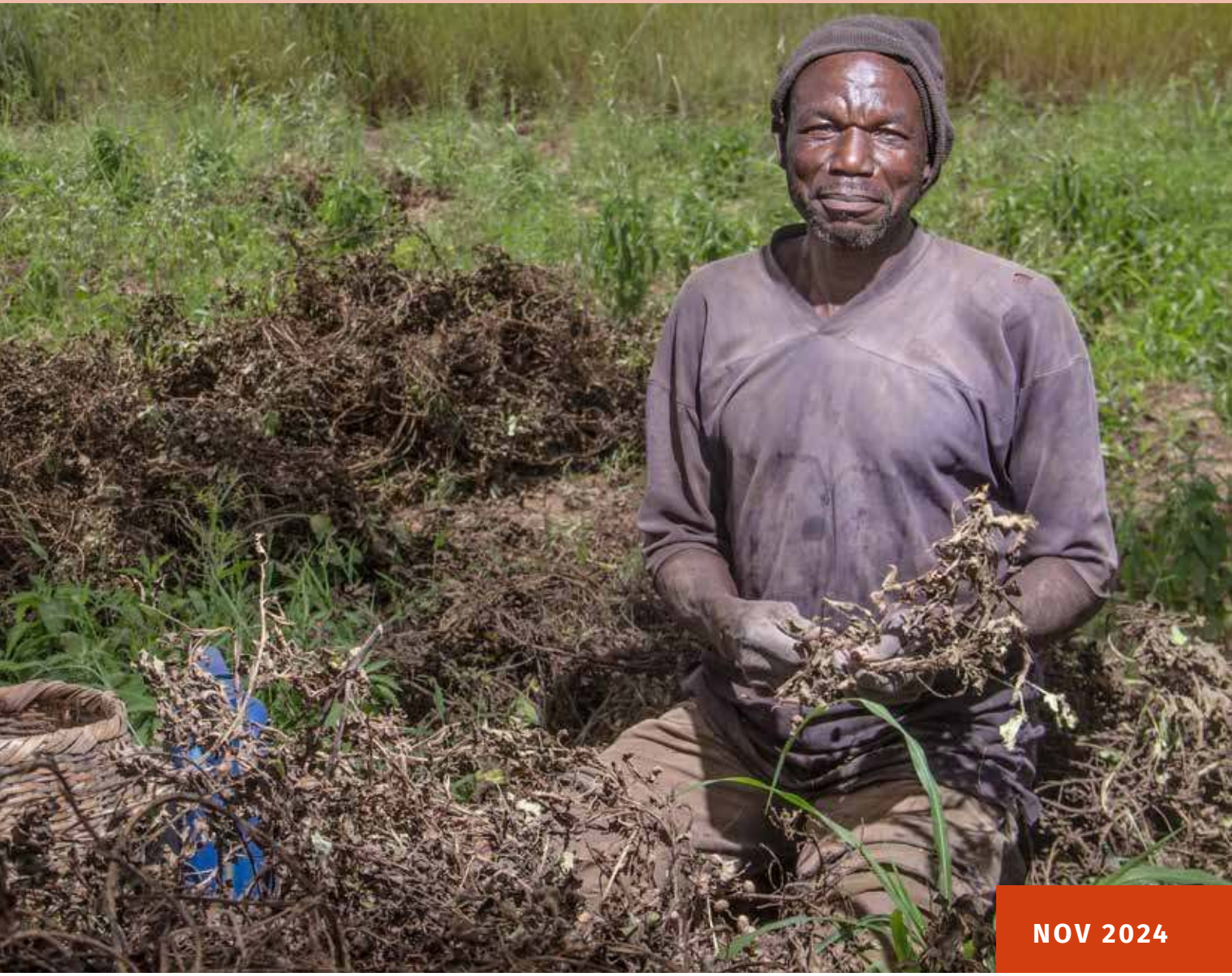
A Roadmap Towards a Sustainable Soil Information System in Ghana

APPLICATION OF THE FRAMEWORK FOR SUSTAINABLE NATIONAL SOIL INFORMATION SYSTEMS



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A Roadmap Towards a Sustainable Soil Information System in Ghana: Application of the Framework for Sustainable National Soil Information Systems

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Executive summary

This roadmap outlines the strategic steps for strengthening Ghana's Soil Information System (GhaSIS) to enhance agricultural productivity, soil health, and informed decision-making for sustainable soil management. It builds on insights from the "Ghana Soil Information System: Roadmap Development Workshop" held in October 2024 in Koforidua, co-hosted by CABI, ISRIC-World Soil Information, and CSIR-SRI. Participants from various sectors addressed common data and capacity challenges and discussed long-term financial sustainability options for GhaSIS.

The workshop reviewed seven components of the SIS framework, crucial for GhaSIS's success: 1) envisioning the SIS, 2) enabling environment, 3) needs assessment, 4) SIS design, 5) partnership development and sustainability plan, 6) data strategy, and 7) organizational and financial sustainability plan. The roadmap includes an overview of each component, addressing available information, gaps, and recommendations, which are optional for the GhaSIS project team to consider.

The **key potential next steps** for CSIR-SRI to consider include:

1. Draft a comprehensive concept note for GhaSIS development for the West Africa Hub meeting in November, using CABI and ISRIC's outline (Annex VI).
2. Establish steering and technical committees to define roles, responsibilities, and activities.
3. Finalize the financial sustainability plan with input from all partners.
4. Organize a validation workshop with broader stakeholder participation once design and work plans are prepared and next steps are consolidated.

Acknowledgements

CABI and ISRIC – World Soil Information would like to thank the workshop participants for their contributions that have led to the development of this roadmap. Specifically, we would like to thank CSIR-SRI for their support in organizing the workshop. With special thanks also to the Bill & Melinda Gates Foundation for their support of the SIS Review project and ISRIC – World Soil Information for co-funding the workshop.

More information, supporting resources and useful tools for each of the components available in the online SIS framework, hosted on ISRIC's Resource Library (**https://resources.isric.org/sis-framework/**). If there are any questions or aspects of the roadmap that require further support or input from CABI and ISRIC, kindly contact **fair@cabi.org** or **thaisa.vanderwoude@isric.org**.

Contents

Acronyms and abbreviations

AFSIS .....Africa Soil Information Service

ANSIS .....Australian National Soil Information System

APNI.....African Plant Nutrition Institute

ATCS .....Africa Targeted Climate-Smart Agriculture Solutions

CABI.....CAB International

CADER .....Centre for Agricultural Development and Extension Research

CSIR-SRI .....Council for Scientific and Industrial Research - Soil Research Institute

DAES.....Directorate of Agricultural Extension Services

DMAP.....Data Management Access Plan

FAIR .....Findable, Accessible, Interoperable, and Reusable (data principles)

FERARI .....Fertilizer Research and Responsible Innovation Project (IFDC-led)

GIDA.....Ghana Irrigation Development Authority

GIS .....Geographic Information System

GhaSIS .....Ghana Soil Information System

INSTI.....Institute for Scientific and Technological Information

ISRIC.....International Soil Reference and Information Centre

iSDA.....Innovative Solutions for Decision Agriculture

LT-LEDS.....Long-Term Low Emission Development Strategies

MAG .....Modernizing Agriculture in Ghana

MESTI .....Ministry of Environment, Science, Technology, and Innovation

MoFA.....Ministry of Food and Agriculture

MRV .....Monitoring, Reporting, and Verification

NDC.....Nationally Determined Contributions

NITA .....National Information Technology Agency

OFRA.....Optimizing Fertilizer Recommendations in Africa

PFJ 2.0 .....Planting for Food and Jobs Phase 2

SAPIP .....Savannah Agricultural Productivity Improvement Project

SIA .....Soil Initiatives for Africa

SIS.....Soil Information System

SRID.....Statistics, Research, and Information Directorate (MoFA)

UM6P.....Mohammed VI Polytechnic University

USAID .....United States Agency for International Development

1. Introduction

A Soil Information System (SIS) is not just a digital platform but a collaborative tool that engages stakeholders—from government agencies to farmers—to improve data access, soil health management, and informed decision-making in Ghana's agriculture sector. 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. There are three levels to consider: the individual (suitable skills, knowledge, competencies, and attitudes), the organizational (efficient structures, processes, and procedures), and the governmental level (establishment of adequate institutions, laws, and regulations).

The project **A Process Toward Strengthening National Soil Information Services**, led by **CABI** and **ISRIC – World Soil Information**, supported by the Bill & Melinda Gates Foundation, has created a framework for SIS development, assessing these levels at the start of a SIS intervention. The **SIS Framework** can help identify activities needed to fulfil the SIS objectives, deciding also on the sequence in which these activities are best performed, who is going to do them, and identifying potential risks, with each specifically tailored to the country context.

In October 2024, the framework was further refined during the **"Ghana Soil Information System: Roadmap Development Workshop"**. This document gathers the information collected and validated during the workshop and proposes a suggested roadmap for implementing GhaSIS. A roadmap is a strategic plan that details the steps required to achieve a specific goal. In this instance, the goal is a sustainable national SIS in Ghana that will last beyond the initial phases of project funding, be built on best practices, and will continue to meet the needs of users.

The intention is that the SIS owner and SIS operator (MoFA/CSIR-SRI – Soil Research Institute) and members of the newly formulated temporary governance and technical steering committees will be able to refer to the roadmap throughout the strengthening process of GhaSIS to ensure continued alignment with the stated purpose of the SIS.

2. Preparation activities for the roadmap

2.1. The SIS framework

CABI has identified patterns of success factors and common limitations across SIS development and maintenance based on comprehensive review and analysis of existing and past SIS. Accompanied by ISRIC's findings on best practice methods, standards, and tools for SIS development, both technological and socio-institutional considerations were integrated to develop the **SIS framework**.

An important aspect of this framework is that it seeks to adopt the **FAIR data principles**. This means that soil data will be Findable, Accessible, Interoperable and Reusable. FAIR data is important for SIS, because it ensures the highest value and usability of data. Throughout the SIS framework's supporting resources, you will see references to **"FAIR Process Framework"** steps, developed by CABI, that will enable the implementation of best data practices throughout the development and lifecycle of a SIS.

The SIS framework follows a multi-stakeholder engagement approach and is for anyone in the soil community who is interested in developing or funding a SIS, or anyone who would like to improve their existing SIS. It also provides guidance for SIS owners, system developers, funders, implementing partners, and research institutions involved to ensure their investments lead to sustainable outcomes.

The framework has four phases: **initiation**, **planning and design**, **implementation** and **operational**. Within each phase, there are "components", which contain suggested activities, accompanied by guiding questions, recommended tools, and supporting resources to make the process as practical and easily usable as possible. The activities within each component are intended as optional and the SIS project team decides which ones to execute. The SIS framework is used as the foundation for the development of the GhaSIS roadmap.

2.2. Component 0: the checklist

In preparation for the roadmap development workshop, the CABI and ISRIC team conducted an online interview with CSIR-SRI to go through **component 0: the checklist**, to help identify which key activities have already been completed, which are in progress, and which activities have not been started. Together with CSIR-SRI, priority activities were selected to guide the focus of the workshop (the complete checklist for GhaSIS can be found in Annex II). These were:

- Align with stakeholders on the mission, definition, and goals of the SIS.
- Develop a clear financial sustainability plan for the SIS.
- Discuss the challenges around data sharing with the stakeholders and identify possible solutions, including aligning on FAIR data principles for the SIS.
- Clearly understand and define the roles, responsibilities, and data/value exchanges between stakeholders.
- Clearly define the needs of end-users to inform the design of the SIS.

2.3. The workshop

The Ghana Soil Information System (GhaSIS) Roadmap Development Workshop was held on October 8-9, 2024, in Koforidua, Ghana. The event was organised by CABI and ISRIC – World Soil Information, in collaboration with the CSIR-SRI, and co-funded by the Bill & Melinda Gates Foundation and ISRIC – World Soil Information. The workshop aimed to apply the SIS framework and design a roadmap to strengthen GhaSIS, ensure its long-term operation and sustainability, and enhance access to soil data for decision-makers, farmers, and other stakeholders in Ghana's agricultural sector.

The workshop attracted a diverse range of 35 participants from across the agricultural value chain (a list of institutions invited is available in Annex III). Over the course of two days, the sessions included presentations, group discussions, and breakout activities to understand common challenges, identify stakeholders' requirements for data and the system itself, brainstorm issues pertaining to financial sustainability, and develop strong partnerships to drive the improvements of GhaSIS forward (the full agenda is available in Annex III). An overview of the workshop, including interviews with key stakeholders, can be viewed here.

3. The roadmap for strengthening GhaSIS

3.1. Component 1: Envisioning

The first component in the SIS framework is "envisioning", which seeks to guide decision-making, strategic planning, and obtain national government buy-in from the very beginning. It does this by setting clear definitions, objectives, long-term goals, and desired outcomes of the SIS. Generally, goals are broad, general intentions that guide the direction of the SIS towards the intended future state, whereas the objectives are specific, measurable actions that must be taken to achieve the goals. The output of envisioning is intended to be revised and aligned later in the framework, after more detailed assessment and information-gathering.

3.1.1 Define the problem, mission statement, and SIS definition.

Workshop findings:

- CSIR-SRI outlined an initial mission for GhaSIS, focusing on three core objectives:
  - **Provide essential soil data**: Deliver comprehensive soil data to support agriculture, environmental management, and infrastructure development.
  - **Support decision-making**: Enable informed decisions on soil health, land use, and policy development.
  - **Monitor soil health**: Enhance monitoring of soil degradation, fertility, and moisture content to guide sustainable land use.
- CSIR-SRI vision for GhaSIS capabilities:
  - **Support national goals**: Guide the national government's decisions on the **low emission strategy** (NDC/LT-LEDS) with relevant soil and environmental data.
  - **Contribute to PFJ 2.0**: Support MoFA's **Planting for Food and Jobs program** (PFJ 2.0) by providing soil data to increase the yield of the target crops.
  - **Leverage historical data**: Analyse soil data trends dating back to 1984 to inform crop nutrient management and policy decisions.
- CSIR-SRI also referenced the existing mission statement on the **CSIR Soil Information hub**, which will be shared with stakeholders for alignment and feedback
- Key considerations
  - **Align with stakeholder agendas**: CSIR-SRI have a working document on the mission and definition of GhaSIS that they will share with the wider stakeholder group for their input.
  - **Align on the focus of GhaSIS**: There is a need to strategically align the SIS with key stakeholders' agendas. It was discussed that initially, the SIS should focus on agricultural users only, and once it is online and meeting initial target users' needs, then it can be expanded to other relevant areas such as mining, land planning, and public health. However, it was also discussed that the SIS should start by addressing in-demand emerging topics, such as soil pollution, emission factors, and mining, which were highlighted during breakout sessions.

Recommended additional next steps:

- **Align on the target users and the use cases** for the initial launch of GhaSIS, considering a phased approach for including a smaller target group first, then to widen the scope to more users and use cases.
  - Other questions to consider addressing in SRI's working document:
  - When defining the SIS, is it considered only as the digital platform itself? Or does the SIS also include the larger context of stakeholders and activities that enable and support the digital platform, as well as the use cases it seeks to serve?
  - What are the desired outcomes from the creation of the SIS?
- **Review the example SIS mission** statement from a convening of key SIS stakeholders in Nairobi, March 2024: "A multi-stakeholder, demand driven public good platform that collects, stores and serves soil data and enables decision and policy support to address food and nutrition security, land conservation and rehabilitation, climate change resilience."
- More guidance can be found on the SIS framework platform **here**.

3.1.2 Articulate the value proposition and business case for government support.

Workshop findings:

MoFA representatives, including the Director of Crop Services and Deputy Directors, voiced strong support for GhaSIS, emphasizing its importance in advancing government initiatives to improve advisory services and promote food security. GhaSIS is well-positioned to support MoFA's Planting for Food and Jobs (PFJ 2.0) initiative.

Private sector representatives expressed interest in accessing high-quality, tailored soil data and indicated a willingness to pay for such information. Identifying and engaging these potential paying users will strengthen the business case and help demonstrate GhaSIS's value across sectors.

Recommended additional next steps:

- **Align GhaSIS objectives with MoFA's priorities**: Identify aligned objectives (current and upcoming), between MoFA initiatives and GhaSIS activities- this could be done by the CSIR-SRI lead and the relevant representatives of the different MoFA department.
- **Document benefits for stakeholders**: Consider clearly documenting the benefits of GhaSIS to the different stakeholder groups, beyond the high-level benefits. Consider how the SIS brings value to private sector, public sector, NGO, and development community actors.
  - Review **this example of the benefits documented by Australia's National SIS (ANSIS)**.
- **Assess market demand**: Consider engaging with more potential users of GhaSIS to assess their willingness and readiness to pay for soil data, finding out what each stakeholder's interests are and how the SIS can benefit them.
  - Review the **use case of New Zealand SIS** on the pay model for their SIS.
- **Implement a phased payment model**: Establish GhaSIS with high-quality data to demonstrate its value to users. Consider introducing payment options once the system has proven its benefits to stakeholders.
- More guidance can be found on the SIS framework platform **here**.

3.1.3 Discuss potential roles, ownership and funding.

Workshop findings:

Feedback from the workshop highlighted the need for clear definitions of SIS ownership and operation. It was discussed that MoFA could be the overall owner, responsible for securing long-term funding and ensuring GhaSIS aligns with national priorities. Whereas CSIR-SRI is also seen to be the operational owner, overseeing development, governance, and maintenance.

A steering committee and technical committee were initially formed with representatives from key stakeholder groups. CSIR-SRI will draft Terms of Reference (ToR) for both committees and seek input from all participants.

Recommended additional next steps:

- Clarify MoFA's role: Ensure clear alignment on the role of MoFA and what the expectations of them are as being responsible for GhaSIS receiving adequate, continuous funding.
- Establish a Terms of Reference (ToR): Develop ToRs for both the steering and technical committees.
- Define key roles and responsibilities: Consider reviewing the list of roles required for SIS development in Appendix 2 of **A Process Towards Strengthening National Soil Information Services: New Evidence for a SIS Development Framework** and the report on the **Landscape of key stakeholders for the development of SIS**.
- More guidance can be found on the SIS framework platform **here**.

3.1.4 Set short-, medium-, and long-term goals

Workshop findings:

To ensure a focused approach, it is recommended to define GhaSIS's scope and target users early on. The initial launch should address the needs of primary users, allowing for system expansion as it matures.

