GIZ CDSDR-SR-II Project

Capacity Development for Strengthening Drought Resilience in Ethiopian Lowlands

Definition of specifications of a database on dry valley rehabilitation measures in Somali region

Draft One

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By:

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ACRONYMS

API = Application Programming Interface

BoANR = Bureau of Agriculture and Natural Resources

BoIT =Bureau of Innovation and Technology

BoLPD = Bureau of Livestock and Pastoral Development

CC0= Creative Commons

CDSDR = Capacity Development for the Strengthening of Drought Resilience

CKAN = Comprehensive Knowledge Archive Network

DMS= Database Management System

DVR = Dry Valley Rehabilitation

DVRPU = Dry Valley Rehabilitation and Productive Use

EIAR = Ethiopian Institute of Agricultural Research

GIZ = Deutsche Gesellschaft für Internationale Zusammenarbeit

GUI = Graphical User Interface

HTTP = Hypertext Transfer Protocol

ICT =Information Communication Technology

KM =Knowledge Management

LAN =Local Area Network

LPD = Livestock and Pastoral Development

MoA =Ministry Of Agriculture

NRM =Natural Resource Management

RAM = Random Access Memory

SDC = Swiss Development Cooperation

SDR = Strengthening Drought Resilience

SLM = Sustainable Land Management

SSI = Small Scale Irrigation

SSI-KM = Small Scale Irrigation-Knowledge Management System

UAV = Unmanned Aerial Vehicle

UNCCD = United Nations Convention to Combat Desertification

WALRIS = Water and Land Resource Information System

WLRC = Water and Land Resource Centre

WOCAT = World Overview of Conservation Approaches and Technologies

1. Introduction

General

The project in Somali Region: Capacity Development for the Strengthening of Drought Resilience of the pastoral and agro-pastoral population in the Ethiopian arid and semi-arid lands – Somali Region (CDSDR-SR II) – co-financed by Swiss Development Cooperation (SDC) – aims to enhance drought resilience, improve livelihoods and food security of vulnerable communities and improve institutional capacity at regional scale in the Somali Region as well as at national level.

In general, the project aims to rehabilitate degraded dry valleys and introduce their sustainable Productive Use (DVRPU) by means of soil and water conservation measures and introduction of innovative and adapted agricultural and pastoral techniques, and land management strategies for economic use.

Mission Overview

As an international cooperation enterprise for sustainable development with worldwide operations, the federally owned Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH supports the German Government in achieving its development-policy objectives. GIZ promotes complex reforms and change processes.

The Ethiopian government recognizes the high economic value of the lowland areas and their products. Therefore, the pastoral and agro-pastoral population is supported in strengthening their drought resilience, allowing them to adapt their farming system to a changing natural and economic environment. German development cooperation participates with the support program to Ethiopian Government “Strengthening Drought Resilience of the Pastoral and Agro-Pastoral Population in the Lowlands of Ethiopia” (SDR) in selected regions in Afar and Somali regions.

It has been in GIZ-SDR-SRII plan to establish a database for various project activities and intervention measures including Database on Dry Valley Rehabilitation (DVR) measures. This is to establish a sustained database system to store DVR interventions, document best practices and establish knowledge management hub for scaling up degraded dry valleys rehabilitation techniques. GIZ-SDR has contracted a consultant to undertake “Definition of Specifications of a DVR measures” in Somali and Afar region for the contract period term for maximum of 16 days between 14.06.2021 and 30.08.2021.

This report provides an overview, findings and recommendations of the consultancy assignment based on the activities conducted as stipulated in the ToRs and scope of the mission.

Objective

The objectives of the present consultancy assignment were:

- Together with BoANR definition of objective, users and target group of the database to be developed.
- Assure that the planned database will be in line with national and sectorial guidelines and compatible with existing databases.
- In consultation with managers/stewards of the potential hosting national data portal, agree on a suitable template and recommend on the necessary next steps (whether a modification is needed in the structure in the data portal, harmonization of the data collected/to be collected etc.)
- Define objectives and tasks for a successive consultation to support BoANR for the implementation of the database.

Scope of the study

The assignment included the following tasks:

- Develop a shared understanding with BoANR of elements and structure of data collected or to be collected with relevant parameters of DVRPU activities in Somali region.
- Investing which organisations already have relevant information and/or databases concerning water and soil conservation measures in Somali region and on national level and analyse existing structures of databases and data types, attributes etc. used.
- Check the national and sectorial guidelines and requirement of the potential software and data portal.
- Discuss and determine with BoANR, BoLPD, CD-SDR-SR II and other concerned organisations in Somali region data types (spatial, biological, socioeconomic, biological, qualitative, quantitative, etc.) and attributes to be included in the data base and get it approved by the partners.
- Propose an appropriate software and structure in line with the “Soil and Agronomy Data Sharing Policy” and related “Implementation Guide” of MoA and get it approved by the partners.
- Design and propose information transmission to feed database.
- Identify technical and training needs as well as placement in the structure of BoANR for implementation of the database.

2. Approach and Methods

Organizational visits and interviews

The consultant worked closely with Bureau of Agriculture and Natural Resources (BoANR), Livestock and Pastoral Development (LPD), and Bureau of Innovation and Technology (BoIT) in Somali Region. In addition, at federal level line offices/directorates of the Ministry of Agriculture (MoA) and CDSDR-SR II project were visited. The visits were accompanied by interviews of responsible people (Appendix Table 2) and those believed to directly and indirectly have database system/knowledge management and data sharing platforms, and related database policy/guidelines. The visits and interviews were conducted from 27 June to 05 July 2021. When a direct visit was not possible, information was obtained from official websites and by contacting the persons in charge via email or phone.

Online resources access and review

Institutional online natural resource development data repositories were accessed and reviewed as per the scope of this assignment. The institutional online search and review included:

2.2.1. Water and land resource center (WLRC), Addis Ababa University and Sustainable Land Management Program (SLM)

Collection, provision and circulation of information on development, and accounting for the use of water and land resources in Ethiopia has been less efficient due to constraint in data and information gaps and lack of an appropriate resource database system. As a consequence, regional, bilateral, national and local agreements policies and interventions were often not based on accurate knowledge and a sound analysis of the situation.

