



POLICY BRIEF

Creating seamless access to data and information along the agricultural value chain: a fact-based decision support hub for sustainable climate smart agriculture.

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About AICCRA

Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA) is a project that helps deliver a climate-smart African future driven by science and innovation in agriculture. It is led by the Alliance of Bioversity International and CIAT and supported by a grant from the International Development Association (IDA) of the World Bank. Explore our work at aiccra.cgiar.org

Summary

Many agricultural projects in recent past have identified digitization as a key component in transforming agriculture to achieve the goal of feeding an increasing population, at less footprint, on less land, and with less water, in a changing climate with increasing demand for quantity and quality of food and nonfood products from plants and animals. A key product in the heart of the digitation agenda is the generation of massive data. Accelerating the impact of collected data in agriculture requires an infrastructure that facilitates seamless access amongst relevant stakeholders in formats that can be easily mainstreamed for different purposes including but not limited to policy-making, product development, data-driven decision support, etc.

This policy briefing captures recommendations for the design infrastructure, implementation and operationalization of an Agricultural-Data Hub as a robust digital data exchange backbone for information and data sharing among relevant stakeholders for fact-based decision making among players in the Agricultural value chain, policy makers, and many others towards a more sustainable and climate smart agriculture. Additionally, this document makes a case for an Ag-Data Hub to be setup as a piping backbone of privately or publicly managed distributed networks of data and information systems.

Introduction

According to the United Nations 2019 world population prospects highlights, global population is expected to rise from about 7.7 billion in 2019 to about 8.5 billion by 2030. This affirms the Food and Agriculture Organization's (FAO) expectation of a 60 percent projected increase in demand for agricultural outputs to commensurate a global population of 9 billion. Plant processes such as growth, photosynthesis, and transpiration or yield formation are the basis of life on our planet, nourishing the presently 7.7 billion global population. These processes will have to be further improved to achieve the goal of feeding the increasing population, at less footprint, on less land, and with less water, in a changing climate with increasing demand for quantity and quality of food and nonfood products from plants[1].

Creating seamless access to data and information along the agricultural value chain promises a radical change in transforming agriculture, climate solutions and food systems around the world, towards eliminating hunger and poverty, creating truly sustainable climate smart systems and meeting the 2030 Sustainable Development Agenda. It is in the light of this that the Ghana Agricultural Data Hub (Ag-Data Hub) is being developed as a secure mission-critical, reliable, multi-tier and multipurpose digital data exchange backbone for information and data sharing among stakeholders and for the development of fact-based decision support systems to drive policy-making and to trigger a move towards sustainable climate smart agricultural practices.



Stakeholder Report: <http://poc.miphost.com/stakeholder.php>

Stakeholder Engagements

The content of this briefing is backed by extensive stakeholder engagement which included identifying, mapping and prioritizing stakeholders to determine the best tactics for effective data sharing as well as optimize the use of available resources. The process carried out has built connections, trust, confidence, and buy-in of key initiatives and institutions. This will mitigate potential risks and conflicts with stakeholder groups, including uncertainty, dissatisfaction, misalignment, disengagement, and resistance towards the goal of establishing an exchange hub between data holding and data consuming institutions.



Identified Solution Gaps

01 Look-up Directory

There is no single look-up directory with a search engine that allows the finding of data or information belonging to different institutions. This is leading to a chunk of duplication in the collection of data by different actors.

02 Data Exchange Infrastructure

Absence of digital data exchange infrastructure between stakeholders and value chain actors creating a communication and information flow gap. Institutions will have to invest in their respective ICT infrastructure to support the collective data exchange goal.

03 End-User Products

Inadequate/ineffective End-User products and dashboards that answers directly to the needs of farmers, policy makers and other actors in the Agricultural value chain. The is however, a ton of research outputs and data that can be translated into forms that address End-User needs directly.



SWOT Analysis

Strengths

- Existing partners have a host of data relevant for climate smart agriculture
- Stakeholders agree to the need to share data
- Government of Ghana (GoG) support through national institutions like MOFA and CSIR
- Aligned with components 1 and part of component 2 of the Food Systems Resilience Program (FSRP)
- ESOKO and other private sector partner endorsement and support

Opportunities

- Trigger a data driven approach to sustainable and climate smart Agriculture
- Create a demand for resources in research and academia.
- Meet the needs of growing demand for precise and predictive agronomic data.
- Develop data backed end-user tools for Climate smart and sustainable farming