Recommended additional next steps:

- Set up specific goals: Once key stakeholders have agreed on the problem statement, mission, and SIS definition, then specific goals can be set and agreed upon by the SIS owner, SIS operator and the steering committee.
- Goal structure:
  - Short-term goals might include, for example: establish a simple, functional SIS that is accessible and serves some of the needs of some of the identified user groups.
  - Medium-term goals might include, for example: add specific functionalities for additional users, or expand data collection / sampling schemes for increased spatial coverage.
  - Long-term goals might include, for example: providing data, information, and related services to policymakers to support updates to specific agricultural and soil policies, and to help decision-makers in other sectors.
- More guidance can be found on the SIS framework platform **here**.

3.2. Component 2: Enabling environment assessment

The second component of the SIS framework is “enabling environment assessment”. This entails developing a detailed description of the existing “system” of stakeholders, institutions, policies, and resources surrounding soil data and information, and identifying the gaps to support the planning and development of the new SIS effort or initiative.

3.2.1 Develop stakeholder and data ecosystem map.

Workshop findings:

Using the workshop invitee list, a stakeholder and data ecosystem map was created on the platform kumu. The group categorised each stakeholder as one of the following:

- Policy makers
- Data users
- Regulators
- Contributors (data providers, advisory, and financial contributions)
- Beneficiaries
- Data stewards
- Intermediaries

This ecosystem map serves as a strategic visual tool that depicts the collection, sharing, and utilization of data across a network of your specific digital ecosystem, considering stakeholders, data, and processes relevant to the development of the SIS. It lays out the roles of various stakeholders and the dynamic interrelations in this space, including Value Exchanges. The map visualizes the flow of your digital solutions data, identifying components of value creation, and highlighting the integration of digital tools and data in achieving your project’s ultimate goals and activities.

Recommended additional next steps:

- Foster collaboration and data sharing: Continue to collaborate with pre-existing efforts and encourage a culture of responsible data sharing.
- Identify collaboration opportunities: Draw upon the **GhaSIS Data Ecosystem Map**, to identify opportunities for data sharing and collaboration.
- Expand to other domains: When GhaSIS is ready to broaden its scope to a wider audience of end users, consider reviewing the list of other domains that use soil data on **page 3 of the Guide for an Assessment of the Enabling Environment**.
- More guidance can be found on the SIS framework platform **here**.

3.2.2 Conduct enabling environment assessment

Workshop findings:

- Social/cultural:
  - **Data sharing concerns**: Stakeholders expressed hesitancy in sharing data due to concerns over what their data could be used for and lack of attribution.
  - **Incentives for data producers**: Data providers emphasized the need for clear incentives from CSIR-SRI to support data-sharing efforts.

- Political:
  - **Election Impact**: Anticipate potential effects of the upcoming December 2024 elections on project continuity.
  - **Data Protection Act**: Ensure GhaSIS compliance with the **Data Protection Act** to safeguard privacy and data integrity.
- Institutional:
  - **CSIR-SRI mandate**: CSIR-SRI is mandated "to undertake scientific research to generate technologies (information), commercialize these technologies and build capacity in sustainable management of Ghana's soil resources for increased agriculture, environmental quality and improved livelihood", but those who need soil data are mostly contacting universities instead of SRI.
  - **Data Access Structures**: CSIR's existing approval processes for data sharing should be clearly communicated to all stakeholders.
- Existing in-country initiatives and legislation:
  - **Relevant legislation**: **Plants and Fertilizer Act, 2010 (No. 803)**. (PFJ 2.0)
  - **Ongoing Initiatives**: **AGRA PIATA**, **RECSOIL**, **APNI ATCS**, **SoilFER**, **EJP Soil C-arouNd**, **Soils4Africa**, **AfSIS**, **SAPIP**, **OCP-SRI**, **MAG**, **SOILS Space-to-Place**, **FERARI- IFDC**
- Technical:
  - **Data Protection Compliance**: GhaSIS must comply with the **Data Protection Act** and maintain SRI's ISO certification.
  - **Digitalisation requirements**: GhaSIS will need infrastructure support for data hosting, including servers, workstations and potentially cloud storage for big data.
  - **Human resources and partnerships**: Expanding partnerships and enlisting technical expertise are essential for ongoing data updates and solutions development.
  - **Existing resources**:
  - **Esoko** – provide information for smallholder farmers. This is also what Farmerline uses.
  - **NITA** – creates the enabling environment for effective deployment and use of ICT by all sectors in Ghana.
  - **UM6P** provide access to high computation operations and clusters analysis.
  - **iSDA** – provide field-level soil maps for Africa and offered to assist with technical aspects of the development of the SIS.

Recommended additional next steps:

- Review budget and financial needs: Consider whether there is someone within CSIR-SRI that has the relevant financial/business analyst expertise to review existing budget and cost recovery structures.
- Address data gaps: Review existing data inventories and identify what data are missing and how will that gap be addressed?
- Standardise data across GhaSIS: Consider how you can ensure the same data standards are used across the GhaSIS ecosystem.
- Investigate existing resources: Which organisations already exist that can help with developing GhaSIS, collecting soil information, creating soil maps and support computational efforts for GhaSIS?
- More guidance can be found on the SIS framework platform **here**.

3.3. Component 3: Needs assessment

The third component of the SIS framework is the needs assessment. The goal is to understand who the data users and producers are, how they interact with soil data, and what are their challenges, needs, and priorities. This will support the planning and development of the new SIS effort or initiative by focusing activities on the people, institutions, and areas of greatest need.

3.3.1 Conduct needs assessment

Workshop findings:

- CSIR-SRI identified key end-user groups who require data from GhaSIS: including:
  - **Farmers and agricultural organisations**.
  - **Environmental agencies and land-use planners**.
  - **Researchers and academic institutions**.
  - **Government and policy-making bodies**.
  - **NGOs focused on sustainability**.
- CSIR-SRI also outlined the types of data these end users need:
  - **Soil properties**: nutrients, pH levels, moisture, texture, soil pollution hotspots.
  - **Spatial data**: geographic distribution of soil types.
  - **Temporal data**: seasonal changes and historical trends.
  - **Environmental data**: climate, topography, and land use patterns.
- An initial stakeholder list of specific contributors, beneficiaries, and end users has been documented in the **GhaSIS Data Ecosystem Map. Key identified end users include organisations such as**:
  - YARA
  - OCP
  - CADER
  - Mining companies
  - IFDC
  - University of Cape Coast
  - FAO
  - iSDA
- **Private Sector Needs**: CSIR-SRI emphasized that assessing the private sector's data needs is crucial, as many potential users in this sector may also be data contributors or funders.

Recommended additional next steps:

- Review existing use cases: Review the list of current use cases, key issues to address and key applications of soil data on **page 4 of this case study**.
- Engage with stakeholders: Refer to the stakeholders and end users identified in the **GhaSIS Data Ecosystem Map**, as a starting point for who to engage with to assess their needs (but it is encouraged to build on this further).
- Consult SIS development resources:
  - 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.
- **Delegate assessment responsibilities**: Consider who within the Technical Committee will be responsible for conducting the needs assessment and mobilise resources to do this.
- More guidance can be found on the SIS framework platform **here**.

3.4. Component 4: Idealized system design

The fourth component is the idealized system design. The goal is to develop a comprehensive description of how the ideal SIS would look, operate, function, and/or deliver information to its users if there were no resource limitations. Then, prioritise what can be done now and what could be done with some additional resources. This "wish list" description merges the insights from the envisioning (component 1), enabling environment assessment (component 2), and needs assessment (component 3). It then expands upon those insights by defining the details of the SIS, such as data, embedded tools, functionalities, and other characteristics that respond to the needs and constraints identified in earlier steps.

3.4.1 Identify what information the ideal SIS would contain

Workshop findings:

- **Metadata**: Include metadata with clear data conversions (variables and components), indicating sources for user reference and ownership.
- **Soil maps**: Soil maps that can be used by farmers, policy makers – crop suitability maps.
- **Fertilizer Recommendations**: Enable data on which fertilizers to use for specific soil types.
- **Multilingual Support**: Offer translations and audio options in multiple languages to enhance accessibility.
- **Weather Data Integration**: Link with weather data to inform agricultural decision-making.
- **Advisory Services**: Investigate possibility to include access to call centres for additional support, with options for region-specific and translatable information.
- **Policy Mapping**: Include maps highlighting vulnerable areas (e.g., swamps, steep slopes) where farming is not advised.

Recommended additional next steps:

- Once an in-depth user needs assessment has been conducted, c**reate the architectural design for GhaSIS** (front and back-end) that meets user needs. You can refer to ISRIC's technical guidance report to support this: **Development options for a Soil Information workflow and System**.
  - **Important Note**: Incorporate phased development into the architectural design. It is advisable to implement functionalities incrementally, ensuring that each one is fully operational before introducing the next.
  - Review who within the technical committee has the required expertise and capacity to take on this activity.
- **Review** the example metadata template from the **LSC hub project**, which is available in an **online ODK form**.
- More guidance can be found on the SIS framework platform **here**.

3.4.2 Develop high-level FAIR aligning principles

Workshop findings:

Stakeholders agreed that FAIR data principles are useful and can strengthen data sharing to have an effective SIS, and as such CSIR-SRI agreed to build the data sharing template on the FAIR data principles.

Recommended additional next steps:

- **Review step 4 of CABI's FAIR Process Framework** to co-develop FAIR aligning principles **here**.
- **Review the example FAIR aligning principles in Annex V** and consider developing GhaSIS's own FAIR aligning principles with key stakeholders to create a common vision for data management for improved sharing, which encourages collaborative working that can aid alignment and help develop buy-in.
  - Whilst there was a general acknowledgement of the importance of the FAIR data principles, it was not clear from the workshop which institutions have already implemented FAIR into their existing data practices.
  - Bringing these stakeholders together again to develop FAIR aligning principles may also bring clarity into how far along each stakeholder is in their "FAIR journey".
  - This activity will improve awareness about the importance of FAIR, support building trust between stakeholders, and in turn could improve the "FAIR-ness" of the wider ecosystem GhaSIS operates within.
  - If this activity is of interest and you would like to find out more, please contact **fair@cabi.org**
- More guidance can be found on the SIS framework platform **here**.

3.4.3 Brainstorm data plan

Workshop findings:

- GhaSIS will be aligned with Ghana's **Data Protection Act** and ensure GhaSIS's data plan fits within this framework.
- GhaSIS is to be registered with the data protection commission to ensure the correct procedures are followed.
- There is need for GhaSIS to have restrictions on uploads, usage, sharing, accessibility, data format e.g. it will not share raw data, but products such as maps would be made open access. This also gives the opportunity in the future to elicit small fees for more processed data to keep GhaSIS sustainable.
- The design of database template must have key data variables.
- For data capture, the sampling points should be georeferenced and use the same standards. It would be ideal if in the future all soil samplings are obliged to use the same standards to be uploaded in GhaSIS.
- Implement security measures to prevent hacking and consider hosting with (for example) Google to implement multiple encryptions that can be provided (cloud storage).
  - **NITA** or the Institute for Scientific and Technological Information (**INSTI**) of CSIR could assist with the data storage. INSTI could lead on the development of design.
- GhaSIS should provide protocols for data producers (field and lab analysis).
  - Technical committee should agree on the protocols.
- The idea is to plan for a self-sustaining GhaSIS containing high quality data.

Recommended additional next steps:

- **Contact NITA and INSTI** for discussing hosting the data for GhaSIS and their storage opportunities.
- **Review the example of the law in the Netherlands**: obligation to upload any new soil information to the soil information system – the National Key Registry of the Subsurface Act.
- Review the case study of developing a soil and agronomy data sharing policy in Ethiopia.
- Review Ethiopia's Coalition of the Willing guideline on data collection.
- Identify who within the technical committee will develop the data strategy for GhaSIS and what expertise are missing to formulate this (more information on this is provided in Chapter 3.6).
- More guidance can be found on the SIS framework platform here.

3.4.4 Brainstorm SIS functionalities

Workshop findings:

- During the workshop, various functionalities were mentioned as requests for GhaSIS. GhaSIS should ideally provide:
  - **Algorithms** to upload data in a standardize format.
  - **Soil classification maps**.
  - **A login function** to serve various users.
  - **Guidance for fertilizer recommendations**.
  - **A user-friendly platform** for different users.

- **A dashboard** showing the traffic of SIS users.
- **A repository**: GhaSIS doesn't need to store all data itself; instead, it can connect to existing resources via a repository, serving as a centralized access point for information. For instance, while weather data is crucial for understanding soil and crops, it's more effectively maintained by meteorological institutes that continuously update this information. The repository ideally should link to:
  - Workflows/methodologies used to create soil maps - for researchers.
  - Crop and geology models that can be used to further process soil data, e.g. FAO's AguaCrop or SWAP (Soil, Water, Atmosphere and Plat) or the crop module of the Soil Water Assessment Tool (SWAT) – for researchers.
  - **OFRA** – Fertilizer Optimisation Tool (FOT) – for advisory services.
  - **FERARI-IFDC** project which focus on fertilizer research and responsible implementation.
  - Ghana meteorological Agency (GMet) for weather data.

- The technical committee should be included in the design process and can ensure that end users are also involved in the process to meet their needs (e.g. private sector, farmers, and other service providers).
- There is a need to investigate and plan for the role of generative artificial intelligence (GenAI).
- There may be lessons to be learned from the CSIR space repository.

Recommended additional next steps:

- **Website designer**: consider hiring a website designer to the GhaSIS project team to ensure GhaSIS has a user-friendly design for various users.
- **Review the example** of the **Land, Soil, Crop information hub Kenya** which uses Terria.JS to visualise spatial information.
- **Review the AI4SoilHealth** project website to investigate the possibilities for AI. There is a free, online conference on **4 December 2024**, also covering GenAI. More info **here** and register **here**.
- **Review functionalities** of **other existing SISs**, e.g. login options.
- More guidance can be found on the SIS framework platform **here**.

3.4.5 Brainstorm feedback and communication plan.

Workshop findings:

- **Feedback mechanisms**: There is a desire for an interactive platform, and so the option of adding a chat box to GhaSIS was discussed.
- **User engagement**:
  - If accessibility (traffic) is monitored through a dashboard, then these users can be followed up with.
  - GhaSIS could examine serving different users with different languages.
  - Audio options in multiple languages was preferred to enhance accessibility, especially if farmers are the end-users.
- **Monitoring plans**: Developing a monitoring and improvement strategy with clear KPIs and reporting was discussed as key for GhaSIS.

Recommended additional next steps:

- **Monitoring plans**: For further guidance specifically on monitoring the system, view the operational phase **here**.
- **User feedback**: Review the Land, Soil, Crop information hub for Kenya that uses **GIT for user feedback collection** and review their **documentation for different users**.
- **Consider the following questions**:
  - Will you provide a platform for data users and data providers to communicate?
  - Do you want to foster an online community through the SIS to ask and answer questions within the community rather than contacting the SIS operators directly?
  - How will the users or operators know how to use the SIS? E.g. through guidelines, chatbot, videos etc?
- More guidance can be found on the SIS framework platform **here**.

3.5. Component 5: Partnership development and high-level financial sustainability plan

Component five of the SIS framework focuses on partnership-building among the institutions and individuals involved in SIS development. 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. Initial thinking on the partnership development and the financial sustainability of the SIS is given. During the workshop, initial perspectives from key stakeholders were gathered on this topic which are detailed below. It is important to understand how people and institutions should work together and align on who is responsible for what. This is a critical step to ensuring the progress of SIS development.

3.5.1 Develop partnerships.

Workshop findings:

- **A 5-member temporary steering committee was discussed**.
- Purpose of this committee is to provide governance, strategy direction, review progress, resource allocation and outreach.
- The committee is a temporary structure for 3-6 months, to oversee the establishment of the system.
- It was discussed there would be co-chairs, and once a formal committee is established there could be bi-annual rotations.
- There will also be a secretary with the role of coordination.
- Members of the committee:
  - Private sector- YARA/OCP (local representative)
  - Research institutes- CSIR-SRI (co-chair)
  - Public sector- MoFA (co-chair)
  - Funders- AGRA (to be discussed)
  - NGOs/CSO- Fertilizer platform Ghana

- **A 7-member technical committee was discussed that will report to the steering committee**.
- Members of the technical committee:
  - Director CSIR-SRI (data analysts)
  - Fertiliser companies (international and local)- e.g. Chemico
  - President of the soil science society
  - IT experts- Director INSTII (GIS expertise)
  - Soil experts- Universities representatives
  - MoFA- extension directorate (DAES)
- **The following activities were discussed for the partnership**:
  - CSIR-SRI will lead on developing a first draft Terms of Reference (ToR) for the steering and technical committees and will share with the representatives by the end of the year.
  - It will need to be discussed which individuals are the best representatives from their respective organisations which best meet the required needs for the committees.
  - The steering committee will develop a legal framework that guides the committee (detailing e.g. process of selection, duration of membership etc.).
  - A kick off meeting will be needed to agree on timelines, and then the committee will meet quarterly.
  - The committee will conduct a comprehensive review of the gaps in the current state of GhaSIS and capacity gaps and develop a review report.
  - Data sharing agreements will be made between committee stakeholders.
  - The checklist (in Annex II) will be shared with the stakeholders.
  - Steering and technical committees will put together a concept note, aligning with funders strategies, including consideration of long-term funding needs, to kick-start the next steps for improving GhaSIS.
  - The steering committee will set timeline, milestones, target activities and budgets so that next steps are actionable.
- **Representation of the full value chain at national level** in the GhaSIS partnership was discussed as neccessary.
- **The key role of the partnership** is to ensure financial sustainability of the SIS.
- It was agreed that everyone on the steering committee will have the same level of approval.
- **Additional expertise required**: A business model expert is required to look at the scope and services in the partnership agreement, as are legal experts to participate in the partnership to support responsible data sharing.
- **The partnership should enhance collaboration** between the different stakeholders- even beyond the stakeholders in the partnership, e.g. extension services, policy & advocacy actors.
- **Other capacities needed** for the partnership are, for example:
  - INSTI responsible for information dissemination, app & platform development.
  - Universities should represent both soil science and ICT.
  - Ministry of Finance to be included in financial sustainability, costs, and revenue generation decisions.
  - CSIR for policy issues.
  - Ghana Meteorological Agency, as weather data input is required.
  - Software developers.

- Advocacy group to maintain government buy-in and articulate the value of soil for society and how soil data can address government needs.