The WLRC is an initiative to fill the above-mentioned gaps, and it seeks to establish a robust database for water and land resources of the country, giving special emphasis to the Blue Nile Basin. Information management system component of WLRC deals with the collection and organization of land and water related data and information and customize it and make available to users using efficient data sharing and information system. The information management system displays spatial and non-spatial data and information, maps, synthesized documents and tools, and relevant publications to respond the needs of policy makers, planners, researchers, and development practitioners for informed planning and decision making. **http://wlrc-eth.org/index.php/projects/act**

WLRC has also huge spatial (EthioGIS) and non-spatial databases of the country and has developed a web-based information-sharing platform called Water and Land Resource Information System (WALRIS). It uses to document and share knowledge with all stakeholders. Besides, it developed various products and decision support computerized systems, such as the Guideline for Sustainability

and other products to support stakeholders at all levels to address land and water management problems sustainably. http://wlrc-eth.org/index.php/projects/completed/exit-strategy-giz.

Further, WLRC is currently handling a project "Developing and Managing the Knowledge Base for the Natural Resource and Sustainable Land Management in Ethiopia". The project scope include: Develop web-based interactive directory for SLM watersheds, knowledge management platform for wider application, and SLM knowledge management system.

http://wlrc-eth.org/index.php/projects/active-projects/slm-km.

2.2.2. Natural Resource Management (NRM) Directorate of MoA- SLM Knowledge Management

The NRM directorate of the MoA has its own web-based data portal with diverse functionalities including: sharing publications, provides guidelines, support documentary videos, and etc. However, the portal is not yet updated since 2019.

https://nrmdblog.wordpress.com/2019/02/

https://nrmdblog.wordpress.com/documentary/ethiopian-slm-documentary-film/

https://nrmdblog.wordpress.com/2016/12/12/water-spreading-weir/

2.2.3. National Soil Information System (NSIS)

This National Soil Information System (NSIS) has two major objectives: (1) to map the fertility status of the agricultural lands and improve fertilizer advisory services to farmers, and (2) to map the land resources of the country and establish a national soil resources database.

It is created to meet the development of comprehensive geographical database that is necessary for generating information that is applicable for soil health and fertility management, land evaluation, planning, and management. Currently, it is under the final stage of development and expected to go live soon.

2.2.4. Agricultural management information system (AGMIS)-MoA

Agricultural management information system (AGMIS) is designed to track the overall agricultural sector performance monitoring platform. It is multitenant web application and it makes it first in its kind to be implemented in ministry of agriculture. The multitenancy means one platform supporting multiple tenants (isolated applications), it runs as one system but each tenant have its own independent database. If there are 10 or 12 projects in the ministry all projects will have their independent database to utilize AGMIS but they will be using the same web and mobile application for their activity. AGMIS as current state have two parts mobile and web application.

https://apkcombo.com/agmis-collect/et.gov.moa.moame/download/apk

2.2.5. Soil and agronomy data portal- The Coalition of the Willing (CoW)

The CoW , supported by GIZ-ISFM project, have established data portal to list, capture, showcase all relevant and useful datasets and data analysis and visualization options. The portal is customized using Data verse (www.dataverse.org) which is an open-source software developed by Harvard University in the U.S.A. Training was given to the portal hosting institution-EIAR aimed at introducing Soil & Agronomy Data (SAD) access, management, and sharing policy and on the application of the data portal which will soon be deployed at EIAR. The portal being implemented soon will be fully deployed at EIAR and become accessible for public IP and domain name configurations. The portal can also be accessible from CoW website: www.geoscow.org

http://www.eiar.gov.et/index.php/eiar-cow-partnership-training-of-trainers-program-on-soil-and-agronomy-data-portal

https://www.youtube.com/playlist?list=PLRvSieEExwOrlzrR7M05GfKybKMvn0T7O

https://www.researchgate.net/publication/347927460_Identifying_Cataloguing_and_Mapping_Soil_and_Agronomic_Data_in_Ethiopia

2.2.6. Ethiopian Institute of Agricultural Research (EIAR) DSpace

EIAR DSpace is a digital service that collects, preserves, and distributes digital material. Repositories are important tools for preserving an organization's legacy; they facilitate digital preservation and scholarly communication. EIAR has put its institutional publications in DSpace for the public to use them freely. http://197.156.72.153:8080/xmlui/

2.2.7. Small Scale Irrigation-Knowledge Management System (SSI-KM), MoA

As outlined in the SSI-KM website, Knowledge Management (KM) is the systematic management of an organization’s knowledge assets for the purpose of creating value and meeting tactical & strategic requirements; it consists of the initiatives, processes, strategies, and systems that sustain and enhance the storage, assessment, sharing, refinement, and creation of knowledge.KM is the right mix of People, Technology and Process. The objective of the SSI-KM website is to serve as the knowledge products portal for the Manuals, Guidelines, publications, Training documents (including audio, video materials) on the SSI to be accessed and used by the wider audience and also it gives a brief insight the current projects working on the SSI sector. This KM portal also links to the five DMS solution implemented on the five targeted government bureaus. https://www.ssi-km.online/

2.2.8. World Overview of Conservation Approaches and Technologies (WOCAT) and SLM

The World Overview of Conservation Approaches and Technologies (WOCAT) is a global Network that was established in 1992. The WOCAT Network launched efforts to compile, document, evaluate,

share, disseminate, and apply sustainable land management (SLM) knowledge. It was far ahead of others in recognizing the vital importance of SLM and the pressing need for corresponding knowledge management. In early 2014, WOCAT's growth and ongoing improvement culminated in its being officially recognized by the UNCCD as the primary recommended Global SLM Database for best practices. The work of WOCAT is guided by the WOCAT Strategy which is a product of experiences gathered in the WOCAT programme since its launch. WOCAT has developed a well-accepted framework and standardized tools and methods for documentation, monitoring, evaluation and dissemination of SLM knowledge. The data is entered in the Global WOCAT SLM Database; reviewed and published it can be downloaded as a user-friendly summary, available in Pdf format, or viewed as html. Data captured through the WOCAT questionnaires is entered in the Global SLM Database by the compiler who is responsible for the compilation and the data quality. https://www.wocat.net/en/

2.2.9. Comprehensive Knowledge Archive Network (CKAN) based platform

Comprehensive Knowledge Archive Network (CKAN) is a free and open-source web-based Data Management System. It is the world's leading open-source data portal platform for the storage and distribution of data. CKAN provides powerful tools for cataloguing, storing, publishing, sharing and accessing data via rich front-end, powerful API, harvesting, searching, visualisation/geo-visualization tools, etc.

