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WORKSHOP REPORT

Scaling Climate-Resilient Irrigation: Partnership Alignment, Coordinated Pathways, and Learning in Nigeria

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Scaling for Impact (S4I) is a CGIAR program (2025–2030) that tests, refines, and scales innovations in food, land, and water systems. It works to align those innovations with stakeholder needs to achieve transformative impact.

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Executive Summary

The Scaling Climate-Resilient Irrigation workshop, held in Abuja on 24th March 2026, established a strategic framework to bridge Nigeria's extensive irrigation deficit. While the nation possesses approximately 84 million hectares of arable land, only a small fraction is currently under functional irrigation, a gap that threatens national food security. To address this, the CGIAR Scaling for Impact (S4I) initiative—with the International Water Management Institute (IWMI) and the International Food Policy Research Institute (IFPRI) acting as dedicated scaling catalysts and systems brokers—outlined a three-year roadmap from 2026 to 2028. This roadmap is explicitly anchored in Area of Work 2 (Scaling Flagships) to accelerate the mass adoption of Solar-Based Irrigation Solutions (SBIS), primarily through Farmer-led Irrigation Development (FLID). By leveraging Area of Work 1 (Engage and Empower) for accurate demand signaling and inclusive partner engagement, the programme sets a directional target to reach between 120,000 and 150,000 smallholder farmers across priority northern states, effectively transitioning from isolated pilot projects to a coordinated national system.

A central theme of the proceedings was the coordination imperative, as stakeholders identified that while technology and funding are available, a lack of institutional dialogue creates significant bottlenecks. For instance, complementary resources from agencies such as NASENI, the Federal Ministry of Water Resources, the Federal Ministry of Agriculture and Food Security, the Rural Electrification Agency (REA), and others are often underutilized because these bodies operate in silos. Resolving this fragmentation requires activating Area of Work 4 (Global Clearinghouse for Scaled Innovations) to mobilize development investments and forge resilient institutional partnerships. Furthermore, financial institutions like NIRSAL and Sterling Bank emphasized that sustainable scaling is impossible without farmers' structuring. They argued that clustering farmers into cooperatives is a non-negotiable prerequisite for de-risking investments and ensuring that affordable credit reaches the end-user.

The roadmap is further informed by Global South-South learning, particularly from India's experience in scaling nearly two million solar pumps over a decade, which directly reflects the objectives of Area of Work 5 (Learning for Impact) to build evidence, monitor progress, and enhance scaling readiness. This transition is supported by a Finance-Technology-Policy triangle, aligning closely with Area of Work 3 (Enabling Environment Lab) to drive necessary policy reforms, such as tariff waivers for agricultural equipment, smart subsidies, and the facilitation of single-digit interest rates. Despite challenges like high initial capital costs and equipment security risks, the workshop concluded with concrete institutional commitments. These include IWMI and IFPRI facilitating a permanent coordination platform, the Federal Ministry of Agriculture digitizing extension services via the NEEP platform, and private-sector partners expanding localized financing models. Together, these coordinated efforts across the entire S4I framework aim to ensure that Nigerian agriculture is no longer limited by seasonal water availability.

1. Background and Context

1.1 The CGIAR Scaling for Impact Program

The engagement with stakeholders is anchored in the Scaling for Impact (S4I) science program, one of eight science programs within the CGIAR consortium of international agricultural research centers (CGIAR, 2024). Within this initiative, the International Water Management Institute (IWMI) and the International Food Policy Research Institute (IFPRI) act as more than mere conveners; they serve as vital scaling catalysts. Aligned strictly with the S4I mandate, these institutions drive the transition to scale by operating as scaling systems brokers, evidence and learning partners, investment matchmaking facilitators, scaling readiness assessors, and policy influence partners.

The S4I programme operates across five integrated areas of work:

- **(1) Engage and empower:** Focuses on demand signaling and understanding partner needs. Crucially, it centers on the end-users by establishing clear evidence of demand and articulating *why* farmers want Solar-Powered Irrigation Systems (SPIS)—primarily to mitigate climate risks and escape volatile fossil fuel costs. This area systematically targets priority farmer segments to ensure inclusive scaling, specifically focusing on women, youth, and dedicated rice and horticulture farmers.
- **(2) Scaling flagships:** Constitutes the heartbeat of the programme and houses the core irrigation work.
- **(3) Enabling environment lab (EE Lab):** Aimed at unlocking policy, market, and normative bottlenecks.
- **(4) Global clearinghouse for scaled innovations:** Connects impact investors with viable investment strategies.
- **(5) Learning for impact:** Drives impact assessment, capacity enhancement, and scaling science.

Scaling smart irrigation falls directly under Area of Work 2, addressing the critical climate adaptation gap through scalable, smart water management solutions. It is currently being implemented in three countries: Nigeria, Ethiopia, and Bangladesh, with this workshop focused exclusively on the Nigeria component.

1.2 The Nigeria Initiative

Nigeria faces a severe irrigation deficit. The country has about 79 million hectares of arable land, with over 3 million hectares suitable for irrigation.¹ Yet the Federal Ministry of Water Resources has reported that the actual irrigated area developed across the country is only around 169,718 hectares, roughly 5.4% of Nigeria's 3.14-million-hectare irrigation potential, leaving over 94% of that potential undeveloped². This is widely regarded as wholly inadequate for a country of Nigeria's scale, agricultural ambitions, and food security challenges.