Weaknesses

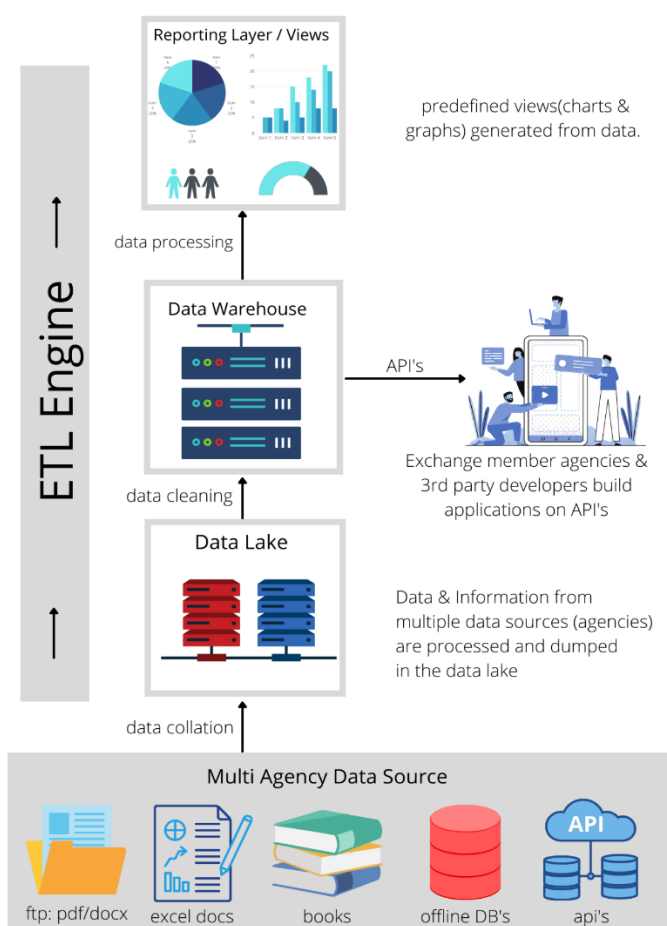
- Limited in-house technical developer expertise in many partner institutions.
- No guarantee of backing funds for operationalization of Data Hub after implementation
- High-Level Bureaucracy, data ownership and data security concerns of partners

Threats

- Executive Sponsorship/Funding (support from leadership i.e. endorsement of stakeholders, money)
- Deciding on type of management for the operationalization of the Ag-Data Hub
- Establishing a clear-cut, long-term sustainability plan to scale and constantly improve the proposed Ag-Data Hub.

Key Objectives of the Ghana Ag-Data Hub

1. To implement a support infrastructure for traditional data migration into Findable, Accessible, Interoperable and Reusable (FAIR) data formats.
2. To engineer a seamless data flow architecture and analytical tools for fast retrieval, analysis and providing complex insight into big data.
3. To implement APIs for data gaps bridging, information sharing among stakeholders and to serve the software developer community under defined contracts and MOUs.
4. To facilitate the development of Application layer decision support systems and dashboards based on information needs of various stakeholders in the value chain