CKAN has a modular architecture and by adding extensions can provide diverse features such as harvesting, comments, analytics, data upload, or link checking. Over 60 extensions under the Open Source licence are ready for downloading and usage. A robust API gives opportunity to integrate third-party applications and services.

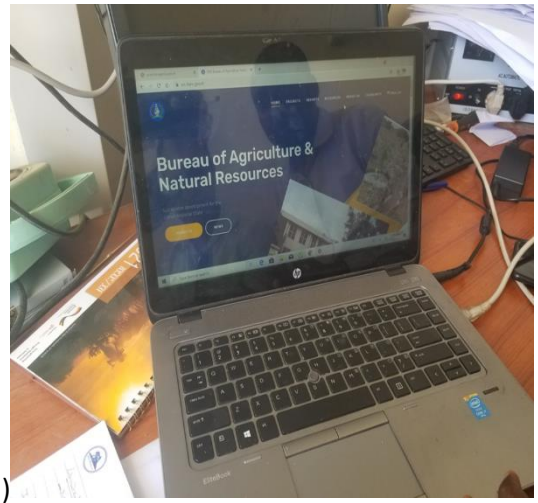
CKAN offers a powerful set of geospatial features that allow adding spatial information to your datasets. CKAN does not mind what format the data is in. A resource can be a CSV or Excel spreadsheet, XML file, PDF document, image file, linked data in RDF format, etc. CKAN can store the resource internally, or store it simply as a link, the resource itself being elsewhere on the web.

https://ckan.org/features; https://ckan.org/showcase; https://ckan.org/government; https://toolkit.data.gov.au/Introduction.html.

3. Findings and discussion

Overview of BoANR and BoLPD

- The BoANR and BoLPD are operational in 93 weredas and 6 administrative cities. There are also 11 zonal coordinators liaising between the regional head office and line offices of the weredas/ administrative cities.
- The bureaus have no functional database system.
- The bureaus have no functional data center and also required human resource.
- Data collection, storage and sharing system include:
    - Analogue ,via telephone and
    - Digital in personal computers which involves facilitated by email exchange and data sharing using external drives.
- The existing manual paper system does not have secured access for different types of users and the data cannot be easily processed as per the required objectives.
- Information flow among different departments is restricted to manual information. This hinders the time and manipulation of data.
- The existing system does not allow important and immediate information retrieval and report generation.
- The bureaus have a website developed by external consultants (https://srs-banr.gov.et/ and https://srslivestock.gov.et/)

a) 

b) 

https://srs-banr.gov.et

https://srslivestock.gov.et/

Figure 1. Website address of SR BoANR (a) and BoLPD (b)

- The websites are used to publish news and activities of the line departments
- The interface operational in two languages(English & Soomaali)

- Existing IT department and facility @ BoANR:
  - 8 months young and currently operational with one IT expert/director
  - Existing office facilities are very limited i.e. currently operational in less than 4m^2 serving both for office and router hosting.

Figure 2.Existing IT department at BoANR

  - IT department structure and human resource requirement have been developed and submitted to the regional civil service bureau for approval.
  - There is no data repository hard ware/server
  - The department with the required human resource is expected to be fully operational in 2014 E.C budget year (as of September 2021)
  - There is internet access with 8 Mbps band width while network interruption occurs occasionally
  - To assist digitalization of agriculture sector, the bureau has acquired two drones(UAV) and thousands of tablets

- Existing IT department and facility @ BoLPD:
  - The IT department is currently run by one IT expert/director. However, the department has approved structure and had about 5 experts. Now, 2 experts are on study leave and one left the department/bureau
  - The bureau has internet with a band width of 8 Mbps

- The bureau has one serve with 6 slots each having 300GB capacity implying 1,800GB.Furtehr, it contains 2 empty slots capable of holding 600 GB storage capacity. The rack has also space to accommodate additional servers. The server acquired before the current IT experts join the bureau and now not possible to locate any descriptive document/user manual. Hence, the server requires testing to check functionality. As indicated by the IT director it was tested and had password. It is planned to crack the password and further confirm its status.

Figure 3. Existing server at BoLPD

Regional Technological Infrastructure: Bureau of Innovation and Technology (BoIT)

The BoIT is responsible for formulating holistic policies relating to innovation and technology; and expediting the development of innovation, technology and related industries in the Somali region. As outlined in the region regulation number 29/2012 the bureau act as central coordinating agency to which all the relevant technology transfer centers engaged on invention , registration and the use of technology. In relation to databases at regional level, the bureau is responsible for quality assurance and overall monitoring of any database system implemented by the regional public bureaus and/or offices. The bureau also provides technical back up for various stakeholders on database making, and database management system implementation including data safety and security at regional level.

The bureau has and/or provides the following facilities and services:

- Central data center with full required hard wares including consistent internet and power supply ,and physical security facilities
- Full option data disaster recovery system.
- Has structure at wereda level and has the required experts at the head office.
- It enables 80% of the weredas connected through WoredaNet
- Serve as a regional data hub and/or provide data backup facility

Figure 4. Data center at BoIT

Data collection, storage and sharing of GIZ CDSDR-SR Projects

- The GIZ-SDR project has been implemented in seven dry valleys in the Somali Region, called Amadle (Jijiga South), Harre (Jijiga South and North), Gobka (Jijiga South), Bolidid (Jijiga South), Hadow (Jijiga South), Kurtumaale (Gode), Togoshiro (Jijiga South).
- The GIZ-SDR intervention measures/activities implemented by the bureaus include: Implementation of DVR measures in selected sites (including physical and biological DVR measures) , Pilot rangeland management and livelihood options directly linked to dry valley sites under rehabilitation, and pilot new digital technologies for planning, design, implementation and monitoring(e.g., unmanned aerial systems).
- Intervention implementation follows demand driven participatory approach
- Database/database template is hardly specified as per the requirements of the attributes needed to collect data as outlined in (old or new version) guidelines such as "Community Based Participatory Watershed and Rangeland Development: A Guideline (MoA, 2020).

