CASE STUDY

Enabling Data Access 2

The lasting impact of advocating for and facilitating FAIR-informed practice in soil and agronomy – the case of the Coalition of the Willing (CoW) and Ethiopia's Soil and Agronomy Data Sharing (SADS) directive

Program Officer	Christian Witt
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CABI worked with multiple partners to institute top-down and bottom-up interventions designed to ultimately improve yields and long-term sustainability for Ethiopia's agricultural ecosystem via responsible data governance and FAIR practices.

> "Agricultural innovation and access to digital agricultural solutions have the potential to boost productivity while reducing negative environmental footprints in agriculture and food system value chains."[1]

Through national policy development, international collaboration, group and individual advocacy and education for national partners, funders and grantees, the EDA project aimed to improve understanding of the value of data sharing and change practice in government and on the ground in Ethiopia. This included encouraging institutions and ministries to increase appropriate data sharing. The impact of a FAIR-informed approach includes reducing waste and opportunity loss (e.g., when data generated from previous investments is not reusable, as experienced in EthioSIS) and, in the long-term, potentially greater yields, food security and sustainability.

[1] Tamene, L.D.; Ashenafi, A. (2022) Digital Agriculture Profile: Ethiopia. Addis Ababa (Ethiopia): Alliance of Bioversity International and CIAT 20 p. https://cgspace.cgiar.org/handle/10568/119309 (Affiliation: Consultative Group on International Agricultural Research)

The background

The Ethiopian Soil Information System (EthioSIS) is a data repository for national system use developed by the Government of Ethiopia and given technical support under the foundation funded AfSIS project. The Ethiopian government had made an investment of around $5m through the Ethiopian Agricultural Transformation Agency (ATA) to build the first version of the system.

At the end of EthioSIS's development it became apparent that the data was not being shared, used and re-used. The full benefits of the system were lost because the original design had not incorporated long-term considerations of other data users, and the project lacked mechanisms for data sharing.

Recognizing this problem, a PO at the foundation approached CABI and the Open Data Institute (ODI) in 2018, to explore why good practice in data management, sharing, and access was difficult for grantees to implement and how the foundation could avoid making future investments which do not deliver the positive and sustainable long-term impact they are designed for. Ethiopia was one of the three countries engaged with in 2018 as CABI helped the foundation understand the systemic challenges in play.

EDA was an intervention to solve this problem and evolved first by working with and building relationships with grantees and in-country decision-makers, but then by looking also at how POs and the foundation itself can prioritize data sharing to avoid wasted opportunity and investment.

Over two phases of engagement in 2018 and 2019 CABI and the ODI, working with partners, supported the Ministry of Agriculture to conduct desk research (reviewing draft geospatial data access and sharing policy and guidelines, and draft options and recommendations for national policy) and conducted face-to-face meetings and workshops to review national and global experiences.

Identifying FAIR as a possible solution

CABI and ODI facilitated consultation processes with CoW members and other national partners, which led to the drafting of the soil and agronomy data sharing policy. They also identified the FAIR framework as a potentially helpful tool for building out the work to other investments. The draft policy was enriched through a CABI-facilitated multistage consultative process that engaged diverse stakeholders.

EDA2 saw the further evolution of that policy and a move to in-country advocacy for policy ratification and implementation, alongside bottom-up interventions to identify gaps in expertise, skills, knowledge and experience (capacities and capabilities) and devise tools, resources and processes to fulfil them which would be replicable. This work also formed the bedrock of developing tools specifically for foundation POs, to help them

address data sharing, governance and policymaking considerations within investments and avoid the opportunity losses or wasted time and effort in data-rich investments.

What CABI delivered through EDA2

A successful policy requires the policymakers and national system to fully understand and be capable of meeting the implementation requirements. The second phase of the project was designed to build capacity, develop guidelines for policy implementation, and facilitate informed discussions on the policy itself.

