Landscape of Key Stakeholders for the Development of Soil Information Systems

Authored by CABI and ISRIC

Readers note

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This document is to be used alongside **the framework for sustainable national soil information systems** and is not a standalone document.

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Bill & Melinda Gates foundation

Contents

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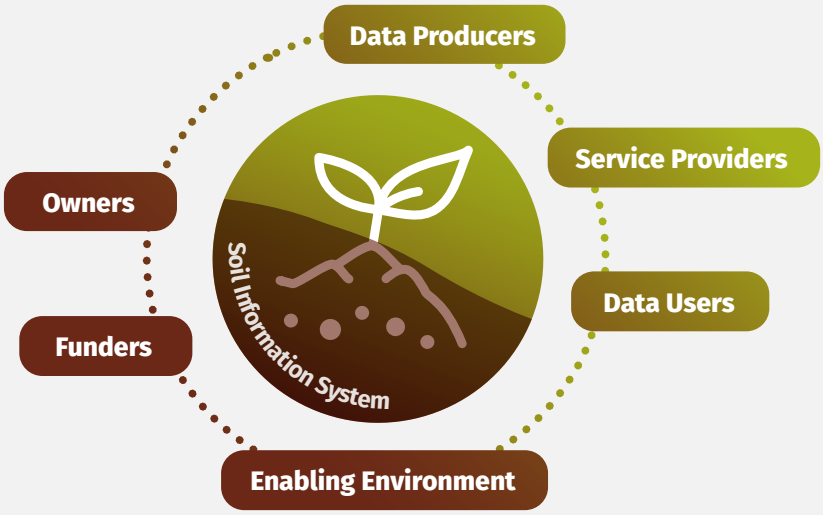


Introduction

The role of Soil Information Systems (SIS) is becoming increasingly important for the promotion of sustainable agricultural practices and environmental stewardship. A SIS provides essential data and insights for informed decision-making in soil management, land use planning, and agricultural productivity enhancement. However, the success of a SIS not only relies on technological infrastructure and data quality but also on effective stakeholder engagement and collaboration. Understanding the diverse range of stakeholders involved in the development and implementation of a SIS is crucial. Defining stakeholder categories based on their nature and how they interact with a SIS can unlock opportunities for inclusive participation, foster collaboration and ensure that the SIS meets the needs and priorities of all stakeholders involved.

Defining stakeholder categories helps those tasked with the development of a SIS to identify and engage with a broad spectrum of actors who have a vested interest or expertise in soil management and agricultural development. These stakeholders may include government bodies, research institutions, agricultural extension services, non-governmental organizations (NGOs), farmers' associations, private sector entities, and international organizations.

Delineating stakeholder categories also helps tailor communication strategies and engagement approaches according to the stage of development of the SIS, and as defined in the **framework for strengthening national SISs**. For example, government agencies may prioritize policy alignment and regulatory frameworks and would need to be engaged in the initial stages of developing a SIS. On the other hand, farmers' associations may emphasize practical utility and accessibility of soil information for on-farm decision-making, and they might need to be engaged at the stage of designing the implementation of the SIS and its service delivery. Understanding these differences can help develop a targeted outreach, engagement efforts and capacity-building initiatives that resonate with diverse stakeholders, fostering buy-in and ownership of the SIS.

Defining stakeholder categories facilitates effective governance and coordination mechanisms within the SIS framework. By clarifying roles, responsibilities, and decision-making processes for each stakeholder group, we can mitigate conflicts, minimize duplication of efforts, streamline workflows, and enhance accountability throughout the system's lifecycle. This structured approach promotes transparency, trust, and collaboration among stakeholders, laying the groundwork for sustained engagement and collective action towards shared goals.

Developing a comprehensive map of stakeholders would be undoubtedly valuable for understanding the landscape of actors involved in soil information system development at the national, regional and global levels. However, the time consuming and static nature of such a map can make it less useful over time. Stakeholder dynamics, interests, and engagements evolve continuously, influenced by changing policies, technologies, and socio-economic contexts. Therefore, this report concentrates on providing the parameters for categorizing different types of stakeholders, which should in turn inform the development of stakeholder maps relevant to a specific geographic context during the development of a SIS.

Ways for categorizing stakeholders

There are three main ways for categorizing stakeholders and the role they can play in the design and implementation of soil information systems, based on: the nature or type of organization; the geographical focus and footprint; and the role they would play in the actual implementation of a SIS.

The use of one type of categorization versus another depends on the exact objective for the stakeholder engagement and mapping. For example, when aiming to inform and influence the global agenda for the promotion of the importance of soils and SIS, the geographical and nature categorizations would be most useful. While on the other hand, for the actual design and implementation of a SIS, the nature and SIS roles categorizations would be most useful.

Categorization based on the nature of the organization

Stakeholders involved in the development of a national SIS can be grouped into different categories based on the type or nature of organisation they are. Using this categorisation can help develop tailored strategies to leverage the unique strengths and roles of each group. This targeted approach ensures that efforts to promote the importance of soils and SIS are more effective, and that the design and implementation of a national SIS are inclusive, sustainable, and aligned with the needs and capacities of all stakeholders involved. There are seven types of stakeholders in this categorisation:

Government Agencies

- **Relevant Ministries (e.g. agriculture and finance)**: May encompass the ministries of agriculture, finance, livestock, rangeland, forestry, water, transport, energy, health, tourism, defence, all of which may have roles in soil management, policy-making, and implementation of soil-related initiatives.
- **Environmental Agencies**: Responsible for environmental conservation, land use planning, and soil protection policies.
- **National Statistical Offices**: Collect data on land use, soil characteristics, and agricultural production for use in soil information systems.
- **Government-run research Institutions**: Conduct scientific research, data collection, and analysis to inform soil management practices and policies.
- **Local Government Authorities (e.g., municipalities, provincial departments)**: Plan and manage local land use, as well as implement soil conservation projects. Also collect local soil data, conduct localized soil surveys and enforce local soil management regulations and ordinances.

