

TERMS OF REFERENCE

Provision of GIS, Remote Sensing and Climate-Smart Agriculture Decision Support Services in Kano and Ogun States – Phase II

1. Background

The Federal Government of Nigeria (FGN), with financing from the African Development Bank (AfDB), the International Fund for Agricultural Development (IFAD), and the Islamic Development Bank (IsDB), is implementing the Special Agro-Industrial Processing Zones (SAPZ) Programme in selected states across Nigeria.

The overall development objective of the Programme is to support the development of agro-industrial processing zones in high-potential agricultural areas while enhancing the productivity, market participation, income, food security, and climate resilience of smallholder farmers, small-scale agro-processors, traders, women, and youth.

Under Component 2: Agricultural Productivity, Production, Market Linkages and Value Addition, the Programme promotes Climate-Smart Agriculture (CSA) approaches to improve agricultural productivity and strengthen farmers' resilience to climate variability and environmental degradation.

Phase I of the GIS and Remote Sensing assignment successfully established a pilot geospatial farmer registry, geo-referenced farmers and farm parcels, and developed an interactive GIS platform. The assignment demonstrated the feasibility of GIS-based farmer registration and parcel mapping as a foundation for agricultural planning and service delivery.

However, the Phase I assessment also highlighted important gaps, including limited climate-risk analysis, absence of crop suitability assessments, inadequate irrigation performance monitoring, weak digital extension mechanisms, insufficient systems for continuous monitoring, and limited institutional capacity for sustaining geospatial information systems.

Building on these lessons, SAPZ intends to engage a qualified consulting firm to implement Phase II of the assignment. The consultancy will establish an integrated Climate-Smart Agriculture Decision Support System (CSA-DSS) that combines GIS, remote sensing, climate intelligence, farmer profiling, digital extension support, and continuous monitoring tools to improve evidence-based planning and decision-making.

The assignment will cover 15 Local Government Areas (LGAs) in Kano State and 8 LGAs in Ogun State and target approximately 24,000 farmers.

2. Objective of the Assignment

Overall Objective

The overall objective of the assignment is to strengthen climate-smart agriculture planning, implementation, monitoring, and service delivery through the establishment of an integrated GIS and Remote Sensing-based Climate-Smart Agriculture Decision Support System for Kano and Ogun States.

Specific Objectives

The Consultant shall:

- i. Establish a comprehensive geospatial farmer and farm registry covering 24,000 farmers and linked to a centralized land parcel database.
- ii. Generate climate-risk and vulnerability information to support climate adaptation and resilience planning.
- iii. Conduct crop suitability assessments and agro-ecological zoning to guide climate-resilient crop diversification and sustainable land management.
- iv. Assess and map irrigation systems, water resources, and agricultural support infrastructure to support investment planning and resource-use efficiency.
- v. Design and operationalize a GIS-enabled Climate-Smart Agriculture Decision Support System comprising mobile data collection tools, geospatial databases, web-based dashboards, and monitoring modules.
- vi. Establish mechanisms for continuous monitoring of agricultural production systems, environmental conditions, and programme interventions.
- vii. Strengthen the capacities of SAPZ staff, extension personnel, relevant government institutions, and farmer organizations in the use of GIS, remote sensing, and digital technologies for climate-smart agriculture.

3. Scope of Work

The Consultant shall undertake the following tasks:

Task 1: Geospatial Farmer Registration and Farm Mapping

The Consultant shall:

- i. Register and geo-reference 24,000 farmers.
- ii. Delineate and map farm parcel boundaries using GPS-enabled devices.
- iii. Assign Unique Farm Parcel Identifiers (UFPIDs) to all mapped farms.
- iv. Capture farmer socio-economic information, production systems, land tenure arrangements, irrigation practices, and support received.
- v. Establish a centralized GIS-enabled land parcel registry.