CABI's advocacy and collaboration with the CoW and other key national partners, included a framework to inform the development of Ethiopia's Soil and Agronomy Data Sharing policy and igniting an in-country culture change around data sharing. CABI also worked with the ODI to create an 'enabling learning environment' and engagement strategies to work with the foundation's Programme Officers and other stakeholders to foster understanding and confidence in applying FAIR principles. During the COVID-19 lockdown CABI also supported the CoW's FAIR awareness campaign.

The journey to bring the data sharing directives into law was long and complex. After ratification by the Ministry of Agriculture (MoA) and translation into local languages, in September 2023 the policy finally became ratified and registered with the Ministry of Justice.

Effecting long-term change – how the foundation's investment supported a ripple effect

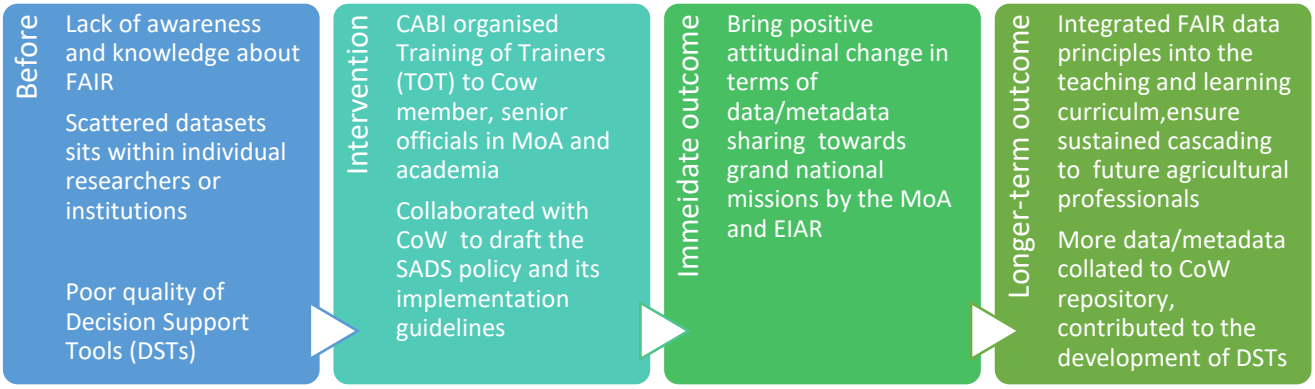

Figure 1: How change happened through capacity building and policy change

CABI's Theory of Change for data sharing looks beyond direct outputs though, to "ripple effects". That is, the wider impact of raising awareness and knowledge about the benefits of making data Findable, Accessible, Interoperable and Reusable for soil and fertilizer decision making and policy implementation.

Initial independent evaluations of CABI's work found conversations and knowledge development around implementing FAIR strategies had penetrated the wider political, funding and agriculture ecosystems:

> "Stakeholders and relevant experts are more aware of the Policy – most understand there is a need for data sharing. Conversations have reached beyond the soil and agronomy domain into the whole agriculture sector. Across disciplines there is noticeable spillover."[2]

CABI and the ODI provided tools, methodologies, and education interventions, including the Data Sharing Toolkit, to improve foundation Programme Officers' capacity and confidence in implementing FAIR processes. All POs found the engagement met or exceeded expectations and left them better equipped to make FAIR-informed decisions about investments going forwards.

[2] The Independent Evaluation Report of the EDA2 project.

At the same time CABI and ODI continued to work with stakeholders and influential actors on the development and drafting of the SADS policy. In collaboration with the in-country partners (GIZ, CoW and MoA), CABI and ODI helped develop the policy using FAIR as a key framing principle. The program helped deliver SADS, supported a stakeholder plan for its implementation, and devised guidelines and incentives.

Additionally, CABI established a "Training of Trainers" model to increase literacy and awareness around FAIR practice for actors across the ecosystem in contexts where we operated, including Ethiopia, which Ashenafi Abduljelil[3], Guest Researcher ISRIC, PhD candidate with Addis Ababa University said the team, "contributed a lot...the knowledge has cascaded to agricultural professional through the (ToT-trained) trainers." FAIR principles are now integrated in some postgraduate's curriculum to enhance FAIR awareness and practice in research. Besides, following the ToT, CoW members brought more data/metadata to the CoW repository which has contributed to the development and quality of various decision support tools and generate the first ever digital soil resource map of Ethiopia.