- Future stakeholder engagement: CSIR-SRI suggested other institutes not at the workshop that could be considered for future engagement or for the partnership:
  - CSIR-INSTI
  - CSIR-STEPRI
  - MESTI
  - GIDA
  - Land Commission
  - Local Blending Companies, e.g. AMG, Omnifert, Glofert
  - MoFA (SRID)
  - Statistical service
  - Software developers
  - Farmerline
  - Esoko
  - Farm Radio
  - Soil Science Society of Ghana
  - NITA
  - Small holder farmer associations
  - Cocoa board
  - Ministry of Lands and Natural Resources

Recommended additional next steps:

- **Co-develop a theory of change**: consider conducting this exercise with the partnership/ committee members to help visualise what GhaSIS is trying to achieve, why, and how. See guidance on this from USAID **here**.
- **Transitioning to a permanent committee**: Consider a plan for when the 3-6 months of the temporary committee is over, and include plans for this in the temporary committees activities, such as handovers to the permanent members, if necessary.
- **Decision-making responsibilities**: Although it was discussed in the workshop that all steering committee members would have the same level of approval on decisions, CSIR-SRI may consider taking on the final decision-making responsibilities as the SIS operator, reporting to MoFA, and this could be reflected in the organogram that was agreed as a useful tool for stakeholders involved in GhaSIS.
- **Core partnership for GhaSIS**: Many institutions have been listed for partnership engagement. In its initial stages, consider a focused core partnership for GhaSIS with clear goals, roles, and tasks with the required capacities and buy-in to address the agreed target users' needs. The scope of the partnership could then be expanded once initial structures and strategies are in place to streamline efforts further.
- **A RACI matrix** may be useful for identifying which stakeholders are essential in the partnership, and which need only be part of broader stakeholder engagements.
- More guidance can be found on the SIS framework platform **here**.

3.5.2 Brainstorm marketing of the SIS

Workshop findings:

There was acknowledgement of the need to create awareness about GhaSIS to ensure users know about GhaSIS and are reminded to use it. Social media can be useful for dissemination of information and creating awareness on GhaSIS (e.g. through Esoko, Farmerline, and communications personnel from CSIR).

When it came to discussing how GhaSIS would measure its impact on the end-users, multiple options were explored to measure the impact:

- Traffic of users of GhaSIS via a dashboard.
- Seek continuous feedback from a range of users.
- Real impact is only achieved once policy makers use soil information of SIS. When this happens, it should be captured and documented.
- Agronomic nutrient efficiency – by measuring the yield of crops or the soil properties over time, impact of GhaSIS can be measured.

Recommended additional next steps:

- **Develop a clear communications plan** for GhaSIS that targets both potential funders and potential end users.
- **Consider adding a communication person** to the GhaSIS project team to take responsibility for awareness creation through the social media channels.
- **Consider contacting a youth organisation** to connect with young professionals in agriculture, such as **YPARD**.
- More guidance can be found on the SIS framework platform **here**.

3.6. Component 7: Develop data strategy

Component seven of the SIS framework focuses on the Data Strategy. The data strategy for the SIS intends to develop a description of the data to be collated from pre-existing sources, newly collected in the field, and delivered by the SIS that ensures data is comprehensive, consistent, high quality, and FAIR-compliant. This includes consideration of who will be involved in which aspects of data management (**people**), what **processes** will be used to develop and manage data assets, and what systems and technologies will be employed to manage data (**platform**).

'People' here are best defined as those within the organizational structure of the key participating agencies involved in data governance. It includes due consideration of the roles and responsibilities of those who own, collect, store, manage, and use data. **'Processes'** refers to guidelines for using, protecting, and managing data, ensuring consistency and compliance. **'Platforms'** (or technology) are the tools and systems that support data governance and can include security protocols or data management platforms. For an effective data strategy to be put into practice, all these components must be considered.

3.6.1 Develop data plan for 'people'

Workshop findings:

The discussions on data plans for 'people' revolved mostly around capacity building needs, such as needing to strengthen the capacity of data generators and technical staff to ensure the production of high-quality data, and that there is currently a lack of technical expertise for advanced stages of data development, including modelling, creating data-driven products, and data delivery.

Additionally, improving communication and transparency around data between stakeholders was also discussed. It was agreed that for the improvement plans for GhaSIS to move effectively, it is essential to clearly identify the appropriate contacts for accessing soil data from the various institutions. Also making clear the ownership of the data is important as it is currently ambiguous and data providers for GhaSIS would like to see their contributions recognized and acknowledged.

Recommended additional next steps:

- To develop a **FAIR data strategy**, please review step 5 of CABI's FAIR Process Framework here.
- **Develop a data governance policy** as part of the data strategy, which will make clear what roles are needed for data ownership and management, and what their responsibilities will be. For example, are there existing data managers or data stewards for GhaSIS, or is there scope for this role to be created? And is there short-term and long-term budget for these roles?
- **Develop capacity building /succession plans** and, where relevant, identify key person risks, so that responsible data management and governance is maintained throughout the lifespan of GhaSIS.
- **Consider regular training and awareness on each stakeholder's role in data governance**, ensuring they understand their roles and responsibilities and are equipped with the knowledge to maintain high standards in data governance.
- Review this **NSW Data Governance Toolkit**.
- More guidance can be found on the SIS framework platform **here**.

3.6.2 Develop data plan for 'processes'

Workshop findings:

- **Data sharing challenges were a widely discussed topic through the two days of the workshop, and the following solutions were share**:
  - CSIR-SRI will provide a template that follows the FAIR data principles for how the stakeholders can share their data.
  - The universities represented agreed that they would send every year new research generated by students to SRI, following the template CSIR-SRI will provide.
  - Stakeholders agreed that the focus should be more on establishing better data sharing processes rather than developing data policies.
- **Data quality and standards were a concern across the stakeholders, and so needs and possible solutions were shared during the workshop's breakout sessions**:
  - A challenge is that there is use of different standards and protocols, and so there's a need for interoperability and harmonization.

- There is a need for synthesis of existing information from existing projects.

- To ensure the SIS is updated with new data, the following ideas were discussed:
  - It was agreed that there should be new data collection every 5 years, specifically looking at soil fertility.
  - It was suggested that research institutes and universities that receive grants for soil related projects that generate data could be drawn upon to update the SIS.

Recommended additional next steps:

- To develop a **FAIR data strategy (which includes guidance for data governance, data management and data sharing)** review step 5 of CABI's FAIR Process Framework **here**.
- **Review the optional tool to assess the quality of data**: **Data Quality & Plausibility Tool**.
- **Review the Soil Assimilation guidance** on soil data standardisation and harmonisation.
- **For guidance on soil data collection/soil monitoring**, refer to Chapter 3 of **Development options for a Soil Information Workflow and System**
  - Review the example of **Australia's national soil monitoring program**
  - Review how **EUSO conducts regular soil monitoring**
- **Data sharing templates**: The technical committee who will develop the data sharing templates could also consider reviewing the data sharing agreement (DSA) template in Annex IV. ***Please note, the template is just a guide, and you will need to seek your own legal advice before using this or any DSA***.
- **Benefits of data sharing policies**: Although there was discussion on the benefits of data policies, consider reviewing the impact of such **data sharing policies in the Ethiopian context**, as well as the template for developing a data sharing policy in Annex IV.
- **Develop a Data Management Access Plan (DMAP)**, as this will create a clear plan for managing the lifecycle of your data, from collection to usage, ensuring that all stakeholders understand their roles and responsibilities. The DMAP should include:
  - a description of the data to be collected or used during a project, this might include reuse of existing data assets as well as collection of new data.
  - the data formats in which data will be stored, and why those formats and standards are appropriate.
  - notes on the sources, volume, storage, sharing and archiving of data.
  - the processes by which data will be collected and processed.
  - notes on data management, including naming conventions, version control, etc.
  - a description of how the quality of the data will be assessed, documented, and maintained.
  - a description of the metadata and documentation that will be produced.
  - notes on the standards used to create and format the metadata.
  - ethics and privacy implications of collecting, storing, and sharing data.
  - notes on any intellectual property rights or licensing issues that are relevant to the data.
- More guidance can be found on the SIS framework platform **here**.

3.7. Component 9: Organisational and financial sustainability plan

Component nine of the SIS Framework seeks to build on the high-level plan brainstormed financial plans in the Initiation Phase, to develop a concrete financial sustainability plan and organisational plan that will guide the following phases. This is intended to be a living document to be iterated throughout the lifespan of the SIS.

Workshop findings:

- **Funding sources**: It was discussed what the role of **Ghana Statistical Services** might play in the funding of the SIS- can funds be drawn from this to collect new soil data to keep GhaSIS updated?
- **Income generation**:
  - There is a need to define who is to pay to access information from GhaSIS, e.g. private companies. Also, there is a need to define who does not need to pay, e.g. students and smallholder farmers.
  - There is a need to assess the different end users and determine which entity pays with price variations.
  - It was also discussed what the initial value for money of the system would be, and that it could start with no payment option, then introduce fees once GhaSIS is more established and high-quality data is delivered.
  - It was discussed that adverts could be used to generate income for the system.
- **Roles and responsibilities**: Finalising the financial sustainability plan is the responsibility of the steering committee, with a deadline to complete this within 6 months.
- **Capacity building needs and potential costs**:
  - There is limited capacity of labs.
  - It was discussed how there is a decrease in the number of students taking soil science at university.
  - Possibility of starting training programs within CSIR and universities to address the skills gap needed for GhaSIS.
  - Technical (IT) staff don't have soil science training.
  - There is a need to identify the costs of digitalization of data and technology.
- Indicative initial funding needs were developed during the workshop (figures not shown):
- **Estimate short-term Funding Needs (1-2 years)**
  1. Personnel and operational costs
  2. Soil data collection and analysis
  3. GIS software and hardware
  4. Training and capacity building
  5. Website development and maintenance
- **Estimate medium-term Funding Needs (2-5 years)**
  1. Expansion of soil data collection
  2. Development of mobile apps
  3. Integration with other agricultural databases

4. Research and development
5. Stakeholder engagement and outreach

- **Estimate long-term Funding Needs (5+ years)**
  1. Sustainability and maintenance
  2. Scaling up to national level
  3. Integration with regional and global soil information systems
  4. Development of decision-support tools
  5. Human resource development and capacity building

Recommended additional next steps:

- **Capacity building plan**: The Universities and CSIR-SRI could consider developing a strategy to gain interest of prospective students as part of the long-term capacity building plan for soil scientists in Ghana.
- Review the **Guide to support SIS financial sustainability planning**.
- The steering committee might consider **updating the financial sustainability plan** once there has been an agreement of initial target end users and an in-depth assessment of their needs, as well as their willingness to pay.
- Consider defining what information might be free to access and what information that can be more tailored, granular and actionable might need to be paid for.
- More guidance can be found on the SIS framework platform **here**.

Conclusion

The roadmap for implementing GhaSIS has been carefully crafted based on the insights gathered throughout the workshop and preceding stakeholder consultations, using the SIS framework to support the design and development plans for GhaSIS.

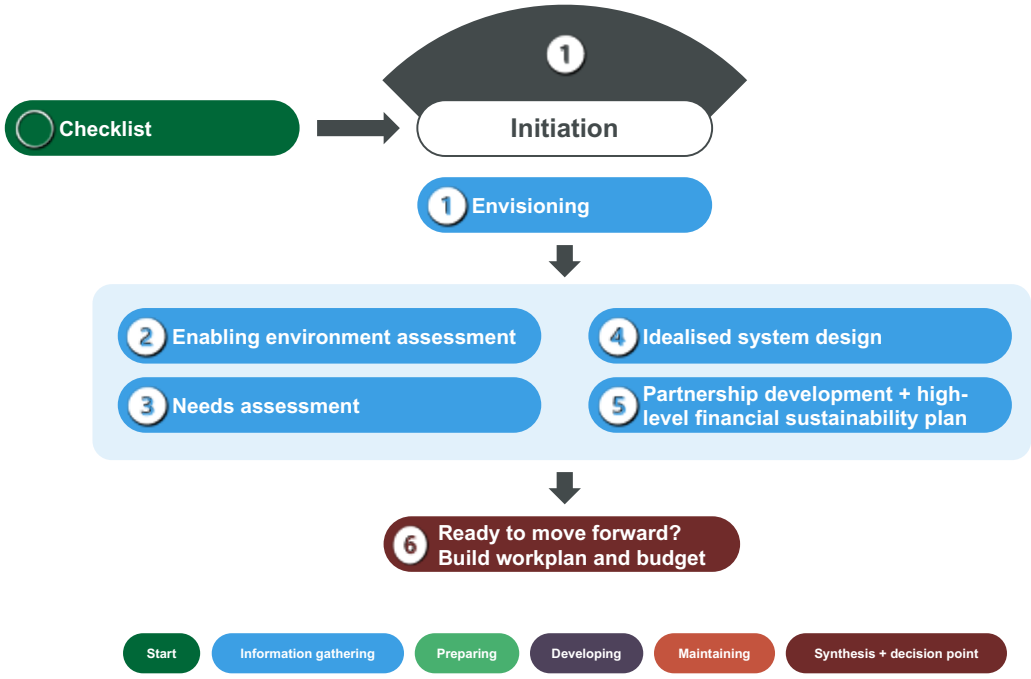
The suggested recommendations provided give advice for next steps in the development for a sustainable GhaSIS, with the note that responsibility to decide which recommendations to follow lies firmly with the GhaSIS project team. They will be best placed to understand which ones to prioritise to ensure that the SIS best matches stakeholders need to ensure GhaSIS can be sustained over the longer term. Identifying the relevant action points and suggestions in this roadmap and building this into a workplan with assigned roles and responsibilities will provide a clear, actionable pathway for the GhaSIS project team.

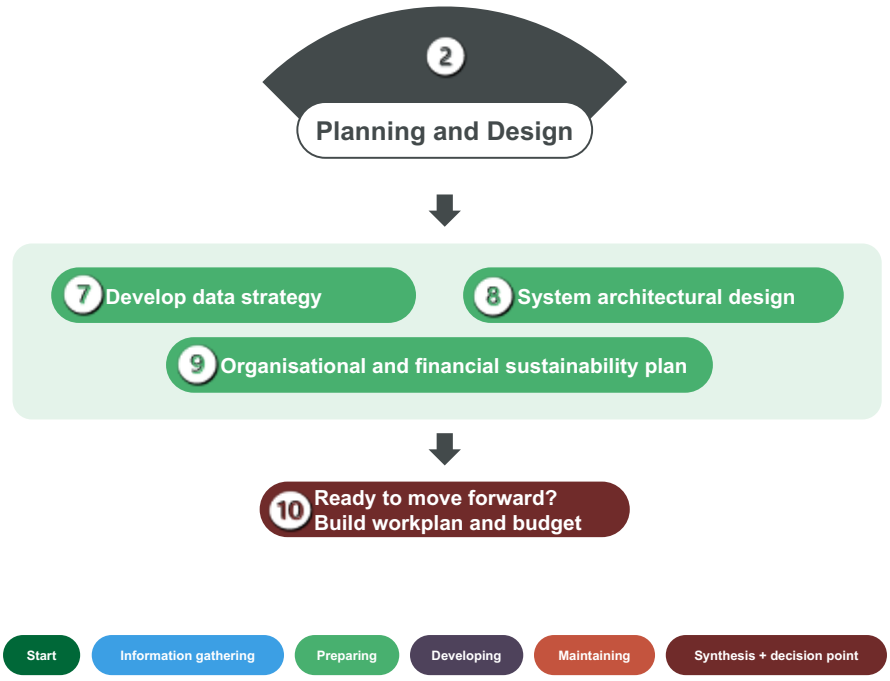
Below is a summary of **key considerations** based on the workshop, noting it is for CSIR-SRI to determine which suggested next steps to take:

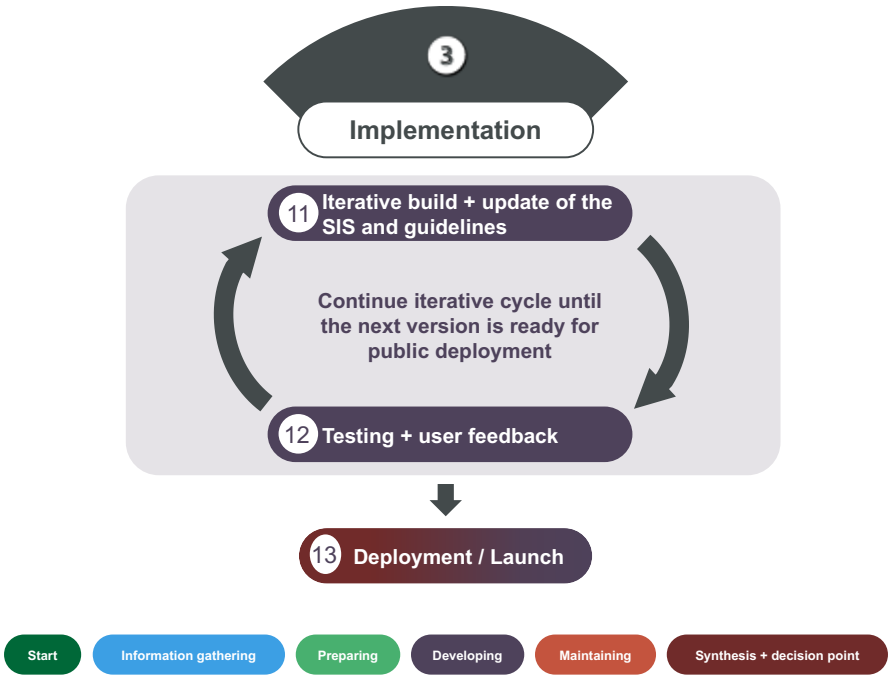
1. Draft a **comprehensive concept note for GhaSIS** development to present at the West Africa Hub meeting in November, following the outline provided by CABI and ISRIC (Annex VI).
2. Establish the **steering and technical committees** as part of the GhaSIS partnership, defining roles, responsibilities, membership terms, and activities.
3. Finalize the **financial sustainability plan** in agreement with all partners, ensuring that the SIS owner and operator take responsibility for its implementation.
4. Develop **data-sharing agreements** among committee members, using templates from Annex IV, and share these with identified data producers for GhaSIS.
5. Circulate the working document on the **mission**, **definition**, and **goals** of GhaSIS to the broader stakeholder group for feedback.
6. The technical committee to conduct a comprehensive **review of data and capacity gaps**, leveraging the supporting resources and solutions outlined in this roadmap report.
7. Identify initial **target users**, assess their **needs**, and create a **SIS design plan** (both front-end and back-end) that aligns with user requirements.
8. Organise a **validation workshop** with broader stakeholder participation once design and work plans are drafted and priority next steps have been consolidated by the GhaSIS project team.

