A Preliminary Workplan Towards Developing a Sustainable Kenyan Soil Information System

Application of the Framework for Sustainable National Soil Information Systems

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Executive Summary

In August 2024, the “Kenya Soil Information System Framework Workshop” was held in collaboration with CABI, KALRO, and other key stakeholders. The workshop aimed to validate the SIS framework and gather preliminary information to develop a high-level initial draft of a roadmap for the implementation of Kenya’s national Soil Information System (KenSIS).

This preliminary workplan is designed to identify and start addressing key challenges in soil data management and to provide the foundations for the development of a comprehensive roadmap, which will outline a clear path forward for the development of a sustainable KenSIS. The workplan explores five core components of the SIS development process: 1) Defining the SIS mission and purpose, 2) Assessing the enabling environment, 3) Identifying the needs of stakeholders, 4) Designing the ideal system, and 5) Developing sustainable partnerships and funding models.

Key recommendations include:

- Finalizing the mission and problem statement for KenSIS to ensure clarity and alignment with national priorities.
- Strengthening data-sharing policies and frameworks to enable collaboration between government, research institutions, and private entities.
- Conducting detailed needs assessments to understand user requirements and address challenges such as limited access to soil data and low digital literacy among farmers.
- Designing an efficient and accessible system architecture that supports decision-making for various stakeholders.
- Securing sustainable funding through a mix of government support, donor funding, and revenue-generation models to ensure the long-term viability of KenSIS.

This workplan offers a preliminary practical approach for Kenya to continue developing a robust and sustainable SIS that serves both agricultural and environmental objectives.

Acknowledgements

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The SIS framework was applied and tested in the Kenya workshop. The framework can be accessed here: https://resources.isric.org/sis-framework/.

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Acronyms and abbreviations

CABI: Centre for Agriculture and Biosciences International
ISRIC: International Soil Reference and Information Centre
KALRO: Kenya Agricultural and Livestock Research Organization
KenSIS: Kenya Soil Information System
MoALD: Ministry of Agriculture and Livestock Development
SIS: Soil Information System
WB: World Bank
FAO: Food and Agriculture Organization

Introduction

A Soil Information System (SIS) is not merely a technological output, but a collaborative process that involves multiple stakeholders, including government bodies, research institutions, farmers, and the private sector. In Kenya, the goal of the Kenya Soil Information System (KenSIS) is to centralize and manage soil data to inform national agricultural policies, improve soil health, and support key programs such as the fertilizer subsidy scheme.

The project A Process Toward Strengthening National Soil Information Services, led by CABI and ISRIC – World Soil Information and supported by the Bill & Melinda Gates Foundation, has created a Framework for Sustainable National Soil Information Systems. This framework is designed to assist those in the soil community who are interested in developing or funding a SIS, or improving existing systems. It provides guidance for SIS owners, system developers, funders, implementing partners, and research institutions to ensure their investments lead to sustainable outcomes. Within each phase of the framework are "components" that include suggested activities, guiding questions, recommended tools, and supporting resources to make the process as practical and accessible as possible.

In August 2024, the Kenya Soil Information System Framework Workshop was organized to bring together key stakeholders from KALRO and validate the SIS development framework. This workshop marked an important milestone in the development of KenSIS and helped shape this workplan, which outlines preliminary steps for building a sustainable KenSIS that addresses the country's soil health challenges.

KenSIS will serve as a comprehensive platform for soil data collection, analysis, and dissemination, providing vital information to improve decision-making in agriculture, land use, environmental management, and other sectors. It aims to support multiple user groups, from farmers seeking to improve crop productivity to policymakers developing land use and agricultural policies.

Looking ahead, a full roadmap for KenSIS will be developed following the "Kenya Soil Information System: Roadmap Development Workshop" in early 2025. This workshop, funded by ISRIC and supported by CABI, will further engage key stakeholders such as NORAD, FAO and the World Bank to ensure that KenSIS is aligned with Kenya's broader development goals. The workshop will be the culmination of preparatory work that began in 2024, including stakeholder interviews and preliminary in-country research. It will be led by KALRO, with CABI taking responsibility for the organization and logistics.