He added: "On national level, the policy has brought change, awareness on FAIR [and] increased [and] changed attitude of individuals in data sharing" and that this is not static, the process of building trust with CoW members means "awareness creation is ongoing".

Ashenafi gave multiple examples of spillover, on national and international levels, which he attributed to CABI and partners' "timely" and effective advocacy, and reusable guidance and tools, enabled wider change in the local research ecosystem. He said, "the directive ...directly influenced agriculture research, encouraging actors to revise their own practices based on it and incorporate some of the articles."

The Ministry of Agriculture (MoA) is revising its own institutional data policy and planning a taskforce to work in parallel with the natural resource management sector to establish an Agriculture Data Hub4 and data-sharing platform. The Ethiopian Institute of Agricultural Research (EIAR) is taking the lead to validate (a national mandate system), standardizing FAIR-informed data sharing policy, because the number of previously systems developed make interoperability a challenge. An 'Agricultural Data Partnership' aspires to link country data assets and portals and recognizes that it will need an overarching policy for the partnership to support its operationalization.

Engagement, including building a network of individuals and organizations supportive of data sharing, allowed the CoW and other actors to challenge preconceived ideas and misconceptions around the legality of sharing data responsibly and ethically. The previously prevailing view that data must be protected, not shared, was widespread, as

[3] Ashenafi Abduljelil supported CABI in this work and has continued to be an active participant in discussions with CoW, including on the ongoing role of the products CABI used when and developed during the project. Our interview strengthened our understanding of the enablers and disablers of the Theory of Change (ToC) for EDA3. It also showed that the time is ripe for the foundation to make genuine impact, by furthering this work, and demonstrated some signs of outcomes to demonstrate the causal effect of our interventions.

EIAR policy focused on data protection and lacked the pillars of FAIR practice. As a national institution, EIAR has now joined the CoW as a member and is informally starting to implement FAIR-aware policies around data sharing.

Interventions positively influenced actors beyond MoA with FAIR-informed data policy and behavior now feeding into work in other sectors. For example, the Ministry of Innovation and Technology's own technical team has adopted the experiences and lessons from CoW processes (including policy and implementation guidelines) and “The Ministry of Higher Education are the really using it, you know, to incorporate learnings and principles when they develop their initial data sharing policies, so the impact is beyond the Ministry of Agriculture.”

International momentum has also been cultivated and supported. “Impact is beyond directly engaged partners,’ explained Ashenafi, noting neighboring countries including Rwanda via the Rwanda Soil Information Service (RwaSIS)[4] are learning from CABI and the CoW with evident impact.

Rwanda Soil Information Service (RwaSIS)

During Covid CABI engaged in extensive desk research and co-creating data sharing principles, guidelines and recommendations with key partners and government teams in Rwanda, including RwaSIS, ministries and sub ministries. From these surveys and interactions CoW developed a proposed suite of proposed policy principles, informed by FAIR data principles. including all RwaSIS datasets should ‘have open and searchable metadata’, ‘be collected to a published open standard’, 'be stored in an agreed format’ with ‘a clear owner’,
‘be shared with a clear license’ and whenever possible ‘be published as open data’.

FAIR-informed activity in practice

- Findability is improved via new approaches which move beyond key data sitting “in researchers’ laptops”. The CoW now has close to 40,000 cleaned and harmonized datasets of ‘crop responses to fertilizer’ data. Though the EIAR data portal is still in development, EIAR has started work pulling data from individual researchers into a central database, with datasets now visible to CoW members. The data portal will be migrated to the National Soil Information System (NSIS) and become fully operational soon.

[4] https://www.cabi.org/projects/rwanda-soil-information-services-rwandasis/

- 20,000 soil profiles were cleaned and harmonized using the latest soil profile data template, which prepared 14,681 data profiles for modelling. A continuous quantitative digital soil map of 18 WRB reference soil groups (EthioSoilGrid version 1.0) at 250m resolution has been produced using machine learning. They have been migrated to NSIS already, with metadata accessible online, on request and are gaining traction with academics. “The validated map will have tremendous significance in soil management and other land-based development planning, given its improved spatial nature and quantitative digital representation”. The map is one of the inputs of the fertilizer advisory support tool.

