LSC IS Needs Assessment and LSC-hub Design Requirements (Work Package 2): Ethiopia Workshops and Key Informant Interviews process

**PROJECT:**

Land, Soil and Crop Information Services

to support Climate Smart Agriculture in

Ethiopia, Kenya and Rwanda









# LSC-IS Needs Assessment and LSC-hub Design Requirements (Work Package 2): Ethiopia Workshops Synthesis

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LSC-IS Needs Assessment and LSC-hub Design Requirements (Work Package 2): Ethiopia Workshops Process Report; Land, Soil and Crop Information Services to support Climate Smart Agriculture in Ethiopia, Kenya and Rwanda (LSC-IS).

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**Executive Summary**

**Having access** to reliable and high quality information and data is fundamental for achieving and promoting sustainable agricultural practices such as Climate Smart Agriculture (CSA). Governments in Ethiopia, Kenya and Rwanda included CSA in national policies and together with the European Union, the Netherlands’ Ministry of Foreign Affairs and other donors made large investments in the land, soil and crop information services (LSC-IS) carried out by their national agricultural research institutes.

LSC-information services can support agricultural innovation but using and continuously updating LSC-information requires strengthening of the capacity of individuals and organizations, it also entails creating an enabling environment and, importantly, dynamic Agricultural Knowledge and Innovation Systems (AKIS), which includes complex networks of actors such as individuals, organizations, and enterprises, together with supporting institutions and policies.

In Ethiopia, the LSC-information is not adequately used to support agricultural decision-making, mainly owing to its inadequacy and non-digitalized nature which does not make it easy to access. Therefore, researchers and other stakeholders who are working at national and local levels, including smallholder farmers, are not well positioned to utilize this information and data to exercise climate smart agricultural practices. This implies the importance of automation of the processes using digitally enabled approaches, while at the same time, moving away from manually collected data to a state in which real-time insights and predictive capabilities can be provided to inform decision making. Furthermore, integrating products from land, soil, and crop data and coupling it with farmers’ data, field sensors, and remotely sensed data, fuelled by strong analytical capabilities will enable near real time and predictive information dissemination to the end users.

Therefore, this needs assessment workshop engaged a variety of stakeholders to map out what the demand for different types of information is, and what the capacity is of different users to interpret and assimilate this information allowing it to guide their decision-making. The needs assessment highlights the gap between current supply of information and user demand and as such provides insights for the subsequent design and capacity strengthening processes underlying this project. The LSC-hubs will particularly facilitate the provision and application of LSC data in CSA related policy and decision making by stakeholders. In this regard, a two-day stakeholder workshop was organized at the national level in Adama from January 23-24, 2023, and at the sub national levels from January 26-27, 2023, in Batu and from January 30-31, 2023, in Debre Berhan.

In the national workshop, all categories of stakeholders, with the exception of farmer organizations, participated by identifying themselves as both providers and users of LSC-IS data. Once stakeholders identified themselves as user and/or provider of LSC-IS data, they were requested to join one of the two use cases and identify which stage of the data valorisation process they were involved in. The two use cases identified were integrated soil fertility management (ISFM) and soil and water conservation (SWC). These two use cases were formed with approximately equal numbers of group participants.

In both use cases, most of the stakeholders were involved in all stages of data valorisation process. The main types of data gathered were soil moisture, soil physiochemical, land degradation, forest cover and hydrological data. The end users of the processed and interpreted information were farmers, private sectors, governmental and non-governmental organizations. The assessment report indicated that the main data use and provision challenges were related to data availability, accessibility, quality, location specificity and absence of institutionally organized and compiled dataset. Lack of finance, human resources, and physical infrastructure were major barriers in the operationalization of institutional mandates. Although there were important policies that contributed to achieving improved livelihood of society, key missing policies such as national data sharing and land use policies hampered stakeholders from functioning in full capacity

by accessing and applying data and information necessary for climate smart agricultural production. To improve the accessibility and application of LSC-IS data, some of the enabling conditions may be building the capacity of stakeholders who are involved in providing and using LSC-IS data. Strengthening partnership among stakeholders may also contribute towards smooth data sharing. Modernizing the physical and IT infrastructure may help in the generation of precise data. In addition, the government needs to be flexible in terms of allowing stakeholders/institutions to have the relevant mandates and policies to use, manage and administer LSC-IS data.

In the first sub-national workshop that was conducted in Batu/Zeway, all the five categories of stakeholders attended the workshop representing the role of LSC-IS data user, supplier, or both. In both use cases, most of the participants were involved in all stages of the data value chain. Types of data gathered included weather and crop production, soil physical and chemical property, land use and land cover, land degradation and socioeconomic data. Data processing tools used ranged from community livelihood improvement index, and GIS software to statistical analysis such as crop simulation models. Government offices, non-governmental organisations, researchers, private sectors, and farmers were end users of processed, analysed and interpreted data. From the needs assessment workshop, it was noted that there was no clear-cut role between those who were using and providing LSC-IS data. In addition, data use and provision challenges stated among stakeholders were like those challenges pointed out by stakeholders at the national workshop. Absence of real time data, lack of digitized data and lack of awareness of data users and providers were also mentioned as challenges that affected proper data use. Lack of institutional mandates and policies also contributed to poor utilization and provision of data. Therefore, better use and management of LSC-IS data could be realized by improving the quality, quantity, and accessibility of data through training and capacity building, investing in physical/IT infrastructure, and granting institutions the relevant mandates to share and manage data. Designing appropriate policies and initiatives also contribute towards better utilization, management, and administration of LSC-IS data.

In the second sub-national workshop in Debre Berhan, a substantial number of cooperatives and farmer unions attended t. They identified themselves as both suppliers and users of LSC-IS data. Representatives from the private sector were missing in this workshop while the other stakeholder categories were present. Different types of data such as soil physical and chemical property, soil erosion and runoff, land degradation and other socioeconomic data were gathered, processed, and interpreted for planning, training and awareness creation, advisory services, monitoring and evaluation by end users such as farmers, national and district level agricultural offices and NGOs. Although LSC-IS data was easily available, the main data gaps and challenges reported by both the provider and user groups in both use cases were inaccurate, incomplete, and poor-quality data. In addition, lack of digitized dataset, limited knowledge in terms of data use, lack of consolidated and consistent data and, lack of location specificity were among the challenges.

To sum up, the needs assessment workshops in both the national and sub national levels indicated that most important data use and provision challenges identified are to some extent similar, demanding nearly the same solution to address them. Therefore, training and capacity building of stakeholders, strong partnership among stakeholders, investing in well-equipped infrastructure, and empowering institutions to have favourable policies, and mandates would allow stakeholders the fair supply, use, management, and storage of well-organised and accessible LSC-IS data. Development of the data hub may alleviate most of the challenges related to disorganised and decentralised dataset and facilitate informed agricultural decision making to enhance the well-being of the end users, mostly farmers.

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# Introduction

Agriculture’s contribution to the economy of Ethiopia is estimated to be 33% (Gebissa 2021). Crop production has the most output in the agriculture sector followed by livestock production. Unfortunately, some agricultural practices such as fertilizer application, manure storage and value-addition process are major contributors to greenhouse gas emissions. This continues to happen amid global crises such as biodiversity loss, food insecurity, political unrest, climate change, and global warming.

Climate change has severe consequences on food security, water resources, and the well-being of human beings. The rise in temperatures, dwindling rainfall periods, and prolonged dry seasons in 2021 made more than 80% of Ethiopians in the northern region suffer severe hunger and malnutrition. Stakeholders utilize climate-smart agriculture practices and innovations to supportsmall-scale farmers, become more resilient to climate change, increase farm income, curb greenhouse gases and be food sufficient. Approaches such as irrigation, conservation agriculture, agrobiodiversity, and soil fertility are climate-smart agriculture practices used to combat food insecurity at the household level. However, issues such as household income, access to lending facilities, and extension services have led to slow adaptation of CSA technologies at the farm level.

On the other hand, government institutions, private companies, farmer organisations, knowledge institutions, and development actors face various hurdles to upscale CSA. These hurdles include a lack of finances, an inadequate policy environment promoting the adoption of CSA at the national and district level, poor extension and advisory services, and short-term projects with small impacts. One of the proposed solutions for upscaling CSA includes a paradigm shift of farmers' approaches, agricultural practices, beliefs, and norms. This can be done by developing open-source and user-friendly agriculture information systems for managing data and establishing long-term publicly-owned input marketplaces. For this to be successful a holistic approach, e.g. an agriculture knowledge information system (AKIS), is one of the ways used to generate and disseminate CSA knowledge.

The DeSIRA Land, Soil and Crop Information Services (LSC-IS) aims to support and develop sustainable land, soil and crop information services (or hubs) in national agricultural research organisations to enhance the effectiveness of national Agricultural Knowledge and Innovation Systems (AKIS) and contribute to rural transformation and CSA in eastern Africa (Ethiopia, Kenya and Rwanda). Currently, LSC information is often not used effectively in decision-making, because it is not available in an organised and accessible form and is not seen as ‘owned’ by national organisations. Therefore, stakeholders at national and local levels, including smallholder farmers, are not well equipped with data and evidence to evaluate their policies, plans and farming practices; improve and transform these in a climate-smart manner to make informed agricultural decisions. This project started, therefore, with the assumption that soil, land and crop information services can help improve the efficacy of CSA-related policies, plans and practices.

Three focus group discussions were held in Adama (national level), Batu/Zeway (district level), and Debre Berhan (district level). The broad objective of the workshops is to understand stakeholders' LSC information needs, current capacity assets and gaps in institutional capacity requirements for LSC information use and users and to assess LSC-AKIS policies and initiatives. The specific objectives are:

* Identify stakeholders’ roles, challenges, and opportunities of LSC-IS;
* Specify LSC-information needs and LSC-information users;
* Identify capacity requirements for LSC-information use and users to inform hub development and engage the stakeholders on opportunities.

The expected outcomes

1. Immediate outcome 1: This is a set of clearly defined user requirements and needs that guide the design of the LSC hubs.
2. Immediate outcome 2: an assessment of the capacity and institutional requirements and needs for the design of the LSC hubs.
3. The two immediate outcomes will contribute towards the medium-term outcome of an effective methodology and strategy for an LSC hub design trajectory based on lessons learned from clearly specifying demands, roles, responsibilities, and capacity of actors existing and ownership has been made explicit.

# Role of Stakeholders

Stakeholders were first grouped into 5 major stakeholder groups i.e. development partners, public sector, private companies, knowledge institutions, and farmer organizations. The stakeholders who participated in the FGD at the national level included development partners (11), the public sector (13), private actors (7), and knowledge institutions (13) at the national level. Farmer organizations were underrepresented at the national level. At the district level, the stakeholders who participated in the FGD included farmer organizations (15), the public sector (20), private actors (2), development partners (6), and knowledge institutions (6). The various groups of stakeholders were further classified as either data providers, data users, or both.

## Data Providers

**National level**

There were 6 stakeholders who identified themselves as data providers at the national level. Data providers in the FGD were composed of

Private sector stakeholders - Kacha Digital Financial Service and Kifiya Financial Tec. PLC

Knowledge institutions - Debre Berhan University and ICRAF

Development partners - Sasakawa Africa and FAO

**District level**

**At a sub-national level,**  2 farmer organisations, Basona cooperatives association office finance team and Basona werena cooperative union office, identified as being data providers.

## Data Users

The only data user is one private company, Midroc Investment Group at the national level. Catholic Secretariat is the only development partner that is data users at the district level. Also, Bulbula Integrated Agro-industry PLC is a farmer organisation that is solely data users at the district level.

## Both Data Providers and Users

**National level**

There are 37 stakeholders who are both data providers and users at the national level and it was made up of:

Public - Space Science and Geo Special Institute (SSGI), Ethiopian Agriculture business corporation, Ministry of Agriculture, Central Statistics Authority, Forest Enterprise, Environment Authority, Irrigation Centre, Sugar Industry, Ethiopian Geological Survey, Ethiopian Public Health Institute, Zeway Dugda, Bako enterprise, Ethiopian Meteorology Institute

Private - One Acer Fund, Leresha, Nyala Insurance, Mekobo Enterprise

Knowledge institutions - Oromia Agricultural Research Institute, CIAT, ILRI, IUCN, EIAR, Debre Berhan Agricultural Research Centre, Debrebrehan University, Arsi University, Artificial Intelligence Institute, Water and Land Resource Centre, Ethiopian Bio Diversity Institute, Biotechnology Institute, Wageningen Research

Development partners - SOS Sahel, GIZ, USAID, DFID, IFAD, Green Climate Fund, REDDS, German Agro Action

**District level**

**Among the organisations represented in the workshops, t**here are 12 farmer organisations, 6 development partners, 1 private entity, 6 knowledge institutions, and 19 government agencies that are both data providers and users.

Development partners include: Agricultural growth program (AGP), SNV Horti Life, SOS Sahel Ethiopia, Wet Land International, Zeway Duguda Seqota Declaration Project and, Ziaway Dugda Woreda Green Climate fund

Farmer organizations include: Basona Warana cooperative promotion office, Bora Union, Debele livestock and milk cooperative, Debut irrigation union, Debut kebele cooperative association, Erer Farmers Cooperation Union, Kebele Cooperative, Lume Adama Farmers’ cooperative, North cooperatives association office, North Shewa zone cooperative office, Tegulet Seed multiplication and marketing cooperative union, Wito, Chiraro Debir, Bas Dengura kebele

Private entities – Adami Tulu Pesticide Processing Factory

Knowledge institutions – Adami Tulu ARC, Arsi University, Batu ARC, Debre Berhan A. R. C., Debre Berhan University, EIAR

Government agencies - Adami Tulu Finance Office, Baso district cooperative office, Basona Warana Livestock resource office, Basona werna district agricultural office, Basona worana statistics office, Batu Soil Research Centre, Bureau of Agriculture, Disaster Risk Management, East Amhara Meteorology service centre, East Shewa Agriculture Bureau, Ethiopian Methodological Institute, Ethiopian Statistics Service, North Shoa zone agriculture office, North Shoa zone cooperatives expansion office, Oromia Agricultural Inputs and Product Regulation Authority, Rift valley lakes Basin Administration, Sinqe Bank, Tsedey Bank, Woreda Agricultural Bureau

# Data valorization

Detailed information was generated that provides insights into LSC-data valorization processes that are currently in place and the stakeholder dynamics that support the flow of data and information in Ethiopia. The generated insights are specific for the two use cases that the project focuses on.

## Use Case 1 – Integrated Soil Fertility Management (ISFM)

### Data Gathering

**National level**

**A large diversity of different types of stakeholders is involved in data gathering at a national level. The data and information that is gathered is not always readily and freely accessible to all stakeholders. The existing data are of different nature and quality. Data are not stored or made available from a centrally managed location or hub. A prototype of an integrated national ag-data hub has been recently launched which aims to “develop and operationalize an agricultural data ecosystem in Ethiopia that integrates disparate systems that are available within the the Ministry of Agriculture and other partner organisations which are at the federal and regional levels”[[1]](#footnote-0).**

| **Stakeholders**  **Development partners - Sasakawa Africa Association, CFGB**  **Knowledge institutions – SWR, Debrebrehan University, CIAT/Alliance, EIAR, Debre Berhan ARC, Arsi University**  **Private entities - Leresha Digital Agriculture Platform, MIDROC, Niyala Insurance**  **Public sector - Ethiopia Meteorology Institute, Ethiopian Forest Development, Ethiopian Forest Development, SSGI** | **Types of data gathered**  **agronomic data such as crop yield, yield component, soil fertility assessment, disease**   * **Weather and climate data** * **Geospatial and topographic data** * **Population data** * **Water data** |
| --- | --- |

**District level**

**A large number of public entities engage in data gathering at a district level. Farmers organisations are also active in data gathering at a district level. From the insights generated in the workshops it can be concluded that land, soil and crop data is available at district level in addition there is also weather and climate data. At this moment, data is not always centrally stored, shared or freely accessible to all stakeholders.**

Development partners - Meki Catholic Secretariat, SNV/Horti -Life, Wetland International, Ziway Dugda district (Green Climate Fund)

Knowledge institutions – Arsi University, Batu soil Research centre, Debre Birhan university, EIAR

Public sector – Adami Tulu and Jidu Combolcha bureau of Agriculture, Agricultural extension office, Chemical Industry Corporation (Adami Tulu Pesticide Processing Factory), East Showa Bureau of Agricultural Office, Ethiopian statistics service (ESS), North Shewa zone agricultural office, Oromia agricultural input and product regulator authority, Seqota declaration, Tsedey Bank, Woreda Agricultural office

Farmer organizations - Basona farmers union, Bora Denbel Cooperative, Bossona werana wereda cooperatives promotion office, Cooperative promotion office, Farmers, Lume Adama farmers’ cooperative unions

Type of data gathered

1. socio-economic data e.g. livelihood, population, gender roles, household nutrition
2. crop productivity data
   1. crop yield assessment
   2. seed variety e.g. improved seeds
   3. farming system
   4. plant tissue
   5. Maturity date
3. Agricultural practices
   1. Farm inputs demand e.g. fertilizer, seeds, pesticides
   2. Soil conservation methods e.g. soil bunds, stone bunds
   3. Animal husbandry
   4. Fertilizer type and application rate
4. Weather and climate data
5. soil data e.g. soil fertility, soil pH, soil water content, salinity, nutrient content, soil type, slope
6. land data e.g. land use e.g. forestry; land cover

### Data Processing

In contrast to the data gathering stage, only a limited number of stakeholders engage in data processing at national level and at district level, with public sector organisations and knowledge institutions playing key roles. At a district level, it is important to note the contributions from knowledge institutions (universities, Agricultural Research centres and Regional agricultural research institutes). There are currently no national guidelines for data processing and quality assurance. Currently there is no centrally maintained repository for processed land, soil and crop data.

**National level**

Public sector - Ethiopia Meteorology Institute, Ethiopian Forest Development, Ethiopian Forest Development, SSGI

Knowledge institutions - CIAT/Alliance, EIAR, SWR, Debre Berhan ARC

Development partners - Sasakawa Africa Association

The data processing approach includes:

* Statistical analysis
* Dynamic and projection modelling
* Geospatial analysis of satellite data from level 0 to 4, GPS data, spatial data

**District level**

| **Stakeholders** | **Data processing approaches** |
| --- | --- |
| **Public sector - Adami Tulu and Jidu Combolcha bureau of Agriculture, Agricultural extension office, North Shewa zone agricultural office, Oromia agricultural input and product regulator authority**  **Development partners - Meki Catholic Secretariat**  **Knowledge institutions – Arsi University, Batu soil Researcher centre, Debre Birhan university, EIAR** | * **Statistical analysis** * **GIS spatial analysis** * **Soil map processing** * **Rainfall onset and cessation dates** |

### Data Interpretation

A limited number of stakeholders engaged in data interpretation both at the National level and at District level. Data interpretation is primarily focussing on crop and location specific agro-advisory services, crop suitability maps, fertiliser recommendations and the design of soil water conservation infrastructure

**National level**

| **Stakeholders** | **Processes** |
| --- | --- |
| **Public sector - Ethiopia Meteorology Institute, SSGI**  **Private entities - Leresha Digital Agriculture Platform**  **Knowledge institutions - CIAT/Alliance, EIAR, SWR, Debre Berhan ARC**  **Development partners - Sasakawa Africa Association, CFGB** | **The data is interpreted to provide recommendations, conclusions, agro advisory, match crop requirements with geospatial data, generate additional information, identify scalable information, validation, verification, quality standardisation, corrections, and potential conservatory agriculture mapping.** |

**District level**

Development partners – Meki Catholic Secretariat, Wetland International

Farmer organizations - Lume Adama farmers cooperative unions, Bossona werana wereda cooperatives promotion office, Tegalet seed multiplication cooperative

Knowledge institutions - Arsi University, Batu soil Researcher centre, Debre Birhan university

Public sector - Adami Tulu and Jidu Combolcha bureau of Agriculture, East Showa Bureau of Agricultural Office

The data is interpreted to develop:

* project designs,
* implementation strategies,
* fertilizer recommendation and advisory for farmers and other private sectors
* maps e.g. soil map, suitability map, base map, development map, slope map, soil map of the selected watershed
* SWC structures

### Data Application

Stakeholders engaged in data application at national level are fairly limited. Within the public sector only a select number of entities are mentioned. These do not include key ministries or operational units.

At a district level the number of stakeholders engaged in data application are numerous. They represent stakeholders who provide different functions and services within the AKIS and the agricultural development planning system of Ethiopia. They include amongst others producer organisations, agricultural input providers and distributors, the agricultural extension system, banks and agri-finance providers and zonal agricultural offices.

| Stakeholders | Data application purpose |
| --- | --- |
| Knowledge institutions - CIAT/Alliance, EIAR, SWR, Debrebrehan University, Arsi University  Public sector - Ethiopia Meteorology Institute, Ethiopian Forest Development, Ethiopian Forest Development, SSGI  Private entities - MIDROC, Niyala Insurance  Development partners - Sasakawa Africa Association, CFGB | to provide information and services such as stability mapping, agro metrology advisory, hydrology advisory, early warning, climate-smart ISFM practices, landscape restoration opportunity and priority map, agronomic practices (Pest and diseases, irrigation, plant nutrient management, forage production), land use land cover (LULC), soil erosion map, soil health map, land productivity (degradation), research innovation /technology/intervention actions, crop insurance, soil fertility management recommendations, soil fertility map, and crop improvement. |

**National level**

**District level**

Development partners – Wetland International

Farmer organizations – Farmers, Lume Adama farmers cooperative unions, Bora Denbel Cooperative, Bossona werana wereda cooperatives promotion office, Basona farmers union, Tegalet seed multiplication cooperative

Knowledge institutions - Arsi University, Batu soil Researcher centre, Debre Birhan university, EIAR

Public sector - Agricultural extension office, Tsedey Bank, North Shewa zone agricultural office, Chemical Industry Corporation (Adami Tulu Pesticide Processing Factory)

Data applications include:

* plan input supply (seeds and fertiliser)
* soil fertilisation recommendations
* Lab analysis
* Safety handling
* Production technology
* Shelf-life determination
* Warehouse handling
* Occupational safety and handling
* ISO/WHO/ FAO standard
* Monitoring and evaluation
* For boosting yield in visioning quality agricultural inputs and products
* production management
* for recommendation
* research and education
* Forecast temperature, precipitation, etc
* Crop modelling to predict productivity
* For further research works
* For planning and implementing community service
* Credit availability
* Crop insurance
* Financial institutions
* Soil fertility
* Applying land cover and land use information that increases water use efficiency decreases pollution, improves productivity and livelihood

### Data Usage

Stakeholders engaged in data utilisation at a national level are fairly limited. Within the public sector they include amongst others research and development institutes but they do not include key ministries and implementing agencies.

