FARMER-CENTRIC DATA GOVERNANCE:
TOWARDS A NEW PARADIGM

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EXECUTIVE SUMMARY

Agricultural technologies (agtech) can benefit farmers, businesses, consumers, and the environment in low- and middle-income countries (LMICs). However, companies that control the flow of data to and from farmers are more integrated than ever. In an era where a small number of agtech providers increasingly hold unprecedented control over farmer data, digital agriculture is on a trajectory to evolve in ways that may inhibit farmer opportunity—unless digital agriculture stakeholders take deliberate steps to change the trajectory of data governance in the agtech sector.

Farmers face a paradox: while the use of data and agtech holds much potential to strengthen the agriculture sector, farmer capacity and data governance challenges raise the possibility that farmers will not benefit economically from their own data. Given agtech's breakneck forward momentum, implementing fair and equitable data governance models that prioritize farmer participation while guarding farmers against potential disadvantages and exploitation is crucial. For this reason, there is a pressing need to unpack data governance practices and challenges within the agriculture sector.

The objective of this report is to showcase farmer-centric data governance models and the enabling factors needed for their implementation. It aims to raise awareness around the current political economy of agricultural data and its implications; identify user-centric data governance models and mechanisms, particularly in LMICs; demonstrate the purpose, value, benefits, and challenges of these models for all stakeholders; and identify appropriate and relevant actionable principles, recommendations, and considerations related to user-centric data governance in the agriculture sector for the donor community.

The methodology consists of a literature review, 45 semi-structured interviews with 50 individual experts conducted between April and August 2022, and seven stakeholder consultations (conducted in August 2022) with a total of 64 practitioners in agriculture. The resulting report is structured in four main parts: (1) The state of the digital agriculture and farmer data; (2) re-imagining agricultural data governance in the context of power and participation; (3) making the case for farmer-centric data governance approaches; and (4) implementing best practices and actionable recommendations.

The report's main recommendations are as follows:
1. User-centric data governance models should be integrated into digital agriculture programs given their immense potential to shift the current paradigms of information imbalances to benefit farmers, communities, and societies.
2. Companies and organizations that handle farmer data need to foster trust with farmers throughout the data lifecycle.
3. Farmer-centric data governance approaches must pursue more consistent, higher-quality data sharing, interoperability, and defragmentation of data.
4. Meaningful participation must strongly tie farmers to data governance.
5. Recognition of the vital role that data stewards play is required within agriculture programs, particularly their role as trusted intermediaries between farmers, data collectors, and data generators.
6. Local context, culture, and existing practices should be centered to determine outcomes, implications, and impact when considering data governance models.

7. User-centric models are not a panacea "one-size-fits-all" solution, although they are important tools for deeper inclusion of farmers and other agriculture sector stakeholders in data governance.

8. More research is needed to further identify training and capacity-building requirements and the financial sustainability of user-centric data governance initiatives.

Why you should read this report

If you are a policymaker or donor who wants to learn more about farmer-centric data governance, this report will help you understand:
- Current data governance paradigms
- The benefits of farmer-centric data governance approaches for farmers and society at large
- User-centric data governance approaches, noting their objectives, pros and cons, applicability in LMICs, and viability and sustainability
- Best practices and practical insights into how governance models are used, as well as their implications, complexities, and critiques

If you work at a company or organization that has developed digital agriculture technologies or manages data governance structures, this report will help you understand:
- The benefits of taking a farmer-centric data governance approach
- How other agtech providers have applied farmer-centric approaches in the real world, their implications, and their complexities

If you work at an organization that collects and/or manages farmer data, this report will help you understand:
- Data governance approaches, including their objectives, pros and cons, applicability in LMICs, and viability and sustainability
- Inspiration and insights from case studies that demonstrate how farmer-centric data governance models have been used in the real world and their practical implications

All readers will also benefit from a deep dive into the most important user-centric data governance models; a practical perspective of their implementation via case studies; a list of practical, actionable recommendations; and an understanding of key considerations and opportunities in data governance.

GLOSSARY

Access Management: Policies and procedures that define, track, and control the data an individual can access in systems or applications.

Account Aggregators: Data exchange platforms that use a certifying authority, such as a central bank, for service providers and limit themselves to prescribing technical standards for sharing and requesting data.

Anonymize: De-identify data by stripping personally identifiable information (PII) from it.

Authentication: The process of verifying the identity of a user or process when accessing a computer or a network.

Authorized Access: Also known as permissible access, allowances made for internal and external users to view and process PII on a need-to-know basis.

Big Ag: Corporations that are large-scale farms, market agricultural technologies (in particular pesticides, fertilizers, and GMOs), have significant economic and political influence, or some combination of the three.

Big Tech: The most dominant companies in the information technology industry; usually only refers to companies in the United States, but equivalents also exist in Asia.

Big Data: The term describes large sets of heterogeneous data that cannot be managed and processed using traditional data management techniques.

Classification: The process of labeling and sorting data assets based on predefined criteria, such as sensitivity level or data owner.

Data Analytics: Processes and algorithms used to examine raw data and extract meaning. Data analysis systems transform, organize, and model data to draw conclusions and identify patterns.

Data Architecture: A framework of rules, policies, standards, and models that governs what data is collected then how it is used, stored, managed, and integrated across an organization.

Data Classification: The organization of data based on its level of sensitivity and the impact should that data be used, shared, altered, or destroyed without authorization.

Data Collaboratives: A cross-sector, public-private collaboration form of data governance aimed at data collection, sharing, and processing, for the purpose of a societal benefit, emphasizing the collaboration between parties, and suggesting going beyond data sharing.

Data Fiduciary: A type of data steward acting as an intermediary that manages access to data between individuals and data collectors based on a legal or contractual duty of care.

Data Commons: A form of data governance that co-locates data as a digital resource to store, manage, share, access, and interact with collectively owned data, with and by a community.

Data Cooperative: A form of data governance centered around the voluntary communal pooling by individuals of their personal data for mutual economic, social, and cultural benefit, and aspirations of a group in a voluntary, united, jointly owned, and democratically controlled autonomous association.

Data Custodian: An administrator responsible for the appropriate storage, transportation, and access of data as well as the technical environment and database structure.

Data Discovery: The process of detecting and organizing data by identifying key characteristics and applying a distinct class to make it easier to locate, track, and retrieve. Once undergoing discovery, data is then tagged, often with the specification of its access restrictions.

Data Flow: The path that data follows through a system,from source to final instantiation (e.g., report, database).

Data Governance: A system of policies, people, and processes for defining who within an organization has authority and control over data assets and how those data assets may be used and shared.

Data Integrity: The completeness, validity, reliability, accuracy, and consistency of data.

Data Ownership: Assignment of formal accountability and legal ownership of data—a single piece or set of data. This comes with a list of owner rights and responsibilities.

Data Management: The practice of collecting, storing, and using data securely, efficiently, and cost effectively.

Data Marketplace: Digital platforms where a data fiduciary enables data generators (sellers) and data consumers (buyers) to identify, match, and trade respective data assets and requirements.

Data Privacy: Defines whether or how data is shared, with whom data is shared, and how data is legally collected or stored, and a person's expectation of this.

Data Security: Measures to protect data, residing in systems or applications, from unauthorized access, corruption, or theft.

Data Silos: A collection of data isolated from—and not accessible to—other parties due to incompatible systems, permissions, or proprietary licensing.

Data Steward: A role within an operation focused on high-level policies and procedures for the monitoring, security, and management of data use according to data governance rules related to access, accuracy, classification, and maintaining privacy.

Data Stewardship: Tactical coordination, implementation, and enforcement of data governance policies and procedures across an organization's data stakeholders.

Data Sovereignty: Typically refers to the understanding that individual nations can assert control over how data is stored and used in their jurisdiction.

Data Trust: A legal structure that provides independent stewardship of data.

Database: An organized collection of structured data that can easily be accessed, managed, and updated.

Digital Agriculture: The integration of digital technologies into agricultural processes such as crop and livestock management for the purposes of reducing risk and increasing production, profit, cost savings, and market efficiencies.

Encryption: The process of converting information or data into code, especially to prevent unauthorized access.

Extension Services: Advice to farmers, including face-to-face and via digital tools.

Fiduciary: A person or institution that is authorized to make financial decisions on behalf of another party.

Indigenous Data Sovereignty: The right of Indigenous Peoples to determine the means of governing their data, from whom it has been derived, or to whom it relates.

Market Linkages: Digital technologies that connect farmers and consumers and/or suppliers via digital services like e-commerce to allow farmers access to markets.

Monopoly: Exclusive possession or control of the supply of or trade in a commodity or service.

Monopsony: A market condition where there is only one buyer.

Precision Agriculture: The use of digital technology to collect data via soil or weather sensors, geographic information systems (GIS), global positioning systems (GPS), remote sensing, drones, robotics, precision irrigation, advanced optics, and image recognition software, etc., in order to provide more precise decision support and farm management advice.

Personally Identifiable Information (PII): Information that can directly identify an individual when used alone or with other relevant data. PII includes name, address, Social Security number or other identifying number or code, telephone number, and email address.

Policy: A rule or set of rules that outlines how companies or organizations and their employees are intended to interact.

Risk Management: The identification, analysis, assessment, control, and avoidance of risk through precautionary steps that reduce or eliminate threats.