The full roadmap, set to be finalized by March 31, 2025, will build upon this initial workplan, providing a detailed strategic path for the design and implementation of KenSIS. This document will focus on five key components of SIS development: defining

the SIS mission and goals (Envisioning), assessing the enabling environment, identifying stakeholder needs, designing the ideal system, and establishing partnerships and sustainable funding. The approach will draw from lessons learned in other countries, such as Zambia, while tailoring solutions to Kenya's unique context.

1. Preparation activities for the roadmap development

1.1 Key Informant Interviews

Before the "Kenya Soil Information System: Roadmap Development Workshop" in early 2025, key stakeholders selected by KALRO, CABI, and ISRIC will be invited to participate in a series of 1-hour online interviews. These interviews will be scheduled during a two-week period leading up to the workshop and will aim to collect valuable information necessary for the development of the roadmap for KenSIS.

The purpose of these interviews will be to gather insights from data producers, data users, and other relevant stakeholders on the current state of soil data, challenges in data sharing, and expectations for KenSIS. By collecting this information in advance, we aim to maximize the productivity and focus of the discussions during the workshop. The interview process will follow Chatham House rules, ensuring that all responses are anonymized when shared with other participants.

Some of the common challenges expected to arise from these interviews, based on previous consultations in other countries, include:

- Limited access to comprehensive soil data
- Restricted data sharing between institutions, as organizations may not fully recognize the benefits of sharing and digitizing their data
- Gaps in data management practices, including outdated or incomplete datasets
- Disconnect between IT developers and soil experts, leading to systems that do not fully meet user needs
- Overlap between similar initiatives, resulting in duplication of efforts and inefficiencies

The interview question template will be prepared in collaboration with KALRO.

1.2 Online surveys

Workshop invitees who are unable to participate in an interview will be invited to complete an online survey. This survey will gather additional information on Kenya's enabling environment, specific needs, and the role each stakeholder might play in the development of KenSIS. Data producers, users, system owners, government representatives, and donors will be encouraged to participate.

The anonymized results of the survey will be used to supplement the findings from the interviews, ensuring a comprehensive understanding of the stakeholder landscape.

1.3 The roadmap co-creation workshop

The “KenSIS Roadmap Development Workshop” is scheduled for January or February 2025 and will bring together key organizations involved in the development of KenSIS, including members of the KenSIS Steering Committee. Co-organized by CABI, ISRIC, and KALRO, the workshop will focus on applying the SIS framework to gather input for developing a comprehensive roadmap that guides the design and implementation of KenSIS. In addition, the workshop will aim to define and agree on actionable next steps for leveraging ISRIC’s Land, Soil, Crop Hub as a short-term solution, enabling KALRO to address critical use cases, particularly those related to the fertilizer subsidy scheme, while a full KenSIS is under development.

The goals of the workshop will be to:

- Present and validate the SIS framework with Kenyan stakeholders, including an online guidance module for using the framework (to be developed by ISRIC).
- Facilitate stakeholder discussions to support KALRO and other key institutions in the co-creation of a roadmap for KenSIS.
- Engage potential funders such as the Ministry of Agriculture, NORAD, FAO and the World Bank, to secure financial support for KenSIS and demonstrate the value of the workshop process.

The primary purpose of this workshop is to collect relevant data, identify existing initiatives and gaps, and outline the next steps for the development of KenSIS. The workshop will also serve as an opportunity to validate the applicability of the SIS development framework in the Kenyan context. Feedback from the workshop will help refine the roadmap and guide future actions, including partnerships and funding strategies, as highlighted in Component 5 of the framework.

2. The preliminary workplan for developing a sustainable KenSIS

1.1. Component 1: Envisioning

Envisioning involves a series of activities that seek to articulate the problem the SIS will aim to solve, define the SIS, assess demand, articulate the value proposition or business case, and plan for funding. This becomes a key part of the project's documentation as more work is done, giving the KenSIS project team clear direction as they complete further steps. This also serves as a reliable point of reference as the KenSIS development process evolves in the future.