International Organizations and Donor Agencies

- **United Nations Agencies (e.g., FAO, UNEP)**: Provide technical assistance, capacity-building support, and funding for soil-related projects and initiatives.
- **Development Banks (e.g., World Bank, African Development Bank)**: Fund soil conservation and land management projects, provide loans and grants for SIS development.
- **Donors (e.g. Bill and Melinda Gates Foundation, GIZ)**: Provide grants for the development of National SIS, as well as to advocate for increased investments and coordination in the development of SIS globally.

Regional Organisation

- **FARA (Forum for Agricultural Research in Africa)**: Facilitates and coordinates agricultural research across Africa, focusing on soil fertility, health, and sustainable land management practices to improve agricultural productivity.
- **ECOWAS (Economic Community of West African States)**: Engages in regional cooperation on agricultural policies and land management, promoting sustainable soil management practices and supporting the development of soil information systems.
- **CORAF (West and Central African Council for Agricultural Research and Development)**: Implements programs and projects aimed at improving soil health, fertility, and conservation to enhance agricultural productivity and food security in West and Central Africa.
- **WAFA (West African Farmers Association)**: Advocates for sustainable soil management practices, provides training and resources to farmers on soil conservation, and works to influence policies that support soil health and sustainable agriculture in West Africa.

Academic and Research Institutions

- **Universities**: Conduct research, provide training, and contribute to knowledge generation in soil science and related fields.
- **Agricultural Research Centres**: Conduct research on soil health, fertility, and management practices to improve agricultural productivity and sustainability.
- **Soil Science Societies**: Promote collaboration, knowledge sharing, and professional development among soil scientists and researchers.

Private Sector

- **Fertilizer Companies**: Supply fertilizers to improve soil fertility, offer soil testing services, and provide guidance on sustainable fertilizer use to prevent soil degradation. They also collaborate with research institutions and farmers on soil health initiatives.
- **Other agribusinesses**: Provide input supplies, machinery, and technology solutions for soil management and agricultural production.
- **Soil Testing Laboratories**: Offer soil testing services to farmers, providing valuable information on soil fertility, nutrient levels, and pH.
- **Technology Companies**: Develop and provide software tools, remote sensing technologies, and data analytics solutions for soil mapping, monitoring, and analysis.
- **Engineering and Mining Companies**: Conducting soil surveys and impact assessments.
- **Extractive Industries**: Requiring soil data for environmental assessments and compliance.
- **Construction and Infrastructure Companies**: Using soil data for site planning and construction projects.

Non-Governmental Organizations (NGOs)

- **Conservation Organizations**: Advocate for sustainable land management practices, promote soil conservation, and provide technical assistance to farmers.
- **Community-Based Organizations (CBOs)**: Work directly with local communities to raise awareness about soil conservation, implement soil management practices, and build local capacity.
- **Advocacy Groups**: Campaign for policy reforms, increased funding, and greater public awareness of soil-related issues.

Civil Society and Community Groups

- **Farmer Organizations**: Represent the interests of farmers, advocate for policies that support sustainable soil management, and promote knowledge sharing among members.
- **Community Groups**: Engage in soil conservation activities, participate in soil monitoring and data collection efforts, and advocate for local environmental protection initiatives.

Farmers and Agricultural Producers

- **Smallholder Farmers**: Manage and utilize agricultural land, rely on soil health and fertility for crop production, and may benefit from access to soil information services.
- **Large-Scale Producers**: Manage extensive agricultural operations, require detailed soil information for precision farming, land use planning, and sustainable resource management.

Role and engagement approach based on the nature of the organisation for influencing the global agenda:

Category	Role	Engagement Approach
Government Agencies	Influence national and international policies, regulations, and standards.	Engage with policy briefs, regulatory impact assessments, and international treaties to emphasize the importance of soils and SIS. Utilize their platforms at regional and international forums to advocate for soil health and sustainability.
International Organizations and Donor Agencies	Provide funding, technical assistance, and global advocacy.	Collaborate on high-profile projects and campaigns that showcase the benefits of SIS. Leverage their extensive networks to promote soil health as a global priority, ensuring funding and technical support for SIS initiatives.
Regional Organizations	Facilitate regional cooperation, research, and advocacy for sustainable soil management.	Collaborate on regional research and development projects, support the development of regional soil information systems, and advocate for soil health in regional policy frameworks.
Academic and Research Institutions	Conduct research and provide scientific evidence.	Publish research in high-impact journals and present at international conferences. Partner with global research initiatives to produce comprehensive studies that highlight the critical role of soil information in sustainable development.
Private Sector	Innovate and commercialize soil information technologies.	Highlight the business case for sustainable soil management through industry conferences and publications. Develop and promote technologies that improve soil health and agricultural productivity, demonstrating their potential for scalability and profitability.
NGOs	Advocate for environmental and agricultural sustainability.	Launch advocacy campaigns, public awareness programs, and policy recommendations that highlight the importance of soils. Use their platforms to mobilize public opinion and influence policymakers globally.
Civil Society and Community Groups	Represent grassroots and community interests.	Share local success stories and grassroots movements that emphasize the importance of healthy soils. Participate in global forums and networks to voice community perspectives and ensure inclusive policy development.
Farmers and Agricultural Producers	Implement sustainable practices on the ground.	Sell practical insights and field-level data that underscore the impact of soil health on agricultural productivity. Engage in international agricultural networks to advocate for farmer-friendly policies and support systems.