Sensitive Data: Data that is classified as information that requires elevated protection and tightly managed access.

Smallholder Farmer: A producer who rears livestock, raises fish, or cultivates crops on a limited scale. In low- and middle-income countries (LMICs), a smallholder farm is a family-owned enterprise operating on up to 10 hectares, or 24 acres, with most smallholder farmers cultivating less than two hectares, or five acres, of land.

User-centricity: Putting the intended beneficiary at the heart of the development process.

1. INTRODUCTION

The potential benefits of digital agriculture for smallholder farmers are prolific, with digitalization—and the farm data it generates—promising to modernize the agriculture sector. Data-driven agricultural planning efforts are critical in this effort, particularly when a lack of access to reliable data threatens the livelihoods of marginalized populations. **However, farmers face a paradox: while the use of data holds much potential to strengthen the agriculture sector, farmer capacity and data governance challenges raise the possibility that farmers will not benefit economically from their own data.**

Agricultural technologies (agtech) can be made to work for farmers, consumers, and the environment. However, agtech companies are more integrated than ever: they supply digital products to farmers and control the resulting flow of data. This introduces the risk that power and money—in the form of Big Ag companies and the tech sector—will determine the future of agtech. In an era where a select few hold unprecedented control over farmer data and food systems, digitalization may actually redirect power and profits away from farmers, unless digital agriculture stakeholders take deliberate steps to change the trajectory of data governance in the agtech sector.

Given agtech's breakneck forward momentum, **implementing fair and equitable data governance models that prioritize farmer participation while guarding farmers against potential disadvantages and exploitation is crucial.** For this reason, there is a pressing need to unpack data governance practices and challenges within agriculture. This report moves beyond theory to explore the practical implementation of agricultural data governance practices in LMICs.

Empowering (smallholder) farmers with more control over their data is critical to improving and protecting their livelihoods. This report provides a **user-centric approach to data governance** that places farmers and their communities at the center of data gathering initiatives and aims to reduce the negative effects of centralized power.

1.1 Objectives

The objective of this report is to showcase farmer-centric data governance models and the enabling factors needed for their implementation. The findings are primarily based on literature, interviews and workshops, to gather the experiences of changemakers in the digital agriculture sector. This report aims to:

- Raise awareness around the current political economy of agricultural data and its implications;
- Identify user-centric data governance models and mechanisms, particularly in LMICs
- Demonstrate the purpose, value, benefits, and challenges of these models for all stakeholders, and;
- Identify appropriate and relevant actionable principles, recommendations, and considerations related to user-centric data governance in the agriculture sector for the donor community.

The report is value-driven about equity, individual and collective agency, and participation and power. Because data governance does not happen in a vacuum or a neutral landscape of benevolent actors, it seeks to address digital transformations that risk reproducing, upholding, or strengthening the status quo. Instead of assuming that Western-derived concepts are universal, the report integrates LMICs' perceptions of value to center robust, culturally- and contextually-rooted data governance activities.

1.2 What is data governance, and why is it important?

The terms data governance, data stewardship, and data management are often used interchangeably, with no broad consensus on their meaning. At a high level, data management and data governance work together to determine actionable steps that can put policies into action. Broadly speaking, data governance defines and controls what data activities should be done, and data stewardship executes.

- **Data governance** is a collection of policies, practices, roles, and responsibilities that establish the authority to manage data. Executed according to agreed-upon approaches that describe who can take what actions with what information, when, under what circumstances, and using what methods, it is a critical part of the digital governance process.
- **Data management** is governance in action, applying policies and practices that manage the data lifecycle and information assets.
- **Data stewardship** is the responsible use, collection, and management of data in a participatory and rights-preserving way. Data stewards ensure the quality of data sharing, holding, privacy, and control across parties, providing data collectors with more consistent and reliable data. To that end, data stewards generally (1) build data opportunities to unlock the value of data; (2) manage data to ensure representation, usability, and quality; (3) define guidelines for quality, usability, safety, and transparency; and (4) help protect the rights of of individuals and communities.

However, because these three terms largely originated in anglophone Western research, they are largely unknown to many LMIC practitioners and communities.

As data-driven planning and management tools have become more common in the agriculture sector, data governance becomes even more crucial. Weak data governance approaches can undermine trust, democracy, and the data economy as a whole. Reflecting on these issues, many questions arise: Who controls agricultural data? What does farm data ownership mean? Is it in the interests of smallholder farmers to provide data to those that share or sell it? Is it preferable to give farmers or farmer organizations control over their data? What level of participation in data governance should farmers and farmer groups expect?

Governments and intergovernmental organizations are increasingly wrestling with these issues as well. The 2022 *US Department of Agriculture's Modernizing Agricultural Data Infrastructure* study identified gaps in governance as one of the five major challenges.[1] The World Bank's World Development Report 2021: Data For Better Lives[2] proposed a transparent and inclusive multi- stakeholder approach to

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1. The Data Foundation & AGree Initiative (2022). Modernizing Agriculture Data Infrastructure to Improve Economic and Ecological Outcomes.
2. World Bank (2021). World Development Report 2021: Data for Better Lives. Washington, DC: World Bank.

data governance within complex data ecosystems. The Organisation for Economic Co-operation and Development's (OECD's) report on data governance within digital agriculture raised concerns about "fragmented and unclear data governance arrangements in farming" and the regulatory environment.[3] The report focuses on farmers' concerns on access, sharing, and data use, and how policies and initiatives can foster greater trust.[4] Similarly, the Global Partnership for Sustainable Development Data's *Data Values Project* report discussed rights implications for data governance and shed light on the need for individuals to possess informal mechanisms that truly hold those in power accountable.[5] The volume of recent scholarship indicates a deep interest within the agriculture community and the donor community to explore data governance issues and enact substantive changes to the status quo.

Establishing innovative data governance models requires pushing the boundaries of multi-stakeholder governance, making use of successful online communities[6] and broadening the range of participants with metaphorical seats at the table.[7] The World Bank's *World Development Report 2021: Data For Better Lives* identified four recommendations to build trust in data governance: (1) design processes—build on consensus and buy-in (e.g., via principles and safeguards)—to handle a range of views and enable meaningful participation;[8] (2) include views from those with less power and resources to ensure power imbalances do not affect participation (e.g., via targeted outreach efforts and support); (3) explicitly set clear rules from the beginning, so they can be contested and re-negotiated; and (4) "[i]nnovate beyond outdated multi- stakeholder governance models that originated in previous eras."

1.3 What is a user-centric approach to data governance?

Empowering farmers with more control over their data is critical to improving and protecting their livelihoods. A **user-centric approach to data governance** places farmers and their communities at the center of data-gathering initiatives, granting farmers greater agency over the inputs and outputs of their data and advancing their meaningful participation in data activities. User-centric approaches hold the potential to strengthen the power of farmers as a cohesive group, transition control over data to individuals and collectives, and build safeguards against privacy invasion, data misuse, opacity, and other harms. These models can also generate better data sharing opportunities, counter fragmentation, increase data quality, and identify avenues for innovation. This has the potential to bring about greater societal and economic equity and contribute towards increased confidence by stakeholders in the use of data overall.

3.Organisation for Economic Co-operation and Development (OECD) (2019). Digital Opportunities for Better Agricultural Policies. Paris: OECD Publishing.

4. Jouanjean, M.A., Casalini, F., Wiseman, L., & Gray, E. (2020). Issues around data governance in the digital transformation of agriculture: The farmers' perspective, OECD Food, Agriculture, and Fisheries Papers, No. 146. Paris: OECD Publishing.

5. For more information on the Data Values Project, see the Manifesto.

6. Jhaver, S., Frey, S., & Zhang, A. (2021). Designing for Multiple Centers of Power: A Taxonomy of Multi-level Governance in Online Social Platforms.

7. World Bank, (2021). World Development Report 2021: Data for Better Lives. Washington, DC: World Bank.

8. E.g., the Wellcome Trust developed a new "learning data governance" model to the traditional data lifecycle aimed at building trust and accountability in the process and increasing representation. Outcomes from the use of data by third parties are reported back to those who granted access to the data. Citizens' panels or forums are then able to scrutinize and learn from previous decisions. The approach helps improve the quality of decision making by using new information on outcomes.

Who Benefits from Farmer-Centric Data Governance?
- Farmers gain more control and agency over their data, more equality, meaningful participation and representation, bargaining power, alignment with interest, and access to new markets and opportunities.
- Agribusiness, tech providers, governments, and development organizations benefit, among others, from:
  - Better and more consistent, reliable, recent, higher-quality data, enhanced data access and availability, greater data sharing opportunities, enhanced data management, and decreased data fragmentation
  - Greater efficiency and productivity, (public) service design and delivery, decision making, situational awareness and response
  - Improved mediation and formalized relationships, communication, transparency, meaningful feedback and nurtured trust
  - Improved reputation, public relations, legal and privacy compliance, and responsibility and meaningful corporate social responsibility
  - Increased knowledge creation and transfer, research opportunities, value creation and new avenues for innovation

1.4 Challenges with user-centric data governance models

Despite the utility of user-centric data governance models, they come with their own set of challenges. Most notably, they can still uphold the status quo: if these models only serve as a tool for individuals or agtech providers to collect and store personal data, they reinforce and promote the current power dynamics in which individual choice counts more than the collective societal benefit. Other distinct challenges include:

- The trade-off between incentivizing data sharing and empowering people, just as elevating individual choice can come at the cost of collective values and interests. The future of data governance must reflect this interconnectedness, with practitioners continuously questioning if tech-driven solutions are needed.
- All contexts are different. Governance models usually do not fit easily or logically into certain contexts, nor do data focused projects always aim to empower specific groups. In practice, the character of specific data governance models depends on who wields power and who benefits from the data.
- Different models can use the exact same data, creating tensions across data governance structures. Similarly, different communities may have interests that are incompatible, not aligned, or their interests may not have been collected and interpreted similarly by stakeholders and implementers.
- Difficulties in shifting the paradigm. Data governance governance models help foster accountability among those in power, requiring honesty, transparency, and inclusivity. Practitioners must ensure that their work does not widen the digital divide[9] or exacerbate existing disparities[10] that leave marginalized people behind.