- The CoW is developing tools and use cases to identify ways to reuse existing datasets including updating national soil types and maps (from datasets first mapped in the 1980s). Legacy datasets will help update the soil resource map of Ethiopia and increase understanding of soil types. The new soil map is online and approaching final publication stage, while it is already being used by MoA and other departments such as land use planning.

- The Agroadvisory Decision Support Tool (DST) is developed using the >25,000 crop responses to fertilizer datasets (out of the above-mentioned 40,000 datasets collated by CoW). Soil data from Soilgrid (with 20,000 soil profiles), climate data and topographic data from other public sources are also part of the inputs. The tool is now being used by MoA for agricultural decision making to inform fertilizer recommendations in Ethiopia.

- Two use cases will help the fertilizer decision support system, which needs legacy data. The system previously existed, based on a limited dataset for few crops but it is now a more substantive platform, that anyone can access and contribute to, and work is ongoing to develop the mobile app and a WhatsApp group, increasing availability to developers.

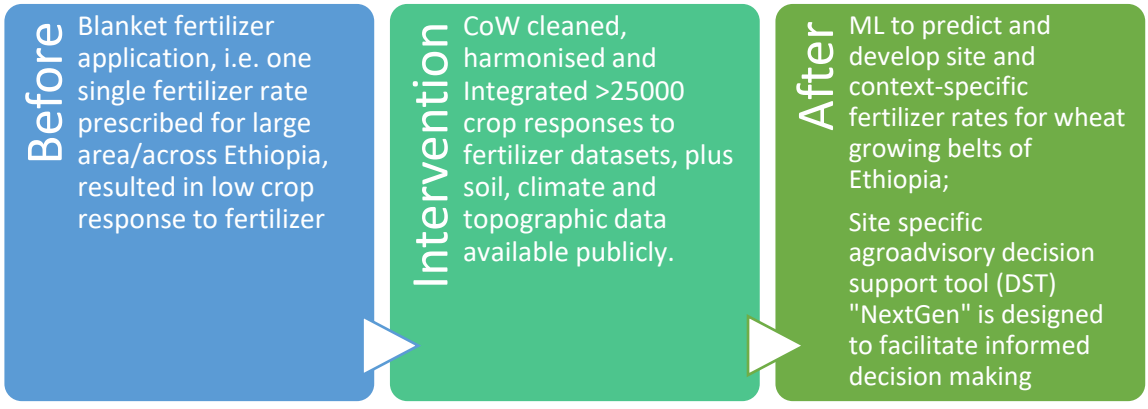

Figure 2: How data sharing improves agricultural advisory services[5]

[5]

1. Soil data was downloaded from the 250-m spatial resolution SoilGrids database (Hengl et al., 2017).

FAIR-informed and data rich future – opportunities for further investment to maintain momentum

Ashenafi states that “People are very motivated” after a protracted period of trust building in the CoW and other actors, but challenges and opportunities remain for development funders to continue to grow this story. Recent unrest and conflict in some parts of the country has affected mobility, dominated national attention, and impacted donor support, and fundamental problems around data quality and interoperability require ongoing investment. Investment now could cement FAIR practice and pave the way for sustainable and long-term improvements to the ecosystem’s data infrastructure to benefit future innovation and improvement.

Additionally, to make a business case for FAIR interventions focused on building capacity at the PO- and grantee- level CABI worked with economists from UWE to research how return on investment could be measured and quantified. ‘Measuring the value of data governance in agricultural investments: A case study’ was published by Cambridge University Press in February 2022. It showed that there were benefits beyond monetary gains, and though it couldn’t at the time of writing prove increased return on investment it made the case that this outcome was not far away.[6]

Low-hanging fruit bringing long-term benefits – how donors can help now

“Donors could help remove technological and human barriers” notes Ashenafi, facilitating more effective data-rich investment in Ethiopia.