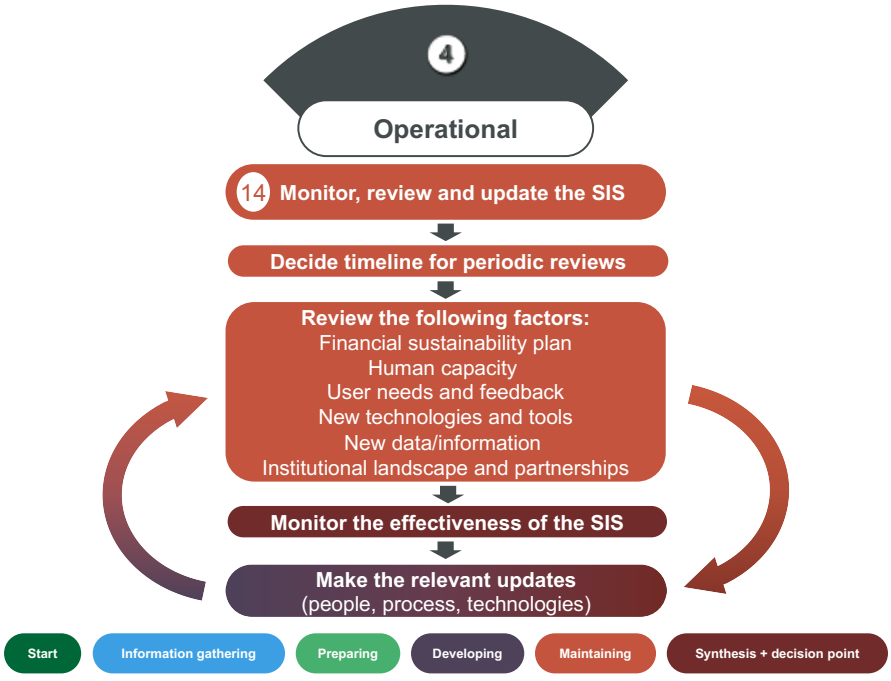
Annexes

Annex I: The SIS framework






3
Implementation
11 Iterative build + update of the SIS and guidelines
Continue iterative cycle until the next version is ready for public deployment
12 Testing + user feedback
13 Deployment / Launch
Start
Information gathering
Preparing
Developing
Maintaining
Synthesis + decision point


4
Operational
14 Monitor, review and update the SIS
Decide timeline for periodic reviews
Review the following factors:
Financial sustainability plan
Human capacity
User needs and feedback
New technologies and tools
New data/information
Institutional landscape and partnerships
Monitor the effectiveness of the SIS
Make the relevant updates
(people, process, technologies)
Start
Information gathering
Preparing
Developing
Maintaining
Synthesis + decision point

Annex II: Preparation materials

Questions	Answers	
Do you already have a national SIS that you wish to improve?	Yes	
Is it clear what problem the SIS is trying to address?	Yes	revise with new stakeholders
Is it clear what the mission and definition of the SIS is?	Yes	bring all stakeholders on board
Is there strong government buy-in?	Yes	
Is it clear who the SIS owner will be?	Yes	CSIR-SRI national owner
Is it clear who will fund the system build?	Yes	Government, need more donors
Have you set and agreed upon the goals of the SIS?	Yes	
If you answered NO to any of the above, we recommend reviewing the activities in Component 1		
Do you know if there are similar soil data initiatives happening in the country?	Yes	IFDC doing a lot, need to work the data they have but has been a challenge
Do you have an inventory of existing/legacy soil data?	Yes	Needs to be added to
Do you know if there are any institutional or national policies and strategies that would impact the SIS?	Yes	Planting for food and jobs 2.0 and policy for soil (fertlizer act). soil policy act had started (AGRA)
Do you have an understanding of what the current in-country expertise, capacities and infrastructure are?	Yes	
Do you know which institutions and organizations have a stake in soil data and information?	Yes	
Do you understand the roles and data/value exchanges between each stakeholder?	Don't Know	not well defined
Do you know what the challenges and incentives are for data management and sharing in your context?	Yes	data sharing, quality issues- aware of the challenges. use of different standards and approaches. interoperability and harmonization needs. CSIR-SRI only has ISO certi.
If you answered NO to any of the above, we recommend reviewing the activities in Component 2		
Do you understand the needs and challenges of soil data users and producers?	Yes	digitalization needs work on to meet the needs
Have you clearly defined the use cases?	Yes	
If you answered NO to any of the above, we recommend reviewing the activities in Component 3		
Do you know what SIS functionalities you want and how end-users will use the system?	No	providers know what they can provide, but need perspective from end-users

Have you mapped user needs to the Soil Information Workflow (SIW)?	No	to some extent
Do all key stakeholders understand and are aligned on how the FAIR data principles will be applied to the design of the SIS?	No	understanding of FAIR different for diff stakeholders
Are all key stakeholders aligned on what the rules are for data governance? (sharing, privacy, access, management)	No	
If you answered NO to any of the above, we recommend reviewing the activities in Component 4		
Do you know how the SIS will be financially sustained in the long-term?	No	
Have roles and responsibilites of key stakeholders been agreed?	No	
Have you developed a partnership to support the SIS build and long-term operation?	No	
Has a Theory of Change (ToC) been developed with the key stakeholders?	No	
If you answered NO to any of the above, we recommend reviewing the activities in Component 5		
Has budget been allocated for data management in the long-term?	No	
Have the roles for data ownership and management been agreed?	No	
Do you have a plan for the components of the Soil Information Workflow (SIW) you want to use?	Yes	
Do you know what data standards will be used?	No	
Have you planned for data governance? e.g. data privacy, data sharing, data access, and data quality management?	No	
Do you know what infrastructure you will use for data quality and data security?	No	to some extent
If you answered NO to any of the above, we recommend reviewing the activities in Component 7		
Have you got a design plan for the front and back end of the SIS, and has it been informed by user needs?	No	
Is it clear how the SIS will be regularly updated with new soil information?	No	
Have you agreed roles and responsibilities for the design?	No	
Do you have a capacity building plan for the design and maintenance of the SIS?	No	to some extent- at CSIR-SRI only
If you answered NO to any of the above, we recommend reviewing the activities in Component 8		

Have you got a concrete financial sustainability plan that has been agreed with all partners and key stakeholders, including the government?	No	
Is there a plan or strategy for communications/ engagement/marketing to ensure continued buy-in and useage of the SIS?	No	limited- CSIR-SRI only
Do you have an organisational plan for the SIS?	No	
If you answered NO to any of the above, we recommend reviewing the activities in Component 9		
Have you built a protoype of the SIS that's been informed by user needs, system architectural design plans and data strategy?	No	to some extent
Has the prototype (or updated existing SIS) been through several rounds of user testing and iteration?	No	
Do you have a continous feedback mechanism for the SIS?	No	
Is there a comprehensive plan for deployment of the SIS?	No	
If you answered NO to any of the above, we recommend reviewing the activities in Component 11		
Do you have a plan to reguarly review and assess key environmental factors that if they change could impact the SIS and require updates?	No	
Is it clear who is responsible for reviewing and updating the data strategy?	No	the roles and responsiblilites will be discussed in the workshop
Is it clear who is responsible for reviewing and updating the financial sustainability plan?	No	to discuss at workshop
Do you know how you will monitor the functionality, performance and impact of the SIS?	No	
If you answered NO to any of the above, we recommend reviewing the activities in Component 14		

For more information on the project visit: **cabi.org/projects/soil-informationsystems-review-a-processtoward-strengthening-national-soilinformation-systems**
To access similar resources and explore the framework visit: resources.isric.org/sis-framework
For further enquiries: **fair@cabi.org** or **thaisa.vanderwoude@isric.org**

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Annex III: Workshop materials

Day 1 - October 8, 2024

Location: Capital View Hotel, Koforidua, Ghana.

Welcome and registration | 09:00 - 09:30

Setting the scene | 09:30 – 10:00

Timing	Speaker	Comment / guiding questions
3'	Welcome by **CABI and ISRIC**	• Goals and format for the workshop and quick background about the project
	The moderator will introduce each speaker before they speak	
5'	**Dr. Victor Clottey** CABI	• Welcome remarks from CABI West Africa • The need for understanding best practice in the development of soil information systems
5'	**Dr. Prem Bindraban** IFDC	• What are the motivations and plans of SOILS Space to Place in Ghana? • How does SOILS Space to Place link to GhaSIS?
5'	**Dr Francis Tetteh** CSIR-SRI	• Opening remarks. Vision and goals of CSIR-SRI for the improvement of GhaSIS
5'	**Mr Michael Owusu** MoFA	• Value of a national soil information system in Ghana • How GhaSIS could support the Planting for Food and Jobs (PFJ)
5'	**Mr. Christopher Gaitu** MoFA	• Role of fertilizer regulation and links to GhaSIS
2'	**Eric Asamoah**	• Key takeaways from initial presentations

Group photo and networking coffee | 10:00 - 10:30

Background to the CABI-ISRIC project and validation Sustainable National Soil Information Systems| 10:30

Timing	Speaker	Comment / guiding questio
5'	Welcome by **Melissa**	• Introduction, objectives,
25'	**Thaïsa van der Woude** ISRIC **Chrow Kurshid** ISRIC **Lydiah Gatere** CABI	• Background and overvie *Strengthening National S* • Soil Information Workflo • Key findings from consul • Sharing information and • Introduction to the *Frame Information Systems* (inc of developing a roadmap
	Poster session *This session will aim to present th*	
	of ongoing projects, as well as to identify examples of tools currently being used and existing challenges around engagement and resources.	

Networking lunch | 12:00 – 13:00

Current state of GhaSIS | 13:00 - 14:00

Timing	Speaker	Comment / guiding questions
2'	Welcome by **Eric**	• Introduction, objectives and format of the session
	The moderator will introduce the speaker before he speaks	
25'	**Dr. Edward Yeboah** CSIR / SRI	• Presentation of initial analysis done by CSIR-SRI and SoilFER: ○ Problem statement, mission and definition of the SIS ○ Stakeholder mapping and engagement ○ Initial needs/demands assessment. ○ Enabling environment assessment (including existing policies that would impact the SIS) ○ Use cases
30'	**Q&A from the audience**	
3'	**Melissa**	• Explanation of the breakout sessions

Transition into breakout rooms and coffee break | 14:00 - 14:15

Action planning sessions – Validation of the requirements for GhaSIS (Part 1) | 14:15 - 16:30

Data requirements Moderators: Eric Asamoah (ISRIC/CSIR) and Melissa Allan (CABI)	**System requirements** Moderators: Lydiah Gatere (CABI) and Thaïsa van der Woude (ISRIC)
• What are the data challenges? • What are the data requirements from user perspective? • What data policies, strategies and mandates exist? • How can data sharing be achieved between SIS related efforts? • How can the FAIR data principles strengthen GhaSIS? • What are the cost implications?	• What GhaSIS functionalities are required from user perspective? • What are GhaSIS digitalisation needs? • What would the backend system architecture look like? • What would the frontend software interface selection or development? • How could data security and privacy be ensured? • What are the cost implications?

Closure of day 1 | 16:45 - 17:00

Timing	Speaker	Comment / guiding questions
3'	**Eric Asamoah**	
6'	**Dr. Francis Tetteh** CSIR-SRI	• Main takeaways of the first day
6'	**Dr. Victor Clottey** CABI	• Thanks, and opening of the networking cocktail

Networking cocktail | 17:00 - 20:00

Day 2 - October 9, 2024

Location: Capital View Hotel, Koforidua, Ghana.

Recap from Day 1 | 08:30 - 09:10

Timing	Speaker	Comment / guiding questions
5'	Welcome by **Eric**	• Recap – the need for a roadmap • Goals and format for the day
	The moderator will introduce each speaker before they speak	
10'	**Dr Andrews Opoku** KNUST	• Summary from session on data requirements
10'	**Mr Alexander Owusu-Ansah** CSIR-SRI	• Summary from session on system requirements
10'	**Feedback from participants**	
5'	**Eric:** explanation of next breakout sessions	

Transition to breakout rooms | 09:10-09:15

Action planning sessions – Validation of the requirements for GhaSIS (Part 2) | 09:15: 11:15

Participants should be assigned to a group number as per their name badge.

Group 1: Funding needs Moderators: Eric Asamoah (ISRIC/CSIR-SRI) and Lydiah Gatere (CABI) Victor (CABI)	**Group 2: SIS stakeholder requirements** Moderators: Melissa Allan (CABI) and Thaïsa van der Woude (ISRIC)
In depth discussion of funding requirements for GhaSIS development: • What are CSIR-SRI estimations of the total cost for developing GhaSIS? • Have the system and data requirements (from action planning session 1) been factored into those calculations? • What is the current and long-term financial commitment from the government to funding GhaSIS? • What is the current financial commitment from development partners (e.g. FAO and IFDC) to develop GhaSIS? • Are there any overarching funding gaps or for specific components of the SIS? • Are there any immediate funding needs? • Are there any additional funders that should be engaged?	Data producers: • Who are they? • Are we missing any in the workshop? • What do they produce? • What are the re-use conditions? • What is the quality? • Wha Service prov • Who • Are • Wha • Wha • Wha • How soil • Wha

Transition back to the main room and coffee break 11:15 - 1

GhaSIS partnership model | 11:30 - 12:30

Timing	Speaker	Comment / guidi
15'	Point persons to provide summary of breakout sessi requirements	
30'	**Dr. Francis Tetteh** CSIR-SRI **Alfred Arthur** CRIG **Mark Segbefia** OCP **Iscandar Ibrahim** AGRA **Atiah Kofi** University of Cape Coast **Prof Mariah Quain** CSIR Head	• Short introduction on your organisation and links to GhaSIS • How do we want the partnership for GhaSIS to look like? Are any partners currently missing (from action planning session 2)? • Which are the most pressing funding needs (from action planning session 2)? • Which funders will be needed to ensure financial sustainability (understanding cost/revenue structure)? • After the discussions over the last 1.5 days, are there any additional organisations that need to be involved to strengthen the development of GhaSIS?
15'	**Feedback from the audience** Victor	

Networking lunch | 12:30 – 13:30

Action planning sessions - Roadmap for GhaSIS | 13:30 - 15:00

Roadmap Moderators: Eric Asamoah (ISRIC/CSIR-SRI) and Melissa Allan (CABI)	**Roadmap** Moderator: Thaïsa van der Woude (ISRIC) and Lydiah Gatere (CABI)
• What needs to happen next? • Who needs to be involved? • What are the timeframes?	• What needs to happen next? • Who needs to be involved? • What are the timeframes?

Transition back to the main room | 15:00-15:05

Closure of day 2 | 15:05 - 15:30

Timing	Speaker	Comment / guiding questions
5'	**Eric**	
10'	**Dr. Edward Yeboah** CSIR-SRI	• Takeaways from the event and next steps
5'	**Michael Owusu** MoFA	
5'	**Dr. Victor Clottey** CABI	• Thanks, and official closure of the workshop

Welcome- Day 1

Ghana Soil Information System Roadmap Workshop

8-9 October 2024 | Capital View Hotel, Koforidua, Ghana

Introductions and welcome remarks
09:30 – 10:00

The Ghana workshop is made possible through co-funding from:

Bill & Melinda Gates Foundation
and
ISRIC – World Soil Information

Workshop Ground Rules

1. Everyone participates, so let everyone have a chance to speak
2. Constructive conversations over destructive feedback
3. Be present and open
4. Look forward, learn from the past

Dr. Victor Clottey - CABI

Regional Director and Representative So Africa - CABI

Dr. Victor Attuquaye Clottey is the Regional Director for West Africa at CABI, based in Ghana. With over 25 years of experience in research and development, he has specialized in agronomy, integrated soil fertility management, and agribusiness cluster formation. Dr. Clottey has worked extensively with various organizations, including the CSIR-Savanna Agricultural Research Institute and the International Fertilizer Development Centre. His work focuses on enhancing agricultural productivity, developing value chains, and facilitating market access for farmers.

Dr. Prem Bindraban- IFDC

Program Leader, FERARI

Dr. Prem Bindraban is the Program Leader for the FERARI program at IFDC, focusing on innovative fertilizers to improve crop yield and food quality while reducing environmental impacts. He has served as Director of ISRIC – World Soil Information and Team Leader at Wageningen University. Dr. Bindraban has contributed to a Strategic Plan for Agricultural Development in Africa and has over 200 research publications.

Dr Francis Tetteh - CSIR-SRI

Principal Research Scientist CSIR-SRI

Dr. Tetteh's work focuses on enhancing soil management practices to improve agricultural productivity and environmental sustainability in Ghana.

Dr. Tetteh has participated in numerous research collaborations, both within Ghana and internationally, focusing on agricultural productivity, environmental health, and the use of technology in modern farming.

He has been involved in advising government bodies and the Ministry of Food and Agriculture on policies related to land use, soil management, and sustainable farming.

Mr. Michael Owusu- MoFA

Deputy Director of Crops Services - MoFA

Mr. Owusu has been involved in the "Planting for Food and Jobs" initiative, which has significantly improved fertilizer application and employment in the agricultural sector.

Mr. Owusu also advocates for integrating organic and inorganic fertilizers to enhance soil fertility and support year-round farming. Additionally, he is a key member of the Fertilizer technical working group which plays a critical role in overseeing and guiding the fertilizer sector, particularly in areas that promote efficient use and sustainable practices.

Project background and introduction to the framework
10:30 – 12:00

Mr. Christopher Gaitu - MoFA

Deputy Director of the Plant Protection and Regulatory Services Directorate (PPRSD)

He focuses on the integration of innovation and technology in agriculture, especially concerning smallholder farmers. He advocates for the use of climate-smart agricultural practices, improved pest management systems to enhance crop protection and use of appropriate fertilizer products for agricultural productivity. His work emphasizes connecting farmers with advanced technologies and promoting inclusive agricultural policies that reach underserved communities, which is vital for boosting food security and export potential in Ghana.

Thaïsa van der Woude - ISRIC

Project Manager - ISRIC

Thaïsa van der Woude works at ISRIC-World Soil Information and is an experience project manager with a background in sustainable land management and soil science. Her work at ISRIC focus on user needs assessment, soil information and promoting sustainable land management practices.

Chrow Kurshid- ISRIC

Program Manager – ISRIC

At ISRIC, Chrow manages the National Soil Information System (NSIS) program with a focus on Africa. Chrow has been actively involved in course coordination, project coordination and community development and management in the MENA region since 2020.

Dr. Lydiah Gatere - CABI

Climate Change and Soil Expert - CABI

Lydiah is a soil scientist with over 15 years experience in management of development programs in Soil Health (food security and poverty alleviation), Climate Resilient Agriculture and Biodiversity Conservation through creating sustainable impact on small-scale agriculture.