9.Organisation for Economic Co-operation and Development (OECD). (2018). Bridging the digital gender divide: include, upskill, innovate, OECD.
10. United Nations Department of Economic and Social Affairs, (2018). 2018 revision of world urbanization prospects.

2. THE STATE OF DIGITAL AGRICULTURE AND FARMER DATA

Section 2 provides an overview of the current digital agriculture landscape, with a particular focus on agtech platforms that are currently reshaping the sector. The next section focuses on defining farmer data, spotlighting its nebulous ownership structure. Linked to this is the common practice of data extraction, an important feature of the digital agriculture sector. The final section outlines the enabling environment around digital agriculture, highlighting the key role that regulation and digital and data literacy play in shaping the sector.

2.1 Digital agriculture landscape

Agricultural digitalization is radically transforming agriculture. Practices, like smart farming and precision agriculture, can promote supply chain traceability, facilitate precise treatments for plant diseases, and quickly obtain soil data. Data-driven efforts are a critical and invaluable component of digitalization, especially when a lack of access to reliable data threatens food security or livelihoods. Agtech can improve critical services for large-scale and smallholder farmers.[11] It can play an important role to, for example, reduce the impact of environmental damage, combat deforestation, reduce waste, improve working conditions, automate for on-farm efficiency, and improve market linkages. Deploying these technologies can make farming more profitable, practical, sustainable, and resilient in both high-income countries and LMICs alike.[12]

However, findings in this report emphasize the importance of a critical approach to agtech. Most agtech research focuses on its technical applications and their transformative potential,[13] as well as how it improves processes.[14] The few critical scholars who have researched issues around power asymmetry, inclusion and exclusion, privacy, ethics,[15] and political economy[16] typically see digital agriculture as reinforcing Western industrialized agricultural production systems.[17] In this sense, agtech is not context neutral: it needs to be unpacked, situated, reconfigured, and supported by a local, context-sensitive support infrastructure.

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11. Although there is no set definition, a "smallholder farmer" can be defined as "a producer who rears livestock, raises fish or cultivates crops on a limited scale: In [LMICs], a smallholder farm is a family-owned enterprise operating on up to 10 hectares, or 24 acres, with most smallholder farmers cultivating less than 2 hectares, or 5 acres, of land." See Knight, A. (2022). <u>What is a Smallholder Farmer?</u> Defining a smallholder farmer is hard, as farmers are not homogeneous. The definition must be flexible to include marginalized people and not be exclusionary to the benefits extended in bringing the very last mile into the conversation.

12. Council, I., (2004). <u>Realizing the Promise and Potential of African Agriculture: Executive Summary</u>; InterAcademy Partnership. (2018) <u>Opportunities for Future Research and Innovation on Food and Nutrition Security and Agriculture</u>; The InterAcademy Partnership's Global Perspective & IAASTD (2009) <u>Agriculture at a Crossroads: Synthesis Report</u>.

13. Gcebe, N., Rutten, V., Gey van Pittius, N.C., & Michel, A. (2013). <u>Prevalence and Distribution of Non-Tuberculous Mycobacteria (NTM) in Cattle, African Buffaloes (Syncerus caffer) and their Environments in South Africa</u>. *Transboundary and emerging diseases*, 60, 74-84.

14. Supra at 21.

15. Carbonell, I. (2016). <u>The ethics of big data in big agriculture</u>. *Internet Policy Review*, 5(1).

16. Rotz, S., Duncan, E., et al. (2019). <u>The politics of digital agricultural technologies: a preliminary review</u>. *Sociologia Ruralis*, 59(2), 203-229; Bronson, K. (2019). <u>Looking through a responsible innovation lens at uneven engagements with digital farming</u>, *NJAS-Wageningen Journal of Life Sciences*, 90, 100294.

17. Worth citing are: Sykuta, M.E. (2016). <u>Big data in agriculture: property rights, privacy and competition in ag data services</u>. *International Food and Agribusiness Management Review*, 19, 57-74; Bronson, K. (2018). <u>Smart farming: including rights holders for responsible agricultural innovation</u>. *Technology Innovation Management Review*, 8(2), 7-14; Supra at 13; Carolan, M. (2018). <u>Big data and food retail: Nudging out citizens by creating dependent consumers</u>. *Geoforum*, 90, 142-150; Eastwood, C., Klerkx, L., et al. (2019). <u>Managing socio-ethical challenges in the development of smart farming: from a fragmented to a comprehensive approach for responsible research and innovation</u>. *Journal of Agricultural and Environmental Ethics*, 32(5), 741-768; Fraser, A. (2019). <u>Land grab/data grab: precision agriculture and its new horizons</u>. *The Journal of Peasant Studies*, 46(5), 893-912; Freidberg, S. (2020). <u>"Unable to determine": limits to metrical governance in agricultural supply chains</u>. *Science, Technology, & Human Values*, 45(4), 738-760; Rose, D.C., & Chilvers, J. (2018). <u>Agriculture 4.0: Broadening responsible innovation in an era of smart farming</u>. *Frontiers in Sustainable Food Systems*, 2, 87; Rotz, S., Duncan, E., et al. (2019). <u>The politics of digital agricultural technologies: a preliminary review</u>. *Sociologia Ruralis*, 59(2), 203-229; Schuster, J. (2017). <u>Big data ethics and the digital age of agriculture</u>. *Resource Magazine*, 24(1), 20-21.

2.2 Agtech developers and platforms

The term "agtech developer" refers to companies, organizations, or other entities that provide agtech platforms and tools to farmers.[18] They are usually private sector companies, as public institutions typically lack the ability to scale and compete. According to agtech developers, their technology lowers farmers' need for literacy and skills, removes middlemen who add "friction" (and higher prices), boosts farmer bargaining power and productivity, makes information systems more responsive to farmer needs, and increases the ability of researchers to share data across fields and disciplines. Most often, agtech platforms can distribute and manage content or act as transaction spaces, though they often require users to possess medium- to high-level expertise to make meaningful use of the information available.

In LMICs, platforms constitute the most widely adopted typology of agtech:
1. **Payment, trading, and marketplace platforms** facilitate financial transactions, such as input purchase and product sales (e.g., MPesa and PayStack) to bring buyers and sellers together and cut out middlemen, reducing spatial and temporal barriers to trade and transaction costs (e.g., IFFCO Kisan, Twiga Foods, Mlouma).
2. **Social networking and messaging platforms**, such as WhatsApp and Facebook, advertise products and connect with users who share similar interests. In part because of their low learning curve, they create a space for farmers and other value chain actors to crowdsource information from a wide audience and peer-to-peer network.
3. **Crowdsourcing/investment platforms** connect investors and philanthropists with farmers and small business owners via third-party mediators (e.g., Kiva, Thrive agric) to obtain funds and information from individual investors (e.g. Farmcrowdy, RuSokoni).
4. **Farm management platforms** enable farmers to make informed farm management decisions (e.g., Hello Tractor, Crop guard, and AgriMap), with features that provide tailored information based on site-specific realities, including location, soil type, and farm enterprise.
5. **Extension advisory platforms** provide services for (1) farmers to remotely connect with extension agents, and (2) for them to facilitate service delivery (e.g., Community Knowledge Worker platform, KHETI), like the provision of information, training, and/or data collection.

Integrated, centralized, or vertically integrated platforms are growing increasingly popular over standalone apps. This shift often results in a power imbalance. Technically, agtech platforms offer many positive features: openness, interoperability, network effects, control over market entry and participation, and the ability to reshape economic relationships and rationalities. However, these platforms can also lock farmers into top-down, controlled systems through which they can ensure repayment of debts, reduce risks of investment, and provide stable and predictable demand or supply for input providers and aggregators.

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18. Datasphere Initiative, (2022) *Datasphere Governance Atlas. Mapping organizations in the data governance ecosystem*. The Datasphere Initiative's comprehensive report on the global data governance environment found that the majority of organizations working on agricultural data governance were NGOs (55%), followed by the private sector (20%), research institutions (15%), and multi-stakeholder groups (10%). The majority (60%) of these aim to serve as data repositories, while 10% aim to affect socio-economic development by using data or by advocating for data sharing and 25% focus on improving data governance at large. Forty percent of the organizations operate globally, and 35% have a domestic focus.#

2.3 Farm data

Data is a crucial input and output of agtech. **Agtech typically collects all types of data about on- and off-farm activities (e.g., location, weather, consumption, energy use, prices) and uses sensors, machines, drones, and satellites to monitor crops or livestock, soil, water, and human behavior.** These types of "smart" technologies produce efficiencies and create opportunities for the users of this data to develop valuable insights. By interpreting the past and predicting the future, this data can help make more timely or accurate decisions.