From the private sector there is an emerging visibility of private extension and advisory provision and companies engaging in agricultural insurances.

At a district level there is a wide diversity of stakeholders within the public sector and within farmers organisations that make use of data. These range from the bureau of agriculture, the extension system, input providers and distributors, banks, development practitioners and partners, and a great diversity of farmers organisations.

**National level**

| **Stakeholders** | **Data is used for** |
| --- | --- |
|  |  |

Development partners - Sasakawa Africa Association, CFGB

Knowledge institutions - CIAT/Alliance, EIAR, SWR, Debrebrehan University, Debre Berhan ARC, Arsi University

Public sector - Ethiopia Meteorology Institute, Ethiopian Forest Development, Ethiopian Forest Development, SSGI

Private entities - Leresha Digital Agriculture Platform, MIDROC, Niyala Insurance

**District level**

Development partners - Meki Catholic Secretariat, SNV/Horti -Life, Wetland International, Ziway Dugda district (Green Climate Fund)

Knowledge institutions – Arsi University, Batu soil Researcher centre, Debre Birhan university, EIAR

Public sector – Adami Tulu and Jidu Combolcha bureau of Agriculture, Agricultural extension office, Chemical Industry Corporation (Adami Tulu Pesticide Processing Factory), East Showa Bureau of Agricultural Office, Ethiopian statistics service (ESS), North Shewa zone agricultural office, Oromia agricultural input and product regulator authority, Seqota declaration, Tsedey Bank, Woreda Agricultural office

Farmer organizations - Basona farmers union, Bora Denbel Cooperative, Bossona werana wereda cooperatives promotion office, Cooperative promotion office, Farmers, Lume Adama farmers cooperative unions

## Use Case 2 – Soil-Water Conservation (SWC)

### Data Gathering

**National level**

Public Sector – EIAR, SSGI, Ziway Agr. Office (Green climate fund Project), Oromia Bureau of Agriculture, MoA

Private entities - MAKUBU Enterprise PLC

Development partners - SOS-Sahel Ethiopia

Knowledge institutes – ICRAF, Bebrebrihan University

Type of data:

1. Soil data – soil erosion, runoff, soil moisture, soil type, soil colour, physio-chemical properties
2. Hydrological data – types and amount of SWC structures, portable water, irrigation command area,
3. Climatic data
4. Infrastructure - irrigation, hydrological station, metrological station
5. Geospatial data - ground control point at higher resolution; non-spatial data at basin, watershed and HRU levels; satellite imagery from medium to very high resolution; aerial photography; lidar point cloud data
6. Land use/land cover - Forest cover, eg. Gully dimension, SWC technologies, land degradation
7. Socio-economic data – household survey, key information and FED

**District level**

Development partners - Farm Africa, SOS Sahel

Farmer organizations - Baso cooperative; Dolicha water user association Irrigation; Erer Union; Kiber for development (seed multiplication), peace (milk), Mehal amba (integrated) and Bisrat (milk) farmers union; North Shewa zone cooperatives promotion office; primary cooperative from kebeles (Watershed and multipurpose)

Knowledge institutions - Adami Tulu ARC, Batu Soil Research centre, Debre Berhan Agricultural Research Centre, Debre Berhan University, EIAR

Public sector - Bosana werana district Agriculture office (SLM, AGP, CALM), CSA, DRM (Adami Tulu), East Amhara Meteorology service, EMI, Environmental protection Authority, North Shoa Agricultural office, Rift valley lakes Basin Administration, Ziway Dugda Agr. Office

Type of data gathered:

1. Soil data e.g. soil type, nutrient, SOC, soil profile, soil moisture, soil erosion and runoff, texture, slope, bulk density, soil depth, soil biological properties.
2. Agricultural practices
   1. IPM
   2. Inputs e.g. seeds, fertilizer, pesticides
   3. Water usage
   4. SWC method
3. Land data
   1. land use e.g. farmland, grazing lands
   2. land cover e.g. forest cover
4. Weather and climate
   1. Rainfall variability
   2. Air temperature
   3. Soil temperature
   4. Wind
   5. Sunshine
   6. Relative humidity
5. Livestock data
6. hydrological data
   1. Surface water flow
   2. water quality
7. Crop productivity
   1. Land size
   2. Crop type
8. Social data e.g. labour force
9. Economics data
   1. Income
   2. Market information
   3. Cost of farm inputs
   4. Source of farm inputs
10. Water resources
11. Livestock data
    1. Milk yield

### Data Processing

**National level**

Public Sector – EIAR, SSGI, Ziway Agr. Office (Green climate fund Project), Oromia Bureau of Agriculture, MoA

Knowledge institutes – ICRAF, Bebrebrihan University

Development partners - SOS-Sahel Ethiopia

Methods of data processing include:

1. Laboratory tests
2. Layer stacking and image mosaicking
3. Georeferencing and image processing with remote sensing
4. Thematic mapping to delineate irrigated and SWC spots
5. Aerial orthophoto
6. Point cloud image
7. DEM
8. Standardization and data quality checking (geometric correction, cleaning, refining, analysis, summarization)
9. Physiochemical effect
10. Farmers perception

**District level**

Public sector - Bosana werana district Agriculture office (SLM, AGP, CALM), CSA, DRM (Adami Tulu), EMI, Rift valley lakes Basin Administration

Knowledge institutions - Batu Soil Research centre, Debre Berhan Agricultural Research Centre, EIAR

Development partners - Farm Africa, SOS Sahel

Methods of data processing include:

1. Using tools like KMIS, ODK
2. crop simulation model

### Data Interpretation

**National level**

Public Sector – EIAR, SSGI, Ziway Agr. Office (Green climate fund Project), Oromia Bureau of Agriculture, MoA

Knowledge institutes – ICRAF, Bebrebrihan University

Development partners - SOS-Sahel Ethiopia

**District level**

Farmer organization - Baso cooperative, North Shewa zone cooperatives promotion office, primary cooperative from kebeles (Watershed and multipurpose)

Development partners - SOS Sahel

Knowledge institutions - Batu Soil Research centre, Debre Berhan Agricultural Research Centre, Debre Berhan University, EIAR

Public sector - Admi Tulu Woreda Agr. Office; Bosana werana district Agriculture office (SLM, AGP, CALM); DRM (Adami Tulu); East Amhara Meteorology service; EMI; Environmental protection Authority; Ziway Dugda Agr. Office

The **data is interpreted** to draw conclusions, recommendations, cloud-based visualization, verification purpose, DEM, donor reports, determine cause and effect relationships, generate facts

### Data Application

**National level**

Public Sector – EIAR, SSGI, Ziway Agr. Office (Green climate fund Project), Oromia Bureau of Agriculture, MoA

Private entities - MAKUBU Enterprise PLC

Knowledge institutes – ICRAF, Bebrebrihan University

Development partners - SOS-Sahel Ethiopia

Data is applied to:

1. Implement, prescale, and demonstrate projects,
2. Advise policy makers, spatial decision support, extension officers, farmers, investors, researchers
3. Communicate scientific community
4. Prepare strategic plan
5. Teaching and CS
6. Verify and provide information
7. Natural, including water, resource management and disaster risk reduction
8. Land ownership property
9. Training
10. Surveillance

**District level**

Public sector - Rift valley lakes Basin Administration; Ziway Dugda Agr. Office; Environmental protection Authority; North Shoa Agricultural office; East Amhara Meteorology service; EMI; CSA; DRM (Adami Tulu); East Amhara Meteorology service; Admi Tulu Woreda Agr. Office; Bosana werana district Agriculture office (SLM, AGP, CALM)

Knowledge institutions – Batu Soil Research centre, Debre Berhan Agricultural Research Centre, Debre Berhan University, EIAR

Development partners - Farm Africa, SOS Sahel

Farmer organization - Baso cooperative; Dolicha water user association Irrigation; Erer Union; Kiber for development (seed multiplication), peace (milk), Mehal amba (integrated) and Bisrat (milk) farmers union; North Shewa zone cooperatives promotion office; primary cooperative from kebeles (Watershed and multipurpose)

Application of data

1. Recommendation, Advisory
2. Extension service, coordination
3. Experts and farmers require training in the SWC technologies
4. Recommendation, Advisory, Water allocation plan, Land scape restoration
5. Early warning
6. Forecasting
7. Applied to help students to get practical insight
8. To help the zone agricultural office with its intervention
9. Pre-scaling and
10. Demonstration
11. Training and awareness creation
12. Pre-season planning and in-season crop management
13. Project development/ intervention
14. For credit
15. Profit dividend

### Data Use

**National level**

Public Sector – EIAR, SSGI, Ziway Agr. Office (Green climate fund Project), Oromia Bureau of Agriculture, MoA

Private entities - MAKUBU Enterprise PLC

Knowledge institutes – ICRAF, Bebrebrihan University

Development partners – SOS-Sahel Ethiopia

Key LSC information usage by stakeholders:

1. Achievement performance
2. Community mobilization
3. Suitability analysis
4. Verification of data for further planning

# Data use and user needs

This segment provides insights into data use and data users needs focusing on the two distinct use cases. As such it delves into some of the challenges regarding data provision, availability and accessibility, and provides insights into specific challenges in terms of availability of human resources, competences and skills to process, interpret and utilise LSC data (both at a national and a district level). In addition it highlights some of the institutional and operational challenges that LSC-data users face.

## Data Users - Use Case 1 (ISFM)

**National level - data users**

Development partners – SAA

Private entities – Leresha Digital Agriculture Platform, MIDROC

Knowledge institutions – CIAT

Public sector – EIAR

Main **data providers** include:

1. Knowledge institutes - National and Regional Research Centers (CIMMYT, CG Centers), Universities, ISRIC
2. Development partners – FAO
3. Public sector - National Metrology Institute, MOA, EIAR
4. Private entities - Water work and design enterprise, Consultant Soil laboratories

type of **LSC data used**:

1. Soil data
   1. Soil physical properties e.g. soil profile, soil texture, soil structure, drainage, moisture, soil type
   2. Soil chemical properties e.g. organic carbon, NPK, CEC, EC, Sulphur, pH
2. Weather and climate data
3. Agricultural practice e.g. fertilizer rate, crop (species and variety), cropping system (intercropping), grain yield

Reasons for **LSC data usage**

1. Decision support tool development
2. Development of recommendations and advisory for proper management
3. Disseminate information and demonstrate to farmers an innovation
4. Irrigation water management
5. Schedule farm inputs and other resources e.g. type of fertilizer to apply as well as the quantity and time.
6. Environmental quality monitoring
7. Capacity building

Challenges and limitations

The **LSC data is either available**, partially available or unavailable. According to SAA, LSC data sets that are unavailable are soil-specific fertiliser recommendations and intercropping data for different crops.

Some of the claimed **LSC data gaps** that may be incomplete or inconsistent include soil and weather data.

Other proposed data gaps are:

1. General data. There is a need for site-specific LSC data
2. Limited awareness of data provider
3. Limited data interpretation capacity (at national and district level)
4. Inexistence of a national guidelines and a certified Manual for standardisation of data handling
5. Data not being available and accessible at the right time
6. Limited IT infrastructure
7. Low expertise in GIS and IT (at national and district level)
8. Absence of nationally standardised procedures, regulations and benchmarks for data validation and quality assurance

Some LSC data can be fully or partially accessible and completely inaccessible.

**Challenges in LSC data use**

1. Poor data quality
2. Unstandardized data
3. Data timeliness – it takes a long time to access some data especially when it is needed urgently
4. Thematic accuracy
5. Temporal and spatial resolution
6. Data accessibility
7. Site-specific data
8. Not institutionalised

**LSC Data opportunities**

1. Data is available, such as web-based data providers, and can be accessed wisely while working with institutes and individuals.
2. Increasing accessibility and availability of open data and software/tools together with improved internet connectivity for downloading tools
3. Conducive policy
4. Different research institutes working on data generating. Thus, there’s a need to link up the research organisations to create synergies.

**Success stories**

1. The CoW has collected 40, 000 crop responses to fertilizer data
2. Millions of smallholder farmers benefited from SAA intervention in Ethiopia since 1993
3. The National Agricultural extension system adopted CA approaches in 1990
4. Leresha currently registered more than 69000 farmers based on the types of soil

**District-level ISFM DATA USERS**

Development partners - Meki Catholic Secretariat, SOS shale Ethiopia, Wetland International

Farmer organizations - Basona farmers union, Bora Denbel cooperative, Cooperatives promotion office

Knowledge institution - Arsi university, EIAR

Public sector - Adami Tulu Pesticide processing factory, Admai Tule and Jidu Kombolcha BoA, East Showa Agricultural office, North Shewa zone agricultural office, Tegalet seed multiplication cooperative, Tsedey Bank

Main **data providers** include:

Public sector

1. Agricultural office
2. Union expansion offices
3. Farmers
4. Government bodies such as agricultural sectors and crop promotion agencies
5. NGOs
6. Policy development bodies
7. Primary cooperatives
8. Research centres e.g. Agricultural research centres
9. Seed multiplication institutes
10. The crop production team of the agricultural office
11. CSA

Farmer organizations

1. Research institutes
2. Agricultural offices
3. Private sectors
4. Crop research department
5. Natural resources management research department

Development partners

1. Agricultural office
2. Financial office
3. Water and energy office
4. Health office
5. Education office
6. Women and children's office
7. CSA
8. National Meteorological Agency
9. Research Centre
10. Local GOs
11. MOWE
12. MOA
13. FAO
14. Primary and secondary cooperatives

Knowledge institutions

1. Research institutes
2. Agricultural offices
3. Private sectors
4. Crop research department
5. Natural resources management research department

Type of **LSC data used**:

1. Agricultural practices data e.g.
   1. Farm inputs demand and supply data
   2. Modern farming systems
2. Crop productivity data e.g.
   1. Yield
   2. Crop varieties such as improved seeds
   3. Row planting
   4. crop lifecycle i.e. anthesis, flowering date, maturity date
   5. crop biomass
3. Land data
   1. Forest cover
   2. Land use-land cover
   3. Cultivated land
4. Livestock data
5. Maps e.g. crop suitability map
6. Social data
   1. Number of farmers,
   2. Gender i.e. male and female
   3. Farmers need
   4. livelihood
7. soil data
   1. Soil physical properties e.g. soil type, erosion status, water holding capacity
   2. Soil chemical properties e.g. soil organic matter, soil pH, CEC, soil fertility
8. Water data
9. Climate and weather e.g. temperature, rainfall

Reasons for **LSC-data usage**

1. Pests and disease management
   1. For pesticide safety
   2. For pesticide warehouse handling
   3. For pesticide production process and procedures
2. For environmental pollution reduction and procedures
3. Monitoring and evaluation of the status of the kebeles
4. The research used to improve on existing technologies and practices like improved seeds
5. Knowledge generation (research for development and project design) and dissemination through awareness and training
6. Enhance soil fertility
7. Financial leverage such as sustainable business models, access to markets

Challenges Regarding LSC-**Data Availability and Accessibility**

Some data sets are available through organizations namely WHO, FAO, EMS, and OSH. Data available through unions and farmer cooperatives is limited. In addition, readily available data sets are costly.

**Data gaps**

1. Some data are incomplete
2. Some data are not specific to the area of interest
3. Low data quality
4. Partial access to data
5. Lab analysis accreditation certificate
6. Unable to meet WHO standards on pesticides
7. Unavailability of updated FAO data
8. Old (not updated) pesticide domestic regulation

Data accessibility

1. Some data are available but not accessible (require cost and willingness)
2. At the initial stage, all data are available, but as the technology changes, updated data in not available
3. Data that is user-friendly and compressed is unavailable
4. Obtaining data takes long

**Data Challenges**

1. Data obtaining process takes a longer time
2. Poor data quality
3. Data sets are not in the right format
4. Pesticide laws (regulations) not updated (the old data not sufficient to encourage formulation)
5. Updated data unavailable on time e.g. updated standards by FAO
6. Insufficient and missing data
7. Internet problems to access online data
8. Limited accessibility of spatial and other data

**Data Opportunities**

1. Presence of specialised technical knowledge such as GIS to generate data (both at national and at district level?)

**Success stories**

Adami Tulu Pesticide processing factory is the only agrochemical manufacturing company in Ethiopia

## Data users – Use case 2 (SWC)

**National level**

Development partners – SOS-SAHEL, Green climate fund

Private entities – Makubu

Knowledge institutions – EIAR

Public sector – EABC, SSGI

Main **data providers** include:

1. Development partners – FAO, IPCC
2. Private entities –
3. Knowledge institutions – European space agency, EIAR, NASA, SERVIR Africa, RCMRD Kenya
4. Public sector – EMI, Ministry of Water and energy, Mapping authority, MoA, EPA, SSGI, CSA, ATI, EABC

Type of **LSC data used**:

1. Soil data
   1. Soil chemical properties e.g. soil pH
   2. Soil physical properties e.g. soil type, drainage, slope
2. Weather and climate data
   1. Temporal meteorological data
   2. Rainfall
   3. temperature
3. Crop data e.g crop type
4. Land data
   1. LULC
   2. land imageries (temporal)
   3. Forest ecosystem change data
5. Maps
   1. Crop suitability map
   2. Yield estimation model map
6. Socio-economic data
7. Water data
   1. Irrigation water quality
   2. Hydrological data
   3. Water quality
   4. Water source, irrigation and drainage area

Reasons for **LSC data usage**

1. disaster management e.g. Runoff erosion assessment, land degradation information, emergency response
2. improve on existing agricultural practices such as fertilizer type and application, pest control
3. water management e.g. Crop water requirement and development of irrigation infrastructure
4. enhance spatial decision-making support tools e.g. spatial programming and information visualization
5. Generate knowledge that will verify existing information
6. Proper land use and management e.g. LULC change, land suitability, landscape restoration, forest conservation, land suitability evaluation and analysis (weighted analysis), geo-locating land use
7. Inform internal company policies e.g. agronomic company policy
8. Improve social aspects e.g. livelihood diversification
9. Climate prediction

Challenges **LSC data availability and accessibility**

Some data sets are available. However, current and future datasets are only available upon request. Also, available meteorological and soil data are not site-specific. Some locations are missing data.

Overview of LSC-data challenges

1. Satellite data is available in low resolution
2. Conflict of interest on data sharing
3. Data is not accessed as per company needs
4. Not site-specific data
5. Outdated data
6. Data is available in a format that the end user cannot use to do further analysis
7. Some of the data is not credible.

Overview of LSC-data o**pportunities**

1. No need for raw data collection
2. Solve issues like missing and unclear raw data
3. saving resources by limiting duplication
4. Potential to create a data hub by developing an LSC database or website

Success Stories

1. Ethiopian soil maps with high resolution generated with the help of CoW

**District level**

Development partners - Netherland Developments Cooperation (SNV), Farm Africa

Farmer organizations – Lume Adama Union, primary cooperative from kebele (Watershed and multipurpose), Bulbula IAIP

Knowledge institutions - EIAR

Public sector - Bosana werana district Agriculture office (SLM, AGP, CALM), CSA

Main **data providers** include:

Development partners - Agricultural office, Research centres, Meki Batu Union, Woreda Agricultural Bureau, Ministry of Agriculture, Cooperatives/Union (Meki-Batu, Bora-Dembel), Agro dealers and Batu soil research centre

Farmer organizations - BOA (DA, woreda), kebele administrative, Farmers, Agricultural input office,

cooperative office, farmer associations, cooperatives, unions, pastoral office, Primary cooperatives, Research centres, Government, NGOs, Universities

Knowledge institutions - EMI, Ministry of Water & energy, Space science institute, Ethiopian mapping authority, FAO, NMI, ICPAC, ECMWF, HC

Public sector - Primary data through assessment and farmers, BOA, RARI, Universities, Primary data from stations, International Research Institute, Ministry of water and energy, Webs, NGOs, Private sectors, Agency of Purchase.