A. Objective

To define the purpose, scope, and mission of KenSIS and clarify the problems it aims to solve.

B. Key activities

- **Draft definition**: KenSIS is envisioned as a comprehensive system designed to collate and disseminate soil information for wider usage. This platform facilitates interactions between soil data providers and users, aiding in the planning and sustainable use of resources in Kenya.
- **Draft mission:** KenSIS will serve as a centralized, public good platform for soil data, supporting decision-making in agriculture, environmental conservation, and land use planning.
- **Draft problem statement**: Soil data in Kenya is currently fragmented across multiple institutions, making it difficult to use for comprehensive planning and policy-making. Farmers and policymakers often lack access to real-time, accurate soil information that can improve productivity and sustainability.
- **Stakeholders**: The primary stakeholders for KenSIS include the Ministry of Agriculture, KALRO, farmers, agricultural extension officers, research institutions, donors (e.g., the World Bank), and the private sector (e.g., agricultural companies, fertilizer manufacturers).

C. Recommendations for next steps

- **Finalize the KenSIS definition, mission and problem statement** through further stakeholder consultations, ensuring that the SIS aligns with Kenya's agricultural policies and broader development goals.

  Guiding questions:
  - What is the current problem that the SIS seeks to solve?
  - What is your desired outcome for the SIS?
  - Who is the SIS for? For whom is the SIS not?
  - What are the primary or most important uses for soil data in the country?

- **Revise and further define the target users and their needs**, particularly focusing on how KenSIS can serve both large-scale agricultural producers and smallholder farmers.
- **Develop a value proposition that highlights the benefits of KenSIS for each stakeholder group**, from improving yields for farmers to informing national policy for government agencies.

1.2. Component 2: Enabling environment assessment

The enabling environment is the underlying social, political, institutional, and financial context that influences, enables, or inhibits the development and sustainability of a SIS.

This includes, for example, assessment of existing soil information efforts, data and resources, and mapping of stakeholders. Information collated from the enabling environment becomes a key input to decision-making at later stages, as well as ensuring reduction of duplicated efforts and identifies areas of alignment between multiple actors operating in the space. It is likely that the enabling environment will need to be reviewed at regular intervals throughout the development and maintenance of KenSIS.

From a policy perspective, the development and maintenance of KenSIS are aligned with government priorities and are likely to remain so. The involvement of key government entities like KALRO and the Ministry of Agriculture underscores the significance of this initiative. Formalizing policies, creating strategic partnerships, and ensuring continuous updates and stakeholder engagement will be crucial for the long-term success and sustainability of KenSIS.

A. Objective

To assess the social, political, institutional, and technological context within which KenSIS will operate.

B. Key information

- **Policy alignment**: KenSIS is aligned with national agricultural priorities, particularly the fertilizer subsidy programme, which will rely on accurate soil data to optimize resource allocation.
- **Existing data**: Kenya has several institutions that collect soil data, including KALRO, ICRAF, KEFRI, and private labs such as CropNuts. However, this data is often siloed and lacks standardization.
- **Data sharing**: Data governance frameworks and policies for sharing soil data across institutions and with the public are weak. There is a need for policies that encourage data sharing while protecting intellectual property rights and ensuring data privacy.
- **Technological context**: Kenya stands out as a leading African nation in the development and implementation of ICT-based value-added services for agriculture. These services encompass both financial and informational support, presenting a unique opportunity to create synergies between the SIS and other existing advisory services aimed at the target users.
- **Existing soil information efforts:** Numerous initiatives are currently advancing soil information systems in Kenya, each aimed at improving access to accurate, actionable data on soil health and fertility to support better agricultural decision-making. These efforts reflect Kenya's increasing capacity to leverage soil data for enhanced agricultural productivity and sustainability. However, there remains a critical need for stronger coordination through KALRO and the

KenSIS Steering Committee to fully maximize synergies and ensure the development of an operational, sustainable and impactful KenSIS.

