



Re-Building Sudan AFTER THE WAR

AGRICULTURE, ENVIRONMENT AND NATURAL RESOURCES

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CHAPTER

18

RESEARCH

An informed Transformation Platform is a Prerequisite for Sustainable Growth: Post War context of Sudan

Professor Ibrahim Adam Ahmed El-Dukheri
Agricultural Economist

Director General, Arab Organization for Agricultural Development AOAD, Sudan
Email: ibrahim.dukheri@aoad.org; ibrahim.dukheri@gmail.com
ORCID: 0009-0006-7121-0330

Dr Ahmad Alfakih

Agricultural Economist, Incubator and Accelerating Unit, AOAD, Sudan
Email: a.alfakih@aoad.org
ORCID: 0009-0002-1308-1607

ABSTRACT

The chapter was authored by the Arab Organization for Agricultural Development (AOAD), an organisation dedicated to enhancing agricultural development and food security in Arab countries. AOAD collaborates with governments, international organisations, and local communities to promote sustainable agricultural practices and socio-economic development.

PURPOSE: This chapter addresses agricultural recovery in post-conflict Sudan, focusing on revitalising rural livelihoods and food security through inclusive, digitally integrated approaches that bring key stakeholders to jointly address the transformation of the agri-food systems for efficiency and effectiveness, especially among smallholder farmers who constitute the bulk of farming communities.

DESIGN/METHODOLOGY/APPROACH: The approach or the model emphasises collaboration among public institutions, private enterprises, civil society, and research organisations and many service providers to the farming community. It focuses on both financial and non-financial services that farmers need to transform the sector and this includes skill development, co-operative organisation, and knowledge dissemination, supported by digital financial services and regional service hubs to shift farmers toward market-oriented agriculture.

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FINDINGS: Establishing decentralised hubs and digital platforms effectively addresses critical transformational issues like gaps in finance, gap in technical/institutional knowledge, and market connectivity, significantly enhancing agricultural productivity and resilience building of smallholder farmers.

ORIGINALITY/VALUE: The chapter's novel integration of digital tools, financial inclusion, and co-operative organisation presents a replicable model aligned with Sustainable Development Goals (SDGs), beneficial to policy-makers and practitioners in similar post-crisis agricultural contexts.

KEYWORDS: *Post-Conflict Recovery; Agri-Food Systems; Agricultural Transformation; Financial Inclusion; Food Security; Sudan; Smallholder Farmers; Sustainable Development.*

INTRODUCTION

For decades, Sudan's agricultural sector has been a key driver of employment and food production, yet it remains vulnerable to political instability, environmental shocks, and economic fragmentation. The prolonged period of conflict has led to the destruction of irrigation networks, displacement of farming communities, and a breakdown in rural financial systems, leaving smallholder farmers with minimal access to markets, credit, and modern inputs.

With over 80% of rural livelihoods tied to agriculture, Sudan depends heavily on staple crops such as sorghum, millet, and groundnuts (ICARDA, 2016). However, systemic inefficiencies, particularly poor post-harvest storage, lack of mechanisation, and fragmented value chains, have left productivity stagnant, with post-harvest losses surpassing 30% (FAO, 2023). Additionally, the absence of a cohesive institutional framework has hindered agricultural investments and limited farmers' ability to transition from subsistence farming to commercial production.

As Sudan navigates a post-conflict recovery phase, agricultural transformation presents an unparalleled opportunity to reverse food insecurity, stimulate economic recovery, and build climate-resilient rural enterprises. This study introduces the Agricultural Transformation Platform, a structured intervention that goes beyond short-term recovery by:

- empowering farmers through skills development and co-operative strengthening;
- enhancing rural financial inclusion and digital banking integration;
- rehabilitating agricultural service infrastructure, particularly irrigation and storage systems; and
- fostering public-private partnerships to create sustainable value chains.

By consolidating diverse stakeholders, including the public sector, financial institutions, farmer groups, and research institutions, this platform provides a scalable, multi-dimensional solution

tailored to Sudan's unique socio-economic landscape. Rather than merely restoring pre-conflict conditions, the approach aims to create an adaptive, innovation-driven agricultural ecosystem that can withstand future shocks and ensure long-term rural prosperity.