A Process Toward Strengthening National Soil Information Services (SIS) (2021 - 2024)

SIS Review: A foundation-funded initiative to develop tools and processes for evidence-based SIS design

Project Rationale - Challenges in SIS implementation

- **Underutilized Potential:** Full value of SIS often not realized.
- **Tech-Focused Issues:** Interventions not responsive to:
  - Local user needs and use cases
  - In-country capacities and resources

Our Goals

Enabling environment

1 Understand the **enabling environment** for developing soil information services

Interviewed countries:
Ethiopia (East Africa)
Ghana (West Africa)
Lesotho (Southern Africa)
Tanzania (East Africa)
Rwanda (East Africa)
Uganda (East Africa)
USA
New Zealand
Australia

Synthesis insights

2 Build an **evidence base** that clarifies:
What works?
What needs improvement?

1. Understand the **value model for soil data** and how it contributes to stakeholders' decision processes
2. **Benchmark new SIS initiatives on any ongoing related efforts** and on existing and legacy soil data
3. Build **long-term buy-in among national partners** and support a **SIS champion to coordinate** across stakeholders
4. Match the **technological design of the SIS with stakeholder needs** and **capacity building** plans

Technical options

3 Establish clear guidance on the **technical options** for developing soil data assets

A report information for designing a SIS for on:

- **methods**
- **standards**
- **tools available**
  - for every step of the soil information workflow

Main output: the framework

4 Develop an evidence-based framework for improved SIS intervention design

A stepwise progression of key components and considerations for SIS design, with examples and tools for each step

Technical, financial, institutional, and capacity aspects

Roadmap workshops

5 Test and refine framework by developing SIS roadmaps with five target countries

- Zambia
- Ghana

Country-specific roadmaps based the *Framework* identify gaps and provide tools and guidance for next steps

Share with soil community

6 Communicate and discuss with the global soil data community

Feedback has been collected during various events (INSII Global Symposium, AFSH Summit, AFSF, Zambia workshop, KALRO workshop).

Your input will improve the framework.

Shared with the Community of Practise

CABI ISRIC

Community of Practise

For Soil Data and Information

Collaborative Initiatives for National Soil Information Services

- Soil Data and Information Community of Practice (CoP)
- Resource Library for Soil Information Producers
- Training: ISRIC Academy platform
- NSIS projects and SIS framework

ISRIC

Soil Data and Information Community of Practice (CoP)

Background

- Started in **May 2023** with **126** members
- **Now we have 700** members from **42** African countries
- **16** ambassadors from **11** African countries

Our vision

- Share ideas and strengthen each other's work
- Collectively guide discussions and professional development
- Innovate for soil information system development
- Co-develop standards for all soil information workflow steps
- Strengthen interdisciplinary connections

ISRIC

Soil Data and Information Community of Practice (CoP)

Goals

- Knowledge sharing
- Foster collaboration and networking
- Education and capacity strengthening

Activities

- Showcase events
- Joint publications
- Trainings
- Regular interactions via communication and networking platforms

ISRIC

Soil Data and Information Community of Practice (CoP)

Become a member

- Online form on our website
- QR code

Follow and Learn more

- **Website**: www.isric.org/utilise/community-practice
- **LinkedIn**: www.linkedin.com/showcase/soil-information-community-of-practice

ISRIC

Resource Library for Soil Information Producers

Tools, tutorials, books, guides, and other resources to help through the soil information workflow steps.

resources.isric.org

ISRIC

Training: ISRIC Academy platform

ISRIC Academy platform

This online platform is where you will find everything you need to know about your training and where you can meet and exchange knowledge, ideas and skills with your trainer and the other participants in your group.

ISRIC

NSIS projects and SIS framework

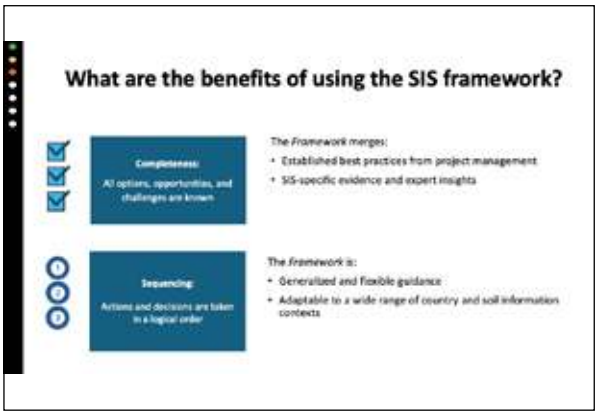
- The program has recently hosted a developed tool by CABI & ISRIC: SIS framework (guide to build/enhance a SIS) and runs a series of initiatives.
- The program hosing the NSIS projects and initiatives that started or will start in some African countries such as Ethiopian SIS, and Liberia SIS, etc...

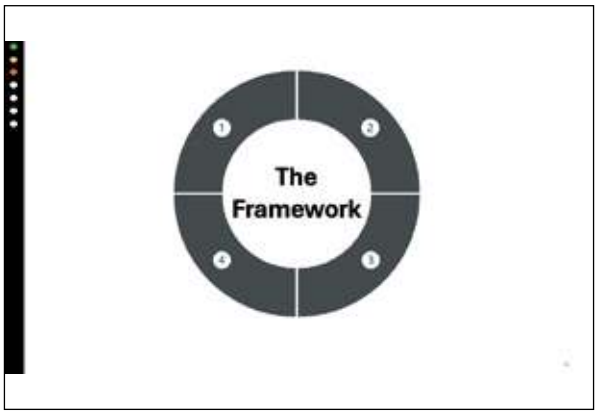
ISRIC

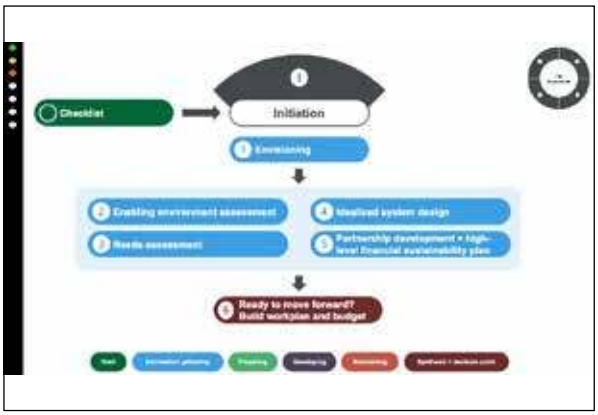
CABI ISRIC

Framework for Sustainable National Soil Information Systems

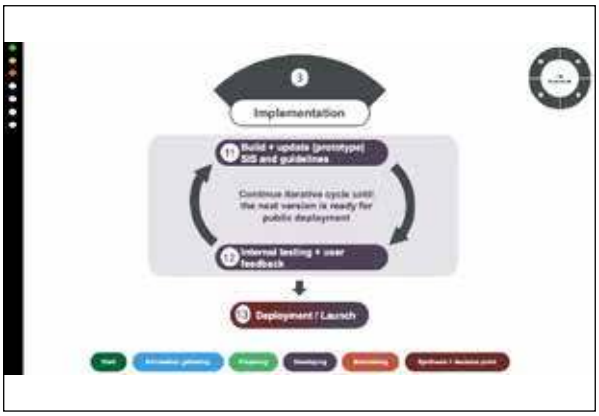
The framework for sustainable national SISs is now online:


What are the benefits of using the SIS framework?
Completeness:
All options, opportunities, and challenges are known
The Framework merges:
• Established best practices from project management
• SIS-specific evidence and expert insights
Sequencing:
Actions and decisions are taken in a logical order
The framework is:
• Generalized and flexible guidance
• Adaptable to a wide range of country and soil information contexts


The Framework


Checklist
1
Initiation
3 Envisioning
2 Enabling environment assessment
4 Idealized system design
5 Partnership development + high-level financial sustainability plan
6 Ready to move forward? Build workplan and budget


2
Planning and Design
7 Develop data strategy
8 System architectural design
9 Organizational and financial sustainability plan
10 Ready to move forward? Build workplan and budget


3
Implementation
11 Build + update (prototype) SIS and guidelines
Continue iterative cycle until the next version is ready for public deployment
12 Internal testing + user feedback
13 Deployment / Launch


4
Operational
14 Monitor, review and update the SIS
Decide timeline for periodic reviews
Review the following factors:
Financial sustainability plan
Human capacity
User needs and feedback
New technologies and tools
New data/information
Institutional landscape and partnerships
Are updates required?
Make the relevant updates
(people, process, technologies)


Feedback on the Framework


Current state of GhaSIS
13:40 – 14:00

Breakout Sessions

Data requirements- MAIN ROOM
System requirements- BREAKOUT ROOM

14:30 – 15:30

SWITCH

15:30 – 16:30

Breakout Session 1

Data requirements- MAIN ROOM
System requirements- DROWAA ROOM

14:15 – 15:15

Breakout Session 1: Data Requirements

OBJECTIVES:

1. Understand what the data challenges and possible solutions are
2. Identify gaps in the enabling environment and how to address them
3. Understand the benefits of implementing FAIR data principles
4. Align on how responsible data sharing can be achieved
5. Identify possible costs that need to be considered

What are the data challenges?

- Data sharing and data quality issues
- Use of different standards and approaches
- There's a need for interoperability and harmonization
- SRI has ISO certification
- A lack of technical expertise available for further stages of data development, such as modeling, developing data-driven information products, and serving data
- It is unclear who the owner of the data is
- Fragmented data between different institutions and sectors
- Limited real-time data and monitoring
- Incomplete data collection
- Lack of centralized or inconsistent data collection
- Legacy data quality issues
- Low capacity of labs
- Need standardized protocols for new data (CSIR-SRI)
- Need data that farmers can easily pick
- Outdated legacy data and outdated methods, but trends guide planning & monitoring

What are the data requirements from a user perspective?

- Emission factors- carbon market ("hot spot")
- Need to prioritise the target end users
- Who is willing and ready to pay?
- Then can broaden scope
- Site specific fertilizer
- Cocoa need info for site specific
- Every year send chemical data to SRI
- Focus more on process rather than data sharing policy
- Incentives for data producers

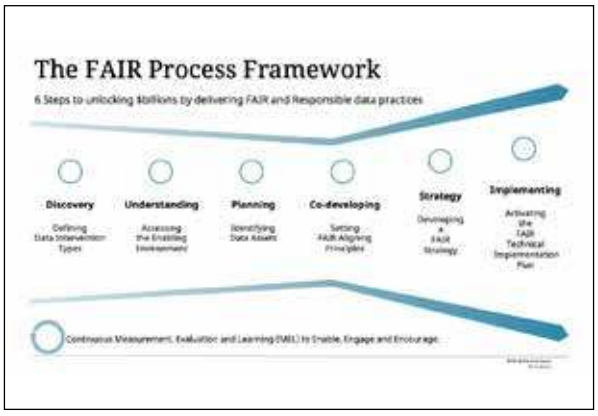
What data policies, strategies and mandates exist?

- Planting for food and jobs 2.0
- Policy for soil (fertilizer act)- soil policy act had started (AGRA)
- SRI mandated- but people go to universities instead of SRI
- CSIR has policy for data sharing (approval process)
- Institutions must make clear their data access structures

How can responsible data sharing be achieved between SIS related efforts?

- Define the data we are sharing – demand driven data
  - Baseline is soil physical properties
  - Expand soil analysis to address the gaps
  - Reponsive to emerging needs
- Outline benefits of sharing from the beginning
- Need a data sharing policy and data governance rules
- Acknowledge data providers
- New soil data collection has to go to SRI- legislation?
- Quality data that's brings value- would be willing to pay
- Agree on what data can be shared openly and freely, and what data can be monetized
- Every new theses to be sent to SRI each year- to adhere to the template provided

How can researchers get hold of available datasets — and avoid creating new datasets which lead to duplications and time-wasting?



How can the FAIR data principles strengthen GhaSIS?

- FAIR principles are useful and can strengthen data sharing to have effective SIS.
- SRI to provide the required data sharing template based on FAIR data principles to the stakeholders.
- Among stakeholders, will be sharing useful soil information. Students research to SRI.
- Research institutions will provide data to address industry needs.

What are the cost implications of implementing FAIR and responsible data practices?

- Digitalisation of data costs
- Technology costs
- New data collection every 5yrs- soil fertility
- MoFA 1% of budget dedicated to this
- Budget prioritisation (agricultural data focus)

- Synthesis of existing information from existing projects

- Role of GenAI
- Ghana statistical centre- funds to draw new soil data to keep GhaSIS updated

Breakout Session 2

Data requirements- MAIN ROOM
System requirements- DROWAA ROOM

14:15 – 15:15

Workshop Ground Rules

1. Everyone participates, so let everyone have a chance to speak
2. Constructive conversations over destructive feedback
3. Be present and open
4. Look forward, learn from the past

Breakout Session 2: System requirements

OBJECTIVES:

1. Review user needs
2. Align on the content and functionalities
3. Address digitalisation needs
4. Review capacity building needs

Knowledge and requirements of the SIS system Frontend software interface selection

Content GhaSIS	Functionalities GhaSIS
1. Metadata and semi processed with clear conversions (variables and components). Metadata source should be indicated for ownership purposes and defined for users 2. Soil maps that can be used by farmers, policy makers – crop suitability maps. 3. Users in end- 4. Fertilisers to use 5. System interprets value and their meaning 6. Translation from english to different languages and audio capability	1. Simple models – crop and geo 2. Algorithms for back-end data for standardized data 3. Protocols for data producers (field and lab analysis) 4. Link to methodologies used 5. Soil classification 6. Fertilizer producers can use data to blend formulations 7. Link to OFRA – FOT tool –

Knowledge and requirements of the SIS system
User interaction

Log in	income
1.Define who to pay eg fertilizer companies, other dont pay eg students and SRF 2. Look at kind of user (researchers, farmers, students etc) and determine/analysis which entity pays, with price variation. 3.	Consider value for money of the system – maybe start with no payment Incentives for data producers, Payment needed for system running costs Adverts to generate income for the system Consider the ability of companies to pay

Knowledge and requirements of the SIS system
Metadata

1. What are GhaSIS digitalisation needs?

2. Does SRI, or another partner (e.g. university of Cape Coast), have the right computational capabilities?

Digitalisation needs	Computational capacities
i. Hosting and licensing ii. Servers and workstations iii. Consideration for storage for big data eg cloud space or link to iSDA or other orgs with cloud services iv. Human resources to meet the needs of SIS for updating information v. Private and public partnerships and diverse experts to work on solutions	i. iSDA can host? ii. Farmerline use T-soko iii. NITA – investigate role that they can play iv. Partnership UMAP to access high computation operations and clusters analysis

Knowledge and requirements of the SIS system
Ongoing efforts

1. What IT or technology-oriented projects are currently ongoing within your organization?

2. Is there a preferred backend and front end for GhaSIS?
for example for catalogue system: GeoNode, GeoNetwork, CKAN, Dataverse, ESRI Geoportal Server...

IT projects	Back-end / Front-end
Link with CSIR- Institute for science and technology, and universities information to investigate of projects. FERARI- IFDC	

Knowledge and requirements of the SIS system
Data management considerations

1. How should GhaSIS capture, manage and organise data?

2. How can GhaSIS ensure my data is secure?

Data management	Security
i. Data protection act and fit in within the framework ii. System registered with data protection commission for protection iii. Restrictions on uploads, usage, sharing, accessibility (data governance), data format eg not share raw data but maps are open access iv. Design of database template for must have key data variables v. Data capture – georeferenced at sampling points vi.	Reliable and secure hosts Implement security measures to prevent hacking and consider hosting with google due to multiple encryptions (cloud storage)

Knowledge and requirements of the SIS system
Data management considerations

1. How can GhaSIS measure its impact?

Impact	
i. Create awareness ii. Accessibility (traffic) and follow up with users iii. Feedback system from various users, and start with a baseline and set up MRV system iv. Agronomic nutrient efficiency depending on the user eg measure yields or soil properties over time v. Dashboard to show traffic vi. Develop strategy with clear KPIs and reporting	

Close of Day 1
16:45 – 17:00

Share your feedback here:

Networking cocktail
17:00 – 20:00

Welcome- Day 2

Ghana Soil Information System Roadmap Workshop

8-9 October 2024 | Capital View Hotel,

Workshop Ground Rules

1. Everyone participates, so let everyone have a chance to speak
2. Constructive conversations over destructive feedback
3. Be present and open
4. Look forward, learn from the past

Reflections from Day 1
08:30 – 09:10

Summary of Data Requirements

Data challenges
- Lack of centralized data repository
- Fragmented data - need for data interoperability and harmonization
- Data management - strengthening internal structures
- Data sharing and data quality issues
- Different standards and methods for soil data measurements - needs standard protocols outlined for GhaSIS
- Limited real-time data and monitoring, e.g. Gen AI, RS
- Incomplete or inconsistent data for some parameters
- Enhance capacity of technical staff to be able to provide quality data

Data requirements from user perspective
- Need to prioritise the target end users:
  e.g. Emission factors- carbon market ("hot spot"), Site-specific fertilizer recommendation, e.t.c
- Who is willing and ready to pay?

FAIR Data principles
- Adhering to FAIR data principles to strengthen data sharing to enhance effective soil information system.

Data Sharing
- Partnership incentives model for data sharing
- Data generators share data annually
- Need for data sharing template based on FAIR data principles to be made available for data generators
- Data generators will provide data to address national and industry needs

Cost implications of implementing FAIR data practices
- Digitalisation of data costs, technology costs
- New data collection every 5yrs- soil fertility
- MoFA 1% of budget to support SIS
- Synthesis of existing information from existing projects
- Ghana statistical centre- funds to draw new soil data to keep GhaSIS updated

Summary of System Requirements

Content SIS:
- Interpretation of soil data for various users, such as policy makers
- Metadata and metadata templates
- Documentation, such as soil sampling protocols
- Link to other relevant data sources, such weather data.