The S4I Nigeria initiative focuses on farmer-led, small-scale solar-powered irrigation systems (SPIS) as a scalable solution to bridge this gap. The programme runs for three years (2026 to 2028) and aims to reach 120,000 to 150,000 farmers across priority northern states. Rather than

¹ FAO, Nigeria at a Glance, <https://www.fao.org/nigeria/fao-in-nigeria/nigeria-at-a-glance/en/>

² There's only 5.4% irrigated farmland in Nigeria—FG, Punch Nigeria (citing the Federal Ministry of Water Resources), <https://punchng.com/theres-only-5-4-irrigated-farmland-in-nigeria-fg/>

introducing new technologies, the programme seeks to scale proven innovations already available in Nigeria and globally, leveraging existing institutional, financial, and technological infrastructure. The priority states initially identified were Kano, Jigawa, and Kaduna, though workshop discussions acknowledged that these selections were provisional and open to revision based on partner input and potential impact.

1.3 Objectives

The core mission of this workshop is to transition from pilot projects to national-scale impact. Over the 2026–2028 period, the objective is to validate country-specific scaling pipelines that ensure modern irrigation reaches the farmers who need it most. To achieve this, this workshop focuses on four integrated objectives:

1. To learn from partners in the scaling of irrigation agriculture, the ambition, targets, and pathways for 2026–2028, and identify key risks, assumptions, and capacity gaps.
2. To redefine S4I and partners' roles, geographic priorities, and implementation responsibilities.
3. To share South–South learning experiences from India/Bangladesh on finance, delivery models, and sustainability.
4. To co-develop an action plan on how S4I supports partners for 2026.

1.4 Workshop Participants

The workshop convened a diverse, senior group of stakeholders that reflected the multi-sectoral nature of the irrigation scaling challenge. Figure 1 shows participants at the workshop which included:

- Government Ministries and Departments: Federal Ministry of Agriculture and Food Security (Federal Department of Agricultural Extension), Federal Ministry of Livestock Development, Federal Ministry of Water Resources and Sanitation (Department of Irrigation and Drainage), and the Kebbi State Commissioners for Ministries of Agriculture and Budget and Economic Planning.
- International Research Organizations: IWMI and IFPRI as co-organizers; Cosmopolitan University Center for Climate Smart Agriculture (Abuja); participants linked to University of Maryland and University of Nebraska partnerships.
- Financial and Cooperative Institutions: NIRSAL PLC (Nigerian Incentive-Based Risk Sharing System for Agricultural Lending), Sterling Bank, and the Federation of Fadama Farmers' Cooperative Society Limited.
- Private Sector and Technology Companies: FarmWorld Technologies Limited, Samaha Integrated Investments Limited (representing Jain Irrigation Systems), AgroPresiso Limited, NASENI (National Agency for Science and Engineering Infrastructure) Solar Irrigation Company, and A-Solar (the country distributor for ENO's solar pumps, a Swiss solar pump manufacturer).
- National Extension Agencies and Farmer Organizations: National Agricultural Extension and Liaison Services (NAERLS), Kano ADP, Kaduna ADP, Sasakawa Africa Association, National Presidents of the Federation of Fadama Farmers' Cooperative Society, and the Rice Farmers Association of Nigeria.
- The Academia: Ahmadu Bello University, Zaria, and the Cosmopolitan University, Abuja.
- Media: News Agency of Nigeria (Agriculture and Environment Editor).

The workshop also included recorded and live online contributions from the IWMI office in India and Ghana (IWMI). See Annex C for the list of registrants at the Workshop.



Figure 1. Participants at the workshop (*photo: Mubaraq Adetunji Owolabi*)

2. Workshop Proceedings

2.1 Opening Remarks

The workshop was opened by Dr. Adebayo Oke of IWMI, who introduced the co-organizing institutions and framed the day's agenda around four goals: achieving better partnership alignment and investment in FLID/SBIS, improving coordination across the ecosystem, unlocking opportunities, and identifying gaps to enhance the nation's efficiency in supporting farmer-led irrigation.

Mr. Ayodele Olawumi, Director of Extension at the Federal Ministry of Agriculture and Food Security, gave the official opening remarks. He emphasized the government's commitment to ensuring that "agriculture should not be limited by water," and highlighted the ministry's focus on transitioning from paper-based systems to digitalization. He affirmed the ministry's readiness to work with both public and private extension systems and its commitment to implementing farmer-led irrigation delivery. He praised the workshop organizers and pledged institutional support for the initiative's success.

2.2 Project Overview: Scaling for Impact

Dr. Oliver Kirui (IFPRI, Country Director in Nigeria) presented the broader architecture of the CGIAR Scaling for Impact programme, situating the irrigation work within the second area of work: Scaling Flagships. He described the five CGIAR grand challenges being addressed and highlighted that solar-powered irrigation for smallholders falls within the "climate adaptation gap" challenge.

Dr. Bedru Balana (IFPRI) then presented the Nigeria-specific component. He drew on his seven to eight years of experience working across Nigerian states from north to south. He stressed that the problem in Nigerian agriculture is not a lack of technology; irrigation has existed for centuries, and solar pumping technology is available and continues to improve. The core challenge is scale. The program aims to move from pilots and small projects to system-wide adoption at the national level.