CORE OBJECTIVES OF THE AGRICULTURAL TRANSFORMATION PLATFORM

To address the challenges of post-conflict recovery and establish a sustainable agricultural sector in Sudan, the Agricultural Transformation Platform is designed with key objectives that integrate human-centred development, technological advancement, and institutional collaboration. These objectives focus on rebuilding livelihoods, increasing productivity, and promoting long-term resilience through sustainable agricultural value chains while ensuring that target communities are fully engaged and empowered.

A fundamental pillar of this transformation is enhancing engagement capacity within farming communities by strengthening the non-financial services necessary for long-term inclusion in financial and market systems. This includes fostering capacity-building and knowledge-sharing to improve technical skills, market literacy, and sustainable farming practices. Strengthening skills development will prepare farmers for participation in structured markets and digital financial services, while enhanced organisational arrangements will empower co-operatives and producer groups, ensuring better access to resources and improving their negotiation powers.

The platform is built on a multi-stakeholder approach, bringing together the public sector, private sector, civil society, and research institutions under a unified framework. This complementary diversity is essential for ensuring that agricultural transformation is sustainable, inclusive, and resilient to future shocks. By focusing on preparing communities for financial technologies through strong engagement mechanisms, the platform ensures that farmers and agricultural enterprises can effectively integrate into digital financial systems, participate in structured value chains, and maximise economic opportunities in post-conflict Sudan.

Strengthening Engagement Capacity through Non-Financial Services

A key component of agricultural transformation is enhancing the engagement capacity of farmers, co-operatives, and rural stakeholders. The platform will focus on non-financial services that are critical for creating an enabling environment before introducing financial technologies. These include:

- **Capacity-Building and Knowledge-Sharing:** Training programmes, farmer-field schools, and workshops to improve farming techniques, post-harvest handling, and financial literacy.
- **Skills Development:** Improving farmers' ability to engage with markets through technical and business skills training.

- **Organisational Arrangements:** Strengthening co-operatives, producer groups, and farmer-led institutions to enhance engagement and collective bargaining power.

By reinforcing these areas, farmers and rural stakeholders will be better equipped to integrate into digital financial systems, participate in structured markets, and improve overall economic resilience.

Sustainable Development Contribution

- **SDG 2 (Zero Hunger):** Enhancing productivity and market access.
- **SDG 8 (Decent Work and Economic Growth):** Promoting employment and sustainable rural enterprises.

Utilising Financial Technologies to Rebuild Livelihoods

Access to finance is one of the most significant obstacles facing farmers in post-conflict areas. To address this, the platform will introduce financial inclusion programmes leveraging digital technologies to provide targeted support. Through partnerships with financial institutions and microfinance organisations, such as the Irada Microfinance Company, the platform will provide:

- affordable microloans and credit facilities for purchasing agricultural inputs and equipment;
- simplified loan application processes using mobile-based platforms to reduce paperwork and bureaucratic delays;
- customised insurance programmes that protect farmers from risks such as droughts, floods, and crop failures, allowing them to recover quickly from shocks;
- digital payment systems to facilitate transactions between farmers, suppliers, and markets, reducing the dependence on cash-based systems.

These initiatives will be particularly focused on supporting women farmers, youth, and smallholder farmers in conflict-affected regions to ensure equitable access to financial resources and the ability to reinvest in production.

Sustainable Development Contribution

- **SDG 1 (No Poverty):** Reducing poverty through access to credit and insurance.
- **SDG 9 (Industry, Innovation, and Infrastructure):** Strengthening rural financial networks to support long-term growth.

Advancing Technological Progress for Sustainable Recovery

Technological innovations are crucial to rebuilding agricultural resilience and improving productivity in the face of challenges posed by post-conflict instability and climate change. The platform will introduce a range of climate-smart and resource-efficient technologies, including:

- smart irrigation systems that optimise water use and reduce waste;
- climate-resilient seed varieties that are adapted to local environmental conditions and resistant to droughts and pests;

- digital monitoring and data-driven applications that provide farmers with real-time information on weather patterns, soil health, and crop management.

Post-conflict recovery programmes will include hands-on training sessions to build farmers' technical capacities, ensuring that they can adopt and implement these technologies effectively. Mobile-based advisory services will also be provided to farmers in remote and under-served regions.