Self-sustain:
- Log in function for different users
- Once system is providing high quality data, ask for small fee
- For data providers, provide incentive

Digitalisation and computational needs:
- Data storage for soil data
- Considering cloud service, such as google
- Private and public partnerships

Security:
- System registered with data protection commission
- Data should follow the data protection act
- NITA – investigate role that they can play
- Restrictions on uploads, usage, sharing, accessibility (data governance)
- Design of database template
- Cloud storage to prevent hacking

Impact:
- Create awareness among stakeholders
- Accessibility (traffic) via a dashboard
- Feedback system from various users and interactions
  - For example: real impact is achieved once policy makers use soil information of SIS
- Agronomic nutrient efficiency

Breakout Session 2

Funding needs (group 1)- DROWAA ROOM
Stakeholder requirements (group 2)- MAIN ROOM

09:15 – 11:15

Funding needs

1. What is the level of commitment from CSIR-SRI? What is needed to attract funding?

1. What is the current and long-term financial commitment from the government to funding GhaSIS?
- MOFA may consider incorporating and funding related objectives
- Staff time commitment by govt, leveraging with fertilizer platform
- Need to know what is required in running the SIS: capital cost expenditure and fixed costs

Funding needs

5. What are CSIR-SRI estimations of the total cost for developing GhaSIS? Have the data and systems costs been factored into these calculations?
- 25 staff highly educated and 7 universities and research institutes, but gradually building up. Set up network; executive secretary position fully funded to start running the project.
- Hard infrastructure – need to be estimated and consider housing at UCC (info dept and agric dept collaboration). Need machinery to train. Opex?
- Soil sampling of coordinated personnel and donor investments (ghana funded) with additional external funding.
- 25% physical; 25% climatic effects eg water and 25% chemical properties and rest 25% from others – to explain yields. What would the soil map communicate? How and who will use the system?
- Consider using new technologies: spectroscopy and drones; remote sensing

Funding needs

7. Are there any immediate funding needs?
- Develop a CN document on needs and actions –
- Fund mobilization committee (use fertilizer platform template and adopt)
- Financial commitment of private sector –
  - AGRA – strategy:
  - IFDC – programmes and projects through institution embedding:
  - OCP – look at synergies of existing programmes to match the objectives:
  - Yara - on-going commitments and beyond
  - CABI: knowledge management of soil health (microbiome –pathogens, weeds/invasives)

6. Are there any overarching funding gaps for specific components of the SIS?

Funding needs

1. What is the level of commitment from CSIR-SRI? What is needed to attract funding?

2. What is the current and long-term financial commitment from the government to funding GhaSIS?

Funding needs

3. What is the current financial commitment from implementing partners to strengthen GhaSIS?

4. Are there any additional funders that should be engaged?

Funding needs

5. What are CSIR-SRI estimations of the total cost for developing GhaSIS? Have the data and systems costs been factored into these calculations?

6. Are there any overarching funding gaps for specific components of the SIS?

7. Are there any immediate funding needs?

Breakout Session 2: Stakeholder Requirements

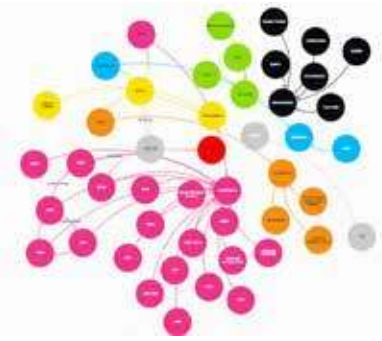
OBJECTIVES:

1. Map the different actors and their roles in the data ecosystem
2. Identify the relationships and value/data exchanges between the different actors
3. Identify areas of existing data flows that could drive new services or improves existing services
4. Identify where changes are needed and what effects these changes might have

Reflections on breakout sessions
11:30 – 11:45

Stakeholder requirements

- Identified the key stakeholders in the data ecosystem using a data ecosystem map
- Categorized the stakeholders as either a:
  - Policy maker
  - Data user
  - Regulator
  - Contributor (data provider, advisory and financial contributions)
  - Beneficiaries
  - Data stewards
  - Intermediaries
- However, noted that particularly for contributors they also played the role of data users
- Identified the flow of value and data exchanges, who funds what
- Identified a need for a technical and governance steering committees
  - Need to establish agreed protocols within the steering committee that will be shared with wider stakeholders
  - The institutions in the committee will have complimentary capacities and skills
- An agreement is needed between CSIR and Universities for future collaboration efforts
- Agreed a second mapping of stakeholders in the broader ecosystem will be needed, such as environmentalist and mining companies



Summary: Funding needs

Commitment of CSIR- SRI

- Need for visibility especially the website to updated with content in order to attract funding
- Endowment funds
- Continue with current structures for GhaSIS and improve on it

Current and long-term financial commitment from the government

- MOFA may consider incorporating and funding related objectives
- Staff time commitment by govt, leveraging with fertilizer platform
- Work with estimates for running the SIS: capital cost expenditure and fixed costs

immediate funding needs

- Develop a CN document on needs and actions –
- Fund mobilization committee (use Fertilizer Platform Ghana (FPG) template and adopt)

additional funders commitments

- Financial commitment of private sector
  - AGRA – strategy:
  - IFDC – programmes and projects through institution embedding:
  - OCP – look at synergies of existing programmes to match the objectives:
  - Yara – on-going commitments and beyond
  - CABI: knowledge management of soil health (microbiome- pathogens, weeds/invasives)

Short-term Funding Needs (1-3 years)
1. Personnel and operational costs: $200,000 - $500,000
2. Soil data collection and analysis: $300,000 - $700,000
3. GIS software and hardware: $50,000 - $150,000
4. Training and capacity building: $20,000 - $50,000
5. Website development and maintenance: $10,000 - $30,000

Medium-term Funding Needs (2-5 years)
1. Expansion of soil data collection: $500,000 - $1,500,000
2. Development of mobile apps: $50,000 - $150,000
3. Integration with other agricultural databases: $100,000 - $300,000
4. Research and development: $200,000 - $500,000
5. Stakeholder engagement and outreach: $50,000 - $150,000

Long-term Funding Needs (5+ years)
1. Sustainability and maintenance: $500,000 - $1,000,000
2. Scaling up to national level: $1,000,000 - $3,000,000
3. Integration with regional and global soil information systems: $200,000 - $500,000
4. Development of decision-support tools: $300,000 - $700,000
5. Human resource development and capacity building: $200,000 - $600,000

Potential Funding Sources
1. Government of Ghana
2. International donor agencies (e.g., USAID, EU, World Bank)
3. Private sector companies (e.g., agricultural, IT)
4. Foundations and philanthropic organizations
5. Research grants and academic institutions

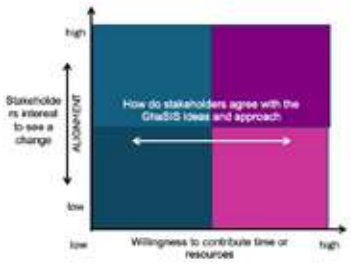
Funding Mechanisms
1. Grants
2. Contracts
3. Public-Private Partnerships (PPPs)
4. Corporate Social Responsibility (CSR) initiatives
5. Crowdfunding

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%)

GhaSIS Partnership Notes

- Need representatives of all of the value chain at national level
- The key role of the partnership is to ensure financial sustainability of the SIS
- Need to delve into what all the different stakeholders' interests are and understand what information they need
- A business model expert is required to look at the scope and services in a partnership agreement
- Need to strategically line the SIS up with what key stakeholders' agendas are. For example, what data can serve the needs of impact (PI)
- Need legal experts to participate in the partnership to support responsible data sharing
- The partnership should enhance collaboration between the different stakeholders- even beyond the stakeholders in the partnership, e.g. extension services, policy & advocacy
- Need to think what capacities are needed for the partnership
  - INSTI responsible for information dissemination, app & platform development
  - CSIR- policy issues
  - Ghana meteorological agency- weather data input is required
  - To expand to private sector
  - Local and national perspectives (fertilizer)
  - Software developers
  - MoFA directorate

STAKEHOLDER MAPPING



Roadmap Planning
13:45 – 14:45

Roadmap Planning - DROWAA ROOM

What's needed? What's next? Who will do what?

6. **Financial sustainability plan** – steering committee from all expertise (research institutions and Universities)will set up the plan.
Composition of steering committee – Academia related to soil and ICT, research institutions, Ministries of finance, Agric, MESTI, Lands and NARS, and Education, NTA, IFDC, AGRA, Fertilizer council (Yaku seats in all fertilizer groups) that includes multinationals and national fertilizer companies (OCP and Yara), A rep from Development partner network, legal entity, Smallholder farmers associations, cocoa board, soil science society
"Option of strengthening the fert platform committees already existing instead of creating a new one?
Research Inst and Universities – grants for project will update the SIS
- Lead partners on CN is CSIR-SRI (Dr. Yeboah with Eric Nartey, Andrews Opoku, Asif Alari, +Dr. Solomon Ansah for review)
- Beneficiaries - such as product developers –
- CN- justification of GhaSIS, introduction (Problem statement, justification, objectives, finances needed, and why SIS), gaps and opportunities, Outcomes - what problems does SIS solve - measure agriculture productivity, what SIS will generate in financial terms and indirect gains (e.g. productivity)
- Form an interim committee before the steering committee?

7. Organisational plan (people plan, capacity building, marketing and engagement)
Organogram – ISRIC/CABI share Ethiopia experience and structure
ToRs will define the sub-committees
Use of excel as a guideline

8. Long-term operation
Steering committee –
Platform has feedback mechanisms, with interactive platform and chats
Self-sustaining mechanisms will high quality data
Soil science society involvement? Still to contact executive committee before the AGM

Roadmap Planning - MAIN ROOM

What's needed? What's next? Who will do what?

1. Aligning on mission and definition of SIS
2. Partnership for GhaSIS
3. Co-developing a Theory of Change
4. Data strategy for GhaSIS
5. SIS design plan (front and back-end) that meets user needs
6. Financial sustainability plan
7. Organisational plan (people plan, capacity building, marketing and engagement)
8. Long-term operation

Roadmap Planning - MAIN ROOM

1. Aligning on mission and definition of SIS
Working document to be sent round to the stakeholder from CSIR SRI to get their inputs

2. Partnership for GhaSIS

- **5-member steering committee (governance),** strategy direction, review progress, resource allocation, outreach
  - Develop legal framework that guides committee (process of selection, duration etc)
  - Temporary structure/membership (3-6 months) to oversee setting up system
- Private sector- YARA/OCP (local representative)
- Research Institutes- CSIR
- Public sector- MoFA
- Funders- AGRA- to be discussed
- NGOs/CSO- Fertilizer platform Ghana
- Co-chairs (rotational chairmanship bi-annually)
- Secretary (coordination)

- **Technical committee be a wider group- ~7 people**
- Director SRI (data analysis)
- Fertiliser companies (international and local)- chemist,
- President soil science society
- IT experts- Director INSTI (GIS expertise)
- Soil experts- Universities reps
- MoFA- extension directorate (DAES)

Roadmap Planning - MAIN ROOM

What's needed? What's next? Who will do what?

Activities for the partnership:
- SRI to lead on ToR for steering and technical committee by EOD
- Which individuals are the best representatives from their organisation that meet required needs for the committee
- Kick off meeting to agree on timelines
- Legal framework
- Comprehensive review gaps in current state of GhaSIS and capacity gaps- review report
- Data sharing agreements between stakeholders

Checklist to be shared with wider stakeholders

Roadmap Planning - MAIN ROOM

What's needed? What's next? Who will do what?

4. Data strategy for GhaSIS
- Technical committee to do (reporting to steering committee)
- Technical committee agree on protocols
- 3-6 months deadline

5. SIS design plan (front and back-end) that meets user needs
- Technical committee- User needs assessment is needed and further stakeholder engagement
- Mobilise resources in order to do this

Roadmap Planning - MAIN ROOM

What's needed? What's next? Who will do what?

6. Financial sustainability plan
- Steering committee's responsibility
- (6months deadline)

7. Organisational plan (people plan, capacity building, marketing and engagement)
- Steering committee responsible for this

8. Long-term operation
- Steering committee responsible for this

- MoFA co-chair but not required for final approval of steering committee's plans
- Quarterly meetings to review plans- everyone has same level of approval

Roadmap Planning - DROWAA ROOM

What's needed? What's next? Who will do what?

4. Data strategy for GhaSIS
Data sharing principles and committee formulate the policy

5. SIS design plan (front and back-end) that meets user needs
Friendly platform –hire website designers, technical committee, end users (private sectors and farmers and other service providers)
- (NST) to lead the development of design

Share your feedback here:

CABI ISRIC

Workshop complete- thank you!

Are you ready for the next steps to strengthen GhaSIS?

BILL & MELINDA GATES *foundation*

gatesfoundation.org

A framework for strengthening soil information system design

Scan the QR code to access the framework for sustainable national soil information systems

Background

Many initiatives have been developed across Africa to organize new and existing soil information by developing Soil Information Systems (SISs). These aim to make soil data available to potential users through an online portal, service, or website, and are often assisted by the development of innovative data collection, modelling and digital soil mapping techniques. SISs help users by sharing data and information on soil health, which can then be used to make more informed decisions about agricultural and environmental practices, and for land use planning. The investments in data generation and infrastructure have enabled large strides towards improving soil health and farmer livelihoods.

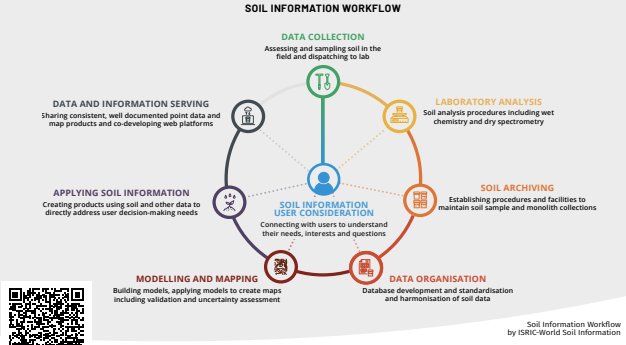
Although the value of these assets and technologies are well-recognized by soil experts, there is a need to encourage greater intentionality and efficiency in the development of data assets, and to be more responsive and adaptive to local demand for soil information. National support, ownership of SIS development, and alignment with user needs can be improved in many existing SIS cases. Several constraints also limit the
interventions, including capacity gaps, data quality and stan
funding, data security and privacy, the national legal and po
resources, technical infrastructure and equipment.

The Project

Soil Information Systems Review project is a collaboration bet
Information, funded by the Bill & Melinda Gates Foundation. T
a comprehensive review of several existing SISs to understand
have worked, have not, which solutions work best and w
The project team interviewed SIS developers in nine countries
SIS enabling environment, focusing on several social, financial
findings revealed that the following aspects are significant for

1. Understand the **value model for soil data** and how it contributes to stakeholders' decision processes
2. **Benchmark new SIS initiatives on any ongoing related efforts** and on existing and legacy soil data
3. Build **long-t buy-in amo national pa** and support **SIS champi coordinate** stakeholder

The project has also developed a detailed review of methods, standards and tools for all steps of the Soil Information Workflow to aid the design of a sustainable and user focused SIS that fits the enabling environment of a country.



Soil Information Workflow by ISRIC-World Soil Information

Scan the QR code to access the technical report on Development Options for a Soil Information Workflow and System.

Using these insights, the project team has developed a framework for strengthening national SIS design, that takes a human-centered approach to SIS intervention design and consists of practical steps and tools to guide the various stakeholders involved, such as soil data practitioners, SIS users and SIS producers, to ensure the development of a successful and sustainable SIS. The framework is available on ISRIC's Resource Library at https://resources.isric.org/sis-framework/

The project team have applied the framework in Zambia and together with FAO, ZARI, UNZA and many other key stakeholders, have co-developed a roadmap towards the sustainable intervention design of ZamSIS. The initiation phase of the framework was also tested and validated with KALRO for the development of KenSIS. The project team will now facilitate a workshop in Ghana with CSIR-Soil Research Institute and other key stakeholders to co-develop a roadmap to strengthen GhaSIS. Insights from this process will then contribute to a refined replicable framework for strengthening national SIS design. This will lead to fit-for-purpose soil information solutions and, ultimately, greater impacts.

The goals of this project are to:

1. Understand the **enabling environment** for developing soil information services
2. Build an **evidence base** that clarifies:
   What works?
   What needs improvement?
3. Establish clear guidance on the **technical options** for developing soil data assets
4. Develop an evidence-based **framework** for improved SIS intervention design
5. Test and refine framework by developing SIS **roadmaps** with two target countries
6. Communicate and discuss with the global **soil data community**

Institution	Role in GhaSIS
FARMERLINE	Data users
Asdeve Consult	Data users
CSIR-SOIL Research Institute	SIS Owners
CSIR HEAD OFFICE	Policy
IFDC/FERARI	Data producers
CRIG	Data providers
MoFA (crop services)	Enabling environment
OCP	Data producers
CSIR-SOIL Research Institute	SIS Owners
CSIR-SOIL Research Institute	SIS Owners
CSIR-INSTI	Service providers
CSIR-SARI	Data producers
SOLIDARIDAD	Data Users
IFDC/FERARI	Data producers
University of Cape Coast	Data producers
MoFA	Enabling environment
Fertilizer Platform Ghana	Enabling environment
ISDA	Service providers
ISRIC	Data providers (CoP)
OCP	Data producers
KNUST	Data producers
CADER	Data users
FARA	Enabling environment
CSIR-SOIL RESEARCH INSTITUTE	Organisers
University Of Ghana, Legon	Data producers
AGRA	Funders
FAO	Data producers and funders
World Bank	Funders
African Development Bank	Funders
GIZ	Funders
IITA	Data producers
AFAP	Enabling environment
Food System Resilience Project (FSRP)	Enabling environment
FERTILIZER COUNCIL	Policy
YARA	Data users
CABI	Organisers
ISRIC	Organisers

Annex IV: Data sharing templates

"INSERT PROJECT NAME" Data Sharing Agreement Template

Version number – Date (DDMMYYYY)

(Note: This document uses color code throughout. As a quick reference:

wording in black font means standard words that can be used when drafting the final DSA;

wording in blue font: text that would need drafting by the parties to the DSA;

wording in green: comments, suggested text to consider, aspects directly pertinent to "INSERT PROJECT NAME" (Please note that some of these aspects are specific to a Gates Foundation investment, and so will need to be carefully considered when using the template in another context); and

wording in golden font: recommendations, aspects that might apply in case DSA is used with third parties.

Text in blue, in green and in gold should be deleted prior to executing the DSA.

Please, delete this note prior to executing the DSA).

Disclaimer: This document is created as a template resource setting out a broad set of provisions that can typically be incorporated into a data sharing agreement. It is categorically stated that this document is merely indicative and not prescriptive. Any use of this resource to draft a data sharing agreement should be vetted by local legal professionals to ensure nothing contained in such data sharing agreements is contrary to local laws and regulations, and is aligned with general legal practices in the applicable jurisdiction. It is also clarified that use of, and/or access to, this document, or any of the links or resources embedded within it, does not in any way create an attorney-client relationship, nor creates any legal obligations or liabilities either for CABI or the Gates Foundation.

	Specific Terms
1. Parties	This Data Sharing Agreement ("Agreement") is made by and between
	1.1. Full Name of Party 1 organization, [insert brief description of nature/type of organization], [insert legal details: incorporation place, registration number, etc.], having its registered office at [insert official physical and mailing address], hereinafter [insert "short name"].