Dr. Balana outlined three core pathways to impact: public-private partnerships combining market linkages and capacity building; irrigation-as-a-service business models enabled by solar equipment; and financial sector engagement to bring affordable credit to smallholders. He presented the programme's three-year ambition of reaching over 120,000 farmers in Nigeria. He underscored that all targets are directional rather than fixed, designed to orient effort rather than constrain ambition.

2.3 Global South-South Learning: Lessons from India

A pre-recorded presentation by Dr. Deepak (an IWMI Regional Research Scientist based in India) provided a detailed account of India's experience with the scaling of solar irrigation, offering directly applicable lessons for Nigeria. Key dimensions covered included:

India's solar irrigation landscape

India has dramatically scaled solar irrigation over the past decade. From approximately 10,000 solar irrigation pumps in 2013-2014, the country now operates around two million. The national PM Kusum scheme, launched in 2019 with an outlay of approximately 35,000 crore Indian Rupees, has been the primary vehicle for this expansion, targeting both on-grid and off-grid systems.

On-grid vs. Off-grid models

On-grid models (exemplified by the Surya Shakti Kisan Yojana in Gujarat) allow farmers to both use solar energy for irrigation and sell excess electricity to the grid, generating additional income. Farmers in pilot cooperatives, beginning with just six members, developed microgrids with state electricity companies. Results showed a 14% reduction in annual groundwater energy use and average additional income of approximately \$257 per year from electricity sales, equivalent to 43% of crop income. Net profit per hectare increased by 27% through combined revenue gains and reduced irrigation costs.

Off-grid models (standalone pumps) are the most relevant for Nigeria, given the inconsistent grid infrastructure. Under PM Kusum component B, 1.4 million standalone off-grid pumps were targeted. Financial assistance included central government subsidies of 30% and state government subsidies of at least 30% (some states, such as Uttar Pradesh, provided up to 60%, leaving farmers responsible for only 10% of costs). Despite this generosity, 23-30% of farmers still reported financial constraints as a barrier to adoption.

Adoption barriers and drivers

Across both models, key adoption barriers identified included: lack of awareness and information (30% of farmers in some surveys); capital constraints, even with substantial subsidies; risk aversion; and complexity of financial models (particularly relevant for on-grid systems involving feed-in tariffs and incentive structures). Education was found to be a primary driver of on-grid adoption, while access to credit was the principal driver for off-grid adoption. Importantly, the majority of adopters came from medium and large landholdings, with smaller farmers underrepresented.

Groundwater and environmental concerns

A critical finding from India is the models' differential groundwater impacts. On-grid systems incentivize water conservation because farmers balance irrigation use against grid electricity revenue. Off-grid systems, by contrast, show a risk of groundwater over-extraction as farmers shift to more water-intensive crops. Policy frameworks must therefore address water use discipline alongside pump deployment, particularly in off-grid contexts such as Nigeria.

Each grid-connected farmer was estimated to offset approximately 11 metric tons of CO₂ annually, roughly twice the mitigation impact of off-grid systems, making on-grid models more attractive from a climate finance perspective.

2.4 Institutional Presentations: The Nigerian Landscape

A series of presentations from Nigerian institutions provided a vivid picture of what is already happening on the ground, identifying both promising pipelines and persistent gaps. This is also captured in Table 1.

2.4.1 Department of Irrigation and Drainage, Federal Ministry of Water Resources

Engineer Anthea Udo (Deputy Director, Department of Irrigation and Drainage) presented the ministry's track record under the TRIMING (Transforming Irrigation Management in Nigeria) project, a World Bank-sponsored initiative. Achievements include rehabilitation of over 14,000 hectares in the Kano River Irrigation Scheme, 6,750 hectares in Hadeja, 2,100 hectares in Dadinkowa, and support to the Middle Rima Valley Irrigation Scheme. Over 100,000 farmers were trained in farmer field and business schools. Irrigation service centers serving as one-stop shops were established in each state, and five community radio stations were also established for stakeholder sensitization.

The ministry also introduced SPIN (Sustainable Power and Irrigation for Nigeria), the successor to TRIMING, now extended to 26 states. The ministry underscored that irrigation policy and infrastructure development fall squarely within its mandate and that collaboration with agriculture and other ministries must be formalized and structured.

2.4.2 Nigerian Incentive-Based Risk Sharing System for Agricultural Lending (NIRSAL)

Ibrahim Abdullahi, Group Head of Value Chain Optimization at NIRSAL, gave a detailed presentation of NIRSAL's financial de-risking framework. NIRSAL operates four principal pillars: risk sharing (credit risk guarantees up to 75% of loan value, with 45 billion Naira allocated); technical assistance (9 billion Naira allocated for farmer structuring (clustering), extension, and capacity building); innovative insurance products tailored to agricultural risk; and incentive systems that reward banks' lending substantially to agriculture.

NIRSAL also presented its flagship project: the identification and development of 40,000 contiguous hectares at the Garin-Ribadu axis in Adamawa State, where Rivers Faro and Benue converge, providing a year-round water source. A 10,000-hectare pilot phase (Irrigate Nigeria) is underway, with a 1,000-hectare proof-of-concept demonstrating rice production using 400

deployed solar pumps and reaching 285 active farmers out of 438 registered. Repayment is structured around harvest outputs with market survey-linked pricing.

NIRSAL stressed that sustainable irrigation financing must begin with farmer structuring. Finance cannot flow efficiently to unstructured, individual farmers. Clustering is a prerequisite. An interest rebate mechanism was highlighted as a particularly innovative tool: farmers who repay diligently may receive up to a 40% rebate on their interest costs, effectively bringing the effective rate down significantly.