Role and engagement approach based on the nature of the organisation for designing and implementing a national SIS:

Category	Role	Engagement Approach
Government Agencies	Provide policy direction, regulatory support and funding.	Ensure the SIS aligns with national development goals and regulatory frameworks. Facilitate inter-agency collaboration and integrate SIS data into national decision-making processes.
International Organizations and Donor Agencies	Offer funding, technical expertise, and global best practices.	Provide financial and technical support for specific phases of SIS development. Share best practices and case studies from other countries to inform the design and implementation process.
Regional Organizations	Facilitate regional coordination, capacity building, and policy alignment in soil management.	Support cross-country collaboration by harmonizing soil data standards, methodologies, and policies. Provide technical assistance, training, and resources to national agencies. Advocate for integrating regional soil data into national SIS to ensure consistency and comparability across borders. Share best practices and success stories from the region to inform the design and implementation of national SIS.
Academic and Research Institutions	Conduct foundational research and data analysis.	Lead the collection, validation, and analysis of soil data. Develop methodologies and standards for SIS and provide training and capacity-building initiatives for stakeholders.
Private Sector	Develop and maintain SIS technologies and infrastructure.	Offer innovative solutions for data collection, storage, and analysis. Ensure that the SIS is user-friendly, scalable, and technologically advanced to meet diverse stakeholder needs.
NGOs	Facilitate community engagement and capacity building.	Mobilize community participation in SIS development and ensure that local knowledge and needs are integrated. Provide training and support to farmers and local stakeholders to effectively use SIS data.
Civil Society and Community Groups	Ensure inclusive and participatory SIS development.	Advocate for the inclusion of marginalized communities and smallholder farmers in the SIS. Provide feedback on the usability and accessibility of SIS data and tools.
Farmers and Agricultural Producers	Provide ground-level data and apply SIS outputs.	Share practical insights and real-world data to inform SIS design. Utilize SIS data to implement sustainable farming practices and improve agricultural productivity.

Soil information needs and data contribution based on the nature of the organisation:

Category	Soil information needs	Contribution to sharing soil data
Government Agencies	Require comprehensive soil data for policy-making, land use planning, and regulatory compliance.	Mandate data collection through national surveys, ensure public access to soil data, and coordinate data sharing across ministries.
International Organizations and Donor Agencies	Need aggregated, standardized soil data across countries to support global reports and monitor SDG progress.	Facilitate international data-sharing agreements, provide platforms for global data exchange, and fund data collection efforts.
Regional Organizations	Need region-wide soil data to inform policy, research, and regional agricultural practices.	Coordinate regional data collection and harmonization efforts, share data across member states, and promote regional data repositories for soil information.
Academic and Research Institutions	Require detailed and high-resolution soil data for research on soil health, climate change, and agriculture.	Contribute by generating new data through research, sharing datasets via open-access repositories, and collaborating on large-scale data analysis projects.
Private Sector	Need precise, real-time soil data for product development, market analysis, and customer support.	Share anonymized data from field trials and customer feedback, collaborate on public-private partnerships f soil or data sharing, and develop data-sharing platforms.
NGOs	Need accessible soil data to support advocacy, awareness campaigns, and community education programs.	Share data collected from community-based projects, partner with governments and academics to disseminate data widely, and ensure data is accessible to local communities.
Civil Society and Community Groups	Require localized soil data to advocate for community needs, improve local agricultural practices, and monitor environmental health.	Collect and share local soil data through community surveys, contribute to citizen science projects, and collaborate with academic institutions to ensure data quality and accessibility.
Farmers and Agricultural Producers	Need real-time, site-specific soil data to optimize crop production and resource management.	Share on-farm soil data through cooperative networks, participate in data collection initiatives, and use farm management software to contribute to broader soil databases.

Categorisation based on the geographical focus and footprint

Categorizing stakeholders based on their geographical focus helps understand which stakeholders can play a role in transforming the global narrative around Soil Information Systems world-wide, to identify which stakeholders are critical for the funding, design and actual implementation of SIS on the ground, as well as the interconnections between these two levels of influence. Based on this type of categorisation there are four levels of stakeholders:

Global-level stakeholders

- **United Nations Agencies**: FAO, UNEP and other UN bodies play a pivotal role in setting the global agenda for soil conservation, environmental sustainability, and agricultural development. They provide frameworks, guidelines, and advocacy that highlight the importance of SIS. They also offer technical support, capacity building, and funding for national and regional SIS projects, ensuring alignment with global standards.
- **International Research Centres**: CGIAR consortium members (among others), including organizations like CIMMYT, IRRI, IITA, AfricaRice and ICRAF, conduct and disseminate research on soil management and agricultural productivity, influencing policies and best practices worldwide. They also provide research findings, technological innovations, and capacity-building programs that countries can adopt to enhance their SIS.
- **Global Networks and Partnerships**: Initiatives like the Global Soil Partnership (GSP) and Global Land Programme (GLP) facilitate collaboration and knowledge exchange, promoting the importance of soil health and information systems at the international level. They also support countries in developing and maintaining SIS by sharing best practices, data, and technologies.
- **Private Sector**: Global agribusinesses, technology companies, and environmental consultancies like Yara, Bayer, Syngenta, and Trimble develop and supply innovative tools and technologies for soil management, precision agriculture, and environmental monitoring. These companies contribute to SIS by providing advanced data collection tools, remote sensing technologies, and data analytics platforms that enable better soil data management and decision-making. They also invest in research and development for sustainable agricultural practices and collaborate with governments and research institutions to scale SIS solutions globally.
- **Multilateral Development Banks**: Institutions such as the World Bank and the African Development Bank advocate for sustainable development projects, including those targeting soil health and management. They also provide financial resources and technical assistance for the development and scaling of national and regional SIS projects.
- **Donors**: Organisations like the Bill & Melinda Gates Foundation support global initiatives on soil conservation, food security, and sustainable agriculture through strategic funding and advocacy. They also provide grants and financial support for the development and implementation of SIS projects worldwide.
- **International NGOs and Foundations**: Organizations like WWF and Oxfam raise awareness and advocate for soil conservation and sustainable agriculture through global campaigns and initiatives. They also support on-the-ground projects that develop and enhance SIS, often focusing on innovation and community engagement.