    - The guideline provide a detail data attributes and templates for planning and reporting of various land rehabilitation measures being implemented in mixed farming and pure pastoral areas considering the different phases of interventions: initial, rehabilitation and economic development phases.
- The implemented data collection tools use analogue/paper templates and later converted into digital format at wereda/zonal/regional level.
- Except for water spreading weirs, other data types are rarely geo-referenced. However, digital data (biophysical data) have been collected using UAV which is a foundation for having digital data of DVR measures implemented sites. The digital image needs to be geo-referenced using control points.
- Digital data stored in the form of progress and annual reports in personal computers and shared via emails and external hard drives to the concerned body.
- Most of the data templates applied fit for reporting and M&E purposes. Implying weakly designed to document the entire required baseline biophysical and socioeconomic data of the intervention areas as outlined in the guidelines related to watershed and natural resource development for pastoral areas.

4. Database user requirements and suggested options

- Both BoANR and BoLPD have strong requirement to establish functional database/data sharing platforms at bureau level than only for the NRM department responsible for GIZ-SDR project implementation. This implies the database platform is supposed to serve both GIZ-SDR project and other departments of the bureau. Hence, this user requirement demand the envisioned database need to have the following features:
    - Establish data sharing platform for the bureaus while the feature support the GIZ-SDR-project interventions database.
    - Database/data sharing platform at the office level implies collection, storage and sharing of government data. This requires platforms suitable for sharing government data and also database/data sharing platform governance requires full implementation of federal and regional data sharing policies and implementation guides.
- The BoANR and BoLPD require separate database infrastructure which will create duplication of effort and resources. There is a possibility to use one facility/server while the web enabled database platform can be constructed for each bureau.
- The bureaus existing websites developed by external consultants are commercial ones. The user manual and source codes are not available at the time of office visit. The experts were trying to communicate the developers to get access to it. Implying there will be limited possibility to link existing website to the envisioned data sharing portal (by upgrading functionalities of the existing website when required)
- Data center/server hosting requires secured reasonable investment including physical infrastructure and security, and consistent power and internet supply. There are two options/possibilities to achieve:

  Option 1: Provision of server and data center facility development either in BoANR or BoLPD.

  Advantage:

  - Own resource and facility directly managed by the respective ICT department (s) of the breaue(s) including direct data, storage, management and sharing.

  Limitation:

  - Require significant resource investment for data center construction and facility development in the bureau (s)

Supportive ongoing plan for option 1:

The ministry of agriculture (MoA) plans to establish agricultural management information system (AGMIS; see section 2.2.4) at regional levels. The AGMIS status was unclear during the field/office visit and after returning to the office. However, it was recently discovered that MoA has bought the requisite server and some basic datacenter facilities and plans to supply them soon. Essentially, one server will be given for BOANR and BOLPD, while the location of the hosting facility will be determined. The AGMIS facility will, in general, create an environment that allows the DVR database to be synchronized with the BoANR and BOLPD AGMIS facilities.

Accordingly, it is reported that the MoA plan to provide one server that serve both BoANR and BoLPD. Implying data ceneter/server housing facility development inevitable though impossible to know/guess when this will be realized. Further, where to host/establish AGMIS server was not decided. However, communication with the MoA IT department- AGMIS project coordination unit confirm that the required server and some data center infrastructure facilities are already acquired and planned to be provided to the respective regional bureaus i.e. one for BoANR and BoLPD (in which office to host the facility will be decided in consultation with BoANR and BoLPD). The data center physical infrastructure development is planned to be conducted by the regional bureau (not by MoA). Hence, there is a possibility to make functional and upgrade the existing server and hosting the envisioned AGMIS data center at BoLPD while placing the new GIZ-SR facility/server at BoANR. The BoANR bureau has strongly expressed the need to have separate DVR database platform at BoANR. **Option 2**: Provision of server and combine with the BoIT data center facility

Advantage:

- There is a possibility to ensure already established data center facility at BoIT which has been functioning along with and linked to the national central database infrastructure. These include sustained provision of physical infrastructure, physical security, consistent power and internet supply, and data security measures which otherwise will be acquired at reasonable investment.
- Better supervision could be possible due to its single location and materials are tightly controlled due to specific area.
- Possibility to benefit from the existing backup and disaster recovery system which includes a possibility to use the BoIT data center as a backup of the envisioned GIZ-SR/BoANR/BoLPD database.
- Overcome duplication of effort and resource wastage
- Possibility to integrate the facility with the existing wereda net infrastructure. Implying, the envisioned central/regional database can be accessed by the respective wereda line offices.

- Ensure data security and ease collaboration with regionally mandated body to oversee database making, database management and data sharing facilities.
- Reduce operation cost related to overall management including ensuring safety of physical security infrastructure.

Limitation:

- Remote location of facilities and remote access might reduce sense of ownership (NB: In terms of absolute physical distance, the current physical location of BoANR, BoLPD, and BoIT very close)
- Require joint understanding, plan and management of common facilities (in some cases require frequent updating to newly assign top management body of each office). Further, it is likely the BoANR and BoLPD data mangers/IT experts sometimes need to travel/physically visit BoIT for big data uploading. However this could be resolved by connecting via dedicated WiFi or LAN connection.

5. Conclusions and Recommendations

i) User requirements and specification

- The BoANR and BoLPD requirement to have separate database infrastructure likely cause duplication of efforts and resources. The consultant suggests providing one server (including the backup server) with a capacity to serve both bureaus.

- It is recommended to consider comprehensive bureau level data sharing open source data management system. In this regards it is advisable to implement Comprehensive Knowledge Archive Network (CKAN). It is an open-source data management system for powering data hubs and data portals. It makes it is easy to publish, share and use data. Its functionalities to power hundreds of data portals, makes best suit for the envisioned GIZ-SDR supported data base management platform for the respective bureaus.

ii) The GIZ-SDR DVR measures and other databases of the BoANR should be constructed following open source database software that can be integrated in the open source data sharing platform. **Data sharing platform functionalities and features**

- The CKAN based data management system should be capable to list, capture and showcase all relevant and useful datasets including geospatial and multimedia data.

- The backend databases required to be built based on open source software.
- Based on the need and general assessment of the data generated by BoANR, BoLPD, and GIZ-SDR, the envisioned data portal should have the following generic functionalities and features:

User Interface:

Attractive and user friendly web based interface both for data consumers and producers. Features to support data managers customize user interface when the need arise. The interface can also be accessed by mobile devices and by any web browser. This will help for DA's to enter basic field data form remote as well.