**Type of LSC data used:**

1. Soil data
   1. Soil chemical properties e.g. fertility, pH, salinity
   2. Soil physical properties e.g. soil water availability, soil type, slope
2. Social data
3. Economics data
   1. Income
   2. Cost of production
   3. Market information
4. Weather and climate data
   1. Rainfall and driving factors
   2. Air temperature
   3. Soil temperature
   4. Wind
   5. Sunshine
   6. Relative humidity
5. Maps
   1. Crop suitability map
   2. Yield estimation model map
   3. Crop suitability map
6. Social data e.g. number of cooperative members
7. Land data e.g. land holding size, land use, number of developed watersheds
8. Livestock data e.g. beef and milk yield
9. Crop productivity
   1. Crop diversity e.g.
      1. grains e.g. wheat, barley, haricot bean
      2. oilseeds e.g. ground nut, sunflower
      3. fruit trees e.g. avocado
      4. vegetable e.g. tomato, onions
      5. Tubers e.g. potato
   2. Crop yield
   3. Seed variety e.g. Early, intermediate and late maturing varieties
   4. Phenological data
10. Models e.g. ENSO forecast

Reasons for **LSC data usage**

1. CSA application
   1. Rehabilitation,
   2. Soil fertility improvement and soil health
   3. Improve production and productivity
2. Policy development and support decision-making by policymakers and when implementing plans
3. Determine crop water requirement
4. Assess land degradation, runoff and erosion
5. Provide services to end users
6. Develop digital advisory platforms
7. For developing business models and markets for commodities
8. Increase water-use efficiency.
9. For quality produce supply (adequate, valuable, variety).
10. Industrial crops supply

**LSC-data availability and accessibility**

Soil pH and salinity data are available from SNV. Data e.g. soil fertility and profile are not available locally. LSC data that do not exist but are needed include soil salinity and recommended soil nutrient rate.

**Challenges and gaps**

1. Poor quality of data and unclear
2. No consolidated database
3. Data is in the custody of individuals.
4. The low resolution of satellite images
5. Collected data is not accessible at the region, zone and woreda level
6. Not accessible at right time and in the right quantity
7. Data is incomprehensive (crop phenology data).
8. Data that is very technical to understand
9. Incomplete and outdated data.
10. Unorganised and mismatched data.
11. invalid and not reliable
12. Different nutrient parameters do not exist.
13. Data available through direct download, incomplete
14. Conflict of interest on data sharing

**LSC Data Accessibility**

1. Web-based access,
2. Request based

**Opportunities**

1. Potential to create a data hub,
2. No need of starting from scratch,
3. Chance for improvement in data quality & resolution
4. Structural arrangement (Agency to institute)
5. Good linkage with farmers and members

Success Stories

1. HC
2. AFSIS
3. ETEOSIS
4. EDACaP
5. Ethiopian soil with high resolution generated with the help of CoW
6. Model watersheds establishment (WUA become WUC),
7. The success of the Gada model Watershed development

# Data providers and data provider needs

## Data providers – use case 1 (ISFM)

**National level**

Development partners – CFGB

Private entities – MAKOBU Enterprises Plc

Knowledge institutions – Debrebrehan University, Debre Berhan ARC, Arsi University, ICRAF

Public sector – SSGI, EIAR

Main **data users** include:

* Knowledge institutes – Universities, Researchers
* Farmers and pastoralists
* Development partners – NGOs
* Public sector – policymakers, ministries (MoA), local agricultural offices
* Private entities
* Students

Type of **LSC data provision**

1. Soil data
   1. Soil chemical properties e.g. soil fertility
   2. Soil physical properties e.g. pH, moisture, texture, depth, soil water availability, and soil type
2. Land data e.g. Land use land cover (LULC), Land degradation, land usage coverage,
3. Economics data e.g income, labour hrs. usage
4. Map e.g Crop suitability map, fertility map
5. Modelling e.g. Prediction of soil erosion
6. Crop data e.g. crop growth, type
7. Agronomic practices
8. Water data e.g. water availability

Reasons for LSC data provision

1. Support decision making
2. Develop policies
3. It is used in research and teaching
4. Create awareness
5. Create jobs and opportunities
6. Investment
7. Improve crop and animal productivity and production
8. Provide recommendations
9. Services and end users
10. Proper soil fertility management by farmers
11. Local extension workers guide on the application of CA practices
12. Targeting sustainable land management practices

Standardized **LSC data is available**. Some of the available data is disorganized and outdated. It takes time for the data to be updated. Knowledge institutes such as, for example, Debre Berhan Agricultural Research Centre, make data available to others through manuals, leaflets, proceedings, journals, and books. An example of unavailable LSC data is high-resolution data because of the high cost incurred to access it.

**LSC data gaps**

1. Less area coverage
2. Real-time data is unavailable to some extent
3. Data is inaccessible and, in some scenarios, it is only available offline
4. Data is not well structured and unstandardized hence causing a challenge to the end user
5. Lack of a centralized data storage location that is accessible to all stakeholders
6. Incomplete and outdated data
7. Lack of feedback on data use

Channels of **accessible LSC data** can be through sending a request via websites, downloading from the digital platform, soft and hard copy, data gathering through research and surveys, secondary data from publications, and dataverse.

**LSC Data Challenges**

1. high-resolution satellite data is expensive
2. Lack of awareness of the use of satellite data
3. Data is not easily accessible
4. Data is available in the wrong format
5. The metadata is not clear
6. Poor standardized data
7. Poor quality of data
8. Poor organization of data
9. Budget shortage
10. Lack of trainings
11. Some of the available data is not site-specific
12. Downscaling data is a challenge
13. Lack of platform at the national level

**LSC data opportunities**

1. Develop new technologies for LSC e.g., satellite of aerial images, lidar
2. There are large datasets that can be shared & used. Data can be made available especially inaccessible for instance through workshop proceedings
3. Enhance data usage by farmers
4. Increase investment potential and leverage funds by accelerating the usage of LSC data
5. Working with policymakers
6. Share and disseminate information
7. Internet access is increasing
8. Use of smart phones and gadgets
9. Collecting fieldwork data and conferences
10. Many people are capable of using the LSC data

**Success Stories**

1. Data services for end users and SSGI by itself
2. BDU launched an online data management system
3. Data hub eiar.gov.et,
4. knowledge bank: eiar.gov.et
5. Published success story on conservation agriculture

**District level**

Knowledge institutions – Batu soil Researcher centre, Adami Tulu Agricultural Research Centre, Debre Berhan university

Public sector – Seqota Declaration, Agricultural extension office, Z/Dugda Agriculture office

Farmer organizations – Farmers, Bossona werana district cooperative promotion office

Development partners - Z/D LCC Project

Main **data users** include:

Knowledge institutions

* Researchers and research institutes (EIAR)
* NGO e.g. FAO, ISUCDO
* Agricultural offices (woreda)
* Universities
* Students (MSc, PhD)
* Farmers
* Das
* Unions (Meki, Batu)
* Woreda agricultural office
* Private sectors
* Policymakers

Public sector

* Farmers, self-organization
* Farmer cooperatives
* Union
* DA
* HEW
* Agri offices at zonal and regional levels
* NGO's
* Input suppliers
* Research institutes

Farmer organizations

* Research offices
* Agricultural offices
* Farmers
* Unions/cooperative
* NGOs
* Trade
* Seed multiplication
* Input suppliers

Type of **LSC data provision**

1. Agricultural practices
   1. Fertilizers types and rate
   2. Agrochemicals
2. Soil chemical properties
   1. Soil PH
   2. Soil nutrients
   3. Soil carbon
   4. Soil salinity
   5. Soil PH
3. Soil physical properties
   1. Soil type and structure
   2. Soil type
   3. Soil water availability
   4. Soil vulnerability
4. Land data e.g. land use-land cover change
5. Crop productivity data
   1. Cropping system e.g. crop rotation
   2. Crop type
   3. Yield
   4. Inputs price
6. Livestock data e.g milk yield
7. Economics data
   1. Marketing
   2. Cooperatives
   3. Credit
   4. Price
8. Weather and Climate
9. Social data
10. Maps
    1. Soil map
    2. Land suitability class

Reasons for LSC data provision

1. Soil fertility management
2. Agronomic decision making e.g. application of fertilizer and pesticides
3. Application of CSA technologies
4. Farmers to increase production
5. Agriculture office- to use data and guide farmers
6. Students enrolled for M.Sc. /PhD courses
7. Input purchase
8. Increase crop and livestock productivity
9. Disseminate knowledge through reports, publish articles
10. Manage market inflation

**Available LSC data**

Some LSC data is available in databases, soft or hard copies. The following data is available from the Z/D LCC project:

* Soil fertility map, climate data (RF, temp)
* Soil PH
* Crop eligibility
* Crop suitability
* Land use and land cover data

**LSC data gaps**

1. Soil fertility information gap
2. Soil PH information
3. Soil usage gap
4. Lack of agriculture digital information
5. No real-time data on daily food availability

**Data Accessibility**

LSC data can be accessed online on university and research websites. However, LSC data is not easily accessible from other relevant stakeholders.

**LSC Data Challenges**

1. Lack of willingness to transfer data by researchers
2. Absence of data sharing policy
3. Little knowledge of LSC
4. Lack of soil information/data delivery station/data hubs and absence of data hubs

**LSC data opportunities**

1. Cost minimization
2. Adequate information gained
3. An agriculture policy on LSC
4. More villages will be considered for irrigation when resources allow.

**Success Stories**

1. Market linkage with breweries

## Data providers – Use case 2 (SWC)

**National level**

Knowledge institutions – Debre Berhan University

Public sector – EMI, SSGI, MoA

**Main data users**

Knowledge institutions – research institutes; universities; students

Public sector – National, regional and local level BoA; MoA

Farmers

Type of **LSC data used**:

1. Land degradation
   1. Cause and effect of soil erosion
   2. Runoff
2. Maps
   1. Erosion severity maps
   2. Soil erosion map
   3. Land degradability map
   4. Satellite images
   5. LULC map
   6. Soil map
   7. Water resources map
3. Weather and climate
   1. Rainfall
   2. Temperature
   3. Relative humidity
   4. Wind speed and direction
   5. Air pollution
   6. Pressure
   7. Evapotranspiration
   8. Sunshine hours
4. Soil data e.g. soil temperature
5. Sustainable land management practices e.g. soil and water conservation measures

Reasons for LSC data provision:

1. Conservation measures e.g. increase soil moisture and reduce soil erosion
2. Knowledge generation ad dissemination e.g
   1. research and validation
   2. education purposes
   3. documentation
   4. share scientific findings with relevant bodies
3. to achieve food security by increasing agricultural productivity
4. climate change mitigation
5. to influence policy and develop strategic plans

**Available LSC data**

1. Soil maps
   1. Soil fertility
   2. Soil acidity
   3. Soil salinity
2. Land use and land cover maps
3. Near real-time data (satellite and aerial)

**Gaps in LSC Data**

1. No centrally managed national database granting access to curated data
2. Data exists in different institutes but sharing is a challenge
3. Limited appropriate data user-interfaces created so far
4. Legal framework with mandated organizations to follow up, monitor and evaluate data sharing processes
5. Incomplete data

**LSC Data Accessibility**

According to SSGI, data sets are available but inaccessible because the web portal is being developed. Accessible data is satellite images using GIS.

**Challenges**

1. Budget constraints e.g. high-resolution data is very costly for private entities
2. Heterogenous data (diverse and non-uniform data with a possibility of low quality and redundancies)
3. Data validation
4. The relevant sectors fail to understand the product that Ethiopia Meteorology produces e.g. seasonal weather forecasts indicating normal, above normal and below normal rains.

**Opportunities**

1. Legacy data exist in different sectors of the ministry, which can be pulled to one data centre
2. The demand for geospatial satellite products is increasing with time
3. Potential researchers are available (knowledge available)
4. An arrangement for data sharing needs and common understanding of it’s utilisation.

**Success stories**

SSGI Launched satellite (ETRSS-1)

**District level**

Farmer organizations – North Shewa zone agricultural office; Kiber for development, peace, Mehal amba and Bisrat farmers’ unions; Baso farmers Cooperatives

Knowledge institutions – Debre Berhan University, Debre Berhan Agricultural Research Centre, EIAR

Public sector - EMI

Main **data users** include:

Farmer organizations - Agricultural development agencies, Land use and management committees and agencies, Rural cooperatives, CSA, Farmers, District agricultural office, Development agents, Agricultural experts, Soil experts, Primary cooperatives, Agricultural office, Researchers, NGOs

Knowledge institutions - MSc and PhD students, Researchers, International and national data centres, researchers, universities, primary and secondary schools, Zone Agricultural office, Researcher institutes, Policy makers, Meteorological agencies, Soil laboratory, Agricultural office

Public sector - Researchers, NGOs, users, and all concerned sectors

Type of **LSC data provision**

1. Soil data
   1. Soil chemical properties e.g. soil nutrient level, soil PH, EC
   2. Soil physical properties e.g. soil type, soil loss, soil water availability, texture
2. Weather and climate
   1. Rainfall amount
   2. Temperature
   3. Relative humidity
   4. Wind speed
3. Crop Productivity
   1. Crop yield
   2. Crop type
   3. Area of production
   4. Cropping system e.g crop rotation
4. Economics data
5. Agricultural practices
   1. Soil and water conservation
   2. Input usage
   3. Pesticides usage
6. Land data e.g. land use and land cover
7. Maps
   1. Land use map
   2. soil and climate map,
   3. landscape map

Reasons for LSC data provision

1. To increase soil fertility and productivity
2. To indicate hot spot areas
3. To interpolate data and map
4. To derive solution
5. To model risks and opportunities
6. To indicate policy changes
7. For input of research work
8. Climate trend analysis, climate characterization,
9. the weather forecast, intervention area identification,
10. watershed characterization
11. For agriculture policy development and services
12. For providing services to farmers

**Available LSC data**

Data available partially on total treated land, forest coverage of land, soil fertility map

**LSC data gaps**

1. Well-organized data is unavailable sometimes
2. Dynamic soil property
3. Rainfall data for local areas
4. Not well-organized data
5. No data centre in the country
6. Data are incomprehensive

**Data Accessibility**

Weather forecast data (climate data product) is accessible via a website. data can be accessible by consulting all concerned parties. According to Debre Berhan Agricultural Research Centre, most data related to climate, soil map, land use map and soil analysis results are available.

**LSC Data Challenges**

1. Lack of proper data
2. Lack of well-organized data
3. Lack of quality data and knowledge
4. The data are not scientifically processed
5. Data is available in hard copy
6. Incompleteness such as not geo-referenced
7. Format differences
8. Data quality/coherence problem
9. Lack of how, when, by whom etc collected
10. Data insufficient for modelling
11. Poor knowledge of how to use the spatial data
12. The data available in large resolution
13. Lack of common understanding between farmers and administrators
14. provision of row data is a challenge since it requires a letter from the organization
15. Inappropriate technology choice
16. Limited weather station, not accessible online

**LSC data opportunities**

1. National and international collaboration base in DBU
2. The availability of CSA in all kebeles
3. Availability of training centres
4. Availability of development agents in all kebeles
5. The presence of land administration agencies in all kebeles
6. Good government policy and strategy
7. Improving digital agriculture service, increasing the availability of open data and software/tools
8. Have a data provider structure in the system for organic and inorganic fertilizer recommendation

**Success Stories**

1. Water and land resources centre (AAU)
2. Open access portal for data availability called WaPOR from FAO
3. Organized data for the nutrients omission trial done
4. Developments of EDACaP, Seasonal forecast for agricultural activities

# Capacity Strengthening and infrastructure

This segment of the workshop report provides insights into the requirements and demands for capacity strengthening for data users and providers and IT infrastructure.

## Data Users at national level

Development partners – SAA

Knowledge institutions – CIAT, EIAR

Private entities – Leresha, Midroc

**Existing Internal Mandates**

Development partners

1. Agricultural extension

Knowledge institutions

1. Generate information and technology
2. Policy advisory or recommendation
3. Develop DST

Private entities

1. Making agriculture easy for everyone e.g. Leresha
2. Digitalizing Ethiopian Agriculture e.g. Leresha
3. Crop- livestock, agrochemical trading and food processing e.g. Midroc

**Missing Internal Mandates**

Knowledge institutions

* Right to store national data e.g. CIAT

**Existing Source of Finance and Investment**

Development partners

* The Nippon Foundation

Knowledge institutions

* Government Budget e.g. EIAR
* EIA e.g. CIAT

Private entities

* CG centres, Service-charge advisory  - Leresha
* Company profit, owner investment and Bank Loan e.g. Midroc

**Missing finance and investment**

* Additional funds e.g. SAA, EIAR, CIAT
* Additional support for MoA and ATI e.g. Leresha

**Existing Technical Capacity**

Development partners

* SAA – 3 staff working on ISFM demos

Private entities

* Leresha - CTO (Application developer team)
* Midroc - Agronomist, Soil laboratory technical, chemist and IT professionals

Knowledge institutions

* CIAT - 1 data scientist, 1 special analysis and 1 web developer
* EIAR - Researchers in soil science and related disciplines

**Missing Technical Capacity**

Development partners

* SAA - Soil scientist expert

Private entities

* Leresha - Researcher (field)
* Midroc - GIS expert, Data manager, Agrometeorologist and Soil scientist

Knowledge institutions

CIAT - IT expert

EIAR - Limited data and knowledge management expert (ICT, big data analysis and tool developer expert)

**Existing Physical and IT Infrastructure**

Development partners

* SAA - IT infrastructure

Private entities

* Leresha - Platform

Knowledge institutions

* EIAR - Soil laboratory, weather station, IT

**Missing Physical and IT Infrastructure**

Development partners

* SAA - Capacity Building

Private entities

* Midroc - Network and server and Data storage
* Network and server and Data storage

Knowledge institutions

* EIAR - Lack of a weather station in some research centres
* CIAT – data storage

## Data Providers at national level

Development partners – CFGB

Knowledge institutions – Arsi University, Debrebrehan Agricultural Research Center, Debrebrehan University, EIAR

Private entities – MAKOBU Enterprises Plc

Public sector - SSGI

**Existing Internal Policies/Mandates**

Development partners

* CFGB's mandate is to support smallholder farmers to improve their food security while maintaining land productivity

Knowledge institutions

* Arsi University - Teaching, research work, community service
* Debrebrehan Agricultural Research Center - Research, develop new technology and demonstrate its usage, give recommendations, teach stakeholders
* Debrebrehan University - Research, community service, teaching, technology and innovation
* EIAR - Based on the agricultural policy of the nation. it does agriculture research, coordinates agriculture research nationally, advises the gov't on agriculture research areas

Public sector

* collect, organize as well as process partial data and disseminate
* do various types of research
* teaching and training

**Missing Internal Policies/Mandates**

Development partners

* CFGB has no mandate to administer the AKIS database and it is not a member of CoW

Knowledge institutions

* Arsi University lacks the mandate to provide consultancy services
* EIAR is missing the mandate to collect /enforce other institutions to share their research data with the central hub

Private entities

Missing mandate that ensures the government delivers on time

Public sector -

**Existing Sources of Finance and Investment**

Development partners

* CFGB is funded by global affairs Canada on a project basis, fiscal sustainability is reliable

Knowledge institutions

* Government support
* Internal income generation e.g. Debrebrehan Agricultural Research Center
* Partnerships with other organizations
* Donor support

Public sector

* Supported by the government

**Missing**

Development partners

* CFGB financially depends on donor support and funding for projects

Knowledge institutions

* Lack of skills to do fundraising for projects
* Poor allocation of funds for data management and limited emphasis on IT infrastructure
* Limited government budget

Private entities

* Lack of funds to scale up projects to the national level

Public sector

* Non-governmental funding is limited

**Existing Technical Capacity**

Development partners

* CFGB – human resource capacity is less stable

Knowledge institutions

* Academic staff
* Researchers and lab technicians
* Teaching assistance
* IT staff

Private entities

* Part-time IT personnel

Public sector

* Have sufficient human capacity in different areas (GIS IC, remote sensing), Researchers

**Missing Technical Capacity**

Development partners

* CFGB – lack of dedicated staff for data management (LCS)

Knowledge institutions

* Debrebrehan Agricultural Research Center is missing a programmer and a GIS expertise
* Debrebrehan University has low experience in project organization
* EIAR lackS skilled ICT experts, having a generalized expert in IT

Private entities

* Unable to hire a full-time IT expert

Public sector

* lack of programmers and a few expertise exists in other agricultural domains

**Existing Physical and IT Infrastructure**

Development partners

* CFGB - IT physical infrastructure is constrained by a lack of sizable server

Knowledge institutions

* buildings, ICT rooms, (internet technology)
* soil, plant, water laboratory, lab instruments like atomic absorption Spectro photometer, PH, and EC meter
* established research data management system and web page developed
* server rooms with network devices

Private entities

* IT Infrastructure

**Missing Physical and IT Infrastructure**

Development partners

* CFGB - no sizable IT infrastructure to generate own data

Knowledge institutions

* Debrebrehan Agricultural Research Center lack a server and data-collecting tablets
* Debrebrehan University is missing state of the art laboratory and demonstration
* EIAR has no modular data centre, and the servers  have a frequent power outage

Private entities

* Data centres
* need to upgrade system requirements to make data accessible to external users

Public sector

* Less IT infrastructure
* high-performance computing is not available
* not enough ground-receiving infrastructure for satellite data

## Data Users at District level

Development - Meki Catholic Secretariat, SOS Sahel Ethiopia, Wetland International

Farmer organizations - Bora Denbel farmers’ cooperative, Cooperative promotion office, Erer farmers’ cooperative, Tegalet seed multiplication cooperative

Knowledge institutions - Debre Berhan University, EIAR, Arsi University

Public sector - Adami Tulu and Jidu Kombolach district BoA, Adami Tulu Pesticides Factory, East Shewa zone agricultural office, North Shewa zone agricultural office, Tsedey Bank

**Existing Internal Mandates and Policies**

Development

* Assisting poor communities e.g Meki Catholic Secretariat
* Complementing development gaps such as health, education, agriculture and food security, gender and youth engagement environment protection, peacebuilding and natural resources management
* Support integrated development / PFM, NRM, emergency support
* Safeguard and restore wetlands and nature such as the Ziway Shals subwatershed
* Improve resilience and sustainable livelihood of the target community

Farmer organizations

* Assessing agricultural mechanization
* Collecting data
* Delivering agricultural inputs
* Potential crop variety selection
* Potential land selection
* Producing pre-basic, basic and certified seeds
* Providing different varieties of seeds and related agronomic information for farmers
* Rendering storage services
* Seed multiplication cluster or area
* Supplying mechanization service
* Sustainable market through cooperatives
* Transportation service