Task 2: Climate Risk and Vulnerability Assessment

The Consultant shall utilize satellite imagery, climate datasets, and geospatial modelling tools to:

- i. Produce drought-risk maps.
- ii. Produce flood-risk maps.
- iii. Assess heat stress risks.
- iv. Map erosion and land degradation hotspots.
- v. Develop climate vulnerability indices.
- vi. Prepare climate-risk and resilience assessment reports.

Task 3: Crop Suitability and Agro-Ecological Analysis

The Consultant shall:

- i. Conduct land capability assessments.
- ii. Undertake crop suitability analyses.
- iii. Develop agro-ecological zoning maps.
- iv. Identify opportunities for climate-resilient crop diversification.
- v. Recommend alternative crop enterprises based on environmental suitability and market opportunities.

Task 4: Irrigation and Agricultural Infrastructure Assessment

The Consultant shall:

- i. Map irrigation infrastructure and water sources.
- ii. Assess irrigation performance and water-use efficiency.
- iii. Map roads, storage facilities, aggregation centres, processing facilities, power infrastructure, and market access routes.
- iv. Identify infrastructure gaps and investment priorities.

Task 5: Development of Climate-Smart Agriculture Decision Support System

The Consultant shall design and deploy an integrated decision-support platform comprising:

Mobile Data Collection Application

The application shall:

- i. Operate in offline and online modes.
- ii. Support GPS-enabled farm mapping.
- iii. Capture climate-smart agriculture indicators.
- iv. Track farmer support and programme interventions.
- v. Facilitate routine field monitoring and reporting.

Centralized Geospatial Database

The database shall:

- i. Maintain farmer and farm records.
- ii. Support spatial analysis and climate-risk integration.
- iii. Track interventions and historical farm information.
- iv. Ensure interoperability with national and programme databases.

Web-Based GIS Dashboard

The dashboard shall provide functionality for:

- i. Farmer and parcel visualization.
- ii. Climate-risk monitoring.
- iii. Crop suitability analysis.
- iv. Infrastructure monitoring.
- v. Programme intervention tracking.
- vi. Reporting and analytical functions.
- vii. Data export and interoperability.

Task 6: Continuous Monitoring and Climate Advisory Services

The Consultant shall establish systems for:

- i. Periodic updating of farmer and farm information.
- ii. Seasonal crop monitoring.
- iii. Land-use and land-cover change detection.
- iv. Environmental monitoring using satellite imagery.
- v. Climate advisory dissemination.
- vi. Weather information services.
- vii. Pest and disease alert systems.
- viii. Monitoring programme performance and impacts.

Task 7: Capacity Building and Knowledge Transfer

The Consultant shall:

- i. Conduct training for SAPZ staff.
- ii. Train extension officers and enumerators.
- iii. Train selected farmer groups and community representatives.
- iv. Develop user manuals and operational guidelines.
- v. Develop system administration manuals.
- vi. Facilitate knowledge transfer to ensure sustainability of the system.

4. Deliverables

The Consultant shall submit the following deliverables:

- i. Inception Report, including methodology, implementation plan, work schedule, staffing arrangements, and quality assurance framework.
- ii. Geospatial Farmer Registration and Farm Mapping Report, including the Centralized Land Parcel Registry and Unique Farm Parcel Identifiers (UFPIDs).
- iii. Climate Risk and Vulnerability Assessment Report, including drought, flood, heat stress, erosion, land degradation, and climate vulnerability maps.
- iv. Crop Suitability, Agro-Ecological Zoning, Irrigation Assessment, and Agricultural Infrastructure Mapping Report.
- v. Operational Climate-Smart Agriculture Decision Support System, including:
 - Mobile data collection application;
 - Centralized GIS database;
 - Web-based GIS dashboard; and
 - Continuous monitoring framework.
- vi. Final Consultancy Report, including:
 - Sustainability and transition plan;
 - Capacity-building report;
 - Training manuals;
 - System documentation;
 - Data and source code handover package.