2.4.3 National Agency for Science and Engineering Infrastructure (NASENI) Solar Irrigation Company Limited

Engineer Sulaiman Ismaila presented on behalf of NASENI's Director of Technical Services. NASENI has established a joint venture company, NASENI Solar Irrigation Company Limited, with a 60-40 equity split between NASENI and Renew Sustainable Agricultural Technologies and Solution Nigeria Limited (RSATS) to commercialize battery-backed solar irrigation pumps. The transition from a research orientation to an implementation orientation was highlighted as a deliberate policy shift under NASENI's current leadership.

Pump specifications produced and deployed include two-inch and three-inch pumps, both with and without battery backup. Pricing currently ranges from approximately 3 million to 6 million naira per unit (reflecting 2025 import costs at an exchange rate of approximately 1,700 naira per dollar), with ongoing efforts to localize production and reduce costs. NASENI has entered into an MOU with Tiamin Rice Limited to pilot the deployment of 2,000 units at a 50,000-hectare farm in Adamawa State, and has received a presidential directive to scale production.

2.4.4 FarmWorld Technologies Limited

FarmWorld, one of Nigeria's largest agro-equipment distributors representing over 25 international original equipment manufacturers, presented a model for making mechanized farming accessible to organized smallholder cooperatives. Their solar water pump system (100% copper-wire motor, 10-year manufacturer's warranty, foldable design) is priced per hectare and designed for ease of mobility.

FarmWorld has developed a financing model in conjunction with a Nigerian bank and NIRSAL, in which farmers (organized into cooperatives such as the Federation of Fadama Farmers' Cooperative Society, a registered body with over 20,000 members) contribute 25% upfront, with the bank funding 75% of the cost (guaranteed by NIRSAL). Repayment is structured to be paid over three years. FarmWorld has worked with Federal and state ministries, the Rice Farmers Association, and World Bank-assisted projects, including ACREsAL, across several northern states.

Key challenges cited include high import tariffs on agricultural equipment, double-digit interest rates, and port clearance delays of up to three months, which undermine timely delivery and farmer confidence.

2.4.5 Federal Department of Agricultural Extension for NEEP

A representative from the Federal Department of Agricultural Extension introduced the National Electronic Extension Platform (NEEP) as a strategic national digital infrastructure to deliver real-time advisory services to farmers. NEEP aggregates both public and private extension agents on a single digital platform, with capacity for weather advisory services (developed with NIMET), irrigation practice guidance, and market information. The platform is operating and active, with plans for further integration with precision agriculture tools and AI-driven services developed in partnership with Extension Africa and Sasakawa.

Technical support needs articulated include capacity building for extension agents in irrigation technology, development of a data-driven irrigation advisory system accessible across geographies,

integration of monitoring and evaluation for digital processes, and knowledge sharing on global best practices.

2.4.6 Cosmopolitan University Center for Climate Smart Agriculture and A-Solar

Dr. Rislan and participants from Cosmopolitan University presented a multi-pronged initiative that combined farmer data profiling (68,000 farmers profiled using geolocation, Bank Verification Number (BVN), and national ID matching), solar energy deployment for irrigation, and an emerging faculty in climate-smart agriculture. Their partnership with A-Solar/ENOs provides access to Swiss-manufactured solar pumps (10 years of R&D, World Bank-certifiable for subsidy purposes) with embedded hyperspectral and remote-sensing data for real-time monitoring and carbon-credit verification.

In Jigawa, 1.7 megawatts of solar energy across 21 sites have been installed, with partial funding from the World Bank and the African Development Bank (45% subsidy). A pilot scheme of 25 hectares per site across 21 sites (totaling 525 hectares) is planned for irrigation deployment in partnership with the state government. The Center has raised 5 billion Naira in venture capital within 18 months.

Hakim Shagaya of A-Solar/UNOs underlined the importance of using World Bank-certified, Distributed Access through Renewable Energy Scale-up (DARES)-approved solar pumps (with productive use support covering 30-40% of the pump cost from the Rural Electrification Agency) and pointed to the systemic failure of Nigerian agencies to coordinate on available subsidy instruments. He emphasized that money, capacity, and technology are not the barriers; coordination and institutional dialogue are.

2.4.7 Sterling Bank

Joshua Zira of Sterling Bank presented the bank's agricultural track record and its readiness to partner in irrigation financing. Sterling Bank has allocated over 18% of its total loan book to agriculture, exceeding the 10% Malabo Declaration benchmark. The bank has financed smallholder irrigation in Kebbi State since 2014 and has more recently funded 5,000 hectares of solar irrigation in Garin-Ribadu.

Sterling Bank acknowledged ongoing challenges in agricultural lending, including commodity price volatility affecting farmers' ability to repay, non-adherence to agronomic practices by some farmers, and market off-take uncertainty. The bank indicated readiness to work with NIRSAL, NASENI, and equipment providers to structure lending instruments suited to the irrigation sector.