Knowledge institutions

* Conducting researcher work
* Rendering community service
* Learning and teaching
* Rendering consultation services
* Collect data from farmers on soil quality type for further research and to recommend appropriate n nutrient requirements for enhancing production
* Researching various issues such as climate change impact assessment, climate change adaptation, crop modelling
* Collect data on various variables such as crop, climate and soil

Public sector

* Implementation of planned activities
* Input supply
* Monitoring and evaluation
* Producing and distributing pesticides and related products to companies and customers
* Providing credit services
* Supporting farmers
* Data training
* Extension service and follow up
* Data collection from agricultural offices and farmers to decide on loan amount
* Contribute towards increasing production and Productivity
* Capacity building from district up to kebele levels

**Missing** **Internal Mandates and Policies**

Development

* The government needs to expand NGO intervention thematic areas
* Market-related linkages information

Farmer organizations

* Timely access to inputs for supply farmers
* Availability of inputs when demanded by farmers
* There is a lack of different varieties of crops for seed multiplication
* Lack of knowledge and skills to implement agricultural mechanization
* During abundant harvest, there are post-harvest losses due to lack of appropriate and enough storage
* Knowledge on appropriate climate-smart agricultural practices for the agroecological zones

Knowledge institutions

* Lack of quality data from providers
* Lack of standard soil laboratory to get data on time

Public sector

* Lack of networking among the companies under the same administration
* Foreign markets
* No mandate to allocate budget
* Regulatory of forest products and management
* No digitalized data
* Lack data accuracy
* Client selection is not fully made by Tsedey bank
* Lack of full information about the client's history

**Source of Finance and Investment**

Development

* Donors - SOS Sahel Ethiopia, Wetland International, Meki Catholic Secretariat

Farmer organizations

* Members contribution
* Financed by farmers
* NGOs
* Bank loans (private and government)
* Government budget
* Bank loan
* Union products sell

Knowledge institutions

* Income generation by enterprises
* External / projects funds
* The budget allocated by the government for the thematic area

Public sector

* Government allocation of funds
* Banks encourage customers to open a savings account so that they can deliver credit for different activities
* Donors funding projects
* Commercial farming system in agricultural production

**Financial needs and gaps**

Development

* Projects need to be designed to complete technical gaps in ICT project fund
* Insufficient contribution of funds from local partners

Farmer organizations

* Shortage of funds
* Difficult to get a loan
* Higher interest rate
* Projects budget are not continuous
* Debt loans

Knowledge institutions

* Insufficient budget allocation
* Poor linkage with funders

Public sector

* The low capital budget for mechanization practice
* Limitation of finance for loans
* Lack of land for investors
* Lack of finance because saving collection could not cover all credit demands
* Utilization of industry development funds
* Lack of foreign exchange
* Unexploited domestic market opportunity
* Unavailability of the foreign market (Export market)
* The infrastructure challenges that inhibit faster/easier movement of farm produce
* Insufficient budgetary allocation

**Internal Technical Human Resource**

Development

* Economists
* Agronomists, environmentalists, hydrologists, and NRM experts
* IT
* Engineers
* Lawyers

Farmer organizations

* Only one expert assisting the seed production

Knowledge institutions

* Academic staffs
* Supportive staffs
* Technical staffs
* Soil and natural resource experts are available
* Crop and climate modelling experts
* GIS experts

Public sector

* Agriculture experts
* Training staff

**Missing** **Internal Technical Human Resource**

Development

* Lack of IT expert
* Lack of GIS expert
* Lack of modelling experts

Farmer organizations

* No data collection and analysing experts
* Lack of appropriate training for personnel
* Database management expert

Knowledge institutions

* The skill gap in big data analysis

Public sector

* Lack of skilled GIS experts
* Lack of data handling experts
* Under-capacity production due to shortage of foreign exchange
* Lack of skilled experts for market promotion

**Existing Physical/IT Infrastructure**

Development

* Server
* Web page
* Broadband internet connectivity
* database
* website

Farmer organizations

* Seed cleaning machines and other facilities such as tractor
* Internet access
* Seed warehouse
* IT experts

Knowledge institutions

* Broadbands and wireless internet

Public sector

* Organized manufacturing machines and lab facilities
* ICT technology materials
* Farmers training centres
* Wifi
* Machinery

**Missing Physical/IT Infrastructure**

Development

* Lack IT infrastructure
* Lack of transport infrastructure; mostly hired cars are used e.g Wetland International
* Lack of an office

Knowledge institutions

* Slow internet connection for running big data analysis
* Lack of good-capacity computers for running big data
* Lack of materials in the laboratory

Public sector

* Lack of powerful computers
* Lack of internet access
* Accreditation of lab certificates by the concerned authority
* state-of-the-art machinery that goes with the current development; existing ones are old
* No transport access
* No fertile demonstration site and input
* Lack of full technology in all branches
* Poor internet connection

## Data Providers at District level

Development partners - Z/D Lowland Climate Change Adaptation (LCCA) Project

Farmer organization – Farmers, Bossona werana district cooperatives promotion office

Knowledge institutions - Batu soil Researcher centre, Debre Berhan university

Public sector - Seqota Declaration, Zeway Dugda Agricultural office, Agricultural extension office

**Existing Policies and Mandates**

Development partners

* Rules and regulations of the project
* Supervising and preparing all activities implemented at the household level
* Follow up and prepare monthly quarterly and annual reports

Farmer organization

* Farming, crop husbandry, livestock, N. Resources management, local leadership, justice
* Identifying farmers' problems, organising farmers' cooperatives based on problems and resources, market

Knowledge institutions

* Conducting research activities
* Soil testing services
* Teaching, research, community service

Public sector

* Capacity building e.g. on nutrition
* Encourage diversification on-farm for adequate food etc
* Extension services provision
* Supplying input (fertilizer, seed)
* Provide training to DAs, farmers
* Support and follow up on all agriculture and natural resource activities,
* collect agricultural and natural resource data

**Missing Policies and Mandates**

Farmer organization

* supply products directly to users

Knowledge institutions

* Not conducting all agricultural research commodities eg. crop research, livestock research, microbiology, mechanization, irrigation, and absence of farm

Public sector

* Research on House Hold (HH) food consumption
* Research assessment
* Finance loan e.g. providing finance to farmers

**Source of Funding**

Development partners

* Donor funding e.g. UNDP, GEF
* Government

Farmer organization

* Personal savings
* credit from micro-finance e.g. Tsedey Bank
* district union
* own farmer cooperative
* government

Knowledge institutions

* Gov't budget
* Donor funding

Public sector

* Gov't budget
* Donor funding e.g. UN

**Financial Needs and Gaps**

Development partners

* Co-financing from stakeholders

Knowledge institutions

* Lack of sustainable income generation

Public sector

* Farmers need access to loans

**Existing Internal Technical Capacity**

Development partners

* Project Coordinator
* Project accounts

Farmers and farmer organizations

* Household members at the farm level

Knowledge institutions

* Support staff and researchers
* academic staff, admin staff

**Missing Technical Capacity**

Development partners

* GIS experts

Knowledge institutions

* well-trained personnel for data analysis and IT personnel

**Existing** **Physical/IT Infrastructure**

Development partners

* Computers
* Automatic Weather (AW) station

Knowledge institutions

* Basic laboratory installation
* High-speed internet capacity
* office, IT, office facilities, vehicles

Public sector

* sub-standard IT infrastructure

**Missing Physical/IT Infrastructure**

Development partners

* Soil laboratory

Farmer organization

* Farm level - Irrigation motors, developing small irrigation wells, farm machinery, (movers, thrashers, planters)
* Farmer organizations - Vehicle to move around rural kebeles, standard grain stores, office

Knowledge institutions

* Lack of maintenance, lack of modernization, logistic problems
* Large data servers, state-of-the-art laboratories, and lab facilities

Public sector

* Data server
* ICT, internet, data
* vehicles, motors, farm techs, tractors, motor pumps, pedal pumps, combine harvesters, breeds (crop & livestock),
* office facilities, tablets, laptops

# AKIS Policies and Initiatives

**National level**

| **Category** | **Policy** | **Objectives and focus of policy/framework** | **Responsible implementing agency** | **Stakeholders involved/ targeted** |
| --- | --- | --- | --- | --- |
| **Existing policies** | Ten-years Perspective Development Plan | To achieve improved welfare of the society by improving the standard of living and quality of life that is captured in the broader national prosperity vision | All Government bodies | Agricultural - office  Peasant admin office  Woreda land admin unit |
| Nationally Determined Contribution (NDC) | Fostering economic development and growth  Ensuring abatement of future emissions by 64%  Setting priorities for resilience building with a focus on drought, flood and cross-cutting intervention | Ministry of Planning | MOA,  Ministry of Irrigation and lowland |
| Digital Ethiopia 2025: A Digital Strategy for Ethiopia's Inclusive Prosperity | To bring technology to the people of Ethiopia as well as to its industries | Ministry of Planning and Innovation  Ministry of Irrigation and lowland | MOA  Industries  Manufacturing  National Bank of Ethiopia  Etio telecom  ICT sectors |
| Agricultural Development Led Initialization (ADLI) | To alleviate absolute poverty and bring progressively takeover industry in the national GDP | MOA | MoA  EPA  MoWE  Rural land admin |
| Climate Resilient Green Economy (CRGE) | To reduce carbon emissions and pollution, enhance energy and resource efficiency, and prevention of the loss of biodiversity and ecosystem services | Ministry of Planning, MOA | MoA  EPA  MoWE  Rural land admin |
| **Missing policies** | Land use policy | To provide a legal administrative, institutional and technological framework for optimal utilization and productivity of land-related resources desirably at the national, regional and communities level | Ministry of Planning | MOA,  Ministry of Irrigation and lowland,   Ministry of Urban Development |
| National Data Sharing Policy | To define a set of guidelines and principles to help create an ecosystem for enhanced access to sharable data to relevant stakeholders protecting the rights of the information provider and the seeker | Ministry of Innovation | Council of Ministers  MOA,  Research Institutes,  Local and International NGOs |
| **Initiatives** | Ethiopian Climate Smart Agriculture Roadmap | To develop based on a context analysis of Ethiopian agriculture | MOA | MOA  Research Institutes,  Farmers  Universities  Local and International NGOs |
| Ethiopian Program of Adaptation to Climate Change (EPACC) | To analyze the current and future climate change scenarios | Ministry of Planning | Ministry of Planning  MOA  Research Institutes,  Farmers  Universities  Local and International NGOs |
| Digital Agriculture Extension and Advisory Service (DAEAS) Roadmap | To increase farmers’ productivity and income,  improve farmers’ climate resilience, advance inclusion of women and youth farmers,   Improve nutrition and food security. | ATI | MOA  Research Institutes,  Farmers  Universities  Local and International NGOs |
| [Vision 2030: Transforming Ethiopian Food Systems](http://unidoseoul.org/en/files/2021/08/ETH-Food-Systems-Vision-15072021.pdf) | Ensuring diversified food production and increasing the supply of nutrient-dense food | The Government of Ethiopia | Public and Private sectors  MOA  Research Institutes  Universities  Civil society organizations |
| Ethiopian Education Development Roadmap | To assess the performance (access, equity, quality, relevance, efficiency) of the education system, assess the gaps and expectations of various stakeholders on education and training policy, evaluate the sufficiency of the policy and its implementation strategy considering the current vision and the development perspectives to become a middle-income country | Ethiopian Ministry of Education | All public and private sectors  Student  Teachers  Universities  Research institutes |
| Disaster Risk Management road map | To reduce the risk of disasters caused by human error, deliberate destruction, and building or equipment failures | DRM | Communication,  Transportation,  Rescue,  Engineering,  Health peoples  public education and  auxiliary services such as firefighting  police in the country |

**District level**

| **Category** | **Policy/Initiative** | **Objectives and focus of policy/framework** | **Responsible implementing agency** | **Stakeholders involved/ targeted** |
| --- | --- | --- | --- | --- |
| Existing Policies | Education and training policy | To build capacities of children to enable them active, responsible, productive and caring members of society | Ministry of Education | Government institutions |
| Education sector | Academic institutions |
| Academic institutes | Private education sectors |
| Research institution | Research institutes |
| Research and technology policy | - To formulate research strategies and performance indicators |  |  |
| - To establish a system of research and outreach service management for the university |
| - To attract research grants for addressing the issue of national concern and facilitating the conduct of strategic research on development issue |
| law of watershed users association exists |  | The district administration, District agricultural office, Kebele administration, All local community, All government sectors, Adami Tule Agricultural Research Center, All private companies, Farmers | The district administration, District agricultural office, Land administration, Cooperatives offices, Women and children offices, Watershed associations, Non-governmental institutions, Investors |
| Environmental regulation and protection |  |  | Ministry of Water and Environment, Environmental Protection Authority, Judiciaries, Ministry of Agriculture, Land administration |
|
| Water legislation | To safeguard environmental and water resource |  |  |
|
| Agricultural production contract proclamation |  | Federal cooperatives, Regional, zonal and district levels cooperatives, Unions, Primary cooperatives, Individual members of cooperatives | Research centres, Universities, Non-governmental organizations, Private companies, farmer’s unions, Customers |
|
|
| Directives | - To increase crop productivity using these proclamations and bylaws |  |  |
| - To improve the livelihood of farmers |
| - To increase the saving ability of farmers |
| A policy that makes change for cooperatives |  | Government bodies, Policy makers, the Bureau of Agriculture, Unions, Private companies, Farmers | Cooperatives, Researchers, Research centres, Universities, Agro dealers, Industries, Non-governmental organizations |
|
| Ten-year perspective development plan | -creating a pragmatic market-based economic system | MoA | MoA, Lowland and irrigation minister, Livestock, EIAR |
| -enhancing the role and participation of the private sectors |
|  |
| Climate resilient green economic policy (CRGE) | - Fostering economic development and growth | Plan Minster | Agri bureaus, EIAR, EMI |
| - Improving resilience to climate change |
| Missing Policies | wetland policy |  |  |  |
|
| buffer zone policy (draft available, but not yet ratified) |  |  |  |
| Land management policy |  |  |  |
|
| Water utilization policy |  |  |  |
|
| Wildlife policy (Natural ecosystem conservation) |  |  |  |
|
| Data sharing policy |  |  |  |
| Land use policy |  |  |  |
| Policy implementation proclamation |  |  |  |
| Initiatives | Nile basin initiative |  |  |  |
| Afforestation |  |  |  |
| Animal forage production |
| Artificial insemination |
| Clustering agricultural production practices |
| The commitment of government structures to sustaining and protecting natural resources base |  |  |  |
| Culture of community in protecting lakes and other natural resources base |
| Green Legacy | Mitigate global warming | Environment office | Agriculture Offices, Researchers, NGOs, Universities, Environmental Protection, Land administration |
| Integrated mechanization and agro-processing |  |  |  |
| Irrigated wheat production | Import substitute, export generation, ensure food security | MOA | Agriculture Offices, Researchers, NGOs, Universities |
| Agriculture Commercialization | To popularize agricultural mechanization, improve large-scale production | MOA | Agriculture Offices, farmer unions, farmers, Agro dealers, Researchers, NGOs, Universities, ATI |
| Yelemate Terufat | Enhance nutrition security | Zonal and district Administration | Farmer, Agricultural Offices |
| Ethiopian Digital agricultural extension and advisory service (EDAEAS) | provides farmers with the relevant agricultural extension via digital channels while strengthening extension systems in-country. | MoA | EMI, EIAR, Agricultural bureaus |
|
| Climate-smart agriculture roadmap (CSA roadmap) | Strengthen the role of MoA in addressing vulnerabilities facing the agricultural sector | MoA | MoA, EMI, EIAR, agri. bureaus |
| Soil and agronomy directive | improves the soil's physical conditions by the maintenance of soil properties (structure, porosity, moisture retention capacity and permeability) | MoA | MoA, EMI, EIAR, Agricultural bureaus |
| Contract farming | transform subsistence agriculture to market-oriented commercial farming in the densely populated mid and high-altitude areas of the country | MoA, lowland and irrigation minister | MoA, EMI, EIAR, Agricultural bureaus, Cooperatives, unions, Exporters, Industries |
|
| Seqota Declaration | - the eradication of the underline malnutrition | Responsible DA, Gov't Health, extension workers, Gov't, NGOs | Gov't and NGOs |
| - the eradication of stunting growth among children’s less than 2 years by 2030 |

**Conclusions and recommendations**

This needs assessment workshop aspires to have roadmaps for the design of an enhanced AKIS that reduces the gap between research and practice, create national and local multi-stakeholder partnerships to constantly improve access to data and information necessary for climate smart production, and have dynamic LSC hubs that are actively used for policy development and decision making for CSA at national and local levels. Therefore, in order to provide the requirement for the design of the hub, agricultural sector needs assessment and stakeholder overviews at national and local levels was conducted with specific objectives of identifying stakeholders’ roles, challenges, and opportunities of LSC-IS use, specifying LSC-information needs and LSC-information users, and identifying capacity requirements for LSC-information use and users. In the following sections conclusions and recommendations of the national and sub-national needs assessment workshops will be presented in brief.

## National workshop – Adama

In the national workshop, all categories of stakeholders but farmer organizations participated by identifying themselves as both providers and users of LSC-IS data. In both use cases, most of the stakeholders were involved in all stages of data valorisation process. The main types of data gathered were soil moisture, soil physiochemical, land degradation, forest cover and hydrological data. The end users of the processed and interpreted information were farmers, private sectors, governmental and non-governmental organizations.

To identify data needs, availability, accessibility and data gaps and challenges, the two use cases were split into providers and users of the LSC-IS information. In use case 1 (ISFM), the data user group emphasized the limitation in data availability and accessibility, and lack of timeliness and location specificity, poor data quality and lack of standardization as the main data use gaps and challenges. While the main concerns of the provider group were presence of outdated data, lack of well-organized dataset and absence of centralized data storage location. Creating linkage with other organizations and operationalizing a conducive data use policy were among the main data use opportunities. Growing interest for AKIS and presence of big datasets that can be shared were considered as opportunities among the provider group. Improving the livelihood of small-scale farmers through various interventions such as adoption of conservation agriculture was the main success story reported by both groups. In use case two (SWC), absence of location specific data, incomplete dataset, and lack of centralized data storage system were highlighted as the main data use gaps and challenges among the user group while the potential to generate a data hub and partnership to international organizations were the main data use opportunities and success story reported by the group. In the provider group the main data provision gaps and challenges were absence of institutionally organized and compiled dataset, and lack of standardization. Important success stories reported were successful launching of ETRSS-1 satellite and availability of LiDAR data.

In the assessment of existing and missing institutional capacity requirements, stakeholders stated specific mandates related to LSC-IS data use and provision. In the ISFM group, stakeholders in the user group stated the several existing mandates related to LSC-IS data use, however, the right to store and centrally organize and manage national database was among the missing mandates. Governmental and non-government sources provided finance, but the existing finance was not sufficient to carry out their mandates. In addition to finance, the existing human and infrastructure capacity were not adequate. Among the missing human resource and physical infrastructure were IT and GIS experts (at a national level and a district level), data server expert and data server and weather station. Similarly, in the provider group administering AKIS database and data sharing policies were the main missing mandates of the group. Lack of finance and IT infrastructure to generate data were also major bottlenecks stated by the group. According to stakeholders in SWC user group, failure to store, centrally organize and manage national database was the main concern as it hampered proper data use and administration. Limited supply of finance and lack of IT infrastructure such as big data server and standard laboratories were reported as missing budget and physical infrastructure. In this use case, most of the provider group underlined lack of physical/IT infrastructure as major impediment.

In the identification of existing and missing AKIS policies and initiatives, major existing polices stated by the two groups in ISFM use case were climate resilient green economy, digital Ethiopia 2025, national extension policy. These policies were intended to alleviate absolute poverty and achieve improved welfare of the society. Both the users and providers of the group indicated important but missing policies such as national data sharing policy and land use policy. Key initiatives the two groups reported were agricultural transformation initiatives, climate smart agriculture roadmap, CoW and map rooms. In SWC use case, national innovation and technology policy, agricultural sector policy, soil, space, and geodetic data sharing directives were vital policies aimed at accessing the best information for agriculture and natural resources management, and capacity building at the national level. Government ministries, research institutes, universities implemented these policies and directives involving beneficiaries such as public and private sector and farmers.

In summary, the report indicated that all categories of stakeholders were involved in most of the stages of the data valorisation process. The main data use and provision challenges were related to data availability, accessibility, quality, location specificity and absence of institutionally organized and compiled dataset. At the district level the number of stakeholders engaging with LSC data is more numerous that at a national level. Lack of finance, human resources, and physical infrastructure were major barriers in the operationalization of institutional mandates. Although there were important policies that contributed to achieving improved livelihood of society, key missing policies such as national data sharing and land use policies hampered stakeholders from functioning in full capacity

by accessing and using data and information necessary for climate smart agricultural production.

To improve the accessibility and use of LSC-ID data, some of the enabling conditions may be building the capacity of stakeholders who are involved in providing and using LSC-IS data. Strengthening stakeholder partnership may also contribute towards smooth data sharing. Modernizing the physical and IT infrastructure may also help in the generation of precise and location specific data. The development of a data-hub may alleviate most of the challenges related to disorganized and decentralized dataset. In addition, the government has to be flexible in terms of allowing stakeholders/institutions to have the mandate and policies to use, manage and administer LSC-IS data.

## 

## Sub-national workshop – Adami Tulu Jido Kombollcha

All the five categories of stakeholders attended the workshop representing the role of LSC-IS data user, supplier or both. In both use cases, most of the participants were involved in all stages of the data value chain. Types of data gathered included weather and crop production, soil physical and chemical property, land use and land cover, land degradation and socioeconomic data. Data processing tools used ranged from community livelihood improvement index, GIS software to statistical analysis such as crop simulation models. Government offices, non-governmental organisations, researchers, private sectors and farmers were end users of processed, analysed and interpreted data.