Post-Conflict Focus

- **Empowering women and youth:** Training programmes will specifically target vulnerable groups to ensure that technological advancements benefit marginalised populations.
- **Mobile advisory solutions:** Expanding the reach of technical advice to regions with limited physical access.

Sustainable Development Contribution

- **SDG 13 (Climate Action):** Promoting climate-resilient agricultural practices to mitigate the impacts of climate change.
- **SDG 5 (Gender Equality):** Ensuring inclusive access to technological innovations for women farmers.

Multi-Stakeholder Collaboration for Complementary Diversity

The platform's theory of change is based on integrating all key actors under a unified framework to ensure sustainable agricultural development. The main stakeholders include:

- **Public Sector:** Providing policy support, funding mechanisms, and regulatory oversight;
- **Private Sector:** Driving investment in infrastructure, technology, and supply chain solutions;
- **Civil Society:** Strengthening farmer representation, promoting inclusive governance, and facilitating community engagement;
- **Research Institutions:** Conducting research, advancing technological innovations, and providing training initiatives.
- By ensuring complementary diversity, the platform maximises efficiency, strengthens institutional capacity, and creates an adaptable agricultural model that can withstand external shocks.

Sustainable Development Contribution

- **SDG 16 (Peace, Justice, and Strong Institutions):** Ensuring inclusive governance and participation.
- **SDG 17 (Partnerships for the Goals):** Fostering collaboration across diverse sectors.

Enhancing Post-Harvest Processes to Reduce Waste and Increase Value

Post-harvest losses represent a major challenge in conflict-affected regions where infrastructure for storage and processing is often inadequate. The platform will implement measures to improve the efficiency of post-harvest handling and maximise the value of agricultural products. Key actions include:

- establishing local processing centres for transforming raw agricultural products into value-added goods such as packaged foods and processed oils;
- upgrading packaging and storage facilities to reduce spoilage and improve product quality;
- training programmes on post-harvest management to ensure that farmers can adopt best practices for handling, transporting, and marketing their produce.

These measures will create new opportunities for income generation, especially in rural areas, by enhancing the competitiveness of local products in regional and international markets.

Sustainable Development Contribution

- **SDG 12 (Responsible Consumption and Production):** Reducing food waste along the value chain.
- **SDG 8 (Decent Work and Economic Growth):** Creating value-added job opportunities and boosting rural economies.

STRATEGIC COMPONENTS OF THE TRANSFORMATION PLATFORM

The platform integrates various overlapping objectives into practical and actionable components. These strategic components are summarised in Table 1 that outlines each component’s role and contribution to post-conflict agricultural recovery.

Table 1: Strategic Components of the Transformation Platform

Strategic Component	Description	Primary Contribution
Service Centres	Establish decentralised centres providing technical support, agricultural inputs, and market access.	Enhances productivity, connects farmers to markets, and provides access to critical inputs and advisory services (IFPRI, 2023).
Financial Technologies (FinTech)	Implement digital payment systems, microloans, and insurance services.	<ul style="list-style-type: none"> - Digital payment systems to facilitate quick and secure transactions. - Digital credit platforms to provide flexible loans tailored to farmers’ needs. - Agricultural insurance programmes to protect against production risks. - Online marketing platforms for contract farming and auction markets (Giordano, 2011).
Technical and Institutional Interventions	Provide capacity-building programmes and policy reforms.	Strengthens agricultural productivity through training, improved access to inputs, and streamlined regulations (Agrilinks, 2014).

<i>Strategic Component</i>	<i>Description</i>	<i>Primary Contribution</i>
Post-Harvest Value Addition	Develop local processing units and improve storage and packaging.	Reduces post-harvest losses, increases value addition, and improves farmers' incomes through expanded market opportunities (ICARDA, 2023).
Innovation Platforms	Foster collaboration among farmers, private companies, and research institutions.	Promotes adoption of modern technologies, entrepreneurship, and innovative agricultural solutions to address climate and resource challenges (Boettiger et al., 2017).

Source: Constructed by the authors based on AOAD internal analysis and reference literature

Service Centres

Decentralised physical service centres will be established across Sudan, particularly in rural and remote areas, to provide comprehensive services to farmers. These services will include technical and marketing support, as well as the supply of agricultural inputs such as machinery, nutrients, chemicals, modern irrigation systems, and sustainable energy alternatives.