Data Exploration and Visualization/Geo-visualization Options

The system capable of supporting exploration and visualization of tabular data and various geospatial data types (shape file, tif, GeoTiff, kml, kmz, etc) via/over thematic maps, Google earth, and world map. Though MoA doesn't have national level geodatabase at the moment, having the system at regional level would be good for possible link whenever possible geodatabase development in MoA.

Support Multiple Data type Uploading and downloading

The system should have a graphical interface to upload any format of data such as image, video, shape file, geospatial/proximal or remote sensing-satellite data and text. It also should support download options in a variety of format. The system should have harvesting API. Data can be harvested from this system and other systems can also extract data from this system.

Data Quality Control

In the platform, data publishing workflows that can help to check the quality of the published datasets (i.e. metadata, anonimization, privacy issue checkup) should be implemented following the national and regional data sharing policies and implementation guides.

Licensing and permission Features

The data sharing platform/ system should allow data producers/originators to control access over their data in different levels. They can also set policies on how others use their data (i.e. licensing). Following the draft soil and agronomy data sharing policy of MOA which states data should be as open as possible and as close as necessary, the default license for any dataset is CC0 which means data should be used for any purpose including commercial purpose. However, the data producer can also set other creative commons licensing options as necessary. Data owners can also provide to ask permissions and notification of access requests. Data can also be restricted for certain number of group of users using Ip. Embargo whereby data can be kept closed for a certain period is another feature to be considered by the system. The system should allow a possibility to make the data totally closed or open.

User Registration

The system required to allow a web-based interface for any user to register in the platform using different options such as Email, Institution, google login. However, registration will be completed when the system admin approve the registration by assigning a role for that particular user. The role can range from data curator, contributor and so on. The system also can give a dashboard to manage registered users.

Search function

The system required to support a search API. It should support faceted search where the facets can be added or reduced by the data manager. It also should include search engine optimization feature, social media share option and a feature to display featured platforms.

iii) Data collection system /data attributes and database management system

- Spatial and non-spatial data collection of DVR intervention measures, necessitating the establishment of open source digital data collection, storage and sharing platform for data management, dissemination and communication.
- Data collection, data attributes, and populating data for DVR measures should consider the following:
  - Follow the various approved guidelines for natural resource development in pastoral areas. For instance, the MoA 2020 guideline (including previous versions) and PSNP pastoral development guidelines have extensively listed the type of data and attributes to be collected including the associated templates for data collection. Hence, SDR projects required to strictly adapt and follow guidelines based data collection approach and standards while considering a possibility to accommodate customized data attributes as required.
  - To ensure sustainability and continuity of the development process triggered by DVR measures, it is advisable to have an inbuilt exit strategy during the planning process. These will ensure sustainability of project impacts continue after a project ends and to enable communities continue the development process using the achievements of the project as a spring board. In line with this, the data attributes and data collection system should follow/adapt guidelines for exit strategy and performance assessment of watershed management/natural resource development guidelines. In this regard it is worth mentioning one nationally developed guideline to adapt or consider regarding data attributes and data collection approach at each phase (initial, intervention/ implementation and economic/development phase) of land rehabilitation measures: “Exit Strategy and Performance Assessment for Watershed Management - A guideline for sustainability (MoA/Zeleke et al,2017).”
  - As outlined in all natural resource development and performance assessment for natural resource development guidelines, it is compulsory to have detail baseline and development option maps that show what should be done where with database. This means any physical intervention in the watershed/intervention site should have physical/geographic reference. Implying activities should have spatial location and they have to be evaluated accordingly. This is because within the given intervention site technologies and management requirements will not be the same which require the necessity to access the performance of each sub-activity in each location specific mapping/management unit separately. Hence, there is a need to have initial/baseline and development map and activities are also should be linked to each of the

spatially explicit land units than making activities aggregated without any location specific reference in a given site. Therefore, it is recommended to prepare geo-referenced baseline and development plan map of each GIZ-SDR interventions along with the required database. This can be materialized by specifying, extracting and populating the required data attributes as outlined in the natural resource development and performance assessment guidelines. However, if required, there is a need to consider adaptation and customization of data attributes, from existing guidelines, for DVR measures.

- Due attention should also be given to DVR measures comprehensive data collection, storage, and sharing. There is a need to include/consider, documentation of success stories, and knowledge management/database management system setup for DVR measures to be uploaded in the envisioned database management platform. These will facilitate and ensured sustained learning and scalability of successful technologies across similar agro-ecologies. Hence, there is a need to adopt comprehensive database making and DVR measures best practices compilation technique to document and scale up technologies. This is being materialized through comprehensive functional DVR database making that is going to be uploaded in the backend of the platform and supposed to be accessed and visualized by diverse users. The DVR measures dataset required to include dataset collected/being collected at the initial, intervention/implementation and economic/development phase of land/natural resource development interventions.

- Data collection, data management and quality assurance mechanism should be in place and standardized in the process. In this regard guideline and standards that work across the board should be prepared that accommodate the needs of stakeholders involved in the development of shared database system. In line with data management, standard data collection and data entry templates should be prepared that properly integrate with the database system. It is recommended to provide training to all NRM , GIS/RS and database/IT experts (Appendix Table 1) involved in the database development activity of the bureaus on the use of standard data collection guidelines, use of data collection standard templates, and populating datasets of DVR measures. It is in such a way that it is possible to have a complete DVR measures dataset to be uploaded and visualized on the platform along with various project reports and datasets.
- Geo-referenced spatially explicit map, directory of the DVR measures, and UAV/drone acquired biophysical digital images along with complete dataset of DVR measures need to be prepared to be uploaded in the envisioned data sharing platform. The data attributes collected/to be collected and populated need to be as outlined in the standard pastoral

guidelines with a possibility to customize when required and should also consider the baseline, implementation and development phase of the data attributes and indicators.

- Baseline information for DVR measures which have been missed to be collected before the acquisition of drones/UAV, advised to be collected from higher resolution satellite images and be integrated as comprehensive baseline database.
- The DVR measures data management system development should consider to develop the DVR measures knowledge base and knowledge management system in the Ethiopian lowlands to enable stakeholders make development actions or scale out DVR measures at different scales. These include:

    - Develop the DVR measures knowledge base (spatial and non-spatial) for the national DVR project sites in Ethiopian lowlands.
    - Develop web-based interactive directory for DVR measures implemented in the Ethiopian lowlands along with computerized knowledge management platform for wider application.

