1,752	-
HVIS Investment	-	2,249	1,593	2,437	6,092	11,341	6,795	10,872	5,483	-
RAP Payments (KRIS, BIS and HVIS)	-	174	286	553	341	671	1,243	1,126	307	-
Institutional Strengthening and Capacity Bu	-	671	2,683	3,354	2,683	1,342	1,342	6,708	6,708	-
Project Management	-	894	1,252	1,252	1,252	1,252	1,252	1,252	5,366	-
Sub-Total Other Costs	320	9,352	22,649	35,816	31,645	40,535	53,736	51,004	25,083	516
OUTFLOWS	27,137	36,169	50,494	54,287	53,195	68,712	90,400	95,987	74,459	51,364
Cash Flow	33,512	24,480	10,155	-17,445	-11,750	-7,949	2,302	32,895	76,352	101,886

Economic IRR = 16.7%, NPV = 225,156
Financial IRR = 15.7%, NPV = 202,632

33. The project's net GHG emission[56] over its economic lifetime (20 years including implementation and capitalization periods) was estimated to be 1,167,470 tCO_2eq, translating to average annual emissions reduction of 58,374 tCO_2eq, falling from 221,738 tCO_2eq (without project) to 163,364 tCO_2eq (with project). Reduction in emissions would result from changes in land use/farmland expansion, higher irrigation water use efficiency, and increase in rice yields per ha with the only increase in emission emanating from more urea use. Overall, there would be a net reduction of emissions by about 25 percent relative to a business-as-usual scenario. When valuing this expected reduction of emissions with the low and high shadow price of carbon (SPC),[57] the ERR of the project base case scenario would increase from 16.7 percent (NPV US$488.4 million) to 17.1 percent (NPV US$510 million) using the low SPC, and to 17.6 percent (NPV US$531.6 million) using the high SPC.

VI. Sensitivity Analysis

34. The ERR and NPV were re-estimated under the following adverse scenarios representing some of the major risks affecting the project results: (a) agricultural prices being reduced from expected levels by 10 percent and 20 percent; (b) investment cost escalation by 20 and 40 percent; (c) post-harvest value addition for rice, tomato, and onions are not implemented; and (d) general agricultural prices drop by 10 percent together with a general investment cost increase by 20 percent. As shown in Table 5.8, the results are strong enough to overcome adverse situations.

Table 5.8. Sensitivity Analysis

Risk Event	Economic Internal Rate of Return (%)	NPV (US$, millions)
Base case scenario	16.7	488.4
Output prices down 10%	14.9	383.5
Output prices down 20%	12.9	278.4
Investment cost up 20%	13.8	397.4
Investment cost up 40%	11.5	306.3
No post-harvest value addition	15.6	421.6
Price down 10% (1) and cost up 20% (3)	10.2	187.6

[56] Ex-ante GHG accounting carried out using EX-ACT quantifying the net carbon balance as tons of CO_2 equivalent (tCO_2eq).
[57] The recommended SPC for 2023 used for this analysis was US$51/$tCO_2eq$ and US$102/$tCO_2eq$ for the low and high alternative, respectively. 2024 Guidance Note on Shadow Price of Carbon in Economic Analysis. World Bank.