Regional-level stakeholders

- **Regional Economic Communities**: Bodies such as the African Union (AU), European Union (EU), and Association of Southeast Asian Nations (ASEAN) address regional agricultural and environmental issues, setting policies and frameworks that influence national SIS development. They can facilitate regional cooperation, provide funding, and harmonize standards for SIS across member countries.

- **Regional Research Networks**: Consortia, networks, and partnerships of research institutions collaborating on soil research and capacity-building initiatives, promote regional collaboration in soil research, sharing knowledge and innovations that improve SIS. They also conduct joint research projects, provide training, and support the adaptation of SIS technologies to regional contexts.
- **Private Sector**: Regional agribusinesses and fertilizer companies like Indorama and OCP Africa play a significant role in promoting soil health through the provision of fertilizers, soil amendments, and other agricultural inputs. These companies support the development and use of SIS by sharing soil data collected from their operations, contributing to research on soil fertility, and developing region-specific solutions for sustainable soil management. They also collaborate with regional bodies to align their operations with regional agricultural and environmental goals.
- **Regional Development Banks**: They support regional development initiatives, including those aimed at improving soil health and agricultural productivity. They also provide financial resources and technical assistance tailored to regional needs for SIS development.
- **Regional NGOs and Civil Society Organisations**: Non-profit organizations operating across multiple countries within a specific region, advocate for soil conservation and sustainable land management, influencing regional policies and practices. They also implement projects that address regional soil management challenges, often involving local communities and stakeholders.
- **Regional Agricultural Development Authorities**: They promote sustainable agricultural practices and policies at the regional level, while they also provide technical support and resources for the implementation of SIS in the agricultural sector.
- **Regional Environmental Offices**: They advocate for environmental sustainability and soil conservation in regional policies, while also monitor and enforce environmental regulations, contributing data and insights to the SIS.
- **Water Basins Authorities**: They address the interconnection between soil health and water management, advocating for integrated approaches. They also provide data on soil and water interactions, supporting the integration of this information into SIS.

National-Level stakeholders

- **National Government Agencies**: These include ministries of agriculture, environment, and land management; national soil research institutes; agricultural extension services. They shape national policies and regulations that prioritize soil health and sustainable land management. They also develop, fund, and oversee SIS initiatives, ensuring alignment with national priorities and standards.
- **Planning departments**: They use SIS data for land-use planning and decision-making, ensuring sustainable development practices.
- **Public and private extension services**: They disseminate SIS data and recommendations to farmers and other stakeholders, facilitating the adoption of best practices.
- **National Research Institutions**: Universities, agricultural research centres, and soil science institutes operating within the country. They conduct and share research that informs SIS development and soil management practices, while also providing scientific data and expertise to support the design and improvement of SIS.
- **Private Sector Entities**: Agribusiness companies, soil testing laboratories, crop nutrition laboratory services and agricultural input suppliers based in the country. They promote innovation and sustainable practices through business operations. They also develop and utilize SIS for improving agriculture products and practices, while contributing data and technological solutions.

- **Civil Society Organizations**: NGOs, community-based organizations, and environmental advocacy groups working on soil conservation and rural development. They advocate for environmental and community interests in soil management. They also engage local communities in SIS projects, ensuring data collection and management reflect grassroots needs and conditions.
- **Farmers' Organizations**: Farmer cooperatives, associations, and unions representing agricultural producers at the national level. They advocate for farmer-friendly policies and sustainable practices and provide feedback on SIS usability and effectiveness, ensuring the system meets the needs of end-users.
- **Aggregators**: They use SIS data to optimize supply chains, improving efficiency and sustainability.

Local-level stakeholders

- **Local Government Authorities**: Including municipalities, provincial departments of agriculture, rural development agencies. They implement SIS at the local level, collecting and managing soil data, and ensuring community engagement and compliance with national guidelines.
- **District Agricultural Offices**: They collect and manage soil data at the district level, supporting local SIS initiatives and ensuring data accuracy and relevance.
- **Municipal Planning Departments**: They use SIS data for local land-use planning and decision-making, promoting sustainable development practices.
- **Community-Based Natural Resource Management Organizations**: They engage local communities in soil data collection and management, ensuring SIS reflects local conditions and needs.
- **Local Environmental Committees**: They monitor and advocate for soil conservation practices within local jurisdictions, contributing data and insights to the SIS.