- • The BoANR and BoLPD have strong requirement to establish their own separate database infrastructure and plan to manage by their own resources. If the human resource requirement (Appendix Table 1) to run functional database is not fulfilled by the respective bureaus, the hardware/server facility is recommended to be housed at BoIT and provide BoANR and BoLPD admin roles for the database management platform/system.This modality will ensure facility safety and data security. It will also avoid duplication of effort and resources, and enable the realization of functional, accessible (even at wereda level) and sustained database management system at the bureau and regional levels. However, if the required IT and database experts are provided either by BoANR or BoLPD , server physical facility established and/or aligned with AGMIS database/data center of the bureaus. It is advisable to establish the DVR database facility at BoANR and with the possibility to link with the existing regional and national platforms as required.The database management platform/database management system working team need to be well experienced in making NRM database platforms and hence should require due consideration before engagement.
- The server specification need to consider future demands such as server requirements that can handle semi and complete computational/analysis requirements.The hardware/server specification preparation and bidding process recommended to be conducted in participation with the regional BoIT bureau and BoANR and BoLPD IT departments' appropriate professionals. This arrangement will ensure inclusion of all the required complete facility and

its accessories. Further, it will avoid overlooked issues during the bidding process and hence ensures immediate acquisition of functional facility as per the requirements of the BoANR , BoLPD and regional data center/BoIT.

Appendices. Generic server specifications and ssupportive documents related to office visits

Appendix 1. Suggested Data management system (DMS)

The DMS system designed and implemented based on the client-server software architecture it requires the following hardware:

1. **Server Computer/machine**

In a technical sense, a server is a software program, or the computer on which that program runs, that provides a specific kind of service to client software running on the same computer or other computers on a network. The client-server model is an architecture that divides processing between clients and servers that can run on the same machine or on different machines on the same network. It is a major element of modern operating system and network design.

The client provides the user interface, such as a GUI (graphical user interface), and performs some or all of the processing on requests it makes from the server, which maintains the data and processes the requests.

The dedicated machine that runs the server software is known as the **Server Computer**, and it has higher capacity and performance than the client computers.

The capacity or performance of the server computer mainly depends on the number of concurrent clients/users access to the server and the type of server applications that runs in it.

The DMS solution runs the following server applications

- **Web server** – is a server software that can satisfy World Wide Web client requests. It stores files related to web sites and serves (i.e., sends) them across the Internet to clients (i.e., web browsers) when requested by a user over HTTP and several other related protocols. The most popular web servers are Apache, Tomcat and the Microsoft licensed webserver IIS
- **Database server** – is computer software that provides other computers with services related to accessing and retrieving data from a database. The most common database server management engines are MySQL, PostgreSQL and MS-SQL
- **DMS Application server** – An application server runs applications for clients, usually contains the GUIs of the system (e.g. CKAN)
- **File server-** is software that is dedicated to storing files and making them accessible for reading and writing to clients (i.e., users) across a network

Separate dedicated server computers can be assigned for the above server application of the DMS solution in a LAN, however in most cases these are installed and configured in a single server computer with high capacity and performance and minimizes the cost of investment and management of the server computers.

For instance if there are 5,000 users/staffs in a bureau that are expected to access the server for DMS usage at the same time, the RAM (Random Access Memory) of the single dedicated server should be 64GB or more and number of CPU should be 8 or more. Acceptable technical specification of the server computer is attached in the annex below.

As the DMS solution becomes operational within the bureau and across the bureau online via internet, the bureau should plan to acquire additional server computer that can be used as redundant server for reliability of the solution and can be used also as backup server for the documents and files stored in the primary server. The server procurment process and budget allocation need to consider all theose requirements.

2. **Server Accessories**

The server computer needs the following software and accessories for proper functioning with in the bureau. This document also considers for those bureaus that do not have standard Data Center or Server Room

Server operating System – also called a server OS, is an operating system specifically designed to run on servers, which are specialized computers that operate within a client/server architecture to serve the requests of client computers on the network. The DMS solution can run on Microsoft server operating systems (MS- Windows Server 2016 OS or on wards) or it can run also with the open source operating systems such as Ubuntu because the solution in implemented using the open source technologies and tools, shown in the next section.

Antivirus software- Symantec (Norton) or Kaspersky or any antivirus software that has server based solution

Server Rack- a fully enclosed, secure server cabinets range in size from 20 U to 42U server rack, which has air ventilator for the server computer

Dedicated Server Room – A server room is a room, usually air-conditioned, and devoted to the continuous operation of computer servers. An entire building or station devoted to this purpose is a data center; or use the existing server room facility at BoIT.

UPS – Rack mountable power UPS ranges from 10k watt depending the IT devices attached to the UPS.

Power Divider – for sharing the electric power among devices

Network infrastructure Requirement

The DMS solution is a web based system that requires network infrastructure with in the bureau. The bureau should have a local area network (LAN) with in the office. The LAN connects the DMS server, the client computers with in the bureau and other network devices (switches, routers, Internet

modems). The internet modem connects the office LAN to the internet cloud so that clients outside the bureau can access and use the system.

The bureau should have a broadband internet subscription for the internet service provider (ISP). The bandwidth or speed of the internet should be 8MB or above depending on the number staffs in the bureau. The bureau should get a public IP address from the ISP in order to access the DMS solution via internet.