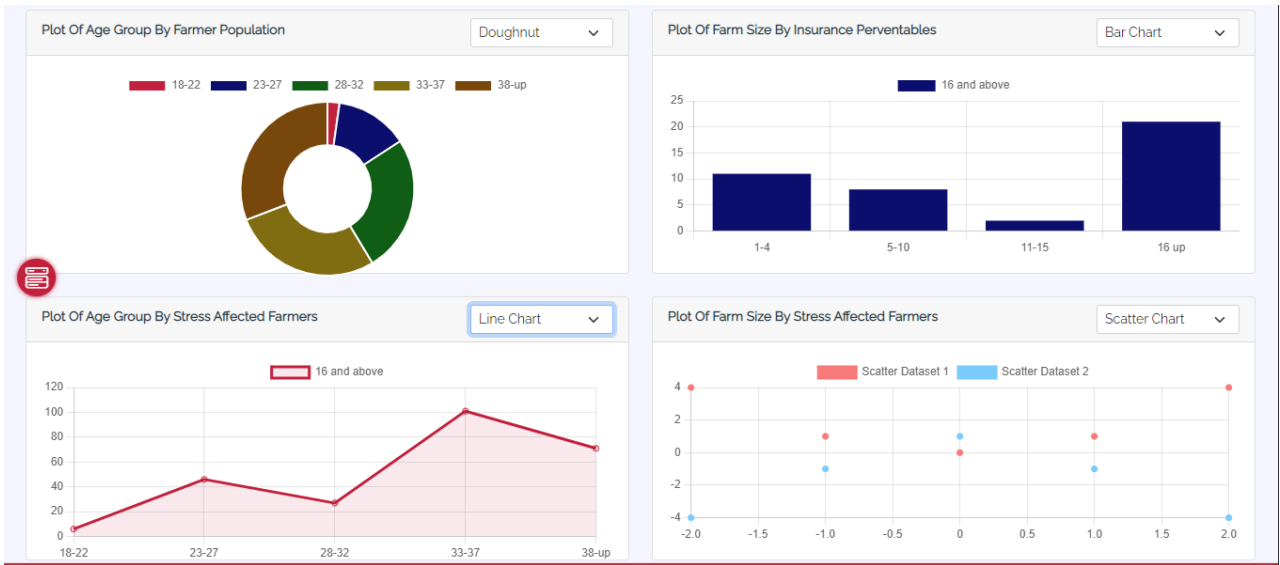


Design Recommendations

To establish global ease of access and uptake by a wide group of developers and users, the recommended design is to consider developing tier-two API's that allows software developers and other third part institutions with authorized access to extract relevant data using Restful APIs for their custom needs. The primary aim is to get reliable and easy to use APIs available and running and allowing a community of developers to continuously innovate novel decision-making tools for different stakeholders in the value chain.

This infrastructure will be the actual Ag-Data Exchange Hub and it is recommended to be hosted and managed by a government institution (for which CSIR-INSTI has been identified) mandated in an equal line of duty.


Policy Oriented Decision Support Dashboard

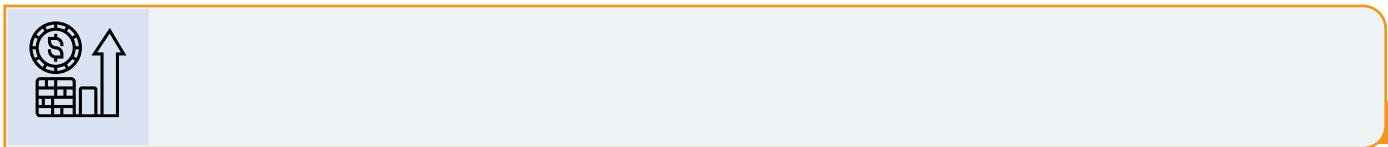


Visualizing data with Dashboards reveal very important metrics and key performance indicators for better decisions and situational understanding. The Ag-Data hub presents the opportunity to develop relevant decision support dashboards from multi-stakeholder databases as a mechanism to assist policy makers in mainstreaming fact-backed indicators in governmental and institutional decisions. The planned dashboards for the Ag-Data hub get even more exciting with the proposal to make them highly customizable and interactive.

CSA Advisories / CSI Dissemination

Research into data available with Ghana Meteorological Agency indicates a decreasing rainfall amount along the coast of Ghana and the forest zone with slightly increasing amount in rainfall along the Northern Zone within the March April May (MAM), April May June (AMJ) season. Farmers are particularly impacted by extreme weather conditions, which include drought, severe heat, flooding, and other shifting climatic trends. All these pose challenges for farmers as they work to grow enough food.

 To better manage these risks, it is important to support the production of scientific data essential for decision-making as well as strengthen the development of tools to disseminate the information to all relevant stakeholders and constantly update of stakeholders' databases.



In Ghana, agriculture activities contribute to 54% to GDP. The lack of timely access to seasonal forecasting limit communities to take the right decision in order to improve their livelihood. End-User tools made available on a varying number of devices and channels will help close this gap.

Climate Smart Tools & Services

Agriculture has conventionally been treated as an intuitive space with wisdom passed down from one generation to another. But today's problems — like the changing climate and depletion of viable farmland — are more complex and urgent in nature. To counter the pressures of increasing food demand and climate changes, policymakers and industry leaders are seeking assistance from technology forces such as IoT, big data, analytics, and cloud computing. IoT devices and field officers help in the first phase of this process — data collection. Sensors plugged in tractors and trucks as well as in fields, soil, and plants aid in the collection of real-time data directly from the ground. Developing dynamic analytics tool that integrate the large amounts of data collected with other information made available by other stakeholders, such as weather data and pricing models can unveil valuable patterns and insights that can assist in mitigating many problems along the agricultural value chain. A strategically built ag-data hub can help pinpoint existing issues, like operational inefficiencies and problems with soil quality, and formulate predictive algorithms that can alert even before problem occurs. The adoption of analytics in agriculture has been increasing consistently; its market size is expected to grow from USD 585 million in 2018 to USD 1236 million by 2023, at a Compound Annual Growth Rate (CAGR) of 16.2%.