5. Expected Results

The assignment is expected to deliver the following results:

- i. A comprehensive geospatial farmer and farm registry covering 24,000 farmers.
- ii. A centralized land parcel database linked to unique farm identifiers.
- iii. Improved understanding of climate risks affecting agricultural production systems.
- iv. Evidence-based crop diversification and climate adaptation recommendations.
- v. Enhanced monitoring of irrigation infrastructure and agricultural investments.
- vi. A functional Climate-Smart Agriculture Decision Support System supporting programme implementation.
- vii. Improved access to climate information, extension services, and advisory support.
- viii. Strengthened monitoring, evaluation, reporting, and decision-making capacities.
- ix. Enhanced institutional capacity for the long-term management of GIS and remote sensing systems.

6. Institutional Arrangements and Reporting

The Consultant shall work under the overall supervision of the National Programme Coordinator (NPC), SAPZ National Coordination Office.

The Consultant shall collaborate closely with the State Project Implementation Units (SPIUs), SAPZ technical teams, relevant government agencies, and other stakeholders as required.

All reports and deliverables shall be submitted to the National Programme Coordinator for review and approval.

7. Duration of the Assignment

The assignment shall be implemented over a period of twelve (12) months.

8. Procurement Method

The consultancy shall be procured through the Consultants' Qualification Selection (CQS) method in accordance with IFAD Procurement Guidelines.

9. Consultant qualifications

9.1. Firm Qualifications and Experience

The consulting firm shall demonstrate the following:

i. Legal Status

- Registered and legally recognized consulting firm with proven operational presence.
- Eligible to operate within Nigeria or internationally with local partnership arrangements.

ii. Core Expertise

- Demonstrated expertise in:
 - ✓ Geographic Information Systems (GIS)
 - ✓ Remote Sensing and Earth Observation
 - ✓ Agricultural geospatial analytics
 - ✓ Climate-smart agriculture systems
- Proven capability in designing and deploying geospatial platforms, including mobile data collection systems and web-based dashboards.

iii. Relevant Experience

- Minimum of 5–10 years of institutional experience in GIS and remote sensing projects.
- Proven track record in:
 - ✓ Land suitability analysis and agro-ecological zoning
 - ✓ Climate risk and vulnerability mapping
 - ✓ Agricultural value chain and infrastructure mapping
 - ✓ Development of geospatial databases and dashboards
- Successful completion of at least 3 similar assignments in:
 - ✓ Agriculture
 - ✓ Climate change adaptation
 - ✓ Rural development or land administration

iv. **Donor-Funded Project Experience**

- Experience working with development partners such as:
 - ✓ AfDB, IsDB and IFAD
 - ✓ World Bank or similar institutions
- Familiarity with donor reporting, safeguards, and data management standards.

v. **Technical Capacity**

- Access to and proficiency in industry-standard tools:
 - ✓ GIS platforms (ArcGIS, QGIS)
 - ✓ Remote sensing tools (ENVI, ERDAS Imagine)
 - ✓ Cloud-based geospatial tools (e.g., Google Earth Engine)
- Ability to develop:
 - ✓ Mobile data collection tools (ODK, KoboCollect, SurveyCTO)
 - ✓ Web GIS dashboards (Leaflet, ArcGIS Online)

9.2. Team Composition

The firm shall propose a multidisciplinary team comprising, at minimum:

- i. Team Lead / Senior GIS & Remote Sensing Expert
- ii. GIS Analyst(s)

- iii. Remote Sensing Specialist
- iv. Software Developer / GIS Web Developer
- v. Field Data Collection Coordinator
- vi. Agricultural / Climate-Smart Agriculture Specialist
- vii. Database & Systems Integration Specialist
- viii. Training & Capacity Building Expert

9.3. Team Lead (Senior GIS & Remote Sensing Expert)

Academic Qualifications

- i. Minimum: Master's degree in:
 - GIS / Remote Sensing
 - Geospatial Science
 - Geography or related field
- ii. PhD is an added advantage.