C. Recommendations

- **Data sharing policy**: Develop a comprehensive data sharing policy that outlines roles, responsibilities, and data governance protocols. This policy should encourage collaboration between public institutions, private labs, and international donors.
- **Stakeholder engagement**: Foster early and ongoing engagement with key stakeholders to secure buy-in and avoid duplication of efforts. Engage with organizations such as FAO, NORAD, and the World Bank to align KenSIS with ongoing soil information initiatives.
- **Technology infrastructure**: Assess the current technological infrastructure available for KenSIS, including the use of cloud platforms, GIS tools, and mobile technologies to improve data accessibility for farmers and policymakers.

D. Supporting resources

- Guide for an assessment of the SIS enabling environment.

1.3. Component 3: Conduct Needs Assessment

Conducting a thorough assessment of the needs of all stakeholder groups is essential for effectively designing and implementing KenSIS. This ensures that the SIS is fit-for-purpose by providing developers with a clear understanding of the requirements of stakeholders—including users, data producers, and beneficiaries—so that the SIS can support their activities and objectives.

A. Objective

To identify the needs of KenSIS users and data producers, ensuring that the system is fit-for-purpose and meets the requirements of all stakeholders.

B. Key Information

Users: The primary users of KenSIS include the Ministry of Agriculture (for policy-making), KALRO (for research), farmers (for soil health information and fertilizer recommendations), and private sector stakeholders (for market intelligence and product development).

Use cases: KenSIS will support a variety of use cases essential for soil and agricultural management, including:

- **Fertilizer application recommendations**: Tailoring fertilizer use to specific soil needs.
- **Fertilizer blending**: Creating custom fertilizer blends based on soil data.

- **Soil fertility management**: Providing insights into soil health to optimize crop yields.
- **Farmer decision-making**: Offering data-driven guidance to farmers for better crop management.
- **Crop suitability mapping**: Identifying the best crops for different soil types.
- **Training and research**: Enhancing educational programs in universities and colleges.
- **Spatial land use planning**: Help in planning and allocation of land resources.
- **Informing policy**: Providing data to support agricultural and environmental policies.
- **Monitoring environmental pollution**: Tracking and mitigating soil and environmental contaminants.

C. Challenges

- **Digital literacy** is low among smallholder farmers, limiting their ability to interact with digital platforms.
- **Soil data is scattered** across institutions and is often not georeferenced, making it difficult to analyse at scale.
- There is **limited capacity for real-time data collection** and integration.

D. Recommendations

- **Conduct in-depth stakeholder consultations**: Organise "KenSIS Roadmap Development Workshop", as well as interviews with key stakeholders to refine the specific needs of KenSIS users, focusing on how they will interact with the system and data. This should include gathering input from both large-scale and smallholder farmers, as well as government agencies and private sector actors.
- **Assess technical expertise and capacities** of each stakeholder group to identify gaps and training needs.
- **Capacity building**: Develop training programs for key user groups, particularly farmers and extension officers, to improve their digital literacy and ability to interact with KenSIS. The training should focus on how to interpret soil data and apply it to farming practices.
- **Data integration**: Prioritize the integration of legacy soil data and ensure that future data collection efforts include georeferencing and standardized formats.

E. Supporting resources

- Review the Landscape of key stakeholders for the development of SISs.
- Refer to chapter 2 of *Development options for a Soil Information Workflow and System* for guidance on conducting needs assessment.

- Refer to Annex I in *Development options for a Soil Information Workflow and System* for guidance on assessing technical capacities.

1.4. Component 4: Idealised system design

This activity describes the idealised system, as if there were no constraints, either financial or other. The information in component four can be used to develop the architectural design of the system in the Planning & Design phase. The architectural design should be technologically feasible and realistic within the current regulatory and institutional environment, be capable of being improved over time and linked to the users, data producers, and their needs.

A. Objective

To design a technically feasible, user-friendly, and scalable SIS architecture that meets the needs of all stakeholders.