Farm data has many beneficial purposes across agricultural value chain actors, like supporting efficient transactions and improving trade facilitation and processes. For example, input and service providers can use data for research or to develop new services and foster new types of collaborations and customization. Smart farming and precision agriculture firms can use data-intensive technologies to make efficient use of inputs (such as satellite-guided machinery or automatic milking). However, even though analyzing farm data can generate information and insights to support on-farm decision making, many farmers continue to be unaware "of all the ways in which a company intends to use their farm data."[19] Especially in a context where farm data can play a crucial role in farmer livelihoods, this enables data capture and extraction.

The implications of data extraction and Big Data

Data extraction is the process by which organizations and companies claim ownership of and privatize the data that is produced by their users and citizens. It is the default business model around the extraction and management of data. Data extraction—in the form of Big Data initiatives[20]—defines the current data economy. Within this dominant paradigm, many agtech developers see individuals and communities only as data points and producers, not data consumers. This underscores the limited considerations of equity within the Big Data field: those most likely to benefit from the data are also more likely to use it in self-interested and exploitative ways.[21] Little is known about the effects of Big Data in agriculture,[22] though some scholars consider it the fourth factor of production along with land, labor, and capital.[23]

According to interviewees, one example of data extraction is the "data fatigue" that farmers experience when answering many surveys, often with the same questions. As a result, some farmers have become reluctant to share data, placing them in the position of forgoing access to beneficial services. Because farmers do not trust that the data collected from them will serve them, they are hesitant to adopt new technologies. This further limits their access to beneficial services, which, in turn, has implications for equitable economic inclusion and growth within the agriculture sector.

19. Clark, P. (2016). Growers shouldn't need a law degree to understand their data terms agreements.
20. i.e. large sets of heterogeneous data that cannot be managed and processed using traditional data management techniques
21. Posada, J.C., (2014). Rights of Farmers to Data, Information and Knowledge. Global Forum on Agricultural Research (GFAR), Rome, Italy.
22. Kamble, S., Gunasekaran, A., & Gawankar, S. (2020). Achieving sustainable performance in a data-driven agriculture supply chain: A review for research and applications. International Journal of Production Economics, 219, 179-194.
23. Manyika, J., Chui, M., et al., (2011). Big data: The next frontier for innovation, competition, and productivity. McKinsey Global Institute.

2.3.1 Farm data ownership

For the purposes of this report, farm data refers to the digital data that is identical to the original farm-level data and is considered the property of the farmer. This may include non-personal data and personally identifiable information.

> **The nature of data.**
> Data is **intangible**. Unlike most physical goods, copies of data are identical to the original. Many entities may have access to these copies. Data is **irreplaceable**; farm data may not be recovered after a transfer. Data is considered **nonrival** because one person accessing it does not alter another's ability to use it, such as weather reports. The **excludability** depends on factors such as sharing data with third parties or a community, and if ownership can be maintained. This carries the owner's right to deny access. Privately held data can be excludable while solely in the possession of the party that generated it; however, once shared or aggregated, excludability is eliminated, at least from the farmer's perspective.[24]

Farm data is "the new cash crop"[25] because it can be easily and effectively monetized. For this reason, **the question of who owns farm data is contentious.** Though farmers generate the data through agtech, agtech developers typically own this data. For this reason, data shared between farmers and companies largely flows in one direction—from farmer to company. This finding underscores the importance of farmer-centric data governance structures: if they do not explicitly protect farmers' data rights, farmers will increasingly lose control over their data and the associated benefits. It also reinforces the idea that data governance is at the core of agtech's business model, because it effectively determines the technology's revenue structure.

Key issues in farm data ownership include:

1. **Contracts offer relatively weak data protections for farmers.** Once data is no longer in the farmer's exclusive possession, ownership provisions in contracts and derived ownership rights effectively determine how this data can be used. Organizations and regulators can develop more solid guidance on contracts and legal rights that account for the specificities of farm data use and/or clarifying the scope of database protection could help ensure that farmers can access and use their own data.

2. **It is unclear whether farm data has intellectual property protections.** Typically, the type of property determines the owner's rights and responsibilities. However, farm data has not been legally classified as intellectual property (IP) or as a trade secret. For example, while the World Trade Organization's Agreement on Trade-Related Aspects of Intellectual Property RIghts (TRIPS) gives property and ownership rights to databases as a whole, it does not codify the rights of the people or entities who supply the data.

3. **Not all data (collections) attract copyright protection.** Copyright law may provide protection for data tables or compilations resulting from the input of some labor, skill, or effort. However, raw data, information, or mere facts are not protectable subject matter. Even if data is protected under copyright law, the ownership can vary by contract, and the contractual provisions can override copyright law. These contracts, not relevant laws, govern farm data relationships because they are the primary means by which farm data is controlled, managed, and shared.

24. Goeringer, P. (2016). Farm Data: Ownership and Protections, *Medium*.
25. Tatge, T. (2016). Data is the New Cash Crop: Understanding the Market for Farm Data.

➔ For example, in October 2019, <u>Bayer Fieldview</u> formed a partnership with <u>Tillable</u>, the self-called "Airbnb of farmland," so that "farmers using Tillable can more easily share data about their operation to continue building their reputation, and landowners can rest assured that their property is being properly cared for and will remain a protected investment."[26] **However, by February 2020, some tenants who used Fieldview received offers from Tillable to lease their land at rates that farmers speculated could only come from data sharing between Tillable and Fieldview.[27]** Whether true or not, the resulting controversy caused the companies to terminate their partnership in that same month.[28]

2.3.2 The role of contracts and private sector agreements

As noted in the previous section, contracts and private sector agreements frequently govern the use of farm data. These contracts often involve a "click wrap" agreement[29], signifying consent to the terms of a data license. Similarly, data licenses are usually complex, lengthy, and non-negotiable agreements governing the way farmers' data is collected, managed, and shared. Research suggests that commercial agreements generally do not specify a particular allowable data use (including by third parties), and that potential corporate gains typically drive how these companies use the collected on-farm data.[30] This gives companies "a privileged position with unique insights into what farmers are doing around the clock, on a field-by-field, crop-by-crop basis."[31] The more vertically integrated the agricultural industry is, the tighter the contractual relationships tend to be.

These contracts and bilateral agreements often codify the relationship between farmers, products and services, and the collected farm data.[32] Private sector actors frequently share siloed farm data mainly via ad hoc bilateral agreements to enhance their own competitiveness, innovation, and data-driven decision making. Agribusinesses may regard data as their intellectual property (IP) in many instances, which adds to the complexity of sharing. Contracts and privacy policies between agribusinesses and farmers usually specify in their terms of use how the data can be used, typically seeking to protect privacy via tight data control. Because the fairness of farm data use is lightly regulated, contracts may not provide sufficient safeguards to protect farmer's data rights. The OECD has already raised concerns on the implications of mergers between tech companies,[33] "intensifying the power imbalance between agribusinesses and farmers in relation to contracting."[34]

26. Janzen, T., (2020). <u>The Fieldview-Tillable Breakup: What went wrong?</u>
27. Ibid.
28. Ibid.
29. A clickwrap agreement is a prompt that offers individuals the opportunity to accept or decline a digitally-mediated policies or terms of service, or any other contract.
30. Bronson, K., (2019). <u>Looking through a responsible innovation lens at uneven engagements with digital farming</u>. *NJAS-Wageningen Journal of Life Sciences*, 90, 100294.
31. *Supra* at 19.
32. Cotton Research & Development Corporation (CRDC), (2017). <u>Accelerating precision agriculture to decision agriculture: Enabling digital agriculture in Australia</u>.
33. Detrick, H. (2018). <u>The Justice Department Is Going to Let Bayer Buy Monsanto. Here's Why It Matters</u>.
34. *Supra* at 7.

⊙ **John Deere's data governance approach**

John Deere's non-negotiable contract with its users maximizes the company's access to farmer data and establishes proprietary ownership of anonymized, pooled customer data. It specifies that John Deere can collect and use farm, machine, and administrative data collected from its equipment and then use that data to provide services; develop, market, and improve products; and comply with requests from government agencies. Farmers who wish to benefit from their own farm data must agree to a Data Services and Subscriptions Statement. This Statement underlines ownership and control of data, stating "YOU CONTROL YOUR DATA". It defines data control as the ability to share, export, delete, and amend farm data and some machine and administrative data. Even though John Deere relies on farmers to generate pooled data, farmers are then unable to access it.[35]

The convoluted nature of agtech contracts leaves farmers with little ability to negotiate data governance. Contracts can be highly technical, obscure, and far-reaching. For example, the mere act of turning on machinery or downloading the tech could mean that a farmer agrees to a broad range of contractual terms that regulate the access and use of this data. Farmers often do not know that they granted permission for an agribusiness to share their data without permission. This indicates a clear lack of transparency prior to entering a contract, which can result in a discrepancy between what a contract says and what farmers think it says. In this scenario, farmers may be unaware of how much control tech providers have, how their data is used, or the extent to which it is shared and traded with third parties.