	1.2. Full Name of Party 2 organization, [insert brief description of nature/type of organization], [insert legal details: incorporation place, registration number, etc.], having its registered office at [insert official physical and mailing address], hereinafter [insert "short name"].
	1.3. Add parties as applicable Where, [insert each party's short name] is also referred to individually as a "Party" and collectively as "Parties", and [insert applicable Party(ies) name(s)] shall act as the "Provider" and [insert applicable Party(ies) name(s)] as the "Recipient" in this Agreement. This Agreement is effective (Choose between option a. or b., and delete option discarded prior to execution of this agreement) a. [once duly signed by each and all Parties and as of the date of last signature] ("Effective Date") OR b. [as of [DAY][MONTH][YEAR] ("Effective Date")
2. Recitals or Background	**2.1. Whereas** this Agreement is under the project [insert full name or the project], hereinafter the "Project", governed by the [insert reference to grant agreement] between [insert names of the parties to grant agreement], [insert any identifier/no./code for such grant agreement and the effective date], and... [introduce or provide brief description of any previous related legal agreement(s) that cover(s)/are directly related to the present data sharing agreement].
	2.2. Whereas [Party 1 short name] [insert brief description of what this party does and the role it plays/will play under the present data sharing agreement].
	2.3. Whereas [Party 2 short name] [insert brief description of this Party 2 as done for Party 1].
	2.4. Whereas [add short Party's name and description for each of the parties as applicable].
	2.5. Whereas [briefly state what all the parties aim to achieve/to do under this data sharing agreement. This could be a general statement of the purpose of the agreement ("the Purpose").
	2.6. Whereas (add any specific concessions or exemptions that may need to be created, for example, exemption from licence fee for access to data, or any other consideration that has been agreed to, among the Parties).

	2.7. Now, therefore, the Parties hereby, intending to be legally bound, agree to share Data according to these Specific Terms, the General Terms and Conditions (GTC) contained in Annex 1, and any other Annexes or Schedules, which as a whole are an integral part of this Agreement.
3. Responsible contact persons	For the purposes of this Agreement, the responsible persons and point of contact shall be: For **[Party's 1 short name]**: Name: [Insert] Job Position: [Insert] E-mail: [Insert] Telephone: [Insert] Correspondence address: [Insert as needed; specially if different from the official physical/mailing organization's address] For [Party's 2 Short Name]: Name: [Insert] Job Position: [Insert] E-mail: [Insert] Telephone: [Insert] Correspondence address: [Insert as needed; specially if different from the official physical/mailing organization's address] Add each of the Parties as applicable. The Parties shall notify each other about any changes in the Responsible Contact Person(s) within [insert number in letters (number) working days] of the effective change.
4. Data	The definitions of "Data", "Metadata", "Personal Data"... [add any other definitions as applicable] are as per the GTC in Annex 1, unless hereby modified and as agreed by the Parties. **[Party's X short name]** [insert as many Parties as applicable] as [a] Provider disclose(s) and provide(s) the Specific Data to **[Party's X short name]** [insert as many Parties as applicable] as [a] Recipient, as described in **Schedule A**. Time schedule for provision of the Specific Data as well as the format and mode of transfer is also provided in **Schedule A**.

5. Authorized use of Data	5.1. The Parties commit to … insert general statement and reminder of the Purpose of the agreement, [and the goal of "INSERT PROJECT NAME", re-stating such a goal, as needed].
	5.2. Pursuant to achieving the Purpose [and the overall "INSERT PROJECT NAME" goal], the Parties have adopted… [you may mention principles, governance framework, data management plan, etc., that are recognized by all the parties involved] [the Global Access vision (i.e., if Gates Foundation are the funder),] which is [insert wording on the Global Access vision as applied to the Project (if relevant)], and all the elements of [the "INSERT PROJECT NAME" Data Governance Framework], if it exists, including [any project FAIR Aligning Principles].
	5.3. Recognizing the above, and in addition to "Access and Use of Data" as per the GTC, the Provider(s) grant(s) the Recipient(s) the rights to use the shared Specific Data for the activities as described in **Schedule B**. Parties may discuss and agree upon additional uses to the Specific Data that may arise during the implementation of this Agreement. Any mutually agreed additional or variations in use will be in writing and described in **Schedule B**.
	5.4. The Recipient(s) is/are allowed to download/ upload, process, analyze, mix, adapt and transform the shared Specific Data to carry out the agreed activities in **Schedule B** [and to generate the agreed Outputs / Results/Deliverables of "INSERT PROJECT NAME", if relevant].
	5.5. The conferred rights of use are for [insert project purpose, e.g., research and development purposes] [within the scope of the Purpose and "INSERT PROJECT NAME"]. [Commercial purposes], as defined in the GTC, are not contemplated. A separate agreement shall be needed among the Parties for such purposes.
	5.6. Where the "INSERT PROJECT NAME" Lead Grantee or a member of the "INSERT PROJECT NAME" Centralized Function is the Recipient of Data in addition to any of the allowed uses mentioned above, it shall be allowed to: 5.6.1. Share the Data with other members of the Centralized Function for analyses and for the generation of outputs according to "INSERT PROJECT NAME" goals, including cross-country analyses, if relevant. 5.6.2. Share the Data with the "INSERT PROJECT NAME" Founder as relevant.

	5.6.3. Upload and display the "Result/Output Data" in a portal accessible to the public, subject to Specific conditions on Data and on Results use, as applicable and described in this Agreement. 5.6.4. Curate, clean and improve annotation of Data, as needed 5.6.5. Strip of Personal Data by anonymization, pseudo anonymization or any other suitable method or approach, as needed 5.6.6. Disclosure or publish "Result/Output Data", subject to Specific conditions on Data and on Results use, as applicable and described in this Agreement
6. Specific conditions on Data	Subject to articles "X", "Y", "Z" of the GTC, the use of the Data shared by the Parties is subject to additional conditions as specified in **Schedule C**.
7. Specific conditions on Result/ Output Data	Subject to articles "X, "Y", "Z" of the GTC, [the "INSERT PROJECT NAME" Grant Agreement] [and any sub-agreements between Parties], the use of the Result/ Output Data generated by the Recipient(s) is subject to 7.1. [No further conditions]; OR 7.2. [additional conditions as specified in **Schedule D**]
8. Disclosure/ Publication of Data	Subject to articles "X", "Y", "Z" of the GTC, [and the "INSERT PROJECT NAME" Data Sharing Policy, if one exists], the Parties agree to:
	8.1. Attribution of shared Data used in Result/Output Data should follow citation requirement as per defined by Provider or agreed by Parties, and described in **Schedule E**.
	8.2. [Where multiple sources of Data (e.g., from various "INSERT PROJECT NAME" Partners or Parties to the agreement) are used to generate Result/Output Data]
	8.3. [As appropriate, use of standard machine-readable licenses (e.g., CC) for Result/Output Data]
	8.4. [If needed - Bespoken license for a specific Result/ Output Data]
	8.5. [Protocol for varied types of publications and peer-reviewed publications]

9. Privacy protection	[Note: Applicable in case personal information and or proprietary/sensitive information of a third party is a part or is as a whole the type of data shared. This is issue may have been dealt with further in the project's Data Governance documents] Subject to data privacy protection laws and regulations that may apply as well as clause 9 of the GTC, the Parties agree with respect to the Personal Data: 9.1. [There are no additional conditions]. OR 9.2. [insert any specific additional conditions that might apply to the Personal data; e.g., specific regulation or measure to apply]
10. Costs	10.1. [The Parties agree that the costs associated with the transfer, receipt, management and use of the Data are covered by the item [insert item name] of the budget part of the ["INSERT PROJECT NAME" Grant agreement] [Sub-agreement "X"] [Subcontract "X"] as relevant. OR 10.2. [Each of the Parties shall bear its own expenses in connection with the sharing of Data under this Agreement.] OR 10.3. [In consideration to the expenses incurred by the Provider Party in the preparation and transfer of the Data, the Recipient Party agrees to pay for such costs the amount of [X].
11. Duration of Agreement	This Agreement shall come into force and effect on the Effective Date as consigned on the section 1 of these Specific Terms and shall remain in force and effect for a period of [Letter](number) [MONTHS][YEARS] from the Effective Date, unless terminated earlier according to clause "X" of the GTC.
12. Counterparts and Signatures	12.1. The Parties may execute this Agreement in counterparts, including facsimile, PDF, and other electronic copies, which taken together will constitute one instrument. A facsimile or PDF of an original signature transmitted to the other Party is effective as if the original was sent to the other Party.
	12.2. This Agreement supersedes and replaces any other verbal or written agreement previously entered into by the Parties to this Agreement on the same subject matter.

	12.3. On signing this binding agreement, the Parties acknowledge and agree to abide by the Specific Terms as set out hereby, by the General Terms and Conditions as stated in Annex 1 of this agreement, and any other Annexes or Schedules included. [Note: to be signed by duly authorized representative of Party] On behalf of [Entity's full name] Signature:.....[Insert] Name (in print): .....[Insert] Position:.....[Insert] On behalf of [Entity's full name] Signature:.....[Insert] Name (in print): .....[Insert] Position:.....[Insert]

Annex 1

General Terms and Conditions

(Note: This document uses color code throughout. As a quick reference: Wording in black font means standard words that can be used when drafting the final DSA; wording in blue font: text that would need drafting by the parties to the DSA; wording in green: comments, suggested text to consider, aspects directly pertinent to a specific Gates Foundation Investment (so will need to be carefully considered when using the template in another context); and wording in golden font: recommendations, aspects that might apply in case DSA is used with third-parties. Text in blue, in green and in gold should be deleted prior to executing the DSA. Please, delete this note prior to executing the DSA)

The following General Terms and Conditions are incorporated by reference in, and shall form an integral part of, the Specific Terms, which as whole and together with any other pertinent annexes form the Data Sharing Agreement ("Agreement"). The Specific Terms and the General Terms and Conditions govern the access, transfer, management and use of Data among the parties of the Agreement. In the event of conflict or inconsistency between the provisions of these General Terms and Conditions and the Specific Terms, the latter shall prevail.

1. Definitions

(Parties may wish to define some of the following terms, if not already defined in precedent related agreements -e.g., "INSERT PROJECT NAME" Grant Agreement, Sub-agreements, and/or in the "INSERT PROJECT NAME" Data Governance Policy, if these documents exist. It is suggested to define terms only as needed and used in "INSERT PROJECT NAME" or applicable to "INSERT PROJECT NAME" related endeavors, avoiding terms that may be superfluous or redundant. Apart from the terms that may have been mentioned in the project-specific Data Governance Framework, if it exists (e.g., "Data", "Confidentiality" (or "Confidential Information"), "Metadata, "Personal Data"), terms that you may wish to define, include:)

1.1. Artificial Intelligence (in case the data being shared is for AI modeling and development)

1.2. "Confidential Information"

1.3. "Commercial Purposes"

1.4. Creative Commons Licenses (in case the data or content to be shared is covered by it)

1.5. Force Majeure (acts of God and unforeseeable disruptions that can render a contract voidable)

1.6. Intellectual Property

1.7. "Intellectual Property Rights"

1.8. "Provider"

1.9. "Recipient"

1.10. "Inputs"

1.11. "Outputs/Result Data"

1.12. Subcontractors (third parties used by either party for performing their obligations under the DSA).

2. Principles

(Parties working in "INSERT PROJECT NAME" may wish to include high-level principles that would guide and be the benchmark for working in the project or "INSERT PROJECT NAME" related endeavors, as well as any project-specific FAIR Aligning Principles. These high-level principles and the FAIR Aligning Principles should be part of the "INSERT PROJECT NAME" Data Governance Policy, if it exists. By inserting principles upfront, Parties would likely emphasize that whatever is done in terms of data sharing and use would need to be compatible with the stated principles).

2.1. High-level responsible data Principles

2.2. FAIR Aligning Principles

3. General Responsibilities of the Parties

(The following clauses refer to responsibilities that are usually expected from any party entering into a binding agreement. Parties may add or delete as applicable. The sentence in blue font in each of the clauses gives an indication of the possible specific responsibility. Indicative wording for each of the clauses is provided in the Supporting Guidance)

3.1. Re. Authority to enter into agreement and comply with requirements

3.2. Re. Working diligently to carry out activities, produce the results according to terms and conditions

3.3. Re. Having and maintaining (or seeking) the skilled personnel needed to carry out the activities and fulfill the terms of the agreement

3.4. Re. Maintaining regular communication to assess progress and/or accomplishment of agreed activities or purpose

3.5. Re. Any subcontractors engaged to carry out some or part of the activities are bound by the terms of the agreement. The party who engages subcontractors would be responsible for making this happen and would remain solely responsible for its obligations under the agreement.

3.6. Re. Ethical behavior

3.7. Re: ensuring compliance with local laws and regulations

4. Responsibilities of a Provider

(The following clauses refer to responsibilities that are usually expected from a party that shares, provides or transfer data ("Provider") in a binding agreement. Parties may wish to add or delete as applicable. The sentence in blue font in each of the clauses gives an indication of the possible specific responsibility. Indicative wording for each of the clauses is provided in the Supporting Guidance, as needed; also this list is indicative and may be added to or modified as necessary)

4.1. Re. Metadata.

4.2. Re. Due diligence by provider party and communicating so to recipient (e.g., restrictions on data use given by law, institutional policy or other regulatory framework; third-party rights or third-party conditions applicable to data; prior informed consent/ethics related approvals, etc.)

4.3. Re. Defining citation and acknowledgement, if applicable, for provided Data

4.4. Re. Applying anonymization, pseudo-anonymization to remove personal identifiers, to the extent possible

5. Responsibilities of a Recipient

(The following clauses refer to responsibilities that are usually expected from a party that shares, provides or transfer data ("Provider") in a binding agreement. The sentence in blue font in each of the clauses gives an indication of the possible specific responsibility. Indicative wording for each of the clauses is provided in the Supporting Guidance, as needed; also this list is indicative and may be added to or modified as necessary)

5.1. Re. Abide by the Authorized use and specific conditions on Data according to the Specific Terms

5.2. Re. Refrain from re-identification of individuals, people, etc. by any means

5.3. Re. Bear sole responsibility for Results/Outputs, in case Provider of data is not involved in generation of Outputs

5.4. Re. Follow attribution, citation and acknowledgments as defined by Provider, or as agreed by the Parties

5.5. Re. Unless otherwise agreed by the parties, no re-transmission, no further transfer, no distribution, and not making available received/shared Data

5.6. Re. Protection of confidential/under temporary restriction data; If required by law to disclose data that is under temporary restriction periods/ confidentiality/sensitive personal info, to notify provider of the need of such disclosure, and use best efforts to limit the nature and scope of required disclosure

5.7. Re: not violating and ensuring its subcontractors don't violate any IP rights held by the Provider.

6. Access and Use of Data

(While Specific Terms would contain details on access and allowed uses of the particular data shared, this section is meant to contain more general terms on access and use that would apply to any type of data sets shared/worked under the agreement. If precedent related agreements such as the "INSERT PROJECT NAME" Grant Agreement or project sub-agreements exist, and if they contain already conditions on this aspect, this section could refer to those terms or re-insert them here. Conditions may be deleted or added as applicable. The sentence in blue font in each of the numerals gives an indication of the possible specific condition. Indicative wording for each of the clauses is provided in the Supporting Guidance)

6.1. Re. Following the Principles (as described in clause 2 of these GTC).

6.2. Re. Parties' access and use of the Data is for the stated Purpose.

6.3. Re. Explaining how the rights of use will apply to the recipient party.

6.4. Re. Maintain accuracy and integrity of Data during transfer, access, use and disclosure

6.5. Re. Provide supporting tools, protocols or any other background information relevant to the data.

6.6. Re. Follow applicable laws (national/international) and institutional policies on protection of human subjects (e.g., Interviews, surveys) and data

6.7. Re. Follow applicable laws/regulations on Personal Data Protection

6.8. Re. Abide by temporary restrictions periods and confidentiality for both shared data and results

6.9. Re. protection of data from loss, misuse, and unauthorized access, etc., according to nature and sensitivity of data.

6.10. Re. General statement regarding striving for the use of standard licenses as much as possible.

7. Publications and Disclosures

(While Specific Terms would contain details on publication/disclosure for the particular data shared or results obtained from such data, this section is meant to contain more general terms on publications that would apply to any type of data sets shared/worked under the agreement. If precedent related agreements such as the "INSERT PROJECT NAME" Grant Agreement or project sub-agreements exist, and if they contain already terms on this aspect, this section could refer to those terms or re-insert them here. Other conditions may be added as applicable. The first paragraph in black font below can be used as a model of a standard introductory paragraph, where alluding to a project-specific Data Governance Policy, would be decided by the "INSERT PROJECT NAME" parties. The sentence in blue font in each of numerals gives an indication of the possible specific condition. Indicative wording for each of the numerals is provided in the Supporting Guidance)

In addition to any specific publication and disclosure schema and data management plan devised and agreed by the Parties [as part of a project-specific Data Governance Policy] and/or described as part of the Specific Terms of this Agreement, the Parties commit:

7.1. Re. Prompt disclosure/publishing

7.2. Re. Observe applicable Temporary restriction periods and confidentiality before disclosure or publication.

7.3. Re. Make metadata always available, regardless of temporary restrictions or confidentiality

7.4. Re. Attribute and give explicit credit to sources of Data (if used in an AI model output, adequate technical measures should be in place to clearly attribute the source of Data used in generating such an output)

7.5. Re. Follow prescribed requirements on acknowledgements of funders

7.6. Re. Follow authorship widely accepted standards in the field

7.7. Re. Recognize and uphold moral rights of authors and creators

7.8. Re. Use of logos, brand names, names of parties only with previous and written authorization

8. Ownership of Data and IP Rights

(If conditions for data ownership and intellectual property rights are spelled out in the "INSERT PROJECT NAME" Grant Agreement and "INSERT PROJECT NAME" sub-agreements (if they exist), "INSERT PROJECT NAME" Parties should follow such terms when entering into a DSA for "INSERT PROJECT NAME". This should occur even if at least one of the parties of the DSA is a party to the "INSERT PROJECT NAME" Grant agreement or to project sub-agreements (if they exist). Otherwise, "INSERT PROJECT NAME" parties may end up without the entitlements over the data and results that they were supposed to have under the project, and this may jeopardize achieving the goals and outputs of the project. If data ownership and intellectual property rights are not fully settled in such agreements, Parties may consider the following example conditions to define these aspects, even in addition to the conditions in such agreements as long as they are compatible. The sentence in blue font in each of the numerals below gives an indication of the possible specific condition. Indicative wording for the numerals is provided in the Supporting Guidance)

8.1. Re. Sole owners of Data obtained and/or generated independently by a Party.

8.2. Re. Duty to disclose third-party rights to the Data.

8.3. Re. Upholding third-party rights.

8.4. Re. Sole or Joint ownership of results.

8.5. Re. Rights of use of results stated as a "license" (e.g., how the rights of use will apply).

8.6. Re. Rights of parties under joint ownership.

8.7. Re. Parties deciding on copyright and other types of intellectual property rights.

9. Confidentiality and Data Privacy

(Parties of the DSA should follow confidentiality and data privacy conditions according to the "INSERT PROJECT NAME" Grant agreement and any "INSERT PROJECT NAME" sub-agreements, if such terms are there. This clause could re-state the terms of such agreements or refer to them. Parties may add more terms as needed. It is better to define "Confidential Information" and "Personal Data" at the beginning of this agreement as part of section 1 of the GTC and use such terms with the understanding that such definition is the one used, if not previously defined in the mentioned "INSERT PROJECT NAME" agreements. The sentence in blue font in each of the numerals gives an indication of the possible specific term. Indicative wording is provided in the Supporting Guidance)

9.1. Re. Labelling of confidential information or informing its nature verbally. No further disclosure.

9.2. Re. Result/Output Data treated as Confidential Information until disclosure or publication.

9.3. Re. Temporary restriction [or protection] period applicable to Data and its finalization.

9.4. Re. Personally Identifiable Information (PII) or Personal Data {Note: include here a definition for PII or Personal Data only in case the term is not defined in clause 1 "Definitions" of this GTC}:

9.4.1. Re. Abide by any national, regional and/or international data privacy laws and regulations.

9.4.2. Re. Maintain any Personal Data as "Confidential Information".

9.4.3. Re. Management while in use.

9.4.4. Re. No disclosure, neither publication

9.4.5. Re. Use anonymization and technical standards in line with best industry practices.

9.4.6. Re. Maintain the "Confidential" character of Personal Data always.

9.4.7. Re. Advice staff and contractors on the conditions of use.

9.4.8. Re: data security audits may be prescribed to ensure periodic review of measures in places to protect sensitive and personal Data

9.4.9. Re: Report of any data breach to the Provider and damage mitigation measures that should kick in.

9.5. Re. Survival of the conditions.

10. Disclaimer and Warranty

(Clauses for these aspects have a standard wording depending on whether the parties accept or not the responsibility of providing warranties and therefore are liable for them. In general, parties in research agreements do not provide warranties for data, materials, tools or any other elements exchanged, generated and used. Each of the parties bears its own responsibility for their use. Assuming that this is the case for "INSERT PROJECT NAME", the following sentences in blue font correspond to terms typically used in R&D projects. Indicative wording for each of the numerals is provided in the Supporting Guidance. Parties may choose different wording to suit their needs).