B. Key features

- **Comprehensive soil data**: KenSIS will include data on soil physical and chemical properties, nutrient levels, pest and disease risks. It will also integrate weather and climate data to support real-time decision-making.
- **Decision-support tools**: The system will provide interactive dashboards, maps, and other tools to help users visualize soil data and make informed decisions. For example, farmers will be able to access fertilizer recommendations tailored to their specific soil conditions, while policymakers can use the data to optimize resource allocation for agricultural programs.
- **Accessibility**: KenSIS will be accessible via multiple platforms, including mobile apps, web-based portals, and offline access for areas with limited connectivity. The system will cater to a range of user skills, from advanced researchers to smallholder farmers.
- **Data security**: Implement robust data security measures to protect user privacy and ensure the integrity of soil data. This includes encryption, access control, and regular system audits.

C. Recommendations

- **Develop a prototype**: Create a prototype of KenSIS, building on the LSC Hubs programme, which focuses on one or two key use cases (e.g., fertilizer recommendations) and test it with a small group of stakeholders. Gather feedback to refine the system before scaling up.
- **Leverage existing tools**: Use existing platforms like the ISRIC Land Soil Crop Hub as a foundation for KenSIS, adapting it to meet Kenya's specific needs. This will accelerate development and reduce costs.

- **Interactive mapping**: Integrate GIS tools to allow users to visualize soil data spatially. This will be particularly valuable for policymakers involved in land-use planning and environmental management.

D. Supporting Resource

- ISRIC's Soil Information Workflow
- The Land, Soil, Crop information hub Kenya uses Terria.JS to visualise spatial information: https://kenya.lsc-hubs.org/#maps

1.5. Component 5: Partnership Development and High-level Sustainable Business Plan

A SIS is, besides a technological output, also a process by which people and institutions must collaborate, explore, iteratively refine, and implement plans for data development, all while balancing multiple evolving sets of needs, setbacks, resources, and priorities. Understanding how these people and institutions should work together, and aligning on who is responsible for what, is a critical step to ensuring the progress of the SIS. Additionally, this component provides initial thinking on the financial sustainability of the SIS.

A. Objective

To develop sustainable partnerships and funding models that ensure the long-term success of KenSIS.

B. Key partnerships

To streamline efforts and prevent duplication, identifying various roles within KenSIS, clarifying responsibilities, and determining optimal partnership models for each role will enhance efficiency and effectiveness.

- **Government**: The Ministry of Agriculture and KALRO will lead the development and management of KenSIS, ensuring alignment with national policies and programs.
- **Donors**: Key donors, including the World Bank, FAO and NORAD, might provide financial and technical support for the initial development of KenSIS.
- **Private sector**: Companies in the agriculture and technology sectors (e.g., fertilizer companies, agritech firms) will be engaged to co-develop tools and services that can be integrated into KenSIS. The private sector can also provide financial contributions through user fees for premium services.
- **Data producers**:

C. Financial sustainability:

- **Government funding**: Secure long-term funding from the Government of Kenya to cover core operational costs for KenSIS, including staffing, data collection, and system maintenance.
- **Donor support**: Continue to engage with international donors to secure grants and technical assistance for the ongoing development of KenSIS, particularly for capacity-building activities.
- **Revenue generation**: Explore revenue-generating models such as subscription services for advanced data products, consulting services for private sector partners, and pay-per-use access for premium features.

D. Recommendations:

- **Formalize partnerships**: Develop Memorandums of Understanding (MoUs) with key stakeholders to clearly define roles and responsibilities. This will help ensure accountability and collaboration across institutions.
- **Business plan**: Create a business plan that outlines both short-term and long-term funding strategies for KenSIS. This should include detailed cost estimates and a breakdown of potential revenue streams.
- **Engage the private sector**: Identify private sector partners who can contribute to the development and sustainability of KenSIS. This could include companies that use soil data for product development, such as fertilizer manufacturers, or those that offer digital tools for farmers.

E. Supporting resource:

- Refer to the SIS Financial Sustainability Guide for detailed recommendations on building a long-term business model for KenSIS.
- Theory of Change guidance
- Review the Landscape of key stakeholders for the development of SISs
- Review the Guide to support SIS financial sustainability planning

1.6. Potential Financial Needs for KenSIS

The following estimation of financial needs for the development of KenSIS is based on the experience from the development of SIS in other countries, like Ghana.