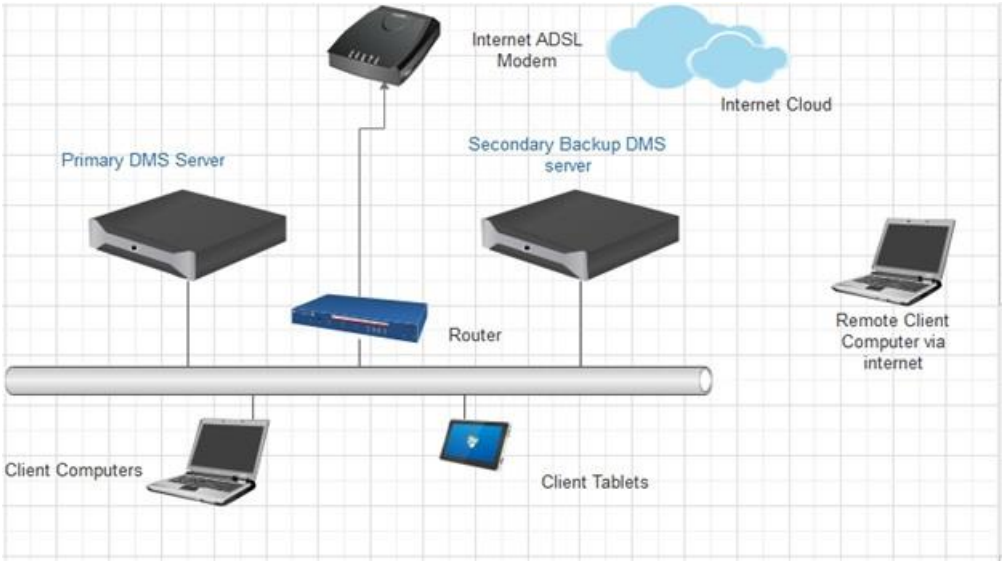


Figure 1 DMS architecture

NB: *The above general requirement is for the establishment of new DMS/facility. However, depending on the availability if existing facility at BoIT (the envisioned data centre to host the dedicated server of BoANR and BoLPD) some items can be added or reduced when the actual bidding doc is prepared.*

Appendix Table 1. Human capacity requirement

No	Specilaization	Quantity
1	Database Administrator	1
2	Web Adminstrator	1
3	Network Engineer	1
4	Programmer	1
5	IT technician (diploma)	1

Appendix Table 2. Suggested Server specification for DMS

Minimum Network Attached Storage requirement Specification	
Physical Requirements	
Brand and Model	**Should be specified clearly**
Form Factor	**2U 8-bay Rackmount NAS** **Compact chassis design with the capability to fit in a 2-post rack**
Processor	**Intel Atom C2538 quad-core 2.4GHz**
RAM	**64 GB** DDR3L-1600 Non-ECC SO-DIMM kit (RAM1600DDR3L-**16GBx4**)
HDD	**Included: 8 x 2.5" SATA HDD – 3 TB Each (Hot Swappable)**
Network adapter	**4 x 1GbE (RJ-45)**
Slots, bays	PCIe slot for optional 10GbE add-on card. Built-in four 1GbE (RJ-45) ports with failover and Link Aggregation support
Expansion	Should support up to 12 drives when connecting with an additional one expansion unit, allowing you to easily scale up on demand for future scalability
Ports	***2 USB 3.0 Ports: 1 x eSATA port*** ***1x Console port***
Case	***2U Rack-Mountable with -Rail Kit Sliding***
Power supply and Fans	*2 Fans and power supply 220v 60Hz/50Hz*
General Disk Station Manager Applications and Features supported	
Networking protocol	SMB, AFP, NFS, FTP, WebDAV, CalDAV, iSCSI, Telnet, SSH, SNMP, VPN (PPTP, Open VPN, L2TP)
File system	**Internal:** Btrfs, ext4 **External:** Btrfs, ext4, ext3, FAT, NTFS, HFS+, exFAT5
Supported RAID type	Basic, JBOD, RAID 0, RAID 1, RAID 5, RAID 6, RAID 10, Synology Hybrid RAID, SHR
File sharing capability	Maximum local user accounts: **2,048** Maximum local groups: **256** Maximum shared folders: **512** Maximum concurrent SMB/NFS/AFP/FTP connections: **500**

Directory service	Windows AD integration: Domain users login via SMB/NFS/AFP/FTP/File Station, LDAP integration
Security	Firewall, encrypted shared folder, SMB encryption, FTP over SSL/TLS, SFTP, rsync over SSH, login auto block, Let's Encrypt support, HTTPS (Customizable cipher suite)
Supported client	Windows 7 and 10, Mac OS X 10.11 onwards
Supported browser	Chrome, Firefox Internet Explorer 10 onwards, Safari 10 onwards; Safari (iOS 10 onwards
Privilege	Windows Access Control List (ACL), application privilege
Packages and Applications	
File Server & Synchronization	
Drive	Drive should provide a built-in universal web portal for you to access and share data at anytime and anywhere. Its real-time synchronization service ensures that you can access the most up-to-date files on multiple platforms, including Windows, macOS, Linux, Android and iOS **Maximum Number of Synced Files: 1,000,000 / single file reaction time 437 ms** **Maximum Number of Concurrent Connections for PC Clients**: **550**
File Station	Virtual drive, remote folder, Windows ACL editor, compressing/extracting archived files, bandwidth control for specific users or groups, creating sharing links, transfer logs
FTP Server	Bandwidth control for TCP connections, custom FTP passive port range, anonymous FTP, FTP SSL/TLS and SFTP protocol, boot over the network with TFTP and PXE support, transfer logs
Universal Search	Offer global search into applications and files
iSCSI Storage & Virtualization	
iSCSI Manager	Maximum iSCSI target: 128 Maximum iSCSI LUN: 256 iSCSI LUN clone/snapshot support
Virtual Machine Manager	Deploy and run various virtual machines on Synology NAS, including Windows, Linux, or Virtual DSM
Virtualization	VMware vSphere 6.5, Microsoft Hyper-V, Citrix®, OpenStack
File system	
Internal Drives	• Btrfs

	• EXT4
External Drives	• Btrfs • EXT4 • EXT3 • FAT • NTFS • HFS+ • exFAT*
Data Protection & Backup Solution	
Hyper Backup	Support local backup, network backup, and backup data to public clouds
Backup tools	DSM configuration backup, macOS Time Machine support, Cloud Station Backup Shared folder sync - maximum tasks: 8
Snapshot Replication	Maximum shared folder snapshots: 1,024 Maximum replications: 32
Active Backup for Server	Business-wise file server backup, Back up servers via SMB or Rsync protocol
Productivity & Collaboration	
Collaboration tools	Collaborate with instant message service "Chat", online editor "Office", and scheduling assistant "Calendar" Chat maximum user: 1,500 Office maximum user: 1,800 Calendar: support and access via mobile devices
Note Station	Rich-text note organization and versioning, encryption, sharing, media embedding
MailPlus Server	Secure, reliable, and private mail solution with high-availability, load balancing, security and filtering design Should include 5 free email account licenses; Should allow for additional accounts by purchasing additional licenses
MailPlus	Intuitive webmail interface for MailPlus Server, customizable mail labels, filters, and user interface
All In One Server	
Active Directory Server	Provide a flexible and cost-effective domain controller solution
CMS	Provide a single interface to manage and monitor multiple NAS