Table 1. Summary of investment and ongoing interventions

Institution	Major FLID/SBIS projects	Targeted states	Ongoing intervention in 2026 (technology and land Area)	Projection beyond 2026	Areas of technical support
Federal Ministry of Water Resources (Dept. of Irrigation & Drainage)	TRIMING (World Bank sponsored) and SPIN (Successor)	Kano, Jigawa, Gombe, Sokoto; SPIN scaling to 26 states	Rehabilitation of over 23,000 hectares; establishment of Irrigation Service Centers and community radio for sensitization.	Nationwide expansion of SPIN to 26 states; formalization of multi-ministerial collaboration.	Infrastructure development, irrigation policy, and farmer training via field/business schools.
NIRSAL Plc	Irrigate Nigeria (Garin-Ribadu Project)	Adamawa (Garin-Ribadu axis)	1,000-hectare proof-of-concept (part of 10,000-ha pilot); deployment of 400 solar pumps for rice production.	Scale up to 40,000 contiguous hectares at the confluence of Rivers Faro and Benue.	Financial de-risking, credit guarantees (75%), farmer clustering, and interest rebate mechanisms.
NASENI Solar Irrigation Co. Ltd	NASENI-ASAP Joint Venture	Adamawa (Pilot with Tiamin Rice)	Deployment of 2,000 solar units (2" and 3" pumps with battery backup) on a 50,000-hectare farm.	Localization of pump production to reduce costs; mass scaling per Presidential directive.	Commercialization of R&D, battery-backed solar tech, and domestic manufacturing.
FarmWorld Technologies Limited	Cooperative-led Mechanization Model	Northern Nigeria (via ACREsAL)	Solar pumps with foldable design and 10-year warranty; 25/75 equity-to-debt financing model.	Scaling through the Federation of Fadama Farmers' Cooperative (20,000+ members).	Distribution of agro-equipment, financing structures for smallholders, and tariff advocacy.
Federal Dept. of Agricultural Extension	National Electronic Extension Platform (NEEP)	National (all states)	Digital advisory via a single platform for weather, irrigation, and market guidance.	Integration of precision agriculture and AI-driven services with Sasakawa and Extension Africa.	Capacity building for extension agents, M&E for digital processes, and data-driven advisory systems.
Cosmopolitan University & A-Solar	Center for Climate Smart Agriculture	Jigawa	1.7 MW solar power across 21 sites (525 hectares total) using Swiss-manufactured remote-sensing pumps.	Expansion of carbon credit verification and remote monitoring for larger irrigation sites.	Farmer data profiling (68,000 profiled), carbon credit verification, and institutional subsidy coordination.
Sterling Bank	Smallholder Irrigation Financing	Kebbi, Adamawa	Financing of 5,000 hectares of solar irrigation in Garin-Ribadu; 18% loan book allocation to agriculture.	Development of specialized lending instruments in partnership with NASENI and NIRSAL.	Structuring agricultural loans, mitigating off-take risk, and managing commodity volatility.

3. Group Session Outcomes

Following the institutional presentations, discussions, and lunch break, participants divided into thematic working groups. Each group (Figure 2) addressed seven questions: (1) priority activities and focus states; (2) scaling partners; (3) capacity gaps; (4) technical support required from IWMI and IFPRI; (5) number of farmers reachable; (6) policy and enabling environment; and (7) risk identification.



Figure 2. Participants at the workshop in a syndicate session and presentations (*photo: Mubaraq Adetunji Owolabi*)

The outcome of the discussions during the group session is in Table 2; It includes scope and areas of priority, scaling partners, capacity gaps identified, technical support needs from IWMI and IFPRI, possible number of farmers to be reached and policy recommendations. The responses from the groups provided details on what are the major considerations for SBIS scaling to be successful and sustainable in the country.

Table 2. Summary of outcomes from the various group discussions

Category	Group 1	Group 2	Group 3
Scope and areas of priority	• Nationwide scope: Interventions for all Nigerian farmers, as challenges vary by state. • Priority: Access to infrastructure, services, and skills. • Focus: Upgrading and rehabilitating existing irrigation schemes.	• Digitalization: Structured registration using GPS, BVN, NIN, and geocustering. • Infrastructure: Development of irrigation hubs/service centers for equipment sharing. • Models: Vendor financing for local fabricators and economic interest groups for collective bargaining.	• Sensitization: Starting with geopolitical zones (focus states: Oyo, Kaduna, Bauchi, Edo, Borno, Niger). • Data Integrity: Reliable, digitalized collection to eliminate duplicate or fraudulent farmer records.
Scaling partners	• Ministry of Environment & National Climate Change Commission. • Int'l Partners (World Bank, AfDB, UNDP). • NADF, Ministry of Finance, and Nigeria Customs (for tariff rebates).	• Zebadzin, NADEV, IFAD, Palm Valleys, and Fadama. • NIRSAL and a consortium of banks (Sterling, BoA, BoI, Unity, First Bank, STEMB, Union Bank).	• NADF, Jaiz Bank, and Precision Development (Prodepa). • Private Sector: Flour Mills, Dangote, and the Bank of Agriculture (BoA).
Capacity gaps identified	• Technical knowledge of modern systems. • Communication gaps (farmer-to-extension and inter-agency). • Policy implementation and security issues are displacing farmers.	• Gaps in farmer data and georeferenced manufacturer profiles. • Lack of structured clusters for commercial viability.	• Technical know-how for extension workers and farmers. • Climate-smart practices, farm accounting, and facility maintenance knowledge.
Technical support needs (IWMI/IFPRI)	• Capacity building on modern irrigation practices. • Assistance in organizing farmers into clusters/associations. • Facilitation of stakeholder engagement among MDAs and institutions.	• Support in developing data platforms for local manufacturers. • Guidance on irrigation hub management.	• Training modules for climate-smart irrigation. • Support in designing digitalized data verification systems.
Possible number of farmers to be reached	10 million farmers (Proposed national ambition over the medium to long term).	50,000 farmers (Targeted for the initial pilot phase).	No fixed target: "As many as possible," given the scale of national need.
Policy Recommendations	• Tariff rebates and duty waivers on agricultural equipment imports via the Nigerian Customs.	• Port duty waivers for equipment. • Single-digit interest rates for agricultural lending.	• Political will to review unfavorable policies. • Enforcement of existing policies. • Adequate government funding for extension services.
Key risks identified	• Poor market linkages, equipment theft, inadequate insurance, and climate change impacts.	• High import tariffs and port delays (up to 3 months) are undermining delivery.	• Fraudulent farmer records and a lack of maintenance and sustainability.