The spread of data collection practices without specific, sustained benefit for farmers erodes trust and impairs efforts to improve their lives. The fact that many agtech providers in LMICs are foreign owned may also affect farmers' trust and confidence in their contractual terms of use. For example, the laws of the country in which the agtech company is registered often governs the license agreements that outline data sharing and data use practices, which can create uncertainty over farmers' legal protections. It is essential that the terms and conditions of data licenses are understandable and transparent, regarding how they regulate who has data access, who derives benefits, and privacy concerns. Including provisions for redress and rectification can help establish clearer guide rails and penalties if large actors infringe upon agreements.

35. Baarbé, J., Blom, M., & De Beer, J. (2019). A proposed "agricultural data commons" in support of food security, *The African Journal of Information and Communication*, 23, 1-33.

➲ **"Data moves at the speed of trust"[36] and the role of trust in agricultural data governance**

In examining farmers' concerns over willingness to share data with third parties, it becomes clear that trust is paramount. Trust is critical in any data sharing agreement, and farmers are increasingly wary of how agtech companies—as well as other private and public sector actors – will use their data.[37] Because their inability to negotiate the standard terms of agribusiness' data licenses,[38] many farmers increasingly become reluctant to share their data. In turn, this reduces the availability and accessibility of farm data. If agtech and data are to transform agrifood networks, agricultural value chain actors need to foster trust around farm data access and use.[39]

2.4 Enabling environment around agricultural data governance

The enabling environment around agricultural data governance refers to the conditions within which farmers and technologies operate, made up of the forces that shape and influence its size, extent, and functioning. It includes societal norms, formal and informal rules, policies and procedures, utilities and infrastructure, and institutions and organizations, as well as legislative coordination and oversight bodies. The regulatory environment, in combination with digital and data literacy, are important factors that affect context-specific agricultural data governance.

2.4.1 The role of contracts and private sector agreements

The rapid growth of agtech underscores the need for new agricultural data policy interventions and regulations across the globe. However, national data protection and privacy laws vary by country, and some countries do not have specific policy frameworks on these topics. Even if they did, it is unclear whether farm data constitutes personal data, even though farming is closely linked to a farmer's private life. Most companies and organizations apply personal data protection frameworks as a benchmark nonetheless. Within countries that do have applicable data protection and privacy laws covering the agriculture sector, many farmers may still not not understand the rights and protections granted to them.

The lack of regulatory authority or accountability in farm data collection and storage can create more uncertainty, especially in terms of farmers' ability to access their own data, data portability rights, and for data security, and particularly if an agtech developer has agreements with farmers in one country and delivers services in another. Greater collaboration between governments on farm data governance "is needed to avoid 'forum shopping' by tech companies; to protect consumer rights effectively; to promote interoperability across regulatory frameworks and enforcement; and to create a favorable environment for the digital economy to thrive."[40] Data localization, local collaborations, and building national capacities are key steps to overcome this imbalance.

36. Hamilton, J.J., & Hopkins, R.S. (2019). Using technologies for data collection and management. The CDC field epidemiology manual. CDC.
37. *Supra* at 60.
38. *Supra* at 19. *Supra* at 60.
39. Barnard-Wills, D. (2017). The technology foresight activities of European Union data protection authorities. *Technological Forecasting and Social Change*, 116, 142-150.
40. *Supra* at 7.

European regulation has a major impact on privacy and data protection globally. The regulations apply to data processing by controllers or processors established in the EU, regardless of where it actually takes place. Entities are accountable for their processing activities, specified purposes, and consent mechanisms. While the General Data Protection Regulation (GDPR) has raised the standard for individual privacy, it is, by no means, sufficient for data privacy protections in the agriculture sector because farm data generally falls outside this realm. This is particularly important because many countries are introducing GDPR-like legislation; its influence is reverberating throughout the world, which may have trickle-down effects on the agriculture sector in LMICs. In India, a similar mechanism has been set up with a Consent Manager framework, which offers a means to uphold user agency and data rights. However, the Consultation Paper on India Digital Ecosystem of Agriculture is problematic because it takes a market-centric approach that ignores farmers' interests for the purpose of digitizing agriculture. It privileges one-way data flow—collected from farmers and shared with businesses that glean valuable insights and create databases and services.

2.4.2 Digital and data literacy

At the individual level, introducing agtech in rural areas can be a challenge due to a lack of infrastructure, basic digital skills, network coverage, and high costs. Only around a third of rural populations are covered by 3G networks.[41] Digital and data literacy and skills remain low in those areas, particularly among women.[42] For this reason, smallholders are less likely to understand how they or others could use their data, which negates farmers' incentives to collect and share data in the first place. Building knowledge within communities via education and awareness raising around farm data collection, control, sharing, and use is fundamentally important to ensuring better data governance.

Lack of data literacy at the organizational level also hampers efforts to establish forward-thinking agricultural data governance models. Even development actors with an interest in serving as responsible data stewards face challenges. Many smaller NGOs work in remote areas with limited bandwidth and simple data collection tools. They lack dedicated technical resources or may not be able to divert significant funding into building or adopting farmer-centric infrastructure. They tend to rely on outsourcing and/or commercial or custom tools, which are often not designed to maximize NGOs' control over their own data. For these reasons, NGOs may not be able to set up their own appropriate data governance structures.

The Consultative Group on International Agricultural Research (CGIAR) Platform for Big Data In Agriculture concluded with themes to be explored to strengthen future agricultural data ecosystems: (1) Who will pay for data? (2) How can useful and accessible data be made cost effective? (3) How to manage the challenges to collect regular, timely data? (4) How can enough trust among ecosystem members be created so that they will share their data?[43]

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41. Global System for Mobile Communications Association (GSMA). (2019). Mobile Economy 2022
42. UNESCO. (2017). Reading the past, writing the future: Fifty years of promoting literacy.
43. The CGIAR Platform for Big Data in Agriculture closed in December 2021. Its work continues under the CGIAR Digital Innovation initiative and the Digital and Data unit at System Office.

3. RE-IMAGINING AGRICULTURAL DATA GOVERNANCE IN THE CONTEXT OF POWER AND PARTICIPATION

This section examines the theoretical underpinnings of agricultural data governance through the lens of power and participation. After a brief discussion of power asymmetry in a digitalized agriculture sector and the potential counterbalancing force of farmer participation in data governance structures, it critically examines the role of agtech platforms and farmers in this paradigm. It concludes with a discussion of the current political economy within the agtech sector, rooted in the previously discussed concepts of power and participation.

Agricultural digitalization is inherently political: agtech and poor data governance practices can lead to new or intensified power asymmetry that threatens the sustainability of food systems.[46] Smart farming is "by definition—never neutral, whether aimed at greater efficiency, profitability, convenience, or security."[47] In a digitalized agriculture sector, some actors hold considerably higher levels of power than others;[48] the proliferation of agricultural data only multiplies and magnifies these concerns. Power dynamics and institutional factors also inform how agriculture sector actors use and access the value of Big Data.[49] **Who collects and translates farm data into commercial value shapes farm systems,** potentially reinforcing structural inequities within a digitalized agriculture sector. In this sense, however, meaningful farmer participation in digital agriculture innovations can shift hegemonic paradigms away from "winner-take-all" commercialized agriculture towards sustainable, equitable, trustworthy, and more successful food systems.

> ⊙ **A move is visible towards integrated, centralized or vertically integrated platforms.** For example, Safaricom is at the forefront of agtech in Kenya with Digifarm and a suite of apps, including Arifu (an agronomic advice platform), M-Pesa (to derive credit scores and eligibility via vouchers for inputs), and iProcure (an input supplier that redeems vouchers). Safaricom seeks to scale and encourage adoption of its mobile phone-based agtech platforms through its agent networks, who 1) connect farmers with the proprietary knowledge embedded within these platforms and 2) enable the sales of inputs, loans, and crop insurance. However, farmers must buy inputs promoted and sold on credit at high interest, follow the advice of the chatbot to qualify for the required insurance, sell crops to the firm at a non-negotiable price, and receive payments on a money app with a fee. Any missteps can affect credit worthiness and access to finance and markets.a fee). Any missteps can affect credit worthiness and access to finance and markets.[44]

44. ETC Group. (2021). Did you know that the digitalization of agriculture could affect farmers' rights?
45. Menne, T. (2017). Digital farming set to revolutionize agriculture.
46. Ribarics, P. (2016). Big Data and its impact on agriculture. *Ecocycles*, 2(1), 33-34.
47. Klauser, F. (2018). Surveillance farm: Towards a research agenda on big data agriculture. *Surveillance & Society*, 16(3), 370-378.
48. Wolf, S., & Wood, S., (1997). Precision farming: Environmental legitimation, commodification of information, and industrial coordination, *Rural sociology*, 62(2), 180-206.