A. Short-term Funding Needs (1-2 years)

1. **Personnel and operational costs:** $200,000 - $500,000
   This covers salaries, project management, administrative support, and operational overheads to ensure the smooth design, implementation and functioning of KenSIS.

2. **Soil data collection and analysis:** $300,000 - $700,000
   Funding will support fieldwork, data collection on soil health, and analysis to create actionable insights for stakeholders.
3. **GIS software and hardware:** $50,000 - $150,000
   Investments in technology for soil mapping, data visualization, and analysis, which are critical for developing a robust soil information system.
4. **Training and capacity building:** $20,000 - $50,000
   Ensuring that government personnel, researchers, and agricultural extension officers have the necessary skills to manage and use soil data effectively.
5. **Website development and maintenance:** $10,000 - $30,000
   Establishing an accessible online platform to share soil information with farmers, researchers, and policymakers.

B. Medium-term Funding Needs (2-5 years)

1. **Expansion of soil data collection:** $500,000 - $1,500,000
   Scaling up data collection to cover more regions, with a focus on high-priority agricultural zones.
2. **Development of functionality compatible with mobile apps in the country:** $50,000 - $150,000
   Building on mobile solutions to make soil health information available to smallholder farmers for better decision-making.
3. **Integration with other agricultural databases:** $100,000 - $300,000
   Linking KenSIS with broader agricultural systems, such as crop, weather, and market data, for a holistic approach to farming.
4. **Research and development:** $200,000 - $500,000
   Promoting innovation in soil management practices, including testing and developing new technologies or methodologies.
5. **Stakeholder engagement and outreach:** $50,000 - $150,000
   Building awareness and promoting the use of soil data among farmers, private companies, and development partners.

C. Long-term Funding Needs (5+ years)

1. **Sustainability and maintenance:** $500,000 - $1,000,000
   Ensuring the long-term operation and maintenance of KenSIS, including periodic updates and system upgrades.
2. **Scaling up to full national level:** $1,000,000 - $3,000,000
   Expanding KenSIS coverage to all agricultural zones across Kenya to maximize its impact.
3. **Integration with regional and global soil information systems:** $200,000 - $500,000
   Linking KenSIS with international platforms to facilitate knowledge exchange and align with global best practices.
4. **Development of decision-support tools:** $300,000 - $700,000
   Building tools to help farmers and policymakers make data-driven decisions, improving productivity and sustainability.

5. **Human resource development and capacity building:** $200,000 - $500,000 Continued investment in the skills and knowledge needed to support and evolve the system over time.

D. Potential Funding Sources

1. Government of Kenya
2. International donor agencies (e.g., FAO, NORAD, World Bank)
3. Private sector companies (e.g., agriculture, IT)
4. Foundations and philanthropic organizations (e.g., Bill and Melinda Gates Foundation)
5. Research grants and academic institutions

E. Funding Mechanisms

1. Grants
2. Contracts
3. Public-Private Partnerships (PPPs)
4. Corporate Social Responsibility (CSR) initiatives
5. Crowdfunding

F. Budget Allocation

1. Personnel and operational costs (30-40%)
2. Soil data collection and analysis (20-30%)
3. GIS software and hardware (10-20%)
4. Training and capacity building (5-10%)
5. Research and development (5-10%)

Conclusion

KenSIS has the potential to transform the way soil data is collected, managed, and used in Kenya. By following this preliminary workplan, Kenya can continue placing the foundations for a sustainable and scalable SIS that supports agricultural productivity, environmental conservation, and national policy goals. This workplan outlines key steps, from defining the mission and needs of KenSIS to building partnerships and securing sustainable funding.

By leveraging the expertise of key stakeholders and aligning KenSIS with national priorities, Kenya can ensure that this system provides long-term benefits for farmers, policymakers, and other stakeholders. Continued engagement and collaboration among partners, including the steering committee, will be essential to the success of KenSIS.