The assessment to specify LSC-IS data needs, availability, accessibility, opportunity, gaps, and challenges among the ISFM user and provider groups indicated that there were limitations in data use and supply including incomplete dataset, inconvenient data format, lack of good quality and quantity data, inaccessibility of the available data, absence of real time data, and lack of awareness of data use and provision. Data use and provision opportunities stated by both groups were collaboration with other stakeholders, provision of data free of charge and focus of government and stakeholders to agricultural development. In the SWC group, the main data use and provision challenges for both groups included poor data quality, incomplete data, data inconsistency, and inaccessible dataset. The main data use opportunity emphasized by the user group was government’s focus and policy on agricultural transformation.

When stakeholders identified the existing and missing institutional capacity to inform hub development, the main missing mandates of the ISFM user and providers groups were absence of centralised and harmonised dataset management and data storage, conducting research on household food consumption and assisting farmers with loans. Although the main source of finance for the groups were government budget and donors fund, absence of co-financing from stakeholders and lack of loan to farmers were listed under missing finance.

Skilled manpower in terms of big data analysis and data hub and ICT centres were missing human resource and physical infrastructure. The SWC user and provider groups also reported missing mandates such as open data sharing, and national agricultural data depository that hindered execution of their institutional mandates. Lack of finance, human resources such as IT experts and big data analyst and weather station data server were also reported as missing institutional capacity.

In the ISFM use case, several AKIS policies and initiatives that aimed at increased crop productivity, enhanced livelihood and food security were listed by both the user and provider groups. Data sharing and land use and land management policies were the most important missing policies highlighted by the groups. In the SWC use case, AKIS polices stated had objectives of creating pragmatic market based economic system that can help to foster economic development. Similar to other stakeholders, the two groups in this use case underlined data sharing and land use policies as the main missing policies. Existing initiatives such as Ethiopian digital agricultural extension and advisory services, climate smart agriculture roadmap and soil and agronomy directives were intended to provide farmers with relevant agricultural extension services and strengthen the role of agricultural offices in different level in addressing vulnerability facing the agricultural sector.

From the needs assessment workshop, it was noted that there was no clear-cut role between those who were using and providing LSC-IS data. In addition, all stakeholders were involved in one or more of the data valorisations processes and used various methods to process and analyse the data. Data use and provision challenges stated among stakeholders were similar to those challenges pointed out by stakeholders at the national workshop. Absence of real time data, lack of digitizing data and lack of awareness of data users and providers were also mentioned as challenges that affected proper data use. Lack of institutional mandates and policies also contributed to poor utilization and provision of data. Therefore, better use and management of LSC-IS data could be achieved by improving the quality, quantity and accessibility of data through training and capacity building, investing in physical/IT infrastructure and granting institutions the relevant mandates to share and manage data. Designing appropriate policies and initiatives also contribute towards better management and administration of LSC-IS data.

## Sub-national workshop – Basona Werena

In this sub-national workshop, the participation of farmer organizations was significant since a substantial number of cooperatives and farmer unions attended the workshop. They identified themselves as both suppliers and users of LSC-IS data. Representatives from private sector organizations were missing in this workshop while the other stakeholder categories were represented. Different types of data such as soil physical and chemical property, soil erosion and runoff, land degradation and other socioeconomic data are gathered, processed, and interpreted for planning, training and awareness creation, advisory services, monitoring and evaluation by end users such as farmers, national and district level agricultural offices and NGOs. Although LSC-IS data seems to be easily available, the main data gaps and challenges reported by both the provider and user groups in ISFM use case were inaccurate, incomplete, and poor-quality data. In addition, lack of centrally stored and managed digitized dataset, and limited knowledge in terms of data use were also among the challenges. In the second use case, main data gaps and challenges highlighted were lack of consolidated data format, lack of location specific and consistent data with reasonable quality.

Institutional capacity requirement was assessed to inform the hub development in the user and provider groups in the ISFM use case, and stakeholders reported missing mandates such as input distribution and supplying of agricultural products. Lack of financial, human and physical/IT resources were the main bottlenecks to achieve their given mandates. The situation was similar for use case two where both the user and the provider groups stated that land and forest use and management as important missing mandates. Adequate financing,, trained manpower, and infrastructure like lab equipment and high-capacity computers were also in short supply.

The main objective of AKIS policy identified by the two groups in ISFM use case was increasing productivity and improving watershed management practices, and collectively solve economic and social problems that members cannot individually achieve. In the SWC use case agricultural led industrialization was an important existing policy that was intended to increase production and productivity. Most important initiatives that aimed to increase the quality and quantity of agricultural production were contract farming and cluster farming. Significant missing AKIS policies stated by the group were university and industry linkages, and land use policy.

To sum up, the needs assessment workshops in both the national and sub national levels indicated that most important data use and provision challenges identified are to some extent similar, demanding nearly the same solution to address them.

Therefore, training and capacity building of stakeholders, strong partnership among stakeholders, investing in well-equipped infrastructure, and empowering institutions to have favourable policies, and mandates would allow stakeholders the fair supply, use, management, and storage of well-organized and accessible LSC-IS data. Development of data hub may alleviate most of the challenges related to disorganized and decentralized dataset and facilitate informed agricultural decision making to enhance the well-being of the end users, mostly farmers.

**Key informant interview**

An in-depth key informant interviews (KII) were conducted to explore and capture new ideas and insights that were not anticipated during the land soil crop information services LSC-IS) needs assessment focus group discussions. The KII were conducted at the national level in Addis Ababa and sub national levels in Basona Warena and Adami Tulu Jedo Kombollcha (ATJK) districts from April 18 -26, 2023. In all the places, similar number of participants (15 LSC-IS data providers and 15 LSC-IS data users) were selected based on the organizations participants come from, and how knowledgeable participants are about the existing capacities, and constraints related to land soil crop information services (LSC-IS) data and also their ability to suggest possible solutions to the existing bottlenecks. In the following sections a summary of the responses given by KII participants who were LSC-IS data providers and users will be presented. Detailed responses of participants in the national and sub national levels are presented in Tables 1-6.

**Responses of LSC-IS data providers at the national and sub national levels:**

1. Which LSC data, services, or advisories do you provide?

Respondents mentioned that important LSC data, services or advisories they provide included: reduced tillage, weed control, soil cover through crop residue, and mulching, crop yield data, land utilization, input use, agricultural cost of production, land area under different crops, land area covered by different type of fertilizer for each crop, dry season data i.e. irrigated crops data including vegetables and wheat, price index, soil temperature, Eto (RH, RF, air T, Radiation), genetic coefficient for different crop varieties, geospatial and biometry data processing, agro-advisories including date of sowing, ploughing or farm management, crop and variety selection for the seasons, land preparation, forecast of rainfall daily, decadal, …), weather data (rainfall, temperature, humidity, sunshine, wind speed and direction.

1. What type of LSC data/information or services or advisories do your users need to address soil fertility and soil and water conservation challenges?

According to participants, different LSC data/information or services are needed by users. The most important being : climate forecast to determine planting time, soil water content to decide what to plant after harvesting, run-off information, soil erosion severity, soil physio-chemical properties, rainfall data used for soil and water conservation related advisory, rainfall amount, rainfall deviation from mean/normal versus crop water requirement, onset of rainfall, dry spell and long/short season forecast, humidity, sunshine, wind speed and direction, soil and water conservation measures (wood check dam, gabions), erosion assessment, river flow. Land use rules and regulations, and land use recommendations

1. For whom do you develop or provide these products, services or advisories?

Land soil crop advisories and services were provided to farmers, development agents (DAs), agricultural SMS, retailers, dealers, students, universities, investors, governmental and non-governmental organizations, scientific community, unions, cooperatives, private sector, aviation, water bureau, health sector, climate change adaptation project, industries (beer and malt factories), legal authorities such as attorneys, courts and police.

1. How is the information from LSC data presented to the users (map portal, GIS system, mobile app)? And is this the best way to present data to users?

According to respondents, LSC data were presented to users in different forms and formats, to mention some: mobile App, GIS system, map portal, picture and videos, web-based application, netcdf , data portal, IVR such as 8028 farmer hotlines, SMS, excel and report in pdf, social media, radio, TV, map data, areal map, soft copy through email and removable devices (e.g., flash disk), directly through oral communication with users, group telegram.

1. Is there a digital data repository of LSC and climate related datasets in your organization? Are these datasets accessible as 1) catalogue service 2) web mapping service 3) APIs

Digital data repositories don’t exist in ATJK and Basona Werana districts except for the Debre Berhan agricultural research center where establishment of central repositories for the available database are in progress and the NRLIS data repository of Debre Berhan University. Whereas at the national level, there are digital data repositories where some data (e.g., climate data) are available and open access, others data repositories are restricted and accessed upon request. These data repositories are found as catalogue service and web mapping.

1. Do you have metadata available for all published: LSC-IS datasets?

Most of the organizations both at the national and sub national levels reported that there are metadata available although some of them are incomplete. Some of the metadata included meteorological metadata, MSC thesis and soil health papers, land use map, and field work data.

1. Are there metadata standards in place in your organization?

Many of the organization have standards for metadata. Some of the standards mentioned by respondents included Dublin core standard, World Meteorological Organization (WMO) standard. Some stated that metadata standard available for land use map location (e.g., region, zone, district, and kebele), name, age and sex of farmers, code for each farmer, size of farmland, farm ID.

There are no centrally agreed on and regulated metadata standards.

1. What is the format of the data you provide?

LSC data are provided in variety of formats including, amongsd others: leaflets, brochures, manuals, GIS vectors, GIS raster

csv, image and flat text, plain tables such as MS Excel, csv, land use map, pdf format, pictures provided in TIFF, JPEG, aerial photograph.

1. How do you provide LSC data to users: data download, web service (WMS, WFS, WCS), API, etc.?

Respondents at both the national and sub national levels stated that they used all the different ways to provide data including data download, data portal, web service (WMS, WFS, WCS),

1. What are current constraints in accessing LSC data for your applications, use case or services?

The current constraints in accessing LSC data are similar at all levels. The main challenges included: unavailability of data, inadequate knowledge and limited financial resource (e.g., lack of finance to purchase relevant hardware/software, tools, data, e.t.c.), inaccessibility of data, missing data, failure to put the data in the right format, lack of data standardization, limited system integration to share data with partners and limitation of data storage. In addition, poor data quality, lack of data sharing policy, lack of human resources (staff with specific skill sets: data analysts, GIS technicians, modelers, etc.), lack of tools for digital data collection. Lack of understanding among data providing sources, for example, farmers may suspect that data is collected to impose tax on them by the government, due to this they are not willing to give precise information. In some parts of the country, security constraints pose a serious issue.

1. What would you like to be done differently to ensure data:

Availability

Accessibility

Usability

Scalable

Impactful

At the national level, respondents indicated that they would like to have data that can be transformed into user friendly data and information, enhanced skill of data users and data that can be scalable. In ATJK, fulfilling standard data collection requirements such as adequate awareness creation to the household ahead of data collection time, ensuring the required logistics that imply the budget requirement, local administrative support is also required. In addition, bringing in satellite data with the station observation, digital tool based data recording using application, downscaling and quality control, girding /extrapolation of the data for specific location-measurement, establishing central data storage and make it interactive or up to date, using Satellite data to fill the gap from station observation, and automated stations were some of the things that needed to be done differently. In Basona Warana, things that needed to be done differently included promotion of the LSC-IS data hub to create awareness both among data providers and users, capacity building to establish data repository, provision of high-capacity computers, awareness creation on data sharing, employ online data collection tools such as Tablets, KOBO collect and ODK.

1. What are the key security and privacy data requirements that the LSC hub should consider in its design?

Most important security and privacy data requirements in the LSC hub design respondents indicated were protecting data from cyber-attack, keeping data confidential, developing rules and regulations for data sharing, implementing monitoring tools to detect unusual traffic, protecting data from deletion and manipulation and misinterpretation, locking data with password to avoid data miss use and management.

1. What do you expect from the LSC hub in terms of functionality? What type of functionality (e.g., data download, data viewer, data catalogue, dashboards (presenting what type of information?), user stories, data interpretation (translating data to advisory), etc.) would be helpful for you?

Respondents at all level indicated that all forms of functionality stated above are very useful and acceptable.

1. How would you like to access the LSC hub: laptop or desktop computer or mobile device (tablet, phone)?

Respondents would like to access LSC hub with laptop, desktop computer or mobile device such as (tablet, phone). In addition to assist people with visual impairment and those who are unable to read sound (audio) is recommended to be available.

1. [Optional, EIAR could answer it] What are the cost of hosting and maintenance of the LSC hub beyond the project life (specific for EIAR)?

This question was posed to respondents from EIAR and one of the replies was: “after the project life, existing staff can share the load to sustain the project.”

1. What (from your view as a data provider) is a critical factor to ensure sustainability of the LSC hub?

A number of opinions and views were expressed with regard to sustainability of LSC data. For example, revisiting and updating the existing policies and introducing the missing polices. Strengthening coordination and collaboration among research, extension, advisory services, private and public service providers, and encouraging and motivating service providers. Participation of the relevant stakeholders who can contribute towards up to date, and quality data, enhancing the skill and capacity of those who are in charge of the hub management. It has to be financially supported by the government in addition to the external support. It also needs to be support by different organizations that have stake to the data. Availability of high-capacity computer and server, reliable internet connection, security protocol against unauthorized access to datasets and institutionalizing the hub were among the crucial factors that can contribute to the sustainability.

1. Do you think users are willing to pay for the LSC information services?

The most frequent replies to this willingness to pay question both at the national and district level were “yes, if affordable, “yes, if the data adds value and “yes, if the data is of good quality.”

Tables 1-3 presents responses given by LSC-IS data providers in Addis Ababa, ATJK and Basona Werena.

Key informant interview in Addis Ababa ---- data provider group

| No. | Key informant questions | National level /Addis Ababa |
| --- | --- | --- |
| 1 | Which LSC data, services, or advisories do you provide? | * Reduced tillage that helps reduction of soil erosion and improve water holding capacity, weed control through mechanical, chemical, and cultural practices, soil cover through crop residue /mulching management, planting cover crops and intercropping. It contributes to soil organic matter build up, improves rainwater percolation, and improve soil moisture holding capacity and improve moisture availability for plant use, crop rotation with major emphasis of including legumes in the rotation as part of improving soil fertility while reducing crop insect pests, diseases, and weed. * Soil fertility status, soil acidity and salinity, market information * From land preparation to post harvest handling for major cereal crops, coffee and vegetables * Soil moisture, soil temperature, rainfall, runoff |
| 2 | What type of LSC data/information or services or advisories do your users need to address soil fertility and soil and water conservation challenges? | * Climate forecast to determine planting time for the main and cover crops, soil water content to decide what to plant after harvesting the first main crop, pH, organic carbon, plant nutrient both macro and micro, topsoil, land use type, management practices/ intensity, inputs, land use system performance (land sustainability, land degradation, soil health indicators, land use productivity: agricultural statical data), institutions (policy, finance, service providers/extension, market). * Run-off information, soil erosion severity, soil physio-chemical properties, socioeconomic survey, types and amount of soil structure * Tillage practices, fertilizer application rate and time, weed and crop management information * Data on Soil fertility – amount and rate of organic product (compost ,vermi compost , manure etc., ) information on amount and rate of Artificial fertilizer such as Dap, Urea, Potash etc. * Soil and water conservation (contour ploughing, tracing, forage grass plantation, mulching etc) |
| 3 | For whom do you develop or provide these products, services or advisories? | * Farmers, Development Agents (DAs), agricultural SMS, and some time retailors and dealers. * Students, universities, investors, governmental and non-governmental organizations * Scientific community, unions * Private sector |
| 4 | How is the information from LSC data presented to the users (map portal, GIS system, mobile app)? And is this the best way to present data to users? | * Mobile App * GIS system * map portal, GIS system, mobile app (SMS), picture and videos, for farmers and DA- SMS video or pictures, for scientist – web-based application * netcdf * Data portal, GIS, IVR such as 8028 farmer hotlines, SMS, Mobil for National market information system. |
| 5 | Is there a digital data repository of LSC and climate related datasets in your organization? Are these datasets accessible as 1) catalogue service 2) web mapping service 3) APIs? | * NA * Yes, some data’s are open access and others are restricted and access upon request * Yes, digital data repository available and accessible as catalogue service and web mapping * Yes, existing climate data is available upon request |
| 6 | Do you have metadata available for all published: LSC-IS datasets? | * NA * Yes, all available data has metadata * Meteorological metadata available * For those data generated by our organization, there is metadata available |
| 7 | Are there metadata standards in place in your organization? | * NA * Yes, the data we accept has specific format and metadata is kept following the standard * Yes, * Yes, customized in Dublin core metadata standard |
| 8 | What is the format of the data you provide? | * Leaflet, brochure, manual * GIS vector, GIS raster * csv, image and flat text * GIS vector, GIS raster files, plain tables such as MS Excel, csv |

Table Cont. ---- data provider group

| No. | Key informant questions | National level/Addis Ababa |
| --- | --- | --- |
| 9 | How do you provide LSC data to users: data download, web service (WMS, WFS, WCS), API, etc.? | * Data download, data portal * Soft copy, web service * We provide by data download, web service (WMS, WFS, WCS) * Using dedicated website |
| 10 | What are current constraints in accessing LSC data for your applications, use case or services? | * Data are not available, inadequate knowledge and limited financial resource. * Data are available but not accessible or not in the right format, lack of technical resources (computers, software), lack of financial resources (purchase of relevant hardware/software, tools, data, e.t.c.) * Lack of data standardization, limited system integration to share data with partners and storage limitation also the major constraints to access the LSC data * Poor data quality, lack of data sharing policy, lack of human resources (staff with specific skill sets: data analysts, GIS technicians, modelers, etc.) |
| 11 | What would you like to be done differently to ensure data:   * Availability * Accessibility * Usability * Scalable   Impactful | * Transforming into useable or users’ friendly data and information * Enhance the skill of the data user * Good quality data and scalability |
| 12 | What are the key security and privacy data requirements that the LSC hub should consider in its design? | * Information needs to be available to the user with knowledge of data owner. * Giving credit to data owners, would be good if the person managing the hub is knowledgeable. * Implementing data policy and guideline, secured application services, detect unusual traffic by implementing monitoring tools. * Designing LSC hub policy * Data governance policy and data governance team |
| 13 | What do you expect from the LSC hub in terms of functionality? What type of functionality (e.g., data download, data viewer, data catalogue, dashboards (presenting what type of information?), user stories, data interpretation (translating data to advisory), etc.) would be helpful for you? | * user-friendly readymade data through available communication technologies. * Consider information value chain and support local language especially advisory. * Data download, data viewer, data catalogue * API |
| 14 | How would you like to access the LSC hub: laptop or desktop computer or mobile device (tablet, phone)? | * Laptop, desktop, mobile device |
| 15 | [Optional, EIAR could answer it] What are the cost of hosting and maintenance of the LSC hub beyond the project life (specific for EIAR)? | * NA * After the project life, existing staff can share the load to sustain the project. |
| 16 | What (from your view as a data provider) is a critical factor to ensure sustainability of the LSC hub? | * Revesting and updating the existing policies and including what is missing, policies are not inclusive of all partners and stakeholders, sometime polices are available but not implemented, lack of appropriate awareness creation of high-level policy decision makers at federal and regional level, strengthening coordination and collaboration among research, extension advisory services, private and public service providers, encouraging and motivating private service providers. * Central office, guideline, and budget   To ensure sustainability, there should be link with other project or government services, and  assigning sufficient expertise would be important.   * Data technical expert, and infrastructure |
| 17 | Do you think users are willing to pay for the LSC information services? | * Yes, Private companies like MakoBu Enterprise PLC and commercial farmers and are willing to pay. * Free access is preferred (1 person) * Yes, if the data is of good quality * Better to do research to find out this |