Interconnections between geographical levels of influence

Global to Regional Interconnections

Global initiatives and standards shape regional strategies for SIS by providing overarching frameworks, guidelines, and best practices. Regional bodies adapt these global principles to their specific contexts, facilitating harmonized soil management practices across countries. Global funding, research, and technical support also empower regional initiatives, ensuring they align with international goals for soil health and sustainability. For instance, global partnerships like the Global Soil Partnership (GSP) influence regional networks to adopt cohesive soil conservation and management strategies, enhancing regional collaboration and effectiveness.

Global to National Interconnections

Global initiatives and standards influence national SIS by providing frameworks, guidelines, and best practices for soil management. National systems benefit from global research, data, and funding opportunities facilitated by international organizations and networks. Alignment with global goals and standards helps national systems attract technical assistance and financial support from entities like the FAO and World Bank. For example, global soil health guidelines can inform national soil policies and practices, ensuring they meet international benchmarks for sustainability.

Regional to National Interconnections

Regional strategies and policies provide a framework for national SIS, ensuring consistency and collaboration across borders. National systems can leverage regional research networks and data aggregation to enhance their own soil management practices. Additionally, regional funding and technical assistance programs support national SIS development and implementation. For example, regional agricultural development authorities may provide resources and expertise to help national initiatives align with broader regional goals for soil health and agricultural productivity.

National to Local Interconnections

National SIS guide local soil management practices by providing standardized data, policies, and support. National frameworks and initiatives are implemented at the local level through municipalities, agricultural extension services, and community-based organizations. Local adaptation of national policies ensures they address specific on-the-ground needs and conditions. For instance, national soil conservation programs are executed by local agricultural offices, ensuring that national strategies are effectively applied to enhance local soil health and agricultural productivity.

Local to National Interconnections

Local initiatives and data collection efforts play a crucial role in informing national SIS. Successful local practices and innovations can be scaled up to influence national policies and strategies. Local data, when aggregated, provides a detailed understanding of soil conditions and management practices, which is essential for developing comprehensive national soil databases. Additionally, local stakeholder engagement ensures that national SIS are grounded in on-the-ground realities, enhancing their relevance and effectiveness. For example, insights from district agricultural offices and community-based organizations can shape national soil conservation laws and agricultural policies.

National to Regional Interconnections

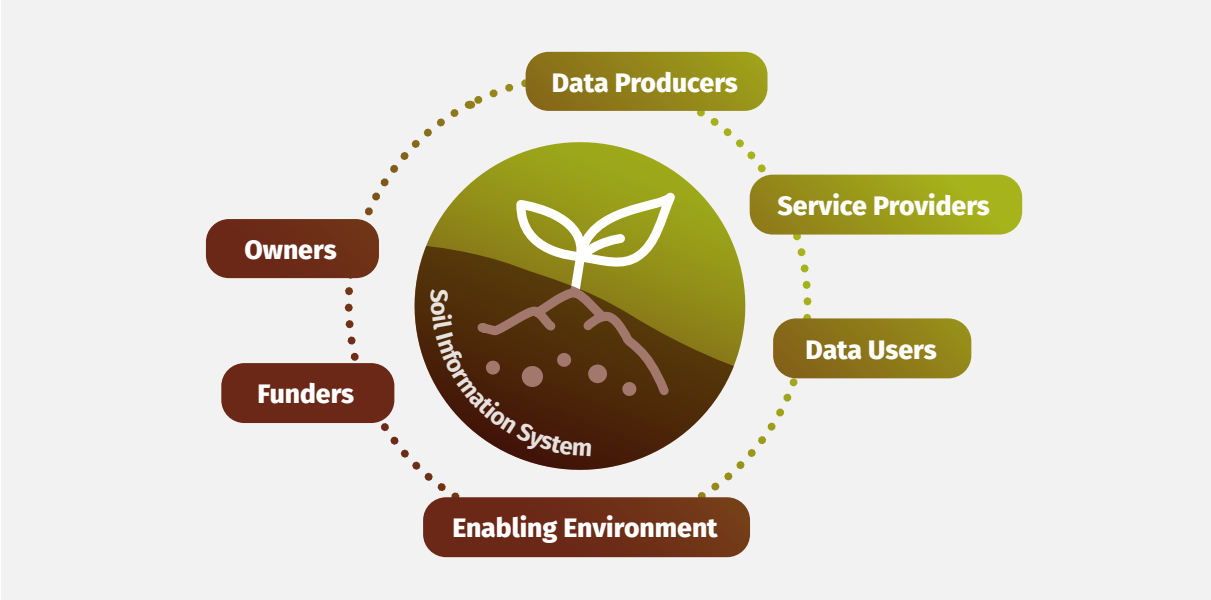
National initiatives in SIS serve as models for regional best practices, sharing innovations and contributing valuable soil data to regional databases, which support cross-border agricultural and environmental initiatives. Effective national policies can align with regional strategies, facilitating cohesive policy implementation across multiple countries. For instance, a well-developed national SIS can inform and influence neighbouring countries through regional conferences, and harmonized data collection methods ensure effective data comparison and utilization at the regional level.

National to Global Interconnections

National experiences and data from SIS contribute to global research, influencing international standards and guidelines for soil management. Participation in global networks allows national stakeholders to bring their perspectives to the global stage, while alignment with global priorities attracts funding and technical assistance from international organizations. For example, national soil data integrated into global research by the FAO enhances global soil management practices, and alignment with global goals can secure funding from institutions like the World Bank.

Regional to Global Interconnections

Successful regional initiatives in soil management can serve as models for global efforts, providing proof of concept for broader application. Aggregated regional data offers a comprehensive picture for global analysis and decision-making, informing global agricultural and environmental policies. Additionally, regional policies and frameworks can shape the development of global standards, promoting harmonization across continents. For example, the European Union's Common Agricultural Policy influences global discussions on sustainable agriculture at forums such as the Global Soil Partnership.