Professional Experience

- i. Minimum 7 years of relevant experience in GIS and remote sensing.
- ii. At least 5 years leading similar projects, particularly in:
 - Climate risk mapping
 - Agricultural geospatial analysis
 - Land administration systems

Technical Expertise

- i. Strong experience in:
 - Land suitability modelling
 - Agro-ecological zoning
 - Satellite image processing (Landsat, Sentinel)
 - Spatial decision-support systems
- ii. Proven experience managing:

- GIS databases
- Mobile data collection systems
- Web-based GIS dashboards

Leadership & Project Management

- i. Demonstrated ability to:
 - Lead multidisciplinary teams
 - Manage timelines and deliverables
 - Engage stakeholders (government, farmers, donors)

Donor Experience

- i. Prior experience with AfDB, IsDB, IFAD, World Bank, or similar programs is highly desirable.

9.4. Key Technical Team Members

9.4.1. GIS Analyst

- i. Bachelor's degree in GIS, Geography, or related field (Master's preferred)
- ii. Minimum 5 years' experience
- iii. Proficiency in ArcGIS/QGIS
- iv. Experience in:
 - Spatial analysis
 - Thematic mapping
 - Infrastructure and accessibility mapping

9.4.2. Remote Sensing Specialist

- i. Degree in Remote Sensing, Geoinformatics, or related discipline
- ii. Minimum 5 years' experience
- iii. Expertise in:
 - Satellite imagery analysis (Landsat, Sentinel)
 - Image classification and change detection

- Climate and environmental modelling

9.4.3. Software Developer / Web GIS Specialist

- i. Degree in Computer Science, Software Engineering, GIS, or related field
- ii. Minimum 5 years' experience
- iii. Strong skills in:
 - Web GIS development (Leaflet, ArcGIS Online, Mapbox)
 - Backend development and APIs
 - Mobile data tools (ODK, Kobo, SurveyCTO)
- iv. Experience developing offline-first applications is required

9.4.4. Database & Systems Integration Specialist

- i. Degree in IT, Database Management, or GIS
- ii. Minimum 5 years' experience
- iii. Expertise in:
 - Spatial databases (PostgreSQL/PostGIS)
 - Data interoperability (GeoJSON, WMS, WFS)
 - System integration and API development

9.4.5. Agricultural / Climate-Smart Agriculture Specialist

- i. Degree in Agriculture, Agronomy, Environmental Science, or related field
- ii. Minimum 5 years' experience
- iii. Strong understanding of:
 - Climate-smart agriculture practices
 - Crop suitability and land management
 - Farmer support systems and value chains

9.4.6. Field Data Collection Coordinator

- i. Degree in Geography, Agriculture, Statistics, or related field
- ii. Minimum 5 years' experience

- iii. Experience in:
 - Managing large-scale field surveys
 - Training enumerators
 - GPS-based farm mapping

9.4.7. Training & Capacity Building Expert

- i. Degree in Education, Development Studies, or related field
- ii. Minimum 5 years' experience
- iii. Proven experience in:
 - Developing training manuals
 - Conducting stakeholder training (farmers, extension officers)
 - Simplifying technical tools for non-technical users

10. Duration of the consultancy

The consultancy is an ongoing activity that commenced in 2025 and will continue through 2026, with the possibility of further renewal depending on the availability of funds and extent of completion.

11. Reporting/submission of reports

The consultant will report to the National Program Coordinator throughout the assignment.

12. Cost

The consultancy service is estimated to cost \$50,000 (Fifty Thousand Dollars) and to be financed from the IFAD Loan.

13. Payment schedule:

- ✓ 60% upon submission and acceptance of the draft reports, maps, and a functional prototype of the mobile application.
- ✓ 40% upon submission and acceptance of the final report, the finalized mobile application, the centralized land parcel registry, and completion of training.