Key informant interview in Basona Werana ---- data provider group

| No. | Key informant questions | Subnational level Basona Warana |
| --- | --- | --- |
| 1 | Which LSC data, services, or advisories do you provide? | * Soil types for the mandate areas, fertility map, local soil fertility status, location of salt affected area. * Area or percentage coverage of acidic, and saline soil, information on acidic soil reclamation, and drainage of verti soil, * soil loss rate for selected watersheds, verti soil coverage in hectare, information on input for soil reclamation, biofertilizer for pulse production * Available crops varieties, disease identification for different crops, recommendation of nutrient for different crops and soil * Suitable agro-ecological and soils requirements for each crop variety * Soil fertility management practices such as tillage frequency, fertilizer rates and drainage methods, compost produced in m3. * Weather data (rainfall, temperature, humidity, sunshine, wind speed and direction) * Soil and water conservation measures (wood check dam, gabions), erosion assessment, river flow * Length of soil bund, stone bund, gabions, wood check dam constructed, * Amount of tree seedlings raised in the nursery and planted in the watershed. * Land use rules and regulations, land use recommendations |
| 2 | What type of LSC data/information or services or advisories do your users need to address soil fertility and soil and water conservation challenges? | * Improved crop varieties that give rise to higher yield and resist to diseases. * Improved crop varieties suitable to different soil fertility groups such as waterlogged soils, acid soils and saline soils * Weather data, soil pH, soil depth, soil loss tolerance limit, extent of alkaline and acidic soil coverage in the zone * Weather prediction advisory for various purposes such as for adjusting sowing dates. * Soil types of information, soil nutrient information (e.g., Nitrogen, phosphors, potassium, zinc, organic matter, organic carbon) * Site specific nutrients (particularly nitrogen and phosphorous) recommendations for each crop * Detailed soil physical and chemical properties * Improved technologies or management practices to improve soil fertility. * Best practices to manage acidic saline and waterlogged soils. * Land use map and land suitability map, areal map |
| 3 | For whom do you develop or provide these products, services or advisories? | * Farmers * Agricultural experts, development agents, * Students at undergraduate and graduate levels and apprenticeship * Universities, NGOs cooperatives, CALM project, SLM project * Research institutes such as Ethiopia's Biodiversity and Biodiversity institutes that work on indigenous knowledge. * Industries particularly beer and malt factories/ Investors * Legal authorities such as attorney, courts, and police |
| 4 | How is the information from LSC data presented to the users (map portal, GIS system, mobile app)? And is this the best way to present data to users? | * Can be downloaded from website of the institute called, Amhara Region Agricultural Research Institute (ARARI) in which proceedings, available technologies, recommendations, and other information are available. Debre Berhan Agricultural Centre belongs to ARARI. * Hard (photo) copy, GIS system, Maps, Manuals, areal map * Soft copy through email and removable devises (e.g., flash disk) * Directly through oral communication with users * Through telephone conversation, group telegram * National rural land information system (NRLIS), a national database |
| 5 | Is there a digital data repository of LSC and climate related datasets in your organization? Are these datasets accessible as 1) catalogue service 2) web mapping service 3) APIs? | * Yes, the datasets are available in personal computers, removable devises (external hard disk) and ARARI website. The datasets are accessed as   + catalogue service from ARARI website   + Written or oral request to the centre. Thus, the datasets can be accessed as soft or hard copy. * Establishment of central repositories for the available database are on progress at DBARC and ARARI. * Yes, there is digital repository called NRLIS in Debre Berhan University |
| 6 | Do you have metadata available for all published: LSC-IS datasets? | * Yes, for MSC thesis and soil health paper. * Available for on-going activities for every year * Available but incomplete (zone agriculture office) * Metadata available for land use map * Metadata available for all field work |
| 7 | Are there metadata standards in place in your organization? | * No, for the published research articles. But metadata available for all research activities conducted during the budget year for all research divisions. These metadata are published and available in directories. Each research division has its own directory. * Apart from directory, there are conventional (not standard) metadata for the activities under progress. These metadata describe.   + who collected the data, where the data collected from (soil type, climate, location, etc)   + special conditions observed during data collection.   + crop type, etc * not to the standard (zone agriculture office) * yes, metadata standard available for land use map location (e.g., region, zone, district, and kebele), name, age and sex of farmers, code for each farmer, size of farmland, farm ID * Metadata standard available which include who collected the data, who approved the data, and time of data collection |
| 8 | What is the format of the data you provide? | * Observational data provided to users in excel, csv, word, and PDF formats. * Pictures provided in TIFF, JPEG and PDF formats. * Electronic-tablet-based data are provided in excel or csv files. * Spatial data collected from the field are georeferenced in point data, polygon, GIS vector file, shape file, aerial photograph |

Table Cont. ---- data provider group

| No. | Key informant questions | Subnational level Basona Warana |
| --- | --- | --- |
| 9 | How do you provide LSC data to users: data download, web service (WMS, WFS, WCS), API, etc.? | * Datasets can be downloaded from ARARI website (https://www.arari.gov.et) * Datasets are provided to users through. * Email, Bluetooth, telegram, flash disk * Information (advisory) is provided to users through. * Leaflet, manuals, FM radio and television as interview and reportage, trainings * LSC datasets are provided through web mapping services as WMS, WFS, WCS formats |
| 10 | What are current constraints in accessing LSC data for your applications, use case or services? | * Generally, the required data are unavailable. * Specific parameters such as soil and climate parameters unavailable * Some data are available but not accessible. * Data incomplete: some data are missing. * Financial resources to procure required data unavailable. * Data available in hard copy which is difficult to convert to soft copy. * Lack of staff with specific skill (e.g., modellers) * Lack of high-capacity computers for storing and processing big data, lack of modern software, lack of staff with GIS skill, statistical analysis skill, modelling skill |
| 11 | What would you like to be done differently to ensure data:   * Availability * Accessibility * Usability * Scalable   Impactful | * Data needs to be available in repositories (websites) for easy access. * Data centre (hub) for storage and access is recommended to be available. * Data should be available/stored with sufficient description; data should be standardized and consistent. * Reliable internet access needs to be available. * Promotion of the LSC-IS data hub is required to aware both data providers and users. * Capacity building to establish data repository, provision of high-capacity computers, awareness creation on data sharing, * Employ online data collection tools such as Tablets, KOBO collect and ODK |
| 12 | What are the key security and privacy data requirements that the LSC hub should consider in its design? | * Data in LSC data hub should not be allowed to be edited (updated) by any users except for the authors who uploaded the data. * Authors need to have access to update their own data. * The hub needs to be secured from data deletion and manipulation and cyber-attack. * Data should not be allowed to be misinterpreted; users should make complete interpretation of the data they get from the hub. * Users need to understand the data prior to making any interpretation. * LSC data providers need to get free access to journal articles that are published using the data they provided to the LSC data hub. * Property right , lock data with password to avoid data miss use and management |
| 13 | What do you expect from the LSC hub in terms of functionality? What type of functionality (e.g., data download, data viewer, data catalogue, dashboards (presenting what type of information?), user stories, data interpretation (translating data to advisory), etc.) would be helpful for you? | * Datasets need to be downloadable as excel, csv, word, PDF or other relevant formats. * Data viewer, * Data catalogue/Dashboard * User stories, * Data translated to advisory in addition to raw data. |
| 14 | How would you like to access the LSC hub: laptop or desktop computer or mobile device (tablet, phone)? | * Phone, Tablet, Laptop, Desktop * Sound (audio) is recommended to be available to assist people with visual impairment and those who are unable to read |
| 15 | [Optional, EIAR could answer it] What are the cost of hosting and maintenance of the LSC hub beyond the project life (specific for EIAR)? | NA |
| 16 | What (from your view as a data provider) is a critical factor to ensure sustainability of the LSC hub? | * Recognition or acknowledgement to LSC data providers * Should not be entirely dependent up on external support. * Needs to be recognized and financially supported by the government in addition to the external support. * It also needs to be support by different organizations that have stake to the data. * Permanent staffs are required for its proper administration. * Needs to have a reliable high-capacity computer and server. * Needs to have a reliable internet access. * Needs to have a reliable security protocol against unauthorized access to datasets. * Needs to be institutionalized |
| 17 | Do you think users are willing to pay for the LSC information services? | * Yes, users will be willing to pay if the payment is affordable. * Yes, users will be willing because they understand that their payment contributes to sustain the LSC data hub. * In addition to the payment to be made individually, it is also advised to be paid by institutes, where employees belong to. This is helpful because staff members of the institutes can have access to dataset by inputting their profile. The Haramaya University’s experience can be a practical example. The university pays for the peer reviewed journal articles for publishing agencies. Students of Haramaya University can access the articles free of charge. The payment that will be made by institute can be a sustainable source of finance for the LSC data hub |

Key informant interview in ATJK ---- data provider group

| No. | Key informant questions | Subnational level ATJK |
| --- | --- | --- |
| 1 | Which LSC data, services, or advisories do you provide? | * crop yield data, land utilization, input use, agricultural cost of production, land area under different crops, land area covered by different type of fertilizer for each crop, dry season data i.e irrigated crops data including vegetables and wheat, price index, population census. * Soil temperature, Eto (RH, RF, air T, Radiation), genetic coefficient for different crop varieties, geospatial and biometry data processing, agro-advisories including date of sowing, ploughing or farm management, crop and variety selection for the seasons, agro chemical ( fertilizer and pesticide) application time advisory, land preparation, forecast of rainfall daily, decadal, …) * Air pollution, Pan evaporation, air pressure, sunshine duration and solar radiation hrs, Agro met advisories eg. 3-days, decadal, 3 months and yearly overview, health met advisories, hydro met advisories |
| 2 | What type of LSC data/information or services or advisories do your users need to address soil fertility and soil and water conservation challenges? | * crop yield data in different soil types and fertilizer input types and amount used for each crop in different locations. * rainfall data used for soil water conservation related advisory, rainfall amount, forecast at different level of detail, rainfall deviation from mean/normal versus crop water requirement, onset of rainfall, dry spell and long/short season forecast * Rainfall status either to conserve the available moisture or provide safe way not to cause erosion or flooding, the rainfall future data could also help to guide agrochemical applications including fertilizer and pest controls |
| 3 | For whom do you develop or provide these products, services or advisories? | * For government at different level for policy decisions, for projects, students for different study purposes * Ministry of Agriculture, Bureau of Agriculture at different levels, Researchers, For different private sectors * Aviation, water bureau, heath sector, climate change adaptation |
| 4 | How is the information from LSC data presented to the users (map portal, GIS system, mobile app)? And is this the best way to present data to users? | * Excel and report in pdf * Map portal, mobile app * Social media, radio, TV, map data |
| 5 | Is there a digital data repository of LSC and climate related datasets in your organization? Are these datasets accessible as 1) catalogue service 2) web mapping service 3) APIs? | * Digital data repository is available at the national level, not at the district and zone level * No digital data repository * Digital data repository available at national level |
| 6 | Do you have metadata available for all published: LSC-IS datasets? | * Yes, there are metadata * Network Common Data Form (NetCDF) are available * Metadata available |
| 7 | Are there metadata standards in place in your organization? | * Yes, there is standard * Yes, available in World Meteorological Organization (WMO) standard * There is standard in World Meteorological Organization (WMO) standard |
| 8 | What is the format of the data you provide? | * Land use map is available * GIS raster files (e.g., GeoTiff, ASCII, ESRI raster; if raster, what spatial resolutions?), plain tables (e.g., MS Excel, csv) all are available. * Excel and grid data (hybrid of station observation and satellite data). |

Table Cont. ---- data provider group

| No. | Key informant questions | Subnational level ATJK |
| --- | --- | --- |
| 9 | How do you provide LSC data to users: data download, web service (WMS, WFS, WCS), API, etc.? | * Excel file is available * Web Map Service, Web Feature Service, Web Coverage Service * Email, web service |
| 10 | What are current constraints in accessing LSC data for your applications, use case or services? | * Lack or limited tools for digital data collection, Resource (budget) for data collection to avail at district, The understanding of the data sources (farmers) about this data collection may affect the quality of data. Farmers may suspect, this data may be used to decide the tax to be paid by each farmer, Data collection too laborious and limited infrastructure to reach the samples areas, Security problems in some parts of the country. * Limited Instruments for climate data collection, limited availability of automatic station in the country, stations network is also limited, lack of server, limited skilled human capacity. * Poor data quality due to recording error, missing data from on station observation |
| 11 | What would you like to be done differently to ensure data:   * Availability * Accessibility * Usability * Scalable   Impactful | * Full fill standard data collection requirements such as adequate awareness creation to the household ahead of data collection time, Ensure the required logistics that imply the budget requirement, Local administrative support is also required * Bringing in satellite data with the station observation, digital tool based data recording using application, downscaling and quality control, girding /extrapolation of the data for specific location-measurement, establish central data storage and make it interactive or up to date * Satellite data to fill the gap from station observation, automated stations |
| 12 | What are the key security and privacy data requirements that the LSC hub should consider in its design? | * protect data from cyber-attacks, keep data confidential, data sharing must have its own rules and regulations on how when and to whom on what base the data can be shared. * Data management policy document, accountability in data access and use * Checking data quality |
| 13 | What do you expect from the LSC hub in terms of functionality? What type of functionality (e.g., data download, data viewer, data catalogue, dashboards (presenting what type of information?), user stories, data interpretation (translating data to advisory), etc.) would be helpful for you? | * data download, data viewer, data catalogue, dashboards, user stories, data interpretation, no language barrier * data management policy * Who at what capacity can access and able to use the LSC hub is important. |
| 14 | How would you like to access the LSC hub: laptop or desktop computer or mobile device (tablet, phone)? | Laptop, desktop, mobile device such as tablet, phone  * Web based services |
| 15 | [Optional, EIAR could answer it] What are the cost of hosting and maintenance of the LSC hub beyond the project life (specific for EIAR)? | NA |
| 16 | What (from your view as a data provider) is a critical factor to ensure sustainability of the LSC hub? | * Network (internet) connection availability and its coverage in the country, electric power (e.g., standby generator), technical capacity on data processing to produce advisories, capacity development and how friendly the hub for different users with different capacity of education, reliable and up to date data for reliable advisories, the benefit obtained from the LSC hub must be considerable as compared to the one not using this hub * All the constraint listed above must get solution, data and advisories derived from them must be reliable, easily understandable and profitable * Participation of the relevant stakeholders who can contribute data, up to date, quality/reliability of the data or the information, skilled manpower to continue the service, responsible organization and budget |
| 17 | Do you think users are willing to pay for the LSC information services? | * If profitable * Not at its early stage; but after getting some benefits or profits, building trust with farmers. * If it adds values to their production and make profit out of it, users can be willing to pay |

**Responses of LSC-IS data users at the national and sub national levels:**

1. What are typical practices/activities around climate-smart agriculture that you have developed/are using (that addresses Soil Fertility Assessment and Soil Water Conservation)?

Participants discussed many practices around climate smart agriculture that they developed or using both at the national and sub national levels. Practices related to soil fertility management included soil fertility assessment (such as recommendation of appropriate fertilizer blends and application rates based on the specific nutrient deficiencies identified), application of compost, inorganic fertilizer, lime. With regard to soil and water conservations practices included promotion of several practices that help farmers conserve soil and water to improve soil moisture retention, improve production per hectare using improved varieties, nutrient management , water management, reduced tillage, use of physical and biological soil conservation measures, use of drought tolerant high yielding crop varieties, promotion of crop diversification, use of climate information services, and landscape climate smart agriculture approach, use of crop rotation, incorporation of crop residue, intercropping and restricted grazing were also practices mentioned.

1. Which LSC data or derived information do you need for your decision-making or decision-support processes or for use case development?

LSC data or derived information required by LSC data users at the national level were: soil fertility assessment (SFA) data, which provides critical information on soil nutrient levels and the health of the soil, soil moisture levels and the effectiveness of water conservation measures, climate and weather data, market information, and information on input availability and pricing, land information to match highly suitable area for specific crops, soil and plant analysis for nutrient management, weather information for crop production (e.g. irrigation management, crop monitoring, disease and pest management), on field soil water and plant testing kits and tools, an updated data interpretation tools or support system. Characteristics of improved and landrace varieties of crops for different agro-ecologies, Soil data (physical, chemical and biological data), site specific weather forecast with possible advisory tips. Similarly, at the sub national levels the LSC data needed included rainfall, temperature, altitude, market data (e.g., current prices of cereals and pulses), soil property (erodibility, mobility, organic matter content etc…), soil acidity/alkalinity (soil pH), soil depth, soil texture, land slope, nutrient content of soil, agronomy data (e.g., planting data, fertilizer recommendation), crop calendar, crop yield/productivity, land size, land use history from farmers, crop type, seed quality, and crop yield data.

1. What products, services or advisories do you produce or provide that require LSC data/information as input?

As stated by users group, there were many products and services produced using LSC information. At the national level, participants stated that they used LSC information such as soil fertility assessment and soil and water conservation data to improve soil health and conserve water, crop and livestock value chain services to understand the local context, assess market trends, and provide effective advisory services to farmers and service providers. They also provide seasonal weather advisory service to farmers and extension agents, and also advise farmers on soil fertility management based on the soil analysis data collected from demonstration sites. At the sub national levels operational procedures, forecasts, management plans, advisory, policy, functional maps, development plan, suitability assessment, published articles, training on quality product supply or value chain process, enhancing production and productivity, promoting agriculture cluster approach, soil water use efficiency, fertilizer need (organic and chemical), crop calendar, land use right, and weather information are all produced using LSC data and information.

1. For whom do you develop or provide these products, services, or advisories?

According to participants at both the national and sub national levels, products and services were developed for smallholder and commercial farmers, input providers and mechanization service providers , extension agents, Ministry of agriculture, district agriculture office, Ethiopian meteorological institute, Central statistical agency, Ethiopia Commodity Exchange, Ministry of Trade, soil lab, EIAR, universities, Ministry of water and energy, cooperatives, and unions, disaster risk management, industrial park, Micro finance, investment office, water users’ association, and women and youth associations.

1. Describe the process or how you developed or provide the advisory services around soil fertility assessment and/or soil water conservation.

Participants at the national level described different processes through which advisory services are developed and provided in terms of soil fertility management and soil and water conservation. For example, advisory services are developed around soil fertility assessment using a participatory approach. The soil fertility assessment process involves collecting soil samples from farmers' fields and analyzing them to determine the soil nutrient content. The results are used to generate recommendations on the appropriate type and amount of fertilizers to use to improve soil fertility. The soil water conservation process involves assessing the farmers' water resources and providing them with advice on the appropriate water management practices to use to conserve water. This includes techniques such as crop rotation, mulching, and use of efficient irrigation systems, which help to reduce water use and improve water efficiency. The farmers are also trained on rainwater harvesting techniques, such as the use of water catchment structures, which can help to supplement their irrigation needs during the dry season.

The process described at the sub national levels included activities starting from data collection to implementation of the recommendations. That is, data collection—data analysis—data interpretation—consultation with farmers—implementation. in some cases, the cooperative holds a consultation meeting among cooperative member farmers to discuss how to use the recommendation, and advisory based on local context, in some cases, the cooperative holds a consultation meeting with stakeholders and make use of the data through different dissemination mechanisms such as leaflets, posting e.g., market information.

1. What are the different levels through which the use case (products, services, or advisories) is applied? Example: National, region, zone, woreda, Kebele, Farmers Training Centre, farm, field

The uses cases were applied at all levels including from top management decision level to national, regional, zonal, district, kebele, farmers training center, farms and field level.

1. Which applications or tools (such as models) related to the soil fertility and soil water conservation are employed in the use cases?

There were different tools employed with regard to soil fertility management and soil and water conservation such as Atlas (Soil Fertility Status and Fertilizer Recommendation Atlas)- developed by ATI – to determine site specific fertilizer application. Ethiosis, agricultural information management system (AGMIS), Commcare (fertilizer application related app), SWAT model, RUSLE model, GIS and remote sensing, GPS, Sustainable ECO industry model, farmers’ Learning Platform (FLP) extension model, supported with digital advisory tools: video based training using Digital Classroom Systems – a multi-functional smart projector, Amplio Talking Book – inclusive, user friendly and simple audio device, mobile apps and radio-talk shows and machine learning approach

1. How would you like to obtain LSC data for your application or decision-making or decision-support process or use case development or service provision? (e.g., data download, web services, API, mobile App)

Participants had different preferences for receiving LSC data, some would like to have structured LSC data that can be easily manipulated for decision-making or integrated with other data sources through API linkage. Others prefer to access a comprehensive database of LSC data that is regularly updated and maintained to ensure the accuracy and reliability of the information provided. Still others needed hard copy (in cases where no internet connection), Mobile app (which was referred as the best option), web service, data download, call blast (e.g., 8028), and SMS.

1. What do you expect from the LSC hub in terms of functionality? What type of functionality (e.g., data download, data viewer, data catalogue, dashboards (presenting what type of information?), user stories, data interpretation (translating data to advisory, etc.) would be helpful for you?

Both at the national and sub national levels, participants expected different requirements to be fulfilled to facilitate the functionality of the hub. Some of the expectations included access to a data catalogue that provides a comprehensive overview of the available LSC data and information that would include details such as the spatial and temporal coverage of the data, the data format, and any associated metadata, access to data viewers and dashboards that present key LSC information in an easily accessible and understandable format. These could include visualizations of soil fertility assessment data, maps of soil and water conservation practices, and other relevant data related to climate-smart agriculture. Furthermore, data download and data interpretation (translating data to advisory), which would enable to manipulate and analyze the LSC data according to users’ specific needs would be helpful. In addition, online data access including information of farm, soil and water, land, climate and crop, an account and password to access information, access to upload local data to the system, process and interpret data and give recommendation, access to soft copy or hard copy report for documentation would help the smooth functioning of the LSC hub.

1. How would you like to access the LSC hub: laptop or desktop computer or mobile device (tablet, phone)?

When participants were asked how they would prefer to access LSC hub, all of them indicated that laptop, and desktop computers, mobile device such as tablet, and phone are all very useful to access the hub.

1. What (from your view as a data user) is a critical factor to ensure sustainability of the LSC hub?

Important factors to ensure sustainability pointed out by participants at all levels included establishing strong partnerships with relevant stakeholders, including government agencies, NGOs, private sector entities, and development partners. Collaboration and coordination among these stakeholders can help ensure the availability of funding, technical expertise, and other resources necessary to support the operations and maintenance of the LSC hub. This can be achieved through ongoing consultation and engagement with key stakeholders to understand their data and information needs, as well as the challenges and opportunities they face in their work. In addition, the LSC hub should be adaptable and responsive to changing contexts and emerging trends and should priorities user-centered design principles to ensure that its products and services are relevant, accessible, and useful to its target audiences. Capacity building of local actors to use and apply LSC data and information in their work is vital. This can be achieved through training, technical assistance, and other capacity-building activities that empower local stakeholders to make informed decisions and take action to address land and soil degradation, improve crop productivity, and promote climate-smart agriculture. Furthermore, a responsible owner must be assigned to manage the hub and there must be political will both at local and national level, and synergy among stakeholders to contribute towards sustainability of the hub.

1. Are you willing to pay for the LSC information services?

Almost all participants agreed that they would be willing to pay for LSC information if the information is more accurate, relevant, to the standard and if the price is affordable.