Categorisation of stakeholders based on their role within a SIS

Categorizing stakeholders into groups such as donors, SIS owners, data producers, and data users provides a clear framework for understanding their roles, interconnection and contributions to the development and implementation of a national SIS. There are six types of stakeholders in this categorisation:

Enabling Environment Stakeholders

- **Regulatory Bodies**: Entities responsible for developing and enforcing policies, regulations, and standards related to data governance, privacy, security, and interoperability within the SIS.
- **Legal Experts**: Professionals with expertise in intellectual property rights, data sharing agreements, and legal frameworks governing access to and use of soil data.
- **Infrastructure Providers**: Companies or organizations that supply hardware, software, telecommunications, and other infrastructure necessary for SIS data gathering, management, storage and dissemination.

Funders

- **Government Budgets**: National and local government budgets allocated to support SIS development and operations, including funding for staffing, infrastructure, and ongoing maintenance.
- **Donor Organizations**: International development agencies, multilateral institutions, bilateral donors, and philanthropic foundations that provide grants, loans, or technical assistance for SIS development projects.
- **Development Banks**: Financial institutions such as the World Bank, African Development Bank, and regional development banks that finance SIS initiatives through loans, grants, and investment programs.
- **Private Sector Investors**: Incubators impact investors, and corporate sponsors that invest in SIS-related projects, technologies, and start-ups with the potential for financial returns or social impact. These stakeholders are not likely to invest directly in the SIS, but in related products and services that can improve the SIS.
- **Public-Private Partnerships (PPPs)**: Collaborative arrangements between government agencies, private sector companies, and civil society organizations to finance and implement SIS projects, leveraging resources and expertise from multiple stakeholders.

SIS Owners

- **Government agencies or departments are responsible for overseeing the development, management, and governance of the SIS**: These stakeholders are accountable for setting strategic objectives, defining standards and protocols, and ensuring the sustainability and usability of the SIS over time. In some cases, these national capacities are enhanced by regional capacities such as through the Regional Hub for Fertilizers and Soil Health for West Africa and the Sahel.

Data Producers

- **Soil surveyors**: Collect detailed information on soil properties and distribution across various landscapes. They conduct systematic field surveys to map soil types, characteristics, and conditions. Their contributions include.
- **Soil analytical laboratory scientists and technicians**: Perform detailed soil analyses, generating data on soil properties such as pH, nutrient content, organic matter, and soil texture. Their standardized testing methods ensure accurate and reliable data for the SIS.
- **Private soil analytical laboratories**: Offer commercial soil testing services to farmers, agribusinesses, and researchers. Provide large volumes of soil test data, which, if paid for, can be aggregated into the SIS for broader analysis and application.
- **Private soil survey and testing services**: Conduct soil surveys and field testing for agricultural and land development projects. Supply detailed reports and datasets on soil conditions across different regions, contributing to the SIS's database.
- **Soil scientists**: Conduct field research and experiments to study soil formation, classification, mapping, and fertility. Provide expert analysis and interpretation of soil data, contributing valuable insights to the SIS.
- **GIS and remote sensing scientists**: Utilize Geographic Information Systems (GIS) to create detailed soil maps, spatially analyse soil data, and integrate various geospatial datasets. Their work enhances the spatial dimension of the SIS, making it more comprehensive and useful.
- **Development organizations with soils expertise**: Implement soil management and conservation projects, often in collaboration with local communities. Generate practical data from project sites, including soil health indicators and impact assessments, to feed into the SIS.
- **Agricultural research organizations**: Perform research on soil-plant interactions, crop performance, and sustainable farming practices. Produce experimental data and research findings that enhance the SIS's knowledge base on soil fertility and management.
- **Public health organizations**: Investigate the links between soil health and public health outcomes, such as the impact of soil contamination on human health. Provide data on soil contaminants and pollutants, contributing to environmental and health monitoring within the SIS.
- **University researchers**: Conduct academic research on various aspects of soil science, including soil microbiology, chemistry, and physics. Publish research data and findings that can be integrated into the SIS for academic and practical use.
- **Environmental agencies**: Monitor and regulate soil quality as part of their mandate to protect the environment. Provide data on soil conservation, erosion, pollution, and land use changes, supporting the SIS's environmental monitoring functions.
- **Engineering & mining companies**: Assess soil properties for construction and mining projects, generating data on soil stability, composition, and suitability for development.
- **Fertilizer companies**: Generate extensive soil fertility data, which could enhance the SIS regarding nutrient management practices and soil amendment needs. Companies have generally been reticent to share such data but it is hoped that regional PPPs will be able to unlock these value resources in due course.

Data Users

Users are defined as individuals or organizations that directly interact with the SIS, use the data provided by the SIS and develop products and services from these data for their clients.