4. Cross-Cutting Themes and Key Messages

4.1 The Coordination Imperative

Perhaps the single most persistent theme across all sessions and group discussions was the failure of relevant agencies and institutions to coordinate with one another. A-Solar/ENO's partner, Hakim Shagaya, stated plainly that NASENI, SPIN, and the World Bank REA, for the productive use subsidy programme do not communicate, despite all three offering complementary resources that together could dramatically reduce the effective cost of a solar pump for an end farmer. The Federal Ministry of Water Resources echoed this, noting that NASENI had launched a flagship project in Bauchi without informing the ministry. IWMI and IFPRI are positioned by participants as potential neutral conveners capable of bridging this coordination deficit.

4.2 Farmer Structuring as a Prerequisite for Finance

Every financing institution present, including NIRSAL, Sterling Bank, and FarmWorld, consistently emphasized that financial instruments cannot be deployed to unstructured, individual smallholder farmers sustainably. Clustering, cooperative formation, and farmer association development are not optional add-ons; they are foundational prerequisites for financing flows. NIRSAL's technical assistance pillar, IWMI's extension work, and NAERLS's outreach capacity are all oriented toward this same structural challenge from different angles.

4.3 The Finance-Technology-Policy Triangle

Workshop discussions repeatedly returned to the interdependence of three enabling conditions: affordable finance (which requires interest rate subsidies, risk guarantees, and innovative lending products); appropriate technology (certified, data-generating, maintainable solar pumps supported by reliable after-sales service); and enabling policy (particularly tariff waivers on equipment imports, single-digit interest rate instruments, and clear sector mandates). Progress on any one dimension is undermined without progress on all three.

4.4 Extension and Digital Advisory as the Last Mile

The extension system emerged as a critical and undervalued link in the scaling chain. India's experience showed that farmer education and extension capacity were among the most significant drivers of solar irrigation adoption. In Nigeria, the NEEP platform, NAERLS radio outreach, ADP networks, and Sasakawa's field presence represent substantial but undercoordinated assets. Integrating digital advisory services with physical extension agent capacity was consistently flagged as a high-priority, high-leverage intervention.

4.5 Data and Evidence as Foundations for Scale

Multiple participants highlighted the data deficit as a root cause of both poor farmer targeting and weak institutional coordination. Cosmopolitan University's profiling of 68,000 farmers, using geolocation and biometric validation, demonstrates what is possible. NIRSAL's equity-linked mapping work, NEEP's digital platform, and the calls for a national irrigation information system all reflect a common understanding that scale requires reliable data infrastructure.

4.6 Youth, Women, and Inclusivity

The Sasakawa Africa Association representative raised a pointed concern about the absence of youth in solar irrigation pilots. Young people represent a natural fit for certified technician roles, after-sales service jobs, and data collection activities, and their inclusion would simultaneously address youth unemployment and the chronic lack of trained technicians for pump maintenance. The Kebbi State Commissioner of Agriculture noted female farmers as active and growing adopters of solar irrigation, a trend that should be deliberately supported in scaling pathways.

5. Key Challenges Identified

The successful deployment of solar-based irrigation systems is currently hindered by a complex intersection of financial, infrastructural, and institutional barriers (Ojeleye et al., 2025), and these are:

- High initial capital cost of solar irrigation pumps (currently 3 to 6 million Naira per unit for the NASENI solar unit), with prices elevated further by dollar exchange rate volatility and import logistics costs. Less expensive solar pumps are often of lower quality and have a limited lifespan.
- High interest rates on agricultural lending, reported at between 18.5% and 35%, make commercial borrowing for irrigation equipment effectively impossible for smallholder farmers without substantial subsidy or guarantee support.
- High import tariffs on agricultural equipment, which add significantly to equipment costs and undermine affordability.
- Port clearance delays of up to three months, creating delivery uncertainty that damages supplier credibility and farmer trust.
- Limited battery storage capacity of current solar pump systems, constraining irrigation to solar daylight hours and reducing effective field coverage.
- Mobility and security of equipment, particularly solar panels, in field settings where theft is a risk.
- Limited technical knowledge among smallholder farmers on solar pump operation, maintenance, and agronomic optimization.
- Scarcity of trained technicians for after-sales service and pump repair.
- Weak farmer organization and cooperative structures that prevent effective delivery of financial products and technical services.
- Fragmented and siloed institutional landscape, with agriculture, water, finance, and extension agencies operating independently rather than in a coordinated fashion.
- Data reliability issues in existing farmer registries, including duplicates, identity mismatches, and the absence of geolocation.
- Security challenges in key farming regions are causing farmer displacement and deterring investment.
- Groundwater sustainability risks in off-grid solar irrigation contexts, requiring accompanying water governance frameworks.