Climate Smart tools and services make farming easier, faster, better, and more fun in many ways.



Gender Equality and Social Inclusion (GESI)

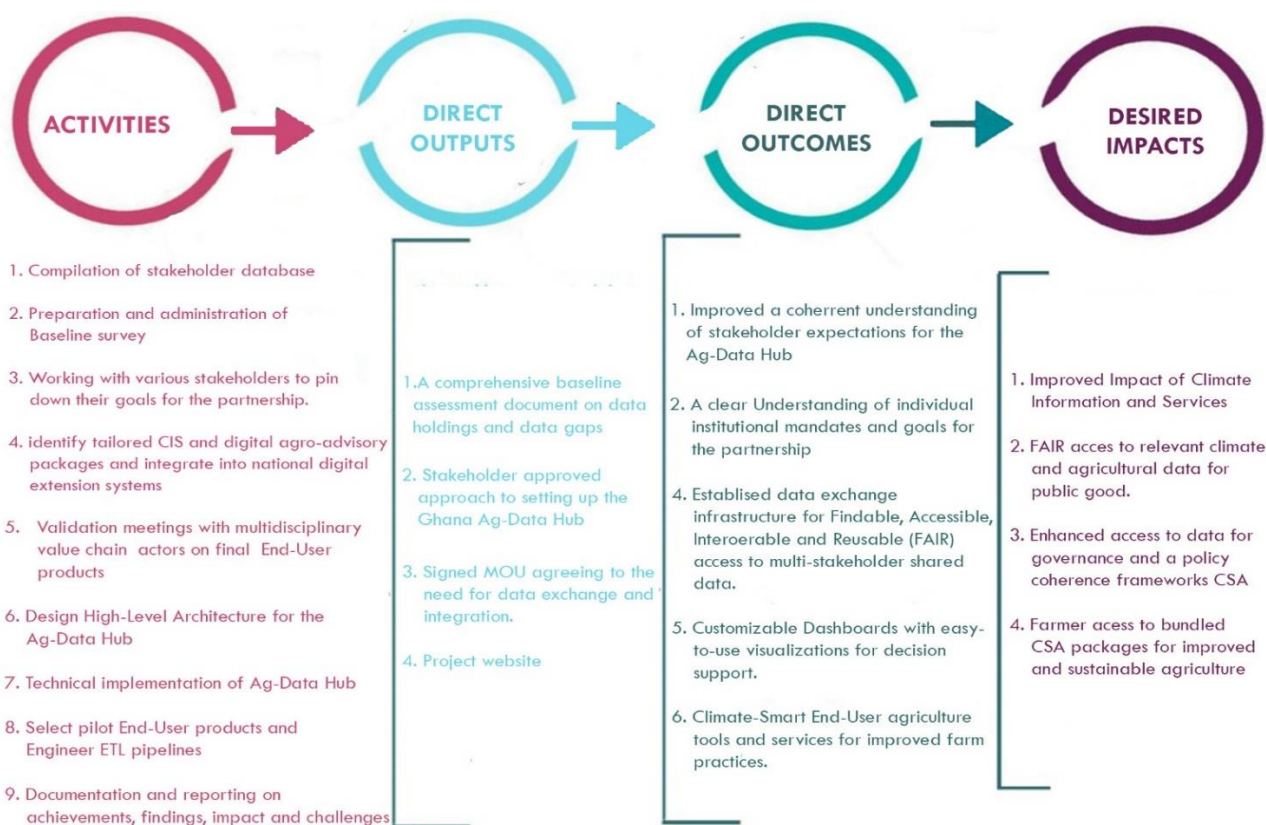
Ghanaian Communities are made up of a variety of social groups, all of which have different needs, assets, opportunities, and challenges. One way to ensure these diverse communities are understood and

considered is by integrating Gender Equality and Social Inclusion (GESI) concepts into the implementation and operational plan of the Ag-Data Hub.

A policy built around Gender Equity and Social Inclusion emphasizes the importance of GESI concepts in development programming; the Sustainable Development Goals directly recognize the issues of gender equality, female empowerment, and social inclusion as fundamental to the end goal of reducing poverty and advancing a healthier, safer, cleaner, better educated, connected, just, and more egalitarian world.