In addition to physical centres, virtual platforms will be developed to enhance access to services digitally. Farmers will be able to connect with experts for technical consultations and purchase agricultural inputs online, overcoming geographical limitations. This integration between physical and virtual centres provides comprehensive support to meet the needs of farmers in various regions, enhancing their productivity and ability to market their products effectively and sustainably.

The centres will cover all stages of the agricultural process, starting from providing consultations on modern agricultural methods and sustainable techniques such as precision farming and climate-resistant agriculture, to providing essential agricultural inputs such as high-quality seeds and fertilisers. They will also assist in marketing agricultural products by connecting farmers to local, regional, and international markets, thus enhancing their income and competitiveness.

Additionally, the centres will efficiently store and distribute agricultural inputs, ensuring timely access for farmers. Awareness and training programmes will be organised to educate farmers on the optimal use of agricultural inputs, helping to reduce waste and increase returns.

Financial Technologies (FinTech)

Digital Payment Systems

Mobile payment systems will be implemented to facilitate financial transactions between farmers, suppliers, and financial institutions, transforming the agricultural financial system into a secure and efficient digital environment. These systems will simplify payment settlements, whether for farmers purchasing agricultural inputs or for suppliers and distributors selling agricultural products. With these systems, farmers will be able to complete transactions quickly and securely without the

need to visit financial centres or traditional payment banks. This solution will effectively address the challenges posed by geographical distance in rural areas, as financial technologies reduce costs and facilitate smooth and secure access to payment services, enhancing transparency and reducing unregulated cash transactions.

Access to Credit

Digital credit platforms will be introduced to provide flexible and tailored financing solutions for farmers. These platforms will enable farmers to obtain small and medium loans to purchase essential inputs such as fertilisers and seeds, as well as agricultural machinery or processing equipment. These platforms will represent an innovative solution to overcome traditional constraints faced by farmers in accessing loans from banks or conventional financial institutions, thanks to simplified and fast procedures that can be completed via mobile phones or the Internet. Moreover, these platforms will be specifically geared towards agricultural needs, ensuring accurate fulfilment of farmers' requirements and improving their ability to obtain financing easily and conveniently.

Insurance

Agricultural insurance is an important tool to protect farmers from natural and economic risks that may impact their agricultural production. Through a digital platform dedicated to agricultural services, agricultural insurance services will be provided in an easy and flexible manner for farmers in various regions. The platform will allow farmers to subscribe to suitable insurance programmes for their crops, with detailed information on the different types of insurance available, such as insurance against drought, floods, or pests. Farmers will also be able to track their insurance status and make premium payments electronically, providing them with a tool to protect their agricultural investments and improve their resilience to climatic and economic challenges.

Marketing Arrangements for Agricultural Products

The digital platform will activate advanced marketing arrangements such as contract farming, off-takers agreements, and auction markets to ensure farmers receive fair prices for their agricultural products:

- through contract farming on the platform, farmers will be able to sign contracts with companies or traders to guarantee the purchase of their crops at fixed prices and clear terms, providing them with income stability and protecting them from market fluctuations;
- *off-takers agreements* will allow farmers to sell their crops before harvest at agreed prices through the platform, enhancing their financial security and reducing economic risks;
- the platform will also provide online auction markets where farmers can showcase their products in competitive auctions and select the best available offers, increasing their ability to achieve the highest possible price.

Technical and Institutional Interventions

Capacity Building

This will include providing training programmes for technicians and farmers aimed at enhancing their skills and knowledge on best agricultural practices and modern techniques. These programmes will cover a range of topics related to all aspects of agriculture, including crop management, the use of sustainable inputs such as organic fertilisers and climate-resilient seeds, as well as agricultural processing techniques that add value to agricultural products. Workshops and training courses will be organised both locally and online, providing farmers with hands-on experience to improve their agricultural performance. These programmes aim to improve productivity, reduce losses, and focus on sustainability by teaching water-saving techniques and efficient resource use. Training will also cover precision agriculture technology, helping farmers accurately assess their crops' needs and provide inputs efficiently, contributing to increased yields and reduced environmental impact.