6. Institutional Commitments and Next Steps

All presenting institutions publicly committed to continued engagement beyond the workshop. To clarify the scaling potential and map exactly where the 120,000–150,000 farmer target will be drawn from, the following specific commitments, reach potentials, geographic focuses, and leveraged resources were identified as highlighted in Table 3 below:

Table 3. Institutional commitment and SBIS scaling partners' targets in Nigeria

Institution	Commitment / Next Step	Reach Potential (Farmers / Hectares)	Geography	Timeline	Resources Leveraged
IWMI / IFPRI	Prepare and circulate consolidated workshop report; conduct follow-up one-on-one meetings; facilitate coordination platform; continue building toward target.	120,000 to 150,000 smallholder farmers.	Priority northern states (including Kano, Jigawa, and Kaduna).	3 years (2026–2028).	S4I science programme framework; Area of Work 2 & 3 platforms; neutral convening capacity.
Federal Ministry of Agriculture and Food Security (Extension)	Continue digitalization of extension delivery via NEEP; coordinate with IWMI on integrating irrigation advisory; pursue farmer-led extension system reform.	National scale integration of public and private extension agents.	National (all states).	Ongoing.	National Electronic Extension Platform (NEEP); NIMET weather data; partnerships with Sasakawa and Extension Africa.
NIRSAL PLC	Develop complementary de-risking arrangements; advance Irrigate Nigeria development; structure cluster-based lending products.	40,000 contiguous hectares (currently scaling from a 1,000-ha proof-of-concept reaching 285 active farmers).	Adamawa (Garin-Ribadu axis) and other priority states.	Ongoing scale-up.	45 billion Naira credit risk guarantees (up to 75%); 9 billion Naira technical assistance; interest rebate mechanisms (up to 40%).
NASENI Solar Irrigation Company	Continue scale-up of pump production; reduce input costs through local assembly; pursue industrial partnerships; align product certification.	Deployment of 2,000 solar units on a 50,000-hectare farm; mass scaling.	Adamawa (Pilot); Nationwide mass scaling.	Ongoing (2026 pilots).	NASENI-ASAP Joint Venture; MOU with Tiabin Rice Limited; Presidential directive for scaling.

FarmWorld Technologies Limited	Expand Fadama cooperative financing model; engage IWMI on clustering support; participate in follow-up coordination meetings.	Over 20,000 members of the Federation of Fadama Farmers' Cooperative Society.	Northern Nigeria.	Ongoing (3-year repayment structures).	25% farmer / 75% bank debt financing model; NIRSAL guarantees; ACREsAL project linkages.
Sterling Bank	Continue agricultural lending; engage with NIRSAL on complementary guarantee products; partner with equipment suppliers for irrigation loans.	Financed 5,000 hectares of solar irrigation recently.	Kebbi, Adamawa.	Ongoing (active since 2014).	Over 18% of total loan book allocated to agriculture; partnerships with NASENI and NIRSAL.
Cosmopolitan University / A-Solar / ENOS	Advance solar irrigation pilot; expand farmer data profiling; explore carbon credit monetization; expand climate-smart agriculture faculty.	68,000 profiled farmers; 525 hectares (25 hectares per site across 21 sites).	Jigawa.	Ongoing.	1.7 MW solar power; 5 billion Naira venture capital; 45% WB/AfDB subsidy; DARES support (30-40% pump cost).
Federal Ministry of Water Resources / SPIN	Coordinate formally with NASENI and S4I program; share SPIN state engagement details with IWMI; pursue joint coordination mechanism.	Rehabilitation of over 23,000 hectares; over 100,000 farmers trained.	Kano, Jigawa, Gombe, Sokoto; scaling to 26 states.	2025–2030 (SPIN timeline).	World Bank funding; Irrigation Service Centers; community radio stations.
NAERLS	Develop irrigation-specific content for radio and digital platforms; collaborate with IWMI on extension agent capacity building; share zonal data.	Regional and national outreach.	Zonal / Northwest.	Ongoing.	Existing physical extension networks; radio outreach platforms.
ADPs (Kano, Kaduna)	Map existing solar irrigation installations; share state-level intelligence on government irrigation programmes; participate in cluster development.	State-wide farming populations.	Kano, Kaduna.	Ongoing.	State extension networks; government irrigation programmes.

7. Conclusions and Post-2026 Action Pathways

This workshop demonstrated with clarity that Nigeria possesses the institutions, the technologies, the financial instruments, and the human capital to scale farmer-led solar irrigation at the national level. What has been missing is not resources in isolation but coordination, structure, and the architecture of collaboration. To transition from these workshop resolutions to concrete action, IWMI and IFPRI are stepping beyond traditional convening roles to act as dedicated scaling catalysts, systems brokers, and evidence and learning partners. They have committed to addressing the critical gaps identified through specific, targeted scaling pathways for 2026 and beyond.

Based on the cross-cutting themes, the post-2026 interventions will capitalize on the following priority areas:

Spearheading institutional coordination as Scaling Systems Brokers (led by IFPRI)

Recognizing the severe coordination deficit among key agencies (such as NASENI, SPIN, and REA), IFPRI will act as the neutral convener and systems broker to establish and lead a continuous, multi-stakeholder dialogue platform. This platform will serve as the engine to harmonize the finance-technology-policy triangle, ensuring that scattered resources, tariff waivers, and subsidy programmes are aligned for maximum impact at the farmer level.