The CoW continues to work with research institutions, to institutionalize activity that will sustain CGIAR, EiA, and wider FAIR infrastructure. Donors show enthusiasm to align with the lessons learned by the CoW and fully realize the potential of FAIR. A coordinated response with organizations working together has the potential to succeed, “effort should be connected, not based on the interest of each institution”.

2. Agroadaivosry DST “NextGen”: https://nextgenagroadvisory.com/methodology. Fertilizer advisory is one of the components of NextGen alongside ISFM, Lime, Irrigation, among other advisory services, some of which are under development.
3. Abera, Tamene, Tesfaye, Jiménez, Dorado, Erkossa, Kihara, Ahmed, Amede, Ramirez-Villegas; Experimental Agriculture (2022), retrieved from https://www.cambridge.org/core/journals/experimental-agriculture/article/datamining-approach-for-developing-sitespecific-fertilizer-response-functions-across-the-wheatgrowing-environments-in-ethiopia/2CC4400FF8239FC24373ACBE8CA9071F on July 25 2023.

[6] Whittard, D., Ritchie, F., Musker, R., & Rose, M. (2022). Measuring the value of data governance in agricultural investments: A case study. *Experimental Agriculture, 58*, E8. doi:10.1017/S0014479721000314

Intervention – the bedrock for an innovative FAIR-informed future

What is still needed? Ashanafi says that the community is calling for institutional and funder support in a few key areas:

- **Improved templates and standardization**: irrespective of the completeness of the datasets, interoperability is an issue. Even for important datasets, data is available in various formats, excel, pdf, with different templates and standards within one project. Standardizing guidelines and templates will harness the value of data set as well.

- **Encouraging alignment among institutions**: including between CoW members and other key stakeholders to further broaden and normalize FAIR approaches. CoW and other stakeholders get individual commitment around FAIR, but they could develop formal data request letters to all institutions, and approach more individual data controllers. Donors should connect their different tools, not base them solely on individual interests of institutions, projects or centers. Public institutions should take the lead to coordinate different missions and enhance alignment.

- **Education**: to help avoid lost opportunities and value, for example, ensuring datasets with quality issues, which may nevertheless contain data which has value, are not discounted.

- **Harmonization**: to ensure new data generated by institutions is most effectively used, stored, shared and available.

- **Investment in infrastructure and human capital**: to support the development of different hubs and address lack of resources “for enhancement” and making sharable resources fully integrated and accessible to the public.

- **Support for ministries:** to identify gaps in resources and avoid duplication.

- **Encouraging and championing publication of FAIR-informed research:** developing use cases and encouraging wider alignment.

- **Creating FAIR champions by building and disseminating FAIR policy:** champions for FAIR-informed work can help actors identify gaps and foster collaboration as they align their work with partners.

Postscript

As of September 19, 2023, ministry officials announced The Soil and Agronomy Data Sharing Guidelines had been registered by the Ministry of Justice of Ethiopia. It had been already implemented by the Ministry of Agriculture in plans to manage the National Soil Information System (NSIS), and as we have described, even before that circulated drafts represented a strong mandate from senior government actors that stakeholders in the sector could refer to as a guiding star.

The five-year process of bring the guidelines to ratification and see them implemented to improve systems which had previously failed demonstrated the time and expertise needed to solve systemic issues around data sharing.

It showed that building PO capacity can create champions for responsible and effective data sharing, both within the foundation, and externally, to boost the value and potential ROI from data-rich investments and develop stronger relationships between the foundation and data experts.

In addition, it forms a ‘proof of concept’, for CABI’s work through EDA3 where by going to the source, and ensuring FAIR practices are embedded in foundation thinking and action from the start of data-rich investments (through interventions with and tools and support for POs and grantees), the FAIR Process has the potential to ensure opportunity loss and wasted effort is increasingly eliminated, and investments have lasting impact.

CABI continues to collate evidence for the business case for FAIR practices and measures to assess the return on investment and wider benefits it can bring to grantees, investors, governments and individuals.

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