Policy Support

Achieving success in implementing these transformations will require collaboration with governmental bodies. This initiative will aim to streamline government regulations and processes related to the distribution of agricultural inputs, such as fertilisers and seeds, and facilitate access to financial services. These policies will also encourage private sector investment in agriculture by creating a flexible and supportive regulatory environment that accelerates agricultural transformation effectively.

Post-Harvest Processes to Increase Value Added

Value Addition

This component aims to encourage and stimulate the establishment of agricultural processing units of various sizes in diverse agricultural areas. These units will increase the value of agricultural products by processing and transforming them from raw products into value-added products, such as processed foods, vegetable oils, beverages, jams, and juices.

The units will help reduce post-harvest losses and are critical in light of challenges such as lack of storage and transportation difficulties in remote areas. Additionally, transforming raw products into ready-to-consume or exportable goods will increase the market value of agricultural products and expand market opportunities.

This will have a positive impact on farmers' income at all production stages, from crop cultivation to the marketing of processed products, stimulating local economic growth by creating new jobs in agricultural processing. To enhance the effectiveness of these units, the focus will be on

developing value chains and supply chains, including manufacturing and storage. This will improve process efficiency and reduce waste, leading to increased productivity and greater sustainability in the agricultural sector.

Market Linkages

Efforts will be made to create strong linkages with local, regional, and international markets to improve the competitiveness of processed agricultural products. By connecting farmers with broader market sources, including local stores and regional and international markets, farmers will be able to increase their sales and reach diverse market segments, contributing to enhanced income through market expansion. These linkages will help reduce the gap between producers and consumers, enabling farmers to obtain fair prices for their agricultural products. At the same time, these linkages will enhance the ability of Sudanese agricultural products to compete in larger markets, both locally and internationally, promoting exports and increasing demand for processed agricultural products.

Innovation Platforms

This component aims to enhance and develop seed systems and pest management, as well as neutralise land degradation, by creating innovation centres that encourage collaboration among farmers, private companies, research institutions, and development partners. These centres will act as collaborative platforms for knowledge exchange and developing innovative solutions to challenges faced by the agricultural sector, such as improving productivity, access to agricultural inputs, and enhancing natural resource management efficiency.

This will accelerate the adoption of agricultural technologies and the development of solutions to address challenges such as climate change, water scarcity, and plant diseases, thereby enhancing the sustainability and resilience of the agricultural sector.

Furthermore, these platforms will be designed to be scalable, catering to different agricultural operations, from smallholder farmers to large-scale producers. This flexibility will allow solutions to be tailored to the size and complexity of agricultural operations, ensuring that everyone, from smallholder farmers to large-scale operations, benefits from the available solutions.

This initiative will foster entrepreneurship in the agricultural sector, contributing to job creation, improved value chains, and the development of supply chains, including manufacturing and storage. This will improve process efficiency and reduce waste, leading to increased productivity and greater sustainability in the agricultural sector.

PUBLIC-PRIVATE PARTNERSHIPS FOR REBUILDING AGRICULTURAL IN-



FRASTRUCTURE

A Dynamic Collaboration for Agricultural Revitalisation

The success of Sudan’s agricultural transformation hinges on a synergistic collaboration between the public and private sectors, with the public sector acting as the enabler and regulator and the private sector driving investment and innovation. However, to ensure the full engagement of target communities, the framework must also integrate civil society and research institutions, fostering a comprehensive and complementary ecosystem. This inclusive approach will operationalise the platform by leveraging the strengths of each actor while ensuring diversity in expertise and contribution.

The public sector’s primary role is to provide the legislative and infrastructural foundation that fosters private sector engagement while protecting local communities and ensuring sustainable outcomes. This collaborative framework will be guided by well-defined roles, targeted legal measures, and inclusive development strategies.

The public sector’s leadership in creating favourable policies, ensuring legal compliance, and involving communities in decision-making is crucial for the success of public-private partnerships. By addressing infrastructural deficits, promoting inclusive participation, and enforcing regulations, the public sector will help create a stable and attractive investment climate. Local communities, as key beneficiaries, will be empowered to actively participate in infrastructure projects and agricultural development, fostering long-term growth and sustainability.

Table 2 outlines the core responsibilities of the public sector, highlighting their role in enabling infrastructure, regulations, and inclusive participation within public-private partnerships.