1. What are currently the main sources of the LSC-IS data?

Main sources of LSC-IS data included Ministry of agriculture, Ministry of Trade, Ethiopian institute of agricultural research, , Agricultural transformation agency, Ethiopian commodity exchange, Ethiopian meteorological institute, Ethiopian statistical services, soil lab, universities, Pest control clinic, Ethiosis, Afrisis, mapping agency, disaster risk management, research centers, regional and zonal agricultural bureau, Media, national Bank, Sinqe Bank, data from own source and different sector institutes and their researchers/experts.

1. What are current constraints in accessing LSC data for your applications, use case or services?

According to participants, the current constraints that hindered accessing LSC data were lack of awareness and lack of skill and Knowledge on data handling and sharing to the user, unavailability and absence of data centers, expensive data analysis service (e.g., soil data) and limited service provider, failure to access data on time, poor data quality, lack of financial and human resources, lack of infrastructure e.g., ICT infrastructure, reluctance of stakeholders to share the available data, Lack of internet, lack of fast server, limited availability of computers, limited man power for IT related expertise, lack of LSC information platform, low capacity of local stakeholders.

1. Are there any requirements with respect to the format of the LSC data that you use?

According to respondents, some of the requirements in terms of format of the LSC data were Word, PowerPoint, excel csv, shape file, point data (observational data), GIS raster file (Geo tif), raster (pixel), up to date information, simplified platform/tool, GIS and remote sensing-based maps pertinent to soil fertility, cadastral map, attribute data for urban and rural land and use of local language,

1. If you are using spatial data, what are requirements do you have with respect to georeferencing of the data? Is there for instance a preferred coordinate system(s)?

Some of the requirements in terms of using spatial data were projected coordinate e.g., UTM, and high spatial resolution data,

1. What would you like to be done differently to ensure data?

Availability

Accessibility

Usability

Scalable

Impactful

To ensure data availability, accessibility and scalability, skilled manpower, sufficient budget, infrastructure such as computers and internet, willingness of stakeholders to share data, interpreted data for easy understanding, were among the key factors mentioned by participants.

1. What type of LSC information or services or advisories do you miss/lack to address soil fertility and soil and water conservation challenges?

Some of the missing LSC information listed by participants included site specific data, onsite soil acidity testing kit, geology, and hydrological data (for Potable water), water quality and water yield data with irrigation land. Tables 4-6 shows the detail responses of the user groups in Addis Ababa, Basona Warana and ATJK districts.

Key informant interview in Addis Ababa ---- data user group

| No. | Key informant questions | National level Addis Ababa |
| --- | --- | --- |
| 1 | What are typical practices/activities around climate-smart agriculture that you have developed/are using (that addresses Soil Fertility Assessment and Soil Water Conservation)? | * Soil fertility assessment (such as recommendation of appropriate fertilizer blends and application rates based on the specific nutrient deficiencies identified), soil and water conservation (such as promotion of several practices that help farmers conserve water and improve soil moisture retention through extension services * Introducing irrigation into irrigable areas, improving water use efficiency by shifting from the existing furrow irrigation system to mainly center pivot irrigation followed by dragline sprinkler and drip irrigation systems, improve production per hectare using improved varieties, nutrient management and water management. * Reduced tillage, use of tie-ridges, use of drought tolerant high yielding crop varieties, promotion of crop diversification, application of recommended rates of inputs, improving water access, * Climate information services, land scape climate smart agriculture approach |
| 2 | Which LSC data or derived information do you need for your decision-making or decision-support processes or for use case development? | * Soil Fertility Assessment (SFA) data, which provides critical information on soil nutrient levels and the health of the soil, soil moisture levels and the effectiveness of water conservation measures., climate and weather data, market information, and information on input availability and pricing. * Land information to match highly suitable area for specific crops, soil and plant analysis for nutrient management, weather information for crop production (e.g. irrigation management, crop monitoring, disease and pest management), on field soil water and plant testing kits and tools, an updated data interpretation tools or support system. * Characteristics of improved and landrace varieties of crops for different agro-ecologies, Soil data (physical, chemical and biological data), site specific weather forecast with possible advisory tips. * Climate smart agriculture practices across Ethiopia and their smartness level in terms of the three CSA pillars |
| 3 | What products, services or advisories do you produce or provide that require LSC data/information as input? | * soil fertility assessment and soil water conservation practices to improve soil health and conserve water, crop and livestock value chain services to understand the local context, assess market trends, and provide effective advisory services to farmers and service providers.   mechanization services provided help to ensure that the appropriate machinery and equipment are used for specific soil and crop types.   * Advice to farms regarding soil, water and crop management, document field by field agronomic information for management decision, evaluate agronomic practices, plant varieties and technologies across location and different environment. * We provide seasonal weather advisory service to farmers and extension agents (EAs) based on information obtained from Ethiopian Meteorological Agency, we also advise farmers on soil fertility management based on the soil analysis data collected from demonstration sites. * Agro advisory on climate and fertilizer, climate smart practices advisory |
| 4 | For whom do you develop or provide these products, services, or advisories? | * smallholder and commercial farmers, input providers and mechanization service providers * farmers and extension agents * smallholder farmers |
| 5 | Describe the process or how you developed or provide the advisory services around soil fertility assessment and/or soil water conservation. | * Advisory services are developed around soil fertility assessment and soil water conservation for farmers using a participatory approach. The soil fertility assessment process involves collecting soil samples from farmers' fields and analyzing them to determine the soil nutrient content. The results are used to generate recommendations on the appropriate type and amount of fertilizers to use to improve soil fertility. * The soil water conservation process involves assessing the farmers' water resources and providing them with advice on the appropriate water management practices to use to conserve water. This includes techniques such as crop rotation, mulching, and use of efficient irrigation systems, which help to reduce water use and improve water efficiency. The farmers are also trained on rainwater harvesting techniques, such as the use of water catchment structures, which can help to supplement their irrigation needs during the dry season. * Soil samples are collected from farm site, send to soil laboratory, results are collected at head office, interpretation and report writing will be made, then report will be sent to farms and relevant offices. * We collect soil sample from demonstration plots and analyze in collaboration with Melkasa agricultural research center, based on the results we advise farmers to improve their soil fertility. * We provide fertilizer advisory by generating site-context and season specific fertilizer advisory. The advisory is developed through machine learning approach that combine legacy crop response to fertilizer experimental data, geo-spatial data, climate forecast model outputs. |
| 6 | What are the different levels through which the use case (products, services, or advisories) is applied? Example: National, region, zone, woreda, Kebele, Farmers Training Centre, farm, field | * District, kebele, farmers training center, farms and field level * To farms and input planning, and top management decision. * Mostly the advisory service and demonstrations are used at kebele (in FTCs and on farmers’ field) and woreda level. But the zonal, regional and federal level also learn and share experience through field day and can use from the lessons they obtained. * Farm level and site level |
| 7 | Which applications or tools (such as models) related to the soil fertility and soil water conservation are employed in the use cases? | * NA * No application/tools employed, instead experts interpretation is used * Promote “Regenerative Agriculture (RA)” and ISFM is one of the interventions promoted through SAA’s Farmers’ Learning Platform (FLP) extension model, supported with digital advisory tools: video based training using Digital Classroom Systems – a multi-functional smart projector, Amplio Talking Book – inclusive, user friendly and simple audio device, mobile apps and radio-talk shows. * Machine learning approach |
| 8 | How would you like to obtain LSC data for your application or decision-making or decision-support process or use case development or service provision? (e.g., data download, web services, API, mobile App) | * structured LSC data that can be easily manipulated for decision-making or integrated with other data sources through API linkage9; access to a comprehensive database of LSC data that is regularly updated and maintained to ensure the accuracy and reliability of the information provided. * Weather data on weekly basis, land and soil information at the beginning and end of cropping season * Websites (e.g., EIAR, MoA), or any other electronic media platform * More experimental data on fertilizer application, climate smart practices |

Table Cont. ---- data user group

| No. | Key informant questions | National level Addis Ababa |
| --- | --- | --- |
| 9 | What do you expect from the LSC hub in terms of functionality? What type of functionality (e.g., data download, data viewer, data catalogue, dashboards (presenting what type of information?), user stories, data interpretation (translating data to advisory), etc.) would be helpful for you? | * Access to a data catalogue that provides a comprehensive overview of the available LSC data and information. This would include details such as the spatial and temporal coverage of the data, the data format, and any associated metadata. access to data viewers and dashboards that present key LSC information in an easily accessible and understandable format. These could include visualizations of soil fertility assessment data, maps of soil water conservation practices, and other relevant data related to climate-smart agriculture. Furthermore, data download and data interpretation (translating data to advisory), which would enable us to manipulate and analyze the LSC data according to our specific needs would be helpful. * Online data access including information of farm, soil and water, land, climate and crop, an account and password to access information, access to upload local data to the system, process and interpret data and give recommendation, access to soft copy or hard copy report for documentation. * Availing site specific data on weather and soil fertility status, preferably to download, having a data catalogue, including technical guidelines and manuals of each technology, practices and approaches, especially on data interpretation, Lessons learnt elsewhere. * Data download, data viewer, data catalogue, dashboard, user story, data interpretation and translation to advisories |
| 10 | How would you like to access the LSC hub: laptop or desktop computer or mobile device (tablet, phone)? | * Laptop, desktop, tablet, mobile device |
| 11 | What (from your view as a data user) is a critical factor to ensure sustainability of the LSC hub? | * Establish strong partnerships with relevant stakeholders, including government agencies, NGOs, private sector entities, and development partners. Collaboration and coordination among these stakeholders can help ensure the availability of funding, technical expertise, and other resources necessary to support the operations and maintenance of the LSC hub. In addition, addressing the evolving needs of its users. This can be achieved through ongoing consultation and engagement with key stakeholders to understand their data and information needs, as well as the challenges and opportunities they face in their work. The LSC hub should be adaptable and responsive to changing contexts and emerging trends and should priorities user-centered design principles to ensure that its products and services are relevant, accessible, and useful to its target audiences. capacity of local actors to use and apply LSC data and information in their work. This can be achieved through training, technical assistance, and other capacity-building activities that empower local stakeholders to make informed decisions and take action to address land and soil degradation, improve crop productivity, and promote climate-smart agriculture. * Mapping, georeferenced information, interpretation tools * Accessibility of the data (free of charge is better, or cheaper price if not possible, and light weight for search in poor networks, Simplicity (to be user friendly) for searching, downloading, Interactive: if it could have an option for comments, questions and answers. * Data input to the system, and maintenance |
| 12 | Are you willing to pay for the LSC information services? | * Understanding the value of high-quality data in supporting our work and ultimately benefiting the farmers we serve, we are willing to pay for LSC data and information services that can help us provide more accurate and relevant advice to farmers, particularly in the areas of soil fertility assessment and soil water conservation. * Yes, as long as the service is adding value. * At the head office level possible to pay but at the district and kebele level may not afford to pay * NA |
| 13 | What are currently the main sources of the LSC-IS data? | * Data from own source * Different sector institutes and their researchers/ experts |
| 14 | What are current constraints in accessing LSC data for your applications, use case or services? | * Lack of awareness, lack of digitizing the farm operation * Unavailability and absence of data centers, expensive soil analysis service and limited-service provider |
| 15 | Are there any requirements with respect to the format of the LSC data that you use? | -------- |
| 16 | If you are using spatial data, what are requirements do you have with respect to georeferencing of the data? Is there for instance a preferred coordinate system(s)? | ---------- |
| 17 | What would you like to be done differently to ensure data Availability  Accessibility  Usability  Scalable  Impactful | ------- |
| 18 | What type of LSC information or services or advisories do you miss/lack to address soil fertility and soil and water conservation challenges? | --------- |

Key informant interview in Basona Warana ---- data user group

| No. | Key informant questions | Subnational level Basona Warana |
| --- | --- | --- |
| 1 | What are typical practices/activities around climate-smart agriculture that you have developed/are using (that addresses Soil Fertility Assessment and Soil Water Conservation)? | * Compost application, Inorganic fertilizer application, lime application, Improved seed (barely, wheat, potato), Terrance for soil and water conservation, biological measures such as multipurpose feed and forage crops (sesbania), *Rhamnus* *prinoides*, Guassa grass * Crop rotation, crop residue incorporation, intercropping, restricted grazing |
| 2 | Which LSC data or derived information do you need for your decision-making or decision-support processes or for use case development? | * Rainfall data, Temperature, altitude data, Market data (e.g., current prices of cereals and pulses), Soil acidity/alkalinity data (soil pH), Seed quality data, Agronomy data (e.g., planting data, fertilizer recommendation), crop calendar, crop yield/productivity * Soil depth, soil texture, land slope, nutrient content of soil, land size, land use history from farmers, crop type and crop yield data, discharge capacity of river for irrigation, crop water requirement |
| 3 | What products, services or advisories do you produce or provide that require LSC data/information as input? | * Operational procedures, Forecasts, Management plans, advisory, policy, functional maps, development plan,   Suitability assessment, published articles, decision makers input |
| 4 | For whom do you develop or provide these products, services, or advisories? | * Ministry of agriculture, district agriculture office, Ethiopian meteorological institute, Central statistical agency, ECX (Ethiopia Commodity Exchange), Ministry of Trade * Farmers, soil lab, EIAR, universities, Ministry of water and energy, cooperatives, and unions, disaster risk management |
| 5 | Describe the process or how you developed or provide the advisory services around soil fertility assessment and/or soil water conservation. | * Some are used directly as they come from stakeholders, in some cases, the cooperative holds a consultation meeting among cooperative member farmers to discuss how to use the recommendation, and advisory based on local context, in some cases, the cooperative holds a consultation meeting with stakeholders and make use of the data through different dissemination mechanisms such as leaflets, posting e.g., market information. * Data received will be analyzed and interpreted, then will be implemented based on consultation with stakeholders and end users/farmers * Data collection—data analysis—data interpretation—consultation with farmers—implementation * Teaching manual preparation, and delivering training to zone, district, kebele level agricultural experts and agricultural students at university level |
| 6 | What are the different levels through which the use case (products, services, or advisories) is applied? Example: National, region, zone, woreda, Kebele, Farmers Training Centre, farm, field | * From field, farm all the way to primary cooperatives, unions, kebele woreda to national level |
| 7 | Which applications or tools (such as models) related to the soil fertility and soil water conservation are employed in the use cases? | * Atlas (Soil Fertility Status and Fertilizer Recommendation Atlas)- developed by ATI – to determine site specific fertilizer application. * Ethiosis, agricultural information management system (AGMIS), Commcare (fertilizer application related app), video extension * SWAT model, RUSLE model, GIS and remote sensing, GPS |
| 8 | How would you like to obtain LSC data for your application or decision-making or decision-support process or use case development or service provision? (e.g., data download, web services, API, mobile App) | * Hard copy (in cases where no internet connection), Mobile app (best option), Link ECX and ATI apps through API, Web service, Data download, call blast (e.g., 8028) |

Table Cont. ---- data user group

| No. | Key informant questions | Subnational level Basona Warana |
| --- | --- | --- |
| 9 | What do you expect from the LSC hub in terms of functionality? What type of functionality (e.g., data download, data viewer, data catalogue, dashboards (presenting what type of information?), user stories, data interpretation (translating data to advisory), etc.) would be helpful for you? | * Data download for analysis and decision making, Data view, data interpretation (translating data to advisory) * User story |
| 10 | How would you like to access the LSC hub: laptop or desktop computer or mobile device (tablet, phone)? | * Mobile device (phone), Desktop computer, Laptop |
| 11 | What (from your view as a data user) is a critical factor to ensure sustainability of the LSC hub? | * Responsible owner must be assigned to manage the hub, Stakeholder engagement needed to upload new data to the hub, * Continues capacity building for better management, set reasonable payment for the service. * Option for offline users, internet access for stakeholders   Universities must get involved in capacity building for better management of the hub  Strong collaboration and consistent data flow and update |
| 12 | Are you willing to pay for the LSC information services? | * Yes, if affordable and data is to the standard |
| 13 | ] What are currently the main sources of the LSC-IS data? | * Cooperatives, Ministry of Agriculture, Ministry of Trade, EIAR, ATI, ECX, Ethiopian meteorological institute, Ethiopian statistical services, soil lab, university, * Pest control clinic * Ethiosis, Afrisis, mapping agency, Disaster risk management |
| 14 | What are current constraints in accessing LSC data for your applications, use case or services? | * Data not accessible on time, less quality, Lack of financial and human resources, lack of infrastructure e.g., ICT infrastructure, data may be available but not accessible due to lack of willingness to share data * Unavailability of data on the right format   Licensed software |
| 15 | Are there any requirements with respect to the format of the LSC data that you use? | * Excel csv * shape file, point data (observational data), GIS raster file (Geo tif), raster (pixel) |
| 16 | If you are using spatial data, what are requirements do you have with respect to georeferencing of the data? Is there for instance a preferred coordinate system(s)? | * NA * Projected coordinate e.g., UTM, * High spatial resolution data |
| 17 | What would you like to be done differently to ensure data Availability  Accessibility  Usability  Scalable Impactful | * Willingness of stakeholders to share data, Data format availability (hardcopy, excel etc) * Easy access, budget availability, skilled manpower * Interpreted data for easy understanding, infrastructure (computer, internet, GPS software) * Coordination among institutions to share data |
| 18 | What type of LSC information or services or advisories do you miss/lack to address soil fertility and soil and water conservation challenges? | * Updated data, Site specific data, high quality data, onsite soil acidity testing kit, collaboration among stakeholders for better access, internet access. |

Table 6 Key informant interview in ATJK ---- data user group

| No. | Key informant questions | Subnational level ATJK |
| --- | --- | --- |
| 1 | What are typical practices/activities around climate-smart agriculture that you have developed/are using (that addresses Soil Fertility Assessment and Soil Water Conservation)? | * Land filling, compost preparation from solid waste * Soil moisture retention potential, soil water need, land restoration potential * Land and soil feature such as fertility, moisture etc. |
| 2 | Which LSC data or derived information do you need for your decision-making or decision-support processes or for use case development? | * Soil fertility improvement data / information, fertilizer recommendation based on soil and crop type, Agro ecology data. * Soil property (erodibility, mobility, organic matter content etc…), plantation calendar/crop calendar, land-crop suitability * Weather pattern, land potential, cropping calendar |
| 3 | What products, services or advisories do you produce or provide that require LSC data/information as input? | * Training on quality product supply or value chain process, enhance production and productivity, promote agriculture cluster approach, to provide services on agricultural input supply and financial support. * Soil water use efficiency, fertilizer need (organic and chemical), weather data, crop calendar * Land use right, weather information |
| 4 | For whom do you develop or provide these products, services, or advisories? | * Value chain commutes of industrial park, farmers, MoA, cooperative and Micro finance, Union, investment, University * Framers, -development agents, water users’ association, cooperatives, women and youth associations |
| 5 | Describe the process or how you developed or provide the advisory services around soil fertility assessment and/or soil water conservation. | * Through quarterly meeting and monitoring and evaluation * Training of trainers, regional and zonal level, preparation of Seasonal training plan (mostly pre-*Meher* plantation), woreda technical team consultation, DAs and farmers training, farm level advisory and follow up * Loan service request by bank customers to invest on agricultural business, confirmation on land availability from Agr. Office and land administration authority, gather LSC data from Agr. Office, advisory service to loan beneficiaries based on information the bank gathers from Agr. Office and other service providers, such as Metrological agency |
| 6 | What are the different levels through which the use case (products, services, or advisories) is applied? Example: National, region, zone, woreda, Kebele, Farmers Training Centre, farm, field | * National (Ethiopia Investment authority and MOA), region (Oromia Bureau of agriculture), kebele and Farmers * District and kebele |
| 7 | Which applications or tools (such as models) related to the soil fertility and soil water conservation are employed in the use cases? | * Sustainable ECO industry model * Mobile phone, web-based service |
| 8 | How would you like to obtain LSC data for your application or decision-making or decision-support process or use case development or service provision? (e.g., data download, web services, API, mobile App) | * Hard copy * Mobile App, data download, web service * Web page, SMS |

Table 6 Cont. ---- data user group

| No. | Key informant questions | Subnational level ATJK |
| --- | --- | --- |
| 9 | What do you expect from the LSC hub in terms of functionality? What type of functionality (e.g., data download, data viewer, data catalogue, dashboards (presenting what type of information?), user stories, data interpretation (translating data to advisory), etc.) would be helpful for you? | * Easily accessible data and on time without any limitation, data download and data viewer, user stories and data interpretation are helpful. * Mobile device, data catalogue, data viewer * Easy, accessible, and scalable information service |
| 10 | How would you like to access the LSC hub: laptop or desktop computer or mobile device (tablet, phone)? | * Laptop, desktop, mobile devices such as tablets * Mobile first option, tablet, and laptop second option |
| 11 | What (from your view as a data user) is a critical factor to ensure sustainability of the LSC hub? | * Data should be credible and reliable /limited errors/, data should be up to date. * political will (local, national), synergy among stakeholders, sustainable capacity building |
| 12 | Are you willing to pay for the LSC information services? | * Yes, if the price is affordable. * Yes, but for high quality information |
| 13 | What are currently the main sources of the LSC-IS data? | * Ministry of agriculture and research centers * Regional agricultural bureau, zonal agricultural office, 8028 advisory service (ATA), Metrological agency * Media, meteorological agency, national Bank, Sinqe Bank head quarter |
| 14 | What are current constraints in accessing LSC data for your applications, use case or services? | * Most of the time data is not available and accessible to the users, the available data also is not up to date data, lack of skill and Knowledge on data handling and sharing to the users. * Lack of internet, lack of fast server, limited availability of computers, limited manpower for IT related expertise * Lack of LSC information platform, low capacity of local stakeholders |
| 15 | Are there any requirements with respect to the format of the LSC data that you use? | * Word, PowerPoint, excel. * Up to date information, simplified platform/tool, use of local language, affordable information * GIS and remote sensing-based maps pertinent to soil fertility, availability of agricultural land etc.., cadastral map, attribute data for urban and rural land |
| 16 | If you are using spatial data, what are requirements do you have with respect to georeferencing of the data? Is there for instance a preferred coordinate system(s)? | * NA * Not so far |
| 17 | What would you like to be done differently to ensure data: Availability  Accessibility  Usability  Scalable Impactful | * Build Leadership commitment, established Legal binding force and polices to ensure, data (availability, accessibility, scalability, reliability and trustful) * Ensure accountability, consistency, independent and locally owned. * Digitized information on land use plan |
| 18 | What type of LSC information or services or advisories do you miss/lack to address soil fertility and soil and water conservation challenges? | * Geology and hydrological data (for Potable water), water quality and water yield data with irrigation land * Limited institutional and human capacity, limited IT infrastructure * Networking and platform of public-private stakeholders and financial institutions |