Driving inclusive scaling (AoW3 integration)

Through Area of Work 3 (AoW3) on inclusive scaling, IWMI will deliberately integrate marginalized demographics into the solar irrigation value chain. This pathway will actively target the recruitment and training of youth for certified after-sales and technician roles, simultaneously addressing youth unemployment and the critical pump maintenance gap, while expanding tailored support for the growing demographic of female solar adopters.

Structuring farmers for bankable finance (Investment Matchmaking)

Because financial institutions have made it clear that credit cannot flow sustainably to unstructured individuals, IWMI will align its grassroots extension initiatives with NIRSAL's technical assistance pillar and NAERLS to facilitate investment matchmaking. The focus will be on accelerating the formation of farmer clusters and cooperatives, treating them as foundational prerequisites for accessing affordable financial instruments.

Integrating data and digital advisory (Evidence and Learning Partners)

To overcome the data deficit that currently limits accurate farmer targeting, IWMI will act as an evidence partner to support the integration of existing physical extension networks with robust digital advisory tools. This includes leveraging platforms like NEEP to provide reliable, real-time agronomic and technical support directly to end-users.

To operationalize these pathways and achieve the directional target of reaching 120,000 to 150,000 farmers, the following phased roadmap will guide implementation:

- **2026:** Focus on partnership alignment, farmer clustering, and pilot validation of bundled technical and financial models.
- **2027:** Drive widespread expansion by embedding proven models through formal finance and national extension systems.
- **2028:** Achieve full institutionalization and sustainability through integration with major national programmes (including SPIN, NEEP, NIRSAL, and NASENI).

To clearly articulate the architecture of this scaling ambition, the strategic pathway is summarized in Table 4.

Table 4. SPIS scaling ambition in Nigeria

Innovation	Scaling Mechanisms	Scaling Partners	Enablers	Target Reach	Expected Outcomes
Solar-Powered Irrigation Systems (SPIS) / Farmer-Led Irrigation Development (FLID)	Cooperative financing; clustered farmer lending; Public-Private Partnerships; Irrigation-as-a-Service	NIRSAL, Sterling Bank, FarmWorld, NASENI, A-Solar, Bank of Agriculture	Tariff reforms, single-digit interest rates, digital extension via NEEP, NAERLS	120,000 – 150,000 smallholder farmers across priority northern states	National-scale agricultural resilience, improved climate adaptation, and year-round food security

The spirit of collaboration expressed throughout the day, and the concrete commitments made by institutions spanning government, finance, the private sector, research, and civil society, provide strong grounds for optimism. By operationalizing these specific pathways, IWMI and IFPRI will provide the disciplined follow-through, structured coordination, and sustained will required to turn these collaborative frameworks into national-scale agricultural resilience.

References

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Annexes

Annex A. List of Participating Institutions

- International Water Management Institute (IWMI)
- International Food Policy Research Institute (IFPRI)
- Federal Ministry of Agriculture and Food Security (Federal Department of Agricultural Extension)
- Federal Ministry of Water Resources and Sanitation (Department of Irrigation and Drainage/SPIN)
- Federal Ministry of Livestock Development (Strategic Feed Resources Development Department)
- Kebbi State (Commission for Agriculture and Budget and Economic Planning)
- NIRSAL PLC (Nigerian Incentive-Based Risk Sharing System for Agricultural Lending)
- NASENI Solar Irrigation Company Limited
- Sterling Bank
- FarmWorld Technologies Limited
- Samaha Integrated Investments Limited (Jain Irrigation Systems representative)
- AgroPresiso Limited
- A-Solar and ENOS (Swiss solar pump manufacturer)
- Cosmopolitan University Centre for Climate Smart Agriculture
- National Agricultural Extension and Liaison Services (NAERLS)
- Kano Agricultural Development Programmeme (ADP)
- Kaduna Agricultural Development Programmeme (ADP)
- Sasakawa Africa Association
- National Agricultural Extension and Liaison Services, Northwest Zonal Office
- Federation of Fadama Farmers' Cooperative Society Limited
- Rice Farmers Association of Nigeria
- News Agency of Nigeria (Agriculture and Environment Editor)
- Ahmadu Bello University Zaria (Consultant, IWMI)

Annex B. Glossary of Key Terms

- CGIAR: Consultative Group on International Agricultural Research, a global consortium of international agricultural research centers.
- DARES: Distributed Access to Renewable Energy through Subsidies, a productive use subsidy programme under the Rural Electrification Agency (REA).
- EE Lab: Enabling Environment Lab, Area of Work 3 of the Scaling for Impact programme.
- IFPRI: International Food Policy Research Institute.
- IWMI: International Water Management Institute.
- NAERLS: National Agricultural Extension and Liaison Services.
- NASENI: National Agency for Science and Engineering Infrastructure.
- NEEP: National Electronic Extension Platform, the federal digital extension platform.
- NIRSAL: Nigerian Incentive-Based Risk Sharing System for Agricultural Lending.
- PM Kusum: Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan, India's national solar irrigation scheme.
- REA: Rural Electrification Agency.
- S4I: Scaling for Impact, the CGIAR science programme anchoring this initiative.
- SPIN/SPRIM: Sustainable Power for Irrigation in Nigeria, successor to the TRIMING project.
- SPIS: Solar-Powered Irrigation System.
- TRIMING: Transforming Irrigation Management in Nigeria, World Bank-sponsored project.



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