Sensors built into John Deere's machinery collect and stream data on soil and crop conditions. Deere signed legal agreements with companies like Bayer to allow them access to its farm data. With the support of its networks and access to markets, Bayer Monsanto transitioned into a data science company. For example, Bayer CropScience partnered with John Deere to develop digital tools, making them the data holders, specialists, and strategists. The head of Bayer's Global Digital Farming Unit has stated that the company profits more from the sale of information than the sale of chemical inputs.[45]

→ **The University of California, Berkeley and the Government of Andhra Pradesh in India** set out to create "smart villages" to empower villagers and yield insights about how to scale interventions.[50] Whether they were successful or not, "there is no evidence to suggest that people in Mori wanted their village to be 'smart' prior to the intervention, but from the outset the process was designed to tap the Mori crowd for insights in a form of co-design that identified specific problems that might be addressed by new technical fixes."[51] A "techno-solutionist" initiative like this example can also generate significant incentives for firms to create new assets and value from data by partnering with entities who can afford this data infrastructure, which may not be aligned with the values and needs of farmers.

→ **The Syngenta Foundation** invested in a network of weather stations in Kenya. Acre Africa, supported by Syngenta, uses this information to build risk-management models for its insurance products. In turn, it established its own agents, forging partnerships with dealers and input providers to build new closed value chains; farmers purchase inputs from partners with scratch card codes to activate contracts. Acre will use their phone number and GPS, the input's number, date, and location to monitor rainfall with satellite data.[52]

Even though the dominant discourse within the development sector privileges the role of agtech in promoting efficiency and reducing costs, it is critical that **donors and policymakers remain aware of the profound power shifts underlying the move to digital agriculture.** Shifts in the balance of power between public and private actors and reorganizations in the division of knowledge and power within agricultural networks can create mistrust and uncertainty among actors[53] or generate new forms of economic and tech dependency.[54] However, **increased farmer participation in the design and exercise of agricultural data governance can counterbalance this effect** to bring about greater societal and economic equity within the agriculture sector.

49. Lioutas, E., Charatsari, C., La Rocca, G., & De Rosa, M. (2019). Key questions on the use of big data in farming: An activity theory approach. *NJAS-Wageningen Journal of Life Sciences*, 90, 100297.
50. Darwin, S., & Chesbrough, H. (2017). Prototyping a scalable smart village to simultaneously create sustainable development and enterprise growth opportunities. In SAGE Business Cases. The Berkeley-Haas Case Series. University of California, Berkeley. Haas School of Business.
51. Fraser, A. (2022). 'You can't eat data'?: Moving beyond the misconfigured innovations of smart farming. *Journal of Rural Studies*, 91, 200-207.
52. Mann, L., & Iazzolino, G. (2021). From Development State to Corporate Leviathan: Historicizing the Infrastructural Performativity of Digital Platforms within Kenyan Agriculture. *Development and Change*, 52: 829-854.
53. Jakku, E., Taylor, B., et al. (2019). "If they don't tell us what they do with it, why would we trust them?" Trust, transparency and benefit-sharing in Smart Farming. *NJAS-Wageningen Journal of Life Sciences*, 90, 100285; See also Fielke, S., Garrard, R., et al. (2019). Conceptualising the DAIS: Implications of the "Digitalisation of Agricultural Innovation Systems" on technology and policy at multiple levels, *NJAS: Wageningen Journal of Life Sciences*, 90(1), 1-11.
54. Carolan, M. (2018). Big data and food retail: Nudging out citizens by creating dependent consumers. *Geoforum*, 90, 142-150; Regan, Á. (2019). Smart farming in Ireland: A risk perception study with key governance actors. *NJAS-Wageningen Journal of Life Sciences*, 90, 100292.

Conservis offers a farm management software that collects data from different sources and platforms, eliminates manual entry of data, creates business plans, and manages costs and production operations. Acquired by Telus Agriculture and Rabobank in 2021, it now combines Telus Agriculture's technologies with Rabobank's knowledge and relationships across the entire food value chain. 365FarmNet is a German farm management software developed and maintained by Claas, a large farm machinery company. The modular platform covers different aspects of farm management, like recording field use, tracking fertilizer use, and herd management. A web-based farming planning tool, Barto builds on 365FarmNet and provides an all-in-one solution for data-driven precision agriculture. The platform offers interfaces to share data with federal agencies or consumers, but the farmer can decide who has the right to access the data.

In 2020, **Microsoft and Alliance for a Green Revolution in Africa (AGRA)** announced a partnership to grow Azure FarmBeats, providing farmers with advice and information inputs. Microsoft and International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in India developed an application to provide farmers advice on optimal timing for sowing, rolled out via extension services. In addition, FarmBeats integrated Climate Edge into its platform as a data broker. It aggregates data on farmers (supplied by third parties) and researchers who use its platform and sells this to insurance companies, certification bodies, pesticide dealers, large food companies, and even NGOs.

3.1 Agtech platforms in the context of power and participation

Big Tech and a small yet powerful group of platforms dominate the agricultural data economy. According to many agtech developers, they replace exploitative value chain actors and strengthen market linkages, promoting efficiency, productivity, and sustainability via digitalization.[55] However, agtech platforms are effectively digital intermediaries themselves: they merely replace the old analog ones, but do not necessarily remove the need for intermediaries in the first place. They can quickly grow to possess a lot of power: for example, as more agricultural value chain actors begin using the same data platform, the developer strengthens its position and deepens the platform's predictive ability and legitimacy. This is not an intrinsic feature of technology, but rather reflects a longer history of shifting power over data governance.

Research has highlighted the potential downsides of centralized agtech platforms and new business models that offer large digital package deals to farmers. Though some research emphasizes their positive impacts in LMICs,[56] these information systems tend to maintain or grow the imbalance of power. By integrating market mechanisms into single platforms, there is also a growing danger of

55. Friederici, N., Wahome, M., & Graham, M. (2020), Digital entrepreneurship in Africa: How a continent is escaping Silicon Valley's long shadow, MIT Press; Mann, L., & Nzayisenga, E. (2015), Sellers on the street: the human infrastructure of the mobile phone network in Kigali, Rwanda. *Critical African Studies*, 7(1), 26-46.

56. David-Benz, H., Andriandralambo, N., & Rahelizatovo, N. (2017). Disseminating price information through mobile phone: are Malagasy farmers ready for it?, IRSTEA; Aker, J. (2011). Dial "A" for agriculture: a review of information and communication technologies for agricultural extension in developing countries, *Agricultural economics*, 42(6), 631-647; Islam, M., & Grönlund, A. (2010). An agricultural market information service (AMIS) in Bangladesh: evaluating a mobile phone based e-service in a rural context. *Information Development*, 26(4), 289-302; Agyekumhene, C., de Vries, J., et al. (2018). Digital platforms for smallholder credit access: The mediation of trust for cooperation in maize value chain financing. *NJAS-Wageningen Journal of Life Sciences*, 86, 77-88.

monopoly power and control over market entry and participation.[57] Not only is data centralized in the hands of a few private sector entities, which creates information silos and prevents knowledge building, but individuals having little to no control over their own data.

3.2 Farmers in the context of power and participation

Many farmers—as well as nonprofits and governments—lack awareness about the true value and potential of their data. In part for this reason, interviewees acknowledge that the value of the collected data does not usually flow back to farmers or farming communities. Development actors highlighted that some partners collected extensive data with limited engagement and feedback afterwards. They showed clear interest in exploring a more equitable, non-exploitative approach to data governance beyond data sharing. One commented: "We [as a donor] are helping to 'include' farmers in a digital economy that is itself deeply exploitative and inequitable. Is there a non-exploitative approach [they wonder]?" This is an important issue for donors and practitioners, indicating their concerns about differential power dynamics in farmer data collection and the need for transparent, farmer-centric data governance paradigms.

At present, agtech is mostly limited to large-scale farms in capital intensive areas or in some ("export-oriented sub-sectors" of) bifurcated LMICs.[58] However, the growth of agtech engenders and deepens the divide between capital-intensive farms and those unable or unwilling to embrace new technologies.[59] It is especially difficult for farmers to opt out of agricultural data collection and data use—by not using agtech at all—when they perceive that doing so will cause them to "fall behind" their competition.[60] Smallholders lack basic mechanisms and abilities to symmetrically compete, afford the cost of Big Data analysis, or interpret and effectively use this information.[61]

3.3 Political economy of the agtech sector

The emergence of agtech will shift or strengthen the status quo in agriculture, with some actors making significant gains and others losing out. Digital agriculture opens the door to new socio-technical spaces that empower Big Tech to draw upon farmers' value by analyzing their data.[62] Many agtech services offer to generate data for "free" because the data subjects become part of the exchange—they use the latest software in return for giving up data and privacy. Farmers all over the world are "locked-in" to agtech platforms, having to adopt more or new technologies.[63] Some view this as a "data grab," with agtech providers intending to collect as much data as possible to create opportunities for further data accumulation and expansion.[64] In this sense, **a form of dispossession occurs when users lose control over their data, inevitably reinforcing structural inequities and consolidating power in the hands of a few.**

57. *Supra* at 47.
58. Akram-Lodhi, A. H. 2007. "Land, Markets and Neoliberal Enclosure: An Agrarian Political Economy Perspective." Third World Quarterly 28 (8): 1437–1456.
59. Fraser, A. (2019). Land grab/data grab: precision agriculture and its new horizons, *The Journal of Peasant Studies*, 46:5, 893-912.
60. Bronson, K., & Sengers, P. (2022). Big Tech Meets Big Ag: Diversifying Epistemologies of Data and Power, Science as Culture, 31:1, 15-28.
61. Kshetri, N. (2014). The emerging role of Big Data in key development issues: Opportunities, challenges, and concerns. *Big Data & Society*, 1(2).
62. Birch, K,, Chiappetta, M., & Artyushina, A. (2020). The problem of innovation in technoscientific capitalism: data rentiership and the policy implications of turning personal digital data into a private asset, *Policy Studies*, 41:5, 468-487.
63. Elkan, P. G. (1982), The Environment from Surplus to Scarcity, by Allan Schnaiberg. Oxford University Press, UK: xiii+ 464 pp.
64. Pickren, G. (2018). 'The global assemblage of digital flow': Critical data studies and the infrastructures of computing, *Progress in Human Geography*, 42(2):225-243.