VPN Server	Maximum connection: 30, supported VPN protocol: PPTP, OpenVPN, L2TP/IPSec
Web Station	Virtual host (up to 30 websites), PHP/MariaDB, 3rd-party applications support
Other packages	DNS Server, RADIUS Server, Log Center
Storage Analyzer	Volume and quota usage, total size of files, volume usage and trends based on past usage, size of shared folders, largest/most/least frequently modified files
Antivirus Essential	Full system scan, scheduled scan, white list customization, virus definition auto update
Packaging	
Package Content Per is Network Attached Storage	*NAS main unit x 1* *Quick Installation Guide x 1* *Accessory pack x 1* *AC power cord x 1* *C13 to C14 power cord x 1*
Manuals	*User manual (English)*
Warranty	***Three (3) years limited warranty***

Remark:

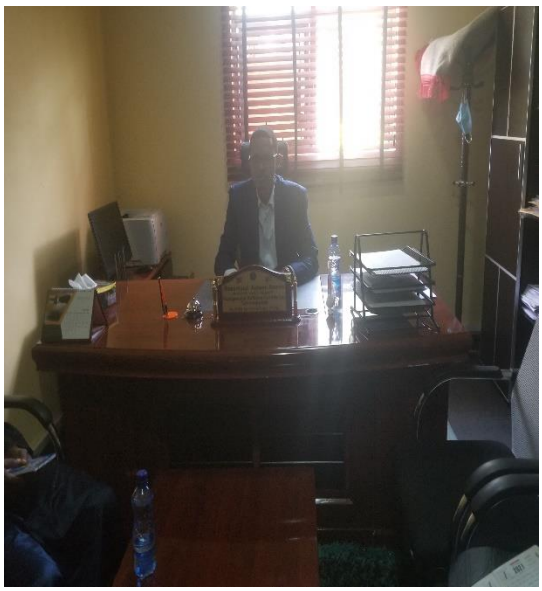
- All the requirements listed above are mandatory
- Bidder compliance sheet at least must contain technical requirement and bidder proposed offer. The technical requirement can't be considered as a compliance sheet. Failing to do so will lead to automatic rejection.
- The supplier must attach MAF(manufacturing authorization form) from the OEM(original Equipment manufacturer)
- On-site training on the implementation and administration of the solution should be provided to IT staffs at BoANR, BoLPD and BoIT regional bureaus to transfer hands on knowledge

NB:

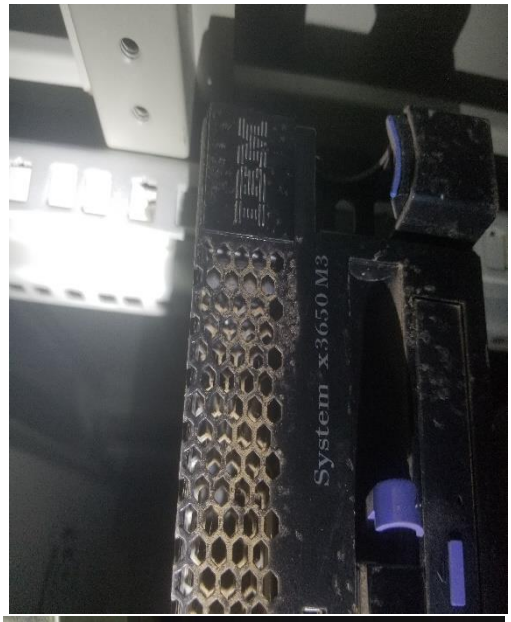
- *It is not a bid document. The server and required associated accessories bid doc preparation need to be worked out by the BoIT- IT engineers in collaboration with the IT/database experts of BoANR and BoLPD . It is strongly advised to ensure/confirm the facility will accommodate the user requirements of two separate bureaus i.e.BoANR and BoLPD.*
- *The above general requirement is for the establishment of new DMS/facility. However, depending on the availability of existing facility at BoIT (the envisioned data centre to host the dedicated server of BoANR and BoLPD) some items can be added or reduced when the actual bidding doc is prepared.*

Appendix 2. Meeting with BoANR

Appendix 3. Visit and meeting with BoIT



Appendix 4. Visit at BoLPD


System x3650 M3


M/T:
7945-D2G
S/N:
06BEXX6
Product ID:
7946D2G
Xeon

Appendix Table 1. List of people interviewed and organizations visited.

Organization	Location	Interviewees
Bureau of Agriculture and Natural Resources (BoANR)	Jigjiga	Dr Abdulkadir Yiman (Brueaue Head)
Bureau of Agriculture and Natural Resources (BoANR)	Jigjiga	Mr Badal Kenedid (NRM Director)
Bureau of Agriculture and Natural Resources (BoANR)	Jigjiga	Mr Hassen Adden (ICT Director)
Bureau of Livestock and Pastoral Development (BoLPD)	Jigjiga	Mr Hassen Abdulahi (Pastoral Development Director)
Bureau of Livestock and Pastoral Development (BoLPD)	Jigjiga	Mr Mohammed Beshir (IT Director)
Bureau of Innovation and Technology (BoIT)	Jigjiga	Mr Mohammed Hussen Ahemed (Deputy bureau Head)
GIZ-SDR-Jigjiga Office	Jigjiga	Mr Ayaleneh Ali Omar (M and E Expert)

REFERENCES

MoA(Ministry of Agriculture).2020. Community Based Participatory Watershed and Rangeland Development: A Guideline. Ministry of Agriculture, Addis Ababa, Ethiopia.

WLRC (Water and Land Resource Center). 2014. Exit Strategy and Performance Assessment for Watershed Management: A Guideline for Sustainability. WLRC - Ethiopia and GiZ-SLMP – Ethiopia.

MoA (Ministry of Agriculture). 2012. Guidelines for PSNP - PW in Pastoral Areas. PWCU/NRM Directorate and Food Security Coordination Directorate of the Disaster Risk Management & Food Security Sector (DRMFSS). Guidelines submitted by ABCON Plc – Consulting House.