Data gathered and shared in the development of the AG-Data Hub takes into consideration the possibility of matching data with youth, children, women aiming at fostering GESI. The implementation is planned to acknowledge that Gender inclusivity in agriculture does not necessarily focus only on women, but rather considers gender as a frame of analysis that incorporates all people: women, girls, men, boys and their experiences and needs within the agricultural value chain. It is in this regard that the ETL engine framework developed looks at all genders in data analysis anywhere applicable.

RESULTS FRAMEWORK



Operational Recommendations

- The Ag-Data Hub will be hosted at a public institution. CSIR-INSTI has been identified and is willing to host the physical infrastructure in its High-Performance Computing Data Center.
- A hot concurrent virtual private server will be hosted on a Infrastructure as a Service (IaaS) cloud platform. The IaaS will run a parallel system with a hot duplicate of the local infrastructure.

- The Ag-Data hub will initiate operationalization on a fully freemium basis and target a consistent 5% annual conversion of freemium user to paid users. This can be achieved through collaborations between stakeholders to offer bundles services that meet the wholistic needs of targeted users.
- All data routing through the Ag-Data Hub will carry creative commons attribution plus any other licenses and regulations applicable.
- A data sharing agreement document shall be adopted for data exchange to/through the Ag-Data hub among stakeholders.

Proposed management model



Advisory Committee: We recommend the setting up of an advisory committee as a system for monitoring and evaluation of the implementation and operationalization of the Ag-Data Hud and to develop a policy and development plan to ensure that the activities initiated in the operational plan is achieved.

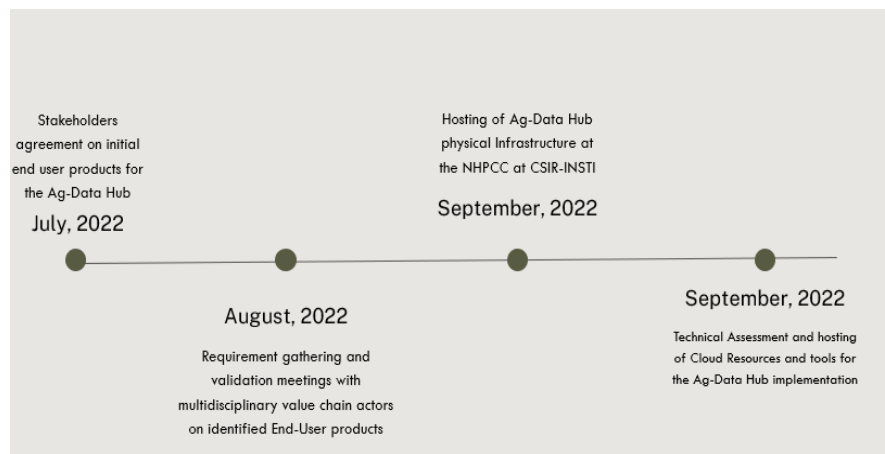
Service delivery for sustainability



- Simulation and decision support services
- Collaborative Product Development
- Collaborative research

- Public Service applications
- Data Driven End-User Product
- Thematic Customizable Dashboards

NEXT STEPS



Conclusion

Relevant stakeholders currently work disjointly in the collection, storage and analysis of data for different interventions within the agricultural value chain. Many of the collected data sit on third party infrastructure that is neither owned or control by the data owners. The leading governmental Agricultural institution (the Ministry of Food and Agriculture) has plans to consolidate its data and that of other stakeholders in a central repository through the Food Systems Resilience Program (FSRP), with the aim to setup a national system for digital advisory services for agriculture and food crisis prevention. The leading research institution (the Council for Scientific and Industrial Research) on the other hand has initiated the National High-Performance Computing Center and developed a Digital Agricultural Innovation Hub under the Modernizing Agriculture in Ghana (MAG) project. Access to the hub is open and the portal can be a rich source of research data and technologies. The Ghana Metrological Agency hosts a rich historical data of climate information and develops climate products on its own and in partnership with private partners like ESOKO.

The key technical recommendations in this policy brief presents the opportunity and guidelines to unify and exchange data among stakeholders while keeping ownership as open as possible yet decentralized to ensure security concerns are met. The Ag-Data Hub is thus, been proposed as a data steward infrastructure to be hosted at the CSIR-INSTI as a secure, mission-critical, reliable multi-tier and multipurpose digital data exchange backbone for information and data sharing among stakeholders as a key for fact-based decision making among players in the agriculture value chain towards sustainable climate-smart agriculture.

About this AICCRA POLICY BRIEF

This brief is an output for AICCRA Ghana Cluster.