As the business model of agtech is often premised on transferring knowledge and skills away from farmers and onto the technical infrastructure, platformization may end up deepening the divide between producing regions and those where digital agriculture innovations are developed and commercialized.[65] This type of data governance approach, which encourages the flow of data out of LMICs, erodes the possibility of developing more pro-farmer arrangements. These extractive data governance approaches allow companies to consolidate their power while disregarding the position of farmers. At the same time, farmers are unable to make informed and context-driven decisions about whether it is in their interest to share their own data. While platforms transform production systems and change flows of value, they also change the way knowledge and theory are produced and validated.

A critical element of user-centricity, farmer participation in data governance structures is an important way to overcome power imbalances within a digitalized agriculture sector.[66] "Key to interrogating these power structures is participation, which refers to people's involvement in influencing the decisions, processes, and practices related to data that affect their lives."[67] However, meaningful participation requires all stakeholders to give farmers a voice in the data governance processes that materially affect their lives: "Participation must not be used merely as an 'ethical scaffolding,'"[68] nor remain a "happy talk" without seriously challenging ongoing structural inequality.[69]

> ⊙ **The role of regulatory regimes in the political economy of agtech.** Some researchers critique the lack of policy interventions stemming from unregulated technological change within the food system and the resulting power imbalances.[70] This type of system can promote regulatory capture in the interests of private actors, shareholders, and donors, away from local public interests.[71] Regulatory enforcement structures are inadequate or nonexistent on a global scale, and necessary transparency and accountability mechanisms are usually neglected by national governments.

65. Isakson, S. (2014). Food and finance: The financial transformation of agro-food supply chains. *The Journal of Peasant Studies*, 41(5).; Kleibert, J., & Mann, L. (2020). Capturing value amidst constant global restructuring? Information-technology-enabled services in India, the Philippines and Kenya. The European Journal of Development Research, 32(4), 1057-1079; Mann, L., & Iazzolino, G. (2019). See, nudge, control and profit: Digital platforms as privatized epistemic infrastructures. *IT for Change*.
66. AI, J. (2021). Participatory data stewardship, Ada Lovelace Institute.
67. Barbero, M., Bett. K., et al. (2022). Reimagining Data and Power A roadmap for putting values at the heart of data. The Data Values Project. Global Partnership for Sustainable Development Data.
68. Chamuah A., & Bajpai H. (2022), Towards Responsible Data Practices for Machine Learning in India: Health & Agriculture. Digital Futures Lab, Goa.
69. Benjamin, R. (2019). Race after technology: Abolitionist Tools for the New Jim Code. Social forces.
70. Bronson, K., & Knezevic, I. (2019). The digital divide and how it matters for Canadian food system equity. *Canadian Journal of Communication*, 44(2), PP63-PP68.
71. McCormack, J. (2021). The Entrepreneurial State: Debunking Public vs. Private Sector Myths. *Defense AR Journal*, 28(4), 480-482; Mkandawire, T., (2015) Neopatrimonialism and the political economy of economic performance in Africa: Critical reflections. *World Politics*, 67(3), 563-612; Peck, J., & Tickell, A. (2008). Neoliberalizing space, *Economy* (pp. 475-499), Routledge; Peck, J., & Tickell, A. (2002). Neoliberalizing space: The free economy and the penal state. spaces of neoliberalism: urban restructuring in North America and West Europe. Maiden: Blackwell Publishers Ltd.

4. A NEW AGRICULTURAL DATA GOVERNANCE PARADIGM

This section analyzes different farmer-centric, participatory data governance approaches in agriculture across LMICs. After a brief introduction to user-centric data governance models, it introduces the main building blocks of data governance models: participatory data governance, data ownership and control, data stewardship, and data sharing. Important lessons learned from the field are included here.

Reimagining how data governance can deepen justice and prosperity in the agriculture sector is necessary. Rooted in the concepts of participation and power, it matters who implements the system, who owns the data and infrastructure, and whose ideas are encouraged. User-centric, participatory data governance approaches center individuals and communities, with a huge potential to address and counter existing power imbalances and to build agency while delivering effective and efficient systems of engagement. They bring stakeholders closer to available data governance policies, frameworks, and guidelines, providing a vehicle to put lessons into practice in a practical, strategic direction. To create equitable, accountable, and just data economies in the agriculture sector, it is critical to maintain or re-establish farmers' agency and control over their data (individual and/or collective ownership of data, stewardship, and practices) with an emphasis on the position of marginalized people—especially smallholder farmers, their dependent communities, women and Indigenous Peoples.

In line with the above, this report recognizes and focuses on **four building blocks to build new user-centric data governance paradigms:**
1. Participatory data governance
2. Data ownership and control
3. Data stewardship
4. Data sharing

4.1 Participatory data governance

By giving voice to and actively engaging individuals or communities, participation "includes empowering the public to advise and assist with decisions on data governance models, collaborating with the public in designing innovative data governance initiatives, and involving the public to ensure their concerns and aspirations are directly reflected in how data is regulated."[72] Though implementing participatory data governance approaches is a complicated process requiring lots of time and investment in the form of listening and learning, it can also spur increased collaboration and innovation, more meaningful policies, and effective use of resources. Most importantly, it helps ensure that the collected evidence reflects farmers' lived experiences, priorities, and concerns. **Embedding user-centric, participatory data governance models leads to improved data quality, rather than an increase in data quantity, with clearer, higher quality, and fit-for-purpose datasets.**

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72. *Supra* at 156.

Often differing based on location and social and political contexts, participatory data governance can be realized at any stage of the data lifecycle: before data collection (who is counted and what are their needs), after data collection (in collaboration with others), and when using data (support greater data use). Ranging from formalized partnerships and legal entities to informal consultations, citizen assemblies, and steering committees, participatory data governance approaches vary in the extent to which they rely on direct or indirect representation, delegation, and institutionalization. They can also build on existing data governance practices. Small changes, such as establishing working groups or consulting the data subjects on their preferences, can have a tremendous impact on data collection and governance.

Participatory data governance requires consistent engagement and public participation with farmers, going further than passive attendance or sharing public notices on new data regulations to check a box.[73] According to the World Bank, "enabling trust, value, and equity in data use requires adopting an approach to data governance that is informed by all people [...] The fairness, inclusivity, transparency, and effectiveness of the process is critical in promoting trust and legitimacy, and therefore incentivizing participation in the data economy."[74] This includes taking into consideration not only farmers' data literacy skills, but also their digital literacy and access to the internet. Similarly, public participation "focuses on people-driven data governance regimes and how public consultations and maximization of such consultations yield effective data governance."[75] It means keeping the public informed about how their data is governed and maintaining a willingness to listen, acknowledge, and respond to their concerns and aspirations. Low levels of public contribution to data governance within many LMICs—mainly due to lack of awareness of rights or applied data governance approaches and an unwillingness by some agtech developers to listen, acknowledge, and provide feedback to the public— underscore the importance of participatory data governance approaches in the agriculture sector.

Meaningful participation in agricultural data governance requires adopting approaches that understand and learn, connect with, are guided by, and formally respond to farmers' views in data-related decision making, thereby shifting the underlying power dynamics in that process. The end goal is a safe environment where the voices of individuals and communities shape data governance systems and structures, which – in turn – builds their trust, confidence, and capacity in the data governance process.

73. Phamodi, S., Singh, A., & Power, M. (2021). Making ICT policy in Africa: an introductory handbook, Namibia: Friedrich Ebert Stiftung.
74. Barzelay, A., Veerappan, M., & Lucey, M. (2021). Promoting trust in data through multistakeholder data governance, World Bank Blogs.
75. Ilori, T. (2020). Maximising Public Awareness for Participatory Data Governance in African Countries, Center for Human Rights.

The Ada Lovelace participatory data stewardship report provides a helpful division for measuring levels of participation in data stewardship, based on Sherry Arnstein's "ladder of citizen participation."[76] Adapted for the agriculture sector, it illuminates the following participatory mechanisms:

1. **Informing** people about data governance, direct or indirectly, in a one-way flow of information to farmers. **Transparency and explainability** contribute to informing subjects on data use, providing farmers with necessary information and tools to assess how data is governed. However, this can create an illusion of control and can distract from addressing more harmful data practices.

2. **Consultation,** as part of data governance, can enable farmers to voice their views. While Arnstein called it tokenistic because of its inability to shift power, the Gunning Principles offer precepts for ineffective and effective consultation.[77] This can be done via **co-creation and enabling agency** over data with and by marginalized groups. These mechanisms can risk misleading people into thinking they have greater power and agency over the terms and conditions of a data governance initiative than they actually do.