# ANNEX: Ethiopia Workshop and key informant interview Participants

**List of participants for the Ethiopia national workshop**

| No. | Name of participant | Organization | Contact address |
| --- | --- | --- | --- |
| 1 | Girma Mamo | Knowledge institute/EIAR | 0911809500 |
| 2 | Bedru Beshir | Knowledge institute/EIAR | 0911382489 |
| 3 | Meron Mekonnen | Private sector/ MAKOBU | 0935998504 |
| 4 | Belete Demissie | Private sector/ MAKOBU | 0911381651 |
| 5 | Demeke Nigusse | Knowledge institute/EIAR | 0911784663 |
| 6 | Endalkachew W/Meskel | Development partner/ICRAF | 0911737318 |
| 7 | John Recha | Development partner/ILRI | +254721264936 |
| 8 | Belay Simane | Knowledge institute/AAU | 0911223044 |
| 9 | Abonesh Tesfaye | Development partner/ILRI | 0920803921 |
| 10 | Gizaw Tesfaye | Knowledge institute/EIAR | 0912803173 |
| 11 | Ayalneh Mulatu | Development partner/ILRI | 0942409532 |
| 12 | Chimdo Anchala | Public sector/ATI | 0921538304 |
| 13 | Ketema Abdisa | Public sector/OBA | 0913244126 |
| 14 | Tilahun Dandesa | Public sector/OBA | 0913356526 |
| 15 | Jules Ruthebuka | Development partner/IUCN | Rwanda |
| 16 | Ermias Betemariam | Development partner/ICRAF | 0935146655 |
| 17 | Kassu Tadesse | Knowledge institute/EIAR | 0911366068 |
| 18 | Takele Nemomsa | Development partner /SOS Sahel | 0979040319 |
| 19 | Abdeta Robi | Development partner/IUCN | 0915700200 |
| 20 | Hailu Tefera | Knowledge institute/DBU | 0947369315 |
| 21 | Solomon Mengesha | Public sector/Nyala Insurance | 0911207772 |
| 22 | Abraham Tadesse | Development partner/SAA | 0911412309 |
| 23 | Tsegaye Getachew | Knowledge institute /DBARC | 0921141809 |
| 24 | Gezahegn Tolosa | Knowledge institute /EIAR | 0913178761 |
| 25 | Birru Yitayew W/Tsadik | Knowledge institute /EIAR | 0912202700 |
| 26 | Abiy Funtaye | Private sector/MIDROC Ethiopia | 0911203137 |
| 27 | Melkamu Demelash | Knowledge institute /EIAR | 0925836961 |
| 28 | Tarekegn Argaw | Knowledge institute /EIAR | 0968607908 |
| 29 | Dawit Solomon | Development partner /ILRI | 0939574958 |
| 30 | Kasahun Bekele | Knowledge institute/DBU | 0917981854 |
| 31 | Mekonen Debesay | Development partner /SWR | 0913381609 |
| 32 | Abrhame Endrias | Private sector/Lersha | 0911491211 |
| 33 | Tadesse Amberbir | Knowledge institute /EIAR | 0912058415 |
| 34 | Tesfaye Fufa | Public sector /SSGI | 0917120818 |
| 35 | Ziyen Achamyeleh | Public sector /SSGI | 0918529201 |
| 36 | Tsegaye Lemma | Public sector /SSGI | 0911908387 |
| 37 | Wondiwosen Dirirsa | Knowledge institute /EIAR | 0911355119 |
| 38 | Mwuletaw Abera | Development partner/CIAT | 0914986874 |
| 39 | Brook Mekonnen | Development partner /ILRI | 0967417616 |
| 40 | Feyera Liben | Development partner /CIAT | 0962228311 |
| 41 | Sewunigus Yemane | Knowledge institute /EIAR | 0920964127 |
| 42 | Feleke Gezahegn | Public sector/EABC | 0917856745 |
| 43 | Yirgalem Kebede | Public sector/ EABC | 0909678767 |
| 44 | Tizazu Geremew | Public sector /EMI | 0911949212 |
| 45 | Dejene Abera | Knowledge institute /EIAR | 0929180822 |
| 46 | Shimeles Tadesse | Knowledge institute/AAU | 0913195863 |
| 47 | Dechasa Bedhada | Knowledge institute /GAS | 0911861858 |
| 48 | Mezgebu Getnet | Development partner/SWR | 0911762484 |
| 49 | Demissie Ejigu | Knowledge institute /Arsi University | 0911282014 |
| 50 | Feyera Wakeyo | Public sector/MoA | 0911190226 |
| 51 | Girma Alemayehu | Knowledge institute/EIAR | 0912162204 |
| 52 | Almaz Meseret | Knowledge institute/EIAR | 0913128513 |
| 53 | Gebremedhin Ambaw | Development partner/ILRI | 0913173340 |

**List of participants for the sub-national workshop in Adami Tulu Jido Kombolcha District**

| No. | Name of participant | Organization | Contact address |
| --- | --- | --- | --- |
| 1 | Husen Hurgesa | Public institution/ district agriculture office | 0910383283 |
| 2 | Genet Alemayehu | Public institution/ district agriculture office | 0945179826 |
| 3 | Olika Dessalegn | Knowledge institute/EIAR | 0924574050 |
| 4 | Tizazu Geremew | Knowledge institute/EIAR | 0913195863 |
| 5 | Demisse Ejigu | Knowledge institute/AU | 0922162204 |
| 6 | Jules Rutebuka | Development partner/IUCN | Rwanda |
| 7 | Tilmo Jema | Development partner/FARM Africa | 0911992597 |
| 8 | Sime Biratu | Public institution/district agriculture office | 0911360504 |
| 9 | Ermias Betemariam | Development partner/ICRAF | Kenya |
| 10 | John Recha | Development partner/ILRI | Kenya |
| 11 | Kebede Milkesa | Development partner/SNV | 0912138441 |
| 12 | Deksiso Abdela | Public sector/District health office | 0911095337 |
| 13 | Gemeda Abe | Public institution/ district agriculture office | 0913925108 |
| 14 | Tsedale Demelash | Knowledge institute/EIAR | 0903640290 |
| 15 | Fekadu Berhanu | Public institution/ district agriculture office | 0921361675 |
| 16 | Abebe Getachew | Development partner/Meki Catholic Secretariat | 0912119241 |
| 17 | Endalkachew W/Meskel | Development partner/ICRAF | 0911737318 |
| 18 | Yasin Esmael | Knowledge institute/OARI | 0913635296 |
| 19 | Zeyneba Gelekisa | Public institution/ district agriculture office | 0927255036 |
| 20 | Adam Abdulrahman | Private sector/OIPDC | 0911900383 |
| 21 | Aman Hussien | Public institution/LCCA | 0928221849 |
| 22 | Woyesa Molke | Public institution/DRM | 0913285552 |
| 23 | Girma Adugna | Farmer organization/Bora Denbel union | 0916520120 |
| 24 | Desalegn Regassa | Development partner/Wetland International | 0926148350 |
| 25 | Mesfin Eshete | Farmer organization/Lume Adama union | 0934926672 |
| 26 | Demeke Nigusse | Knowledge institute/EIAR | 0911784063 |
| 27 | Daniel Gosame | Public institution/ district agriculture office | 0913944390 |
| 28 | Tadesse Hailu | Farmer organization /Erer Farmers’ cooperative union | 0912229060 |
| 29 | Safayo Jato | Public sector/district Agriculture office | 0921101017 |
| 30 | Aman Edo | Public sector/district Agriculture office | 0910399949 |
| 31 | Yilma Teshome | Public sector/district Agriculture office | 0910420518 |
| 32 | Mengesha Lema | Public sector/district Agriculture office | 0911988727 |
| 33 | Gamula Dugassa | Public sector/Central Statistics Authority | 0917855845 |
| 34 | Asnake Abera | Public sector/OAIP Regulation | 0925103794 |
| 35 | Sultan Ahmed | Public sector/district Agriculture office | 0911382296 |
| 36 | Takel Nemomsa | Development partner/SOS Sahel Ethiopia | 0979040399 |
| 37 | Tilahun Abera | Knowledge institute/Batu soil research | 0921096149 |
| 38 | Zewditu Alemayehu | Public sector/district agriculture office | 0912125655 |
| 39 | Asafa Hirpa | Public sector/ Sinqe Bank | 0910742807 |
| 40 | Ushoto Woyu | Public sector/district agriculture office | 0916831560 |
| 41 | Almaz Meseret | Knowledge institute/EIAR | 0913128513 |
| 42 | Abonesh Tesfaye | Development partner/ILRI | 0920803921 |
| 43 | Mulatu Ayalneh | Development partner/ILRI | 0942409532 |
| 44 | Gebremedihin Ambaw | Development partner/ILRI | 0913173340 |
| 45 | Brook Mekonnen | Development partner /ILRI | 0967417616 |

**List of participants for the sub-national workshop in Basona Warana District**

| No. | Name of participant | Organization | Contact address |
| --- | --- | --- | --- |
| 1 | Anteneh Berhanu | Public sector/Sustainable land management program | 0978791212 |
| 2 | Moges Bizuneh | Public sector/district agriculture office | 0913399714 |
| 3 | Hailu Terefe | Knowledge institute/Debre Berhan University | 0947369315 |
| 4 | Nigusse W/Mariam | Public sector/district agricultural office | 0913790078 |
| 5 | Gadissa Oljira | Farmer organization/North Shewa zone Cooperatives office | 0912886510 |
| 6 | Shibiru Debele | Public sector/district agricultural office | 0910855988 |
| 7 | Alemayehu Abera | Knowledge institute/Debre Berhan University | 0925941760 |
| 8 | Tewulgn Shibabaw | Public sector/district agricultural office | 0918057920 |
| 9 | Ermias Betemariam | Development partner/ICRAF | Kenya |
| 10 | Blaise Amony | Development partner/ASARECA | Uganda |
| 11 | Tsegaye Getachew | Knowledge institute/Debre Berhan Agricultural Research Centre | 0921141809 |
| 12 | Dejene Abera | Knowledge institute/EIAR | 0911861658 |
| 13 | Melaku Demelash | Knowledge institute/EIAR | 0925836911 |
| 14 | Kassu Tadesse | Knowledge institute/EIAR | 0911366068 |
| 15 | Tesfaye Mebratu | Knowledge institute/Debre Berhan University | 0911312067 |
| 16 | W/Mariam Negese | Farmer organization/Baso cooperative | 0910294569 |
| 17 | Hailu W/Kidan | Farmer organization/Baso cooperative | 0933035634 |
| 18 | Melese Kiflu | Farmer organization/Baso cooperative | 0922361229 |
| 19 | Demessie Asfaw | Farmer organization/Baso cooperative | 0922565041 |
| 20 | T/Georgis Dagne | Farmer organization/Baso cooperative | 0988736217 |
| 21 | Musa Hailu | Farmer organization/Baso cooperative | 0942822382 |
| 22 | Dereje Asibe | Farmer organization/Baso cooperative | 0985172856 |
| 23 | G/Amanuel Belay | Farmer organization/Baso cooperative | 0947970946 |
| 24 | Estifo Fekadu | Farmer organization/Baso cooperative | 0924139279 |
| 25 | Zenebe Eshete | Farmer organization/Baso cooperative | 0963206860 |
| 26 | Genevieve Apio | Development Partner | 256758862794 |

| 27 | Abdeta Robi | Development partner/IUCN | 0915700200 |
| --- | --- | --- | --- |
| 28 | Askale Yigru | Public/district agriculture office | 0913207190 |
| 29 | Yeshewatsehay Hailu | Public/district agriculture office | 0938482025 |
| 30 | Tigist Tsegaye | Knowledge institute/EIAR | 0911760661 |
| 31 | Habtam Awgachew | Farmer Organization /Tinsae Union | 0915552062 |
| 32 | Girma Taye | Farmer Organization/Farmer cooperative | 0913043830 |
| 33 | Gebyehu Abate | Farmer Organizations/cooperatives | 0922330030 |
| 34 | Dr Kassahun Bekele | Knowledge Institute/Debre Berhan University | 0917981854 |
| 35 | Bezabih Mengesha | Farmer Organization/cooperative | 0922134580 |
| 36 | Addis Gebreyes | Farmer Organization /cooperative | 0920632288 |
| 37 | Aschalew Siyoum | Farmer Organization /cooperative | 0995954695 |
| 38 | Tekle Muluneh | Farmer Organization /cooperative | 0913073413 |
| 39 | Bayu Kebede | Farmer Organization /cooperative | 0913049120 |
| 40 | Gizaw Tesfaye | Knowledge institute/EIAR | 0912803173 |
| 41 | Kinfe wolde | Private/ESS | 0911098827 |
| 42 | Tarekegn Argaw | Knowledge Institute /EIAR | 0968607900 |
| 43 | Tegene Seifu | Public/district agriculture office | 0910359492 |
| 44 | Abera Esheetie | Farmer Organization /cooperative | 0920681029 |
| 45 | Kassahun Tefera | Farmer Organization /cooperative | 0910891078 |
| 46 | Abebe Beza | Farmer Organization /cooperative | 0910964630 |
| 47 | Sasu Tadesse | Public/ district agriculture office | 0910110724 |
| 48 | Mekonnen G8iorgis | Farmer Organization/cooperative | 0911782699 |
| 49 | Letekeyehana Yehualashet | Farmer Organization/cooperative | 0913280875 |
| 50 | Yimer Mohamed | Public/ District meteorology office | 0913417279 |
| 51 | Tilahun Moges | Farmer Organization /cooperative | 0920631702 |
| 52 | Demelash Teshome | Farmer Organization /cooperative | 0923163044 |
| 53 | Bayise W/Michael | Farmer Organization /cooperative | 0924001122 |
| 54 | Yohannes Goshu | Farmer Organization /cooperative | 0921205192 |
| 55 | Solomon Kabtimer | Farmer Organization /cooperative | 0929276065 |
| 56 | Emebt Zeleke | Public/district agriculture office | 0910349940 |
| 57 | Tizita Kebede | Farmer Organization/cooperative | 0924749396 |
| 58 | Abebe Getachew | Public/district agriculture office | 0911053281 |
| 59 | Tale Lemma | Public/district agriculture office | 0920803855 |
| 60 | Ketsela Gebru | Farmer Organization/cooperative | 0960709178 |
| 61 | Zewge Zewdu | Farmer Organization /cooperative | 0912907979 |
| 62 | Asgelilew Hulushew | Farmer Organization /cooperative | 0920189465 |
| 63 | Kebede G/Amanuel | Farmer Organization /cooperative | 0920060225 |
| 64 | Gessese Debebe | Farmer Organization /cooperative | 0920314113 |
| 65 | Getaneh T/Mariam | Public/ district agriculture office | 0912415661 |
| 66 | Million Tesfaye | Farmer Organization /cooperative | 0910965580 |
| 67 | Estifanos Lemma | Knowledge Institute/Debre Berhan University | 0902518095 |
| 68 | Abonesh Tesfaye | Development partner/ILRI | 0920803921 |
| 69 | Mulatu Ayalneh | Development partner/ILRI | 0942409532 |
| 70 | Gebremedihin Ambaw | Development partner/ILRI | 0913173340 |
| 71 | Brook Mekonnen | Development partner /ILRI | 0967417616 |
| 72 | John Recha | Development partner/ILRI | Kenya |

**List of participants for the Ethiopia national key informant interview in Addis Ababa**

| LSC - IS Providers | organization |
| --- | --- |
| Belete Demisie | MAKOBU |
| Fayer Waqoya | EIAR |
| Gezahegn Tolosa | EIAR |
| Ketema Abdisa Wolde | Oromia Bureau of Agriculture |
| Asaminew Teshome | EMI |
| Birru Yitaferu | EIAR |
| Chimdo Anchala | ATI |
| Degefie Tibebe | CIAT |
| Wuletawu Abera | CIAT |
| Zebene Mikru | MIDROC Investment Group, Agri Cluster |
| Mezgebu Getinet | Stichting Wageningen Research Ethiopia |
| Endalkachew Wolde-meskel | ICRAF |
| Ahmed Ebrahim | CSA |
| Shimeles Tadesse Zelelew | Space Science and Geospatial Institute (SSGI) |
| Tesfaye Fufa | SSGI |
| Ziyen Achamyeleh | SSGI |
| LSC - IS Users |  |
| Abraham Endrias Butta | Green Agro Solution PLC |
| Abiy Fantaye | ELFORA Agro-Industry PLC |
| Melese Liyhe | Sasakawa Africa Association |
| Solomon Zegeye | Nyala Insurance Share Company |
| Demeke Nigussie | EIAR |
| Asaminew Teshome | EMI |
| Degefie Tibebe | CIAT |
| Wuletawu Abera | CIAT |
| Zebene Mikru | MIDROC Investment Group, Agri Cluster |
| Feyera Merga | Alliance of Bioversity International and CIAT |
| Meron Mekonnen | MAKOBU |
| Tilahun Dandesa | Oromia Buearue of agriculture |
| Tsegaye Demsis | EIAR |

**List of participants for the sub-national key informant interview in Adami Tulu Jido Kombolcha District**

| LSC - IS Providers | organization |
| --- | --- |
| Belete Demisie | MAKOBU |
| Fayer Waqoya | EIAR |
| Gezahegn Tolosa | EIAR |
| Ketema Abdisa Wolde | Oromia Bureau of Agriculture |
| Asaminew Teshome | EMI |
| Birru Yitaferu | EIAR |
| Chimdo Anchala | ATI |
| Degefie Tibebe | CIAT |
| Wuletawu Abera | CIAT |
| Zebene Mikru | MIDROC Investment Group, Agri Cluster |
| Mezgebu Getinet | Stichting Wageningen Research Ethiopia |
| Endalkachew Wolde-meskel | ICRAF |
| Ahmed Ebrahim | CSA |
| Shimeles Tadesse Zelelew | Space Science and Geospatial Institute (SSGI) |
| Tesfaye Fufa | SSGI |
| Ziyen Achamyeleh | SSGI |
| LSC - IS Users |  |
| Abraham Endrias Butta | Green Agro Solution PLC |
| Abiy Fantaye | ELFORA Agro-Industry PLC |
| Melese Liyhe | Sasakawa Africa Association |
| Solomon Zegeye | Nyala Insurance Share Company |
| Demeke Nigussie | EIAR |
| Asaminew Teshome | EMI |
| Degefie Tibebe | CIAT |
| Wuletawu Abera | CIAT |
| Zebene Mikru | MIDROC Investment Group, Agri Cluster |
| Feyera Merga | Alliance of Bioversity International and CIAT |
| Meron Mekonnen | MAKOBU |
| Tilahun Dandesa | Oromia Buearue of agriculture |
| Tsegaye Demsis | EIAR |

**List of participants for the sub-national key informant interview in Basona Werana District**

| LSC - IS Providers | Organization |
| --- | --- |
| Kefyalew Taye | Debre Birhan Agricultural Research Center (DBARC) |
| Abebe Getachew | N.Shewa Agri office |
| Anteneh Birhanu | Bosona Werana district office of agriculture |
| Alemayehu Abera | Debre Birhan University |
| Abebe Chirotawe | Basona Werana district land administration |
| Tilahun Getachew | Debre Birhan Agricultural Research Center(DBARC) |
| Tesfaye Mebrate | Debre Birhan University |
| Tsegaye Getachew | Debre Birhan Agricultural Research Center (DBARC) |
| Emebet Zeleke | Zone agriculture office |
| Getaneh T/Mariam | Zone agriculture office |
| Kinfe Wolde | CSA |
| Tegene Seifu | Baso AGP (Agricultural Growth Program) |
| Temesgen Alene | ILRI/Africa RISING |
| Estifanos Lemma | Debre Berhan University |
| Gebeyehu Abebe | Chimbre dual purpose farmers’ cooperative |
| LSC - IS Users |  |
| Askale Yifru | Horti & irrigation team leader |
| Gadissa Oljira | N.shewa coop & marketing team |
| Sasu Tadesse | Bassona Worana district agriculture office |
| Shibire Debebe | N.Shewa Agri office |
| Kasahun Bekele | Debre Berhan University |
| Belay Girma | N.Shewa Agri office |
| Gebeyehu Abata | farmers cooperative |
| Tekele Muluneh | North Shewa zone cooperative office |
| Yeshewatsehy Hailu | Basona Werana Agriculture Office |
| Moges Bizuneh | Basona Werana Agriculture Office |
| Tewulgn Shibabaw | North Sewa Agriculture Office |
| Negesse W/Mariam | Basona Werana Agriculture Office |
| Getachew Demissie | CALM project |
| Estifanos Lemma | Debre Berhan University |
| Tesfaye Mebrate | Debre Birhan University(DBU) |

1. [Ag DataHub - Ethiopia (moa.gov.et)](https://datahub.moa.gov.et/about) [↑](#footnote-ref-0)