- **Food and beverage companies**: Use SIS data to ensure the quality and sustainability of their supply chains. This includes verifying soil health and suitability for specific crops, ensuring compliance with environmental standards, and optimizing sourcing strategies.
- **Policymakers from government ministries, agencies and departments**: Rely on SIS data to formulate policies and regulations related to agriculture, natural resource management, environmental protection, rural development, and land use. This ensures that decisions are based on accurate and comprehensive soil information.
- **Planning departments**: Use SIS data for land-use planning, zoning, and infrastructure development. This helps in identifying suitable areas for agricultural expansion, urban development, and conservation efforts, ensuring sustainable land management.
- **Public and private extension services**: Access SIS data to provide tailored advice and support to farmers and other land users. This includes recommendations on soil management, crop selection, and best practices to enhance agricultural productivity and sustainability.
- **Aggregators**: Use SIS data to advise contracted farmers on inputs.
- **Researchers**: Access and analyse SIS data to conduct scientific studies on soil properties, crop performance, environmental impacts, and sustainable farming practices. This contributes to the advancement of agricultural and environmental science.
- **NGOs**: Utilize SIS data to design and implement projects focused on soil conservation, sustainable agriculture, rural development, and environmental protection. This helps NGOs target their interventions more effectively and measure their impact.
- **Environmental agencies**: Rely on SIS data to monitor soil health, assess environmental risks, and enforce regulations related to soil and land management. This supports efforts to protect natural resources and promote ecological sustainability.
- **Fertilizer companies**: Use SIS data to develop and market soil-specific fertilizers and soil amendments. This ensures that products are tailored to the needs of different soils, enhancing their effectiveness and supporting sustainable agricultural practices.

Beneficiaries

Beneficiaries are those who ultimately benefit from data and services provided by the SIS but do typically not interact with the SIS themselves.

- **Farmers**: Access SIS data through for instance improve extension services, to make informed decisions about crop selection, soil management practices, fertilization, irrigation, and pest control. This helps improve crop yields, soil health, and overall farm productivity.

Service Providers

- **Public Sector IT Departments**: Government agencies may have dedicated IT departments responsible for developing and maintaining public-sector SIS platforms. They ensure the platform aligns with national standards and policies.
- **Technology Companies**: Develop and maintain the software, platforms, and applications for the SIS. This includes creating user-friendly interfaces, ensuring data security, and integrating various data sources.
- **IT and Software Development Firms**: Provide technical expertise in building and customizing the SIS platform. They may be responsible for coding, software updates, and troubleshooting technical issues.

- **Geospatial and GIS Companies**: Develop and manage GIS-based platforms that visualize and analyse soil data. They ensure that the SIS has robust mapping and spatial analysis capabilities.
- **Data Management Companies**: Specialize in managing large datasets, ensuring data quality, and implementing data standards. They help in organizing and storing soil data efficiently.
- **Research Institutions**: In some cases, research institutions with strong IT departments may develop and manage SIS platforms, especially if the system is part of a research project.
- **International Organizations**: Organizations like FAO may develop and manage regional or global SIS platforms, providing tools and frameworks that can be adapted at the national level.

Playing multiple roles within a SIS

It is common for organizations to play multiple roles within a SIS. Many organizations may engage in various activities related to soil data, particularly in producing and using data, therefore some organisations might be listed in more than one category of stakeholders based on their role within a SIS. Below are some examples (not an exhaustive list) of organizations that might fulfil multiple roles within an SIS:

Category	Data producer	Data user	Other roles
Government Agricultural Department	Conducts soil surveys, collects field data, and manages soil databases.	Utilizes soil information for land use planning, agricultural policy development, and extension services to farmers.	Might be the SIS owner, responsible for overseeing the development, management, and governance of the SIS.
Research Institution	Conducts scientific research on soil health, fertility, and management practices, generating new data and insights.	Accesses existing soil data for research purposes, analyses data to inform research projects, and contributes findings back to the SIS.	Might be a service provider, developing and managing SIS platforms.
Agribusiness Company	Collects soil data from farm operations, conducts soil testing, and generates soil fertility maps.	Uses soil information to optimize crop inputs, improve agricultural productivity, and make informed decisions about land management practices.	They might not be a core funder of the SIS, but might be interested in paying (becoming a client) for specific tailored services of the SIS

These examples illustrate how organizations might fulfil multiple roles within a SIS. This multi-faceted engagement reflects the interconnectedness of stakeholders within a SIS and underscores the importance of collaboration and data-sharing among diverse actors in the soil information ecosystem, both during the design and implementation stages of a SIS.

Relevant stakeholders in specific regions

Although the development of a SIS in a specific country needs to be rooted in a detailed mapping and deep understanding of the stakeholders and their potential roles in a SIS at the national level, a regional level analysis can help assess the existing predisposition and willingness to promote the development of national SIS in a given region. As it has been described in previous sections, there is a role that regional players, structures, strategies and policies play in creating a more conducive and enabling environment. This section provides a very high-level mapping of regional stakeholders across two regions (Africa and South Asia) that provide an indication of key stakeholders and motivations that might help promote the development of national SIS in those regions.

Africa

There are a number of relevant stakeholders in Africa focusing on soil management, agricultural development, and environmental conservation. These organizations play crucial roles in coordinating regional initiatives, providing technical assistance, and promoting sustainable soil management practices across the African continent. Key actors in the region include:

- **African Union (AU)**: Provides continental leadership and coordination for agricultural and environmental initiatives, including soil management. Sets policies and frameworks that guide member states in developing sustainable soil management practices.
- **New Partnership for Africa's Development (NEPAD)**: Implements the agricultural agenda of the AU, focusing on sustainable land management and soil health. Facilitates programs and partnerships that support the development of SIS across African countries.
- **Regional Economic Communities (RECs)**, including: **Economic Community of West African States (ECOWAS)**, **Southern African Development Community (SADC)**, **East African Community (EAC)**, and **Common Market for Eastern and Southern Africa (COMESA)**. They promote regional integration and cooperation in various sectors, including agriculture and environmental management. They also develop regional policies and initiatives that support soil information systems and sustainable land management practices.
- **Regional Development Banks**, including: **African Development Bank (AfDB)**, **Development Bank of Southern Africa (DBSA)**, and **West African Development Bank (BOAD)**. They provide financial and technical support for regional agricultural and environmental projects. They also fund and support the development and implementation of SIS projects across the region.
- **Regional Agricultural Development Authorities**: Implement regional agricultural policies and programs, focusing on land and soil management. Support the adoption and integration of SIS into regional agricultural development strategies.
- **Africa Soil Information Service (AfSIS)**: Provided a platform for collecting, analysing, and sharing soil data across Africa. Supported the development of SIS by offering technical expertise, data standards, and capacity-building initiatives. **iSDASoil** has now taken over responsibility of hosting this public resource. The current platform leverages machine learning and large-scale soil data to provide soil property estimates across Africa. It supports the development of SIS by offering data-driven insights and decision-support tools to enhance soil management practices.
- **African Soil Partnership (AfSP)**: Part of the Global Soil Partnership, focuses on soil health and management in Africa. It facilitates knowledge exchange, capacity building, and the implementation of sustainable soil management practices among African countries.

- **Forum for Agricultural Research in Africa (FARA)**: Coordinates and advocates for agricultural research and development in Africa. It also supports research initiatives that enhance soil information systems and sustainable agricultural practices.
- **Global Soil Spectral Library and Estimation Service**: This initiative provides a comprehensive database of soil spectral data from across the globe, including Africa. It supports SIS by offering standardized soil property estimations based on spectral data, enabling more accurate and consistent soil assessments.
- **Soil Spectroscopy for Global Good**: A collaborative effort that promotes the use of soil spectroscopy for soil health assessment. It provides tools, training, and data services that enhance the capacity of African stakeholders to integrate advanced soil spectroscopy techniques into their SIS and soil management practices.
- **International Institute of Tropical Agriculture (IITA)**: Leads the Excellence in Agronomy program across the CGIAR network, with a strong focus on Sub-Saharan Africa. IITA coordinates research and innovation in soil management and agronomy, providing technical leadership and fostering collaboration among CGIAR centres to enhance soil health and agricultural productivity. Their work includes developing and promoting best practices for soil management and supporting the implementation of SIS through extensive research and capacity-building initiatives.
- **Regional Agricultural Research Networks**, including: **Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA)**, **West and Central African Council for Agricultural Research and Development (CORAF/WECARD)**, and **Food, Agriculture and Natural Resources (SADC FANR)**. They promote collaborative research and capacity building in agricultural sciences, including soil management. They also facilitate research projects, knowledge sharing, and capacity-building activities related to SIS.
- **Regional NGOs and Civil Society Organizations**, including: **African Conservation Tillage Network (ACT)** and **Alliance for a Green Revolution in Africa (AGRA)**. They advocate for sustainable soil management practices and support local implementation of SIS initiatives. They also provide on-the-ground support, capacity building, and advocacy for soil health and information systems.

South Asia

In South Asia, there are several important stakeholders dedicated to soil management, agricultural development, and environmental conservation. These entities are instrumental in coordinating regional efforts, offering technical support, and advocating for sustainable soil management practices throughout the South Asian region. Key actors in South Asia include:

- **Asian Development Bank (ADB)**: Provides financial and technical assistance for development projects across Asia, including those focused on agriculture and environmental sustainability. Funds projects and initiatives aimed at developing and implementing SIS in South Asian countries.
- **South Asian Association for Regional Cooperation (SAARC)**: Promotes regional integration and cooperation among South Asian countries, including in agriculture and environmental management. Facilitates regional policies, frameworks, and initiatives that support sustainable soil management and the development of SIS.
- **SAARC Development Fund (SDF)**: Promotes regional integration and economic cooperation by funding development projects within SAARC member states. Provides financial resources and support for projects related to soil management and SIS development.

- **SAARC Agriculture Centre (SAC)**: Enhances agricultural research and development across SAARC member countries. Promotes research collaboration, capacity building, and information sharing on soil health and management.
- **Asia-Pacific Association of Agricultural Research Institutions (APAARI)**: Connects national agricultural research institutions with regional and international experts, promoting knowledge exchange and best practices in soil management. Offers technical support and expertise for the design and implementation of national SIS, drawing on the wide range of knowledge within its member institutions.
- **International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)**: Conducts agricultural research to improve food security and livelihoods in semi-arid regions, including South Asia. Provides research data, expertise, and technical support for soil health and management initiatives, including SIS.
- **CGIAR Research Program on Water, Land, and Ecosystems (WLE) South Asia**: Promotes comprehensive management strategies that include soil information as a key component of sustainable agricultural practices. Provides extensive datasets and analytical tools related to soil and land management. Also trains national researchers and policymakers in advanced soil information technologies and systems.
- **International Water Management Institute (IWMI)**: Focuses on improving water and land management practices in South Asia. Integrates soil information with water management practices, supporting the development of SIS through research and technical assistance.
- **International Centre for Integrated Mountain Development (ICIMOD)**: Focuses on sustainable mountain development in the Hindu Kush Himalaya region, which includes several South Asian countries. Conducts research, provides technical expertise, and promotes knowledge sharing on soil health and management in mountainous regions.
- **Regional NGOs and Civil Society Organizations**, including: **International Union for Conservation of Nature (IUCN)** Asia, **South Asia Cooperative Environment Programme (SACEP)**, and various local NGOs focused on soil and environmental conservation. They advocate for sustainable soil management practices and support local implementation of SIS initiatives. They also provide advocacy, capacity building, and on-the-ground support for SIS development and implementation.

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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