10.1. Re. No representation, no warranty as to fitness or merchantability. Data is provided "AS IS".

10.2. Re. No representation as to third party rights.

10.3. Re. Recipient solely liable for use of Data.

10.4. Re. No Party is responsible to any other Party for losses, except in case of confidentiality breach.

10.5. Re. Each Party is liable for any loss, damage or injury to third parties.

10.6. Re. No limitation on liability if there is gross negligence.

11. Termination

(This DSA should follow or be according to the termination conditions applicable to the "INSERT PROJECT NAME" Grant Agreement and any "INSERT PROJECT NAME" Sub-agreements. Parties could refer to them or re-write them. Parties may add other terms as necessary. The sentence in blue font in each of the numerals are examples of conditions generally used for termination of agreements. In addition, Parties may specify the effects of such termination in the sharing of data and operation of the project. Some of the possible effects of termination that Parties might consider are also in blue font. Indicative wording is provided in the Supporting Guidance)

11.1. Re. Mutual agreement suspension or termination with notice.

11.2. Re. Immediate termination with notice in the following situations:

11.2.1. Re. Breach not capable of being remedied within prescribed time duration (say 24 or 48 hours).

11.2.2. Re. Breach that capable of remedy is not remedied within prescribed time duration (say 24 or 48 hours).

11.2.3. Re. Force majeure makes party unable to meet its obligations; or

11.2.4. Re. Insolvency, bankruptcy.

11.3. Effects of Termination: On expiration or anticipated termination of this Agreement for any reason:

11.3.1. Re. Access and use of Data [ceases], except for the use of Result/Output Data as provided in the Agreement.

11.3.2. Re. Provider may request return of shared Data, and stipulate the deletion, destruction

and purging of actual shared Data, or its backup copies from the systems of the Reciepient and any sub-contractors used by it. Provider may consider a written confirmation or other proof of such removal and destruction of its shared Data from the Receipient. Recipient should comply within [number] days of receiving written request.

11.3.3. Re. Confidential Information obligations survive termination or expiration of this Agreement.

11.3.4. Re: IP provisions and obligations survival clause

11.3.5. Re: Applicable law, and any dispute resolution clauses should also survive

12. General

(The terms under this section tend to be standard for most agreements. It is what law practitioners called "boiler plate" clauses, because they are present in most agreements and deal with the mechanics of how the agreement works. They are however important, as they may have an impact on other terms of the agreement and the agreement as a whole. For this section, the heading of aspects usually classified as "General" or "Miscellaneous" are written in black font below, while the matter addressed in each of them is written in blue font. An example of the standard wording is given for each of the numerals in the Supporting Guidance. Parties may choose to adopt them as written or select alternative wording that suits them better)

12.1. **Re: Notices:** How to issue and at what address, and the format (digital, physical, or both)

12.2. **Re. Force majeure:** it is when there are situations beyond any Party's control (e.g., riots, pandemics, civil unrest, etc.) and they may have a harmful effect on the implementation of the agreement. In this case, the party experiencing a "force majeure" event can be exonerated from delays or impossibility to perform.

12.3. **Re. Amendment:** it confirms that the agreement can be amended or modified, and explains when the amendments become binding on the parties.

12.4. **Re. Assignment:** it says if a party can or cannot pass on its rights and obligations to another party and in doing so, it is or is not able to give up its rights and obligations under the agreement.

12.5. **Re. Relationship of the Parties:** it clarifies if the parties to the agreement create or not a certain type of business relationship. The relationships may include a partnership, an agency, a joint venture, among other things.

12.6. **Re. Non-Waiver of Remedies:** "a non-waiver" means that if a party does not exercise a right due to any reason (e.g., it has not notified another party of a breach of a term), it does not mean that it has waived (given up) such a right.

12.7. **Re. Third-party beneficiaries:** it is a principle in contract law that the only beneficiaries of rights and obligations in an agreement are its parties, not third parties, unless the latter are expressly mentioned as beneficiaries.

12.8. **Re. Invalid Clauses:** If any term is declared invalid, the rest of the Agreement will remain in effect.

12.9. **Re. Surviving Provisions:** enumerating the specific clauses of this Agreement that will survive the agreement's termination or expiration. For example, it is common that provisions relating to ownership and intellectual property rights, confidentiality and data privacy, disclaimer and warranty, effects of termination, and most, if not all the terms included under this section 12, be considered surviving clauses or provisions.

12.10. Re: Data Managers: to be appointed as nodal persons for Parties to be responsible for executing this Agreement data and serve as points of contact in their respective organizations.

12.11. **Re. Governing law and Dispute Resolution**

(Note: Ideally, it should match or at least be consistent with the "INSERT PROJECT NAME" Grant Agreement or any "INSERT PROJECT NAME" Sub-agreements. Two situations are exemplified here. Numerals 12.9.1 and 12.9.2 is when the law governing the agreement is a specific country law and in case disputes are not resolved by negotiation between the parties, they will resort to take the dispute to the courts of such country. The second situation in numerals 12.9.3 and 12.9.4. is when the agreement is governed by principles of international law, including some of the standard principles in international contracts, and if amicable negotiation does not work to resolve a dispute, the parties will resort to arbitration tribunals. The second option or situation is usually preferred among international organizations and where the parties involved come from multiple countries and it may be difficult to agree on specific country laws. When choosing one or the other one, or even a mixed option (e.g., parties may select a particular country law but decide to go for arbitration, instead of national courts, for dispute resolution), Parties are encouraged to be aware of their institutional position regarding this matter, ask their legal experts, and what has been previously agreed in precedent related agreements (e.g., "INSERT PROJECT NAME" Sub-agreements, if they apply))

12.11.1 Re. Governed by a specific country law

12.11.2 Re. dispute resolution in the courts of the chosen governing country law.

OR

12.11. 3 Re. Governed by principles of international law.

12.11.4 Re. Dispute resolution by an arbitration tribunal.

12.12. **Re. Entire Agreement:** what constitutes the whole agreement and bound its parties.

Schedule A. Data to be shared

(Please note that the examples provided in this table are an EXAMPLE. Please replace them with project-specific examples as necessary)

Data Type	Data Status	Format/Method of Delivery	Accessibility	Time frame
E.g., data sets related to genotypic data, survey data, reports, etc. Each data type ideally goes in each row. Add if each type would be accompanied of metadata as well	E.g., raw/ uncleaned data, processed/ cleaned data, personal data	E.g., csv,. FASTQ, .data, .pdf, .xlsx, etc., and through internet/server/ physical means	E.g., if nothing is required to get access to file once is received password or any	E.g., within a specific time period after certain event; one-off event; or if recurrent how often

Schedule B. Authorized Use of Data

(Please note that the examples provided in this table are an EXAMPLE. Please replace them with project-specific examples as necessary)

Data	Usage
E.g., data set related to genotypic data, survey data, reports, etc. Each data type ideally goes in each row. Add if each type would be accompanied by metadata as well. Names and types of data should match the ones used in the first column of Schedule A.	E.g., describe in broad terms activities to be carried out with each type of data to be able to achieve the sought and agreed results for "INSERT PROJECT NAME". Allowed activities should be clear for each of the types of data shared If DSA is used, for instance, by a country leading partner to provide certain data to an in-country/out-of-country third party organization, the allowed use could be more specifically described or limited.

Schedule C. Specific conditions on Data

(Please note that the examples provided in this table are an EXAMPLE. Please replace them with project-specific examples as necessary)

Data	Specific Conditions
E.g., data set related to genotypic data, survey data, reports, etc. Each data type ideally goes in each row. Names and types of data should match the ones used in the first column of Schedule A.	Notice that specific conditions should not impede carrying out the allowed uses to achieve the agreed purpose. Specific conditions should match each data entered in first column, as applicable E.g., specific conditions may include: None (should be stated if this is the case) Specific national policies or regulations or, institutional policies – this should be relevant and stated as specific as possible to the type of data shared Specific conditions imposed by a third party, e.g., data contain proprietary private sector info/government agency info, etc. Temporary restriction or protection periods – due to e.g., data not already ready to be published or be publicly available Confidentiality – it may or may not be linked to the temporary restriction period; it could be related to sensitive or private information, personal data. It is advisable to specify for how long confidentiality goes. Safety - In case there are any specific measures that the Parties must implement to access, store, use or transfer. Other

Schedule D. Specific Conditions on Result/Output Data

This section may be optional for "INSERT PROJECT NAME" if the terms applicable to Results/Output data are explicit and comprehensive enough in the project Grant Agreement and any existing project sub-agreements among the main "INSERT PROJECT NAME" partners, without a need to add more conditions to them. In this case, the applicable numeral of section 7 of Specific Terms would likely be 7.1. "No further conditions".

For exchanges of information/data between, for example, a Country Leader organization and an in-country/out-of-country third party, specific types of Results might be agreed due to the nature of agreed activities, and or the purpose. In this case, the Country Leader organization may opt for numeral 7.1. if for instance all conditions on results are spelled out in a precedent and related agreement among the parties; or it may opt for numeral 7.2 and fill out this Schedule D table to specify conditions that may apply to the envisioned results.

Result/Output Data	Specific conditions
E.g., list of the categories of varied *types of resulting/outputs that are envisioned for generation* with the shared/provided Data already described in previous Schedules A to C.	E.g., besides anything stated in the General terms and Conditions, consider if additional conditions might be applicable to the Resulting/Output Data

Schedule E. Attribution/Citation

Data	Citation
E.g., Datasets to be shared to be used in Result/Output Data. Specify citation applicable, as needed	E.g., you may include author (person or corporate), year, title, edition or version, funder (as needed for acknowledgements)

Data Sharing Policy Template

Created by CABI 2023

Please note this document is not legal advice. If you are uncertain, seek guidance from a legal professional.Please contact CABI via email fair@cabi.org if further information is required.

1. Data Sharing Policy Attributes

Version Number	Action / Update	Approved by	Approval date	Effective date	Next review date

2. Definitions

Terms/Acronym	Definition

3. Relevant Policies

Policy	URL/Link	Notes

4. Data Sharing Policy

Executive summary
4.1. Purpose, scope and goals
4.1.1: What is the purpose of the data sharing policy? Why does the data sharing policy exist?
4.1.2: Who and what are within the scope of this policy?
4.1.3 What are the goals and intended outcomes to data sharing and "INSERT PROJECT NAME HERE"?
4.2 Laws and other policies that relate to the sharing of data
4.2.1: Supporting the "INSERT PROJECT NAME HERE" to share data in line with laws and other policies.
4.3 Intellectual property considerations for data sharing
4.3.1: For any third-party data identified in data management plan, are there restrictions on "INSERT PROJECT NAME HERE" sharing the third-party data OR data derived from it?
4.3.2: What is the process for agreeing intellectual property rights to ensure "INSERT PROJECT NAME HERE" can reshare third-party data AND/OR data derived from it?
4.4 Supporting responsible data sharing decisions
4.4.1: Are there any actions that must be ensured in all circumstances of data sharing?
4.4.2: What is a valid data access request when the data in question is not published/publicly accessible?
4.4.3: What are the preferred terms when sharing data that is not already published?
4.4.4: What are the preferred licenses that the "INSERT PROJECT NAME HERE"
will use when publishing data?
4.4.5: Considering commercial reuse of data shared by "INSERT PROJECT NAME HERE"
4.5 Process for data sharing – data publication
4.5.1: For each type of data identified in the data management plan, outline if it is suitable to be published.
4.5.2: For each type of data identified in the data management plan, outline if "INSERT PROJECT NAME HERE" plans to publish it.
4.5.3: For each type of data that is intended to be published, where will it be published?
4.6: Publication – metadata publication and assigning identifiers
4.6.1: For each type of data identified in the data management plan, will the data have metadata published online?
4.6.2: For each type of data identified in the data management plan that will have associated metadata published online, how that metadata will be published?
4.6.3: How will identifiers be assigned to metadata and data that are published by the "INSERT PROJECT NAME HERE"?

4.7 Processes for data sharing – unpublished data (responding to data requests)

4.7.1: How to make a third-party request to access data?

4.7.2: Internal requests to access data.

4.7.3: How do "INSERT PROJECT NAME HERE" stakeholders decide whether to accept or deny a third-party request to access data?

4.7.4: Accepting or denying internal requests for data.

4.7.5: Data sharing agreement considerations.

4.7.6: What will be the technical processes for sharing data resulting from a data access request?

4.7.7: How will data access requests be recorded by the "INSERT PROJECT NAME HERE"?

4.7.8: How will requests for data access be prioritised, should they need to be?

4.7.9: Who will be required to cover costs associated with data sharing via data request?

4.7.10: Spreading awareness of compliance regarding legislation, laws and other policies that relate to sharing of data when acting on a request for data access.

4.7.11: Spreading awareness of compliance regarding intellectual property rights considerations that relate to sharing of data

4.8 Alternative processes to share data

4.8.1: Will access be provided to any data following a process that is not already described in other sections of the data sharing policy?

4.9 Restricted data access and exclusive use

4.9.1: Please outline here any considerations regarding "INSERT PROJECT NAME HERE" stakeholders exclusive use of data during "INSERT PROJECT NAME HERE".

4.9.2: What are the timescales that access to "INSERT PROJECT NAME HERE" data may be temporarily restricted?

4.10 Compliance and Enforcement

How can the data sharing policy be complied with more effectively?

4.10.2: How will the data sharing policy be enforced?

5. Roles and responsibilities

What roles have you defined, who will take them, and what will their responsibilities be?

Annex V: FAIR aligning principles

Authored by CABI

For further information on how to develop FAIR Aligning Principles please contact Martin Parr m.parr@cabi.org

In 2020 there was a data sharing principles workshop conducted by CABI as part of the development of a new national soil information system. The different questions asked to the participants included:

- What needs to be in place so data can be accessed?
- What does Accessible mean to you?
- How do we make data interoperable?
- What are the constraints in reusing the data?
- How do you know what you can do with the data?

Based on the feedback of the participants, the following FAIR aligning Principles were created:

FAIR	Principles
Findable	Datasets should have open and searchable metadata
	If any dataset is considered sensitive data, it will still have a metadata record
	Datasets should have persistent identifiers
Accessible	Datasets should be stored in agreed electronic formats
	Each dataset will have a clear owner
	Datasets should be shared using a standard process
Interoperable	Datasets should be collected to a published open standard
	Metadata should indicate the provenance and lineage of the data
Reusable	Datasets should be shared with a clear license
	Datasets will be published as open data wherever possible
	Metadata will indicate the original purpose the dataset was collected for
Other	A (long term) capability and capacity building programme for (potential) users of datasets needs to be in place
	The SIS should have a user community developed and supported to agree on standards, training and processes etc.

Annex VI: Outline GhaSIS concept note

supported by

Lead by: Prof. Mariah Quain (CSIR)

Support by: Dr. Collins (CSIR), Dr. Edward Yeboah (CSIR) Prof. Eric Nartey (UG), Dr. Andrews Opoku (KUNST), Dr. Kofi Atiah (UCC), Eric Asamoah (CSIR)

Review by: Dr. Solomon Ansah (MoFA)

Draft concept note GhaSIS

(max 2-3 pages)

Introduction

Background on GhaSIS, history (AfSIS)

Problem statement

Which problems wants to solve and for who. Who will benefit from GhaSIS.

Justification for GhaSIS

Gaps and opportunities. Why is SIS needed.

Objectives of GhaSIS

What are the objectives of GhaSIS.

Initial funding needs for GhaSIS

What funds does GhaSIS need for the different sections
(refer to outcomes from financial sustainability break-out session from roadmap workshop).

Long-term sustainability plan of GhaSIS

What and how will SIS generate in financial terms and indirect gains (e.g. productivity).
(Refer to system requirements slides from roadmap workshop).

Measuring impact of GhaSIS

How will GhaSIS measure impact and reach out to stakeholders
(see slides on system requirements break-out session). E.g. by measuring agriculture productivity.

Annex I: draft functionalities of GhaSIS

(see slides on system requirements break-out session)

Further information

For more information on the project visit: **cabi.org/projects/soil-information-systems-review-a-process-toward-strengthening-national-soil-information-systems**

To access similar resources and explore the framework visit: **resources.isric.org/sis-framework**

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ISRIC World Soil Information

Bill & Melinda Gates foundation