Table 2: The Public Sector’s Responsibilities

<i>Responsibility</i>	<i>Description</i>	<i>Expected Outcome</i>
Creating a Supportive Policy Environment	Developing comprehensive land-use policies, investment incentives, and streamlined regulations to attract private sector engagement.	Reduction in bureaucratic delays, increased private sector participation, and enhanced investment in rural infrastructure projects.
Co-Investing in Critical Infrastructure	Public funds will be used to co-finance key infrastructure projects such as irrigation system rehabilitation and storage development.	- Infrastructure improvements in high-risk rural areas, leading to enhanced productivity and market access.
Enforcing Regulatory Standards	Establishing and enforcing labour, environmental and quality standards to protect communities and ensure sustainable development.	Compliance with sustainability goals, protection of local communities, and adherence to quality standards for domestic and export markets.

Responsibility	Description	Expected Outcome
Monitoring and Accountability Mechanisms	Implementing governance frameworks to monitor project implementation, address bottlenecks, and maintain oversight of resource allocation.	Increased transparency, equitable resource distribution, and effective monitoring of private and public sector activities.

Source: Constructed by the authors based on AOAD internal analysis and reference literature

Target Communities and Engagement

The platform will prioritise communities most affected by conflict: marginalised farmers, women, and youth. Key strategies to target and engage communities include:

- **Outreach Programmes:** Public awareness campaigns and stakeholder meetings will be held in rural areas to inform communities about available services, investment opportunities, and capacity-building programmes.
- **Community-Led Initiatives:** Local communities will be involved in decision-making processes through farmer co-operatives, village committees, and stakeholder workshops. This participatory approach ensures that interventions are tailored to local needs.
- **Capacity-Building and Training:** Targeted training sessions will be conducted to equip farmers with technical, financial, and entrepreneurial skills, ensuring their active involvement in value-added production and marketing.

MONITORING AND EVALUATION FOR ADAPTIVE RECOVERY

The platform will adopt a comprehensive monitoring system to ensure sustained progress. Key indicators will track:

- increases in agricultural productivity (target: 30% increase within 5 years);
- reductions in rural poverty by 15% within targeted regions;
- adoption rates of sustainable practices among 60% of farmers within 3 years.

The feedback system will ensure flexibility, allowing adaptive measures based on real-time data (Wiggins et al., 2023)

CONCLUSIONS

The Agricultural Transformation Platform offers a strategic pathway for rebuilding Sudan’s agricultural sector by addressing the challenges of post-conflict recovery through innovation, governance, and financial inclusion. By integrating modern technologies, capacity-building initiatives, and public-private partnerships, the platform will contribute to sustainable growth, food security, and economic stability, serving as a model for other regions undergoing similar transitions.

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BIOGRAPHY



Professor Ibrahim Adam Ahmed El-Dukheri has been the the Director General of the Arab Organization for Agricultural Development (AOAD) since 2017. He is a prominent figure in agricultural economics, known for his expertise in system analysis and sustainable agriculture. Professor El-Dukheri has a PhD in Agricultural Economics with a focus on system analysis and mathematical methods from the Technical University of Munich, Germany (1997). He also holds an MSc in Agricultural Economics from Washington State University, USA (1987), and a BSc with Honors in General Agriculture from the University of Khartoum, Sudan (1983). Before joining AOAD, Professor El-Dukheri was the Federal Minister of Agriculture and Forestry in Sudan (April 2017) and the Director General of the Agricultural Research Corporation (ARC) from December 2012 to June 2015. He has authored 23 research papers on topics related to agricultural economics, food security, and sustainable development, and is an active participant in various scientific bodies.



Dr Ahmad Alfakih is an agricultural engineer specialising in agricultural economics and rural development. He holds a PhD in this field and currently works at the Arab Organization for Agricultural Development (AOAD) in the Department of Agricultural Integration and Food Security in the Entrepreneurship Unit, contributing to initiatives that promote sustainable agriculture, value chain development, and rural empowerment in Arab countries. His work focuses on enhancing food systems through innovation, inclusive agribusiness models, and capacity building for local communities. He actively collaborates with stakeholders from the public, private, academic, and civil society sectors to strengthen regional agricultural transformation platforms. His contributions aim to improve livelihoods, increase resilience, and align agricultural practices with sustainable development goals (SDGs).