3. **Involvement** places farmers in an **advisory position to deliberate** and shape conditions for data governance activities. Farmers are provided with meaningful access to privileged information. The cost, resources, and time involved in the field of agtech can make it difficult to embed farmers' perspectives in this way.

4. **Collaboration** enables farmers to **negotiate and engage in trade-offs** on aspects of decision making with power holders and those governing the data. It has the potential to enable the participation of beneficiaries as collectives, to enable collective consent, and to be enacted within the data lifecycle. A report by The Involve Foundation offers three possible stages of deliberation: scoping, co-design, and evaluation.[78]

5. **Empowerment** means farmers can make decisions about data governance that enables them to **exercise full managerial power and agency** on how data is governed. Here, the dynamic of power shifts from the data steward to the data beneficiary, advised where necessary by specialist expertise. Few examples exist, such as shared control and data ownership (see data cooperatives), electoral models for beneficiary involvement (e.g., voting on boards), and setting terms and conditions for licensing and data access.

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76. AI, J. (2021). Participatory data stewardship. Reading time.
77. The principles are: (1) consultations should be undertaken when proposals are still at a formative stage, (2) there must be sufficient information to permit "intelligent consideration" by the people who have been consulted, (3) there must be sufficient time for consideration and response, and (4) responses must be conscientiously taken into account.
78. Lansdell, S., & Bunting, M. (2019). Designing decision making processes for data trusts: lessons from three pilots. The Involve Foundation (Involve).

> ⊕ **Participatory data governance in the Amazon.**
> During the Ictio project, the Wildlife Conservation Society worked closely with local NGOs and fishing communities to define suitable approaches to data governance. Eventually, negotiations led to the testing and renegotiation of preliminary technical and governance solutions. Similarly, the Citizen Science for the Amazon initiative collects, monitors, and shares Indigenous, local, and global knowledge through its network of partners and citizens. Its data governance system was designed to connect to local efforts, aggregating data, using interoperable standards, and prioritizing open, safe, and accessible information. The partners agreed on a participatory data governance approach—including principles, variables, protocols, terms of use, credit, and privacy—to foster the sustainable use and management of resources, improve livelihoods, and empower local communities to use the collected evidence when negotiating on issues such as fishing permits and sustainably selling catch in markets with high prices.

💡 Guiding lessons on user-centricity and meaningful participation

1. **Engagement: decreasing distance with local farmer organizations can improve user participation.** According to interviewees and field research, many actors find it difficult to establish direct contact with farmers due to political reasons, lack of farmer organization or technology use, and/or scale and access. Whereas farmers might be hard to reach, farmer organizations or groups can capture value in many ways, with each being best positioned to decide on their focus areas. Working with community "leads" using a "train-the-trainer" model also was highlighted in the consultations as another way to foster greater user participation.

2. **Trust: genuine community engagement and collaboration with local, regional, and national actors is essential to foster participation and build trust.** Data governance processes need to cater to specific needs and experiences—such as traditional knowledge and customary governance systems—to foster ownership. Successful community outreach initiatives initiate consensual dialogue to raise awareness and provide an avenue for all community members to participate in decisions affecting their lives. Personal interactions, like sitting down with local leaders and participating (focus) group discussions or locally practiced council meetings (like Gram Sabha in India), nurture these relationships. In more sensitive or complex areas, closer collaboration with relevant organizations is critical, and outcomes depend greatly on working together. These initiatives promote more profound democratic and socio-economic reform, collective action, and institutional sustainability.

3. **Inclusion: equip smallholder farmers and communities with the necessary knowledge to govern and use data, on- or offline platforms, and other tools.** It is important that smallholder farmers and their communities, especially women and Indigenous People, understand the value of their data, of data governance, and of digital tools. This likely requires the use of multiple local languages, symbols, and labels; accuracy in mapping; and the potential to replicate and scale. To foster meaningful participation, technology is adapted to fit local context, generating an easy-to-understand solution that people will use every day and adds value to their lives. Inclusion can also mean financial compensation for their data and for their participation in governance.

4. **Co-design: cater to the needs of farmers by designing tech and governance approaches with them.** Creating a sense of ownership via co-design and joint learning about data, governance processes, and technology can result in increased knowledge, solidarity, and cohesion among farmers. This requires extensive participatory, iterative design to create usable digital solutions for relatively low-skilled, low-literate people. At a minimum, feedback mechanisms should collect actionable data—including gender disaggregated data—to enable alignment with individual and community needs. As one actor shared, "Increasing buy-in is not about applying successes from elsewhere, but connecting with [farmers] at the very first stages to understand their context, learn how to craft incentives, and build trust." This could therefore also mean that individuals decide what co-design means.

5. **Hard work: prepare and resource for a lot of social and organizational social work.** As one development actor put it, building farmer-centric data governance approaches requires resources and time, specifically to organize common resources and understand local historical, legal, and institutional pluralism. Genuine user-centricity and participation thus promotes more profound democratic and socio-economic reform, collective action, and sustainability, where farmers and communities are engaged as more than passive data collectors. This helps increase power parity among actors in the value chain.

4.2 Data ownership and control

Farmer-centric data governance also focuses on data ownership and control. **The general consensus is that farmers should own their own data about individual farm practices, inputs, and outputs.**[79] One actor characterized the rights of farmers to data as: "the right to access, control, and use data to get information useful for [their] farm management; avoid information to be used for unbalanced relations with [their] customers or suppliers; and the right to get return when [their] data is necessary for further processes."[80] Per a Foresight Study of the European Parliament, "[m]aking farmers the owners of their data and providing opportunities to control the flow of their data to stakeholders should help build trust with farmers for exchanging data and harvest the fruits of the analysis of big data."[81]

Regardless, the language of "ownership" can distract from important issues of data collection, control, and access.[82] Building trust and confidence with farmers requires more than clarifying data ownership. Importantly, it is possible to legally "own" data but have little control over who uses it and how. Stakeholders tend to have different attitudes toward sharing various data with different actors, and research shows that farmers are more willing to share data with other farmers and researchers and least willing to share with tech providers.[83] Farmers with an understanding of data use conditions (i.e., the terms of licenses) are more willing to share their data.

79. USAID, (2018). Digital Farmer Profiles: Reimagining Smallholder agriculture.
80. Posada, J.C. (2014). *Rights of farmers for data, information and knowledge*. In Rome: *Global Forum on Agricultural Research*.
81. Lieve, V. (2016). Precision-agriculture and the future of farming in Europe.
82. Wiseman, L., & Sanderson, J. (2017). The legal dimensions of digital agriculture in Australia: An examination of the current and future state of data rules dealing with ownership, access, privacy and trust. Griffith University, USC Australia and Cotton Research and Development Corporation.
83. Zhang, A., Baker, I., Jakku, E., & Llewellyn, R. (2017). Accelerating precision agriculture to decision agriculture: The needs and drivers for the present and future of digital agriculture in Australia.

The communal ownership of data is a type of developing property rights regime within the data economy.[84] Some debates revolve around the propertization of data.[85] However, this could lead to data commodification, which some researchers consider undesirable because of the personal nature of data and the inherent power imbalance. Instead, they argue for dropping the idea of data ownership in favor of a "bill of data rights"[86] or "club good", as one interviewee noted.[87] Others propose a combination of "reciprocity licenses" with data commons,[88] a commons-focused practice of inclusion and exclusion,[89] or "quasi-ownership" between individual and collective ownership.[90] A discussion of "who owns data" raises more questions than answers.

Alternatively, data sovereignty requires that actors develop principles, policies, and practices that determine whether the emergent value of data should be held in common, rather than be privatized.[91] The objective of data sovereignty is to contest how the globalization of tech architectures takes shape.[92] However, this is not straightforward. Some public actors aim to regulate the commercial use of data under the pretense of sovereignty, without setting clear rules on data governance. The OECD warned that countries may use data governance to shift power away from companies to themselves, believing they are better positioned to control the market.[93]

⚬̣́- Guiding lessons on data ownership

1. **Empowerment: data ownership and control enables farmers and farmers' organizations (FOs) to develop greater empowerment and agency in their value chains.** Participants in this assessment—governments, nonprofit, multinational or small companies—generally agreed that farmers and FOs need to have unabated access to their own data, though some initiatives place ownership at the community level rather than at the individual level. Conversations on data ownership point out that ownership includes how data is generated and used, how value is created and shared, and what other opportunities they provide for the owner (i.e., sovereignty, control and agency).

2. **Clarity and transparency: data ownership and control includes understanding data and its governance structure.** Explaining data ownership in a format and language that farmers understand is essential for clarity and transparency. Data ownership and control includes the ability to visualize and analyze data, as well as the flexibility to modify or delete data or opt out of data collection as required. Purpose limitations can tell users exactly what the recipient intends to do with their data.

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84. Pasquale, F. (2014). IP Law Book Review: Configuring the Networked Self: Law, Code, and the Play of Every Day Practice.
85. Hicks, J. (2022). The future of data ownership: An uncommon research agenda. *The Sociological Review*, 00380261221088120.
86. Tisne, M. (2018). It's time for a Bill of Data Rights.
87. Rabley, P., & Keefe, C. (2021). Introducing PLACE: Mapping data in the public interest.
88. Smichowski, B. (2016). Data as a common in the sharing economy: a general policy proposal.
89. Prainsack, B. (2019). Logged out: Ownership, exclusion and public value in the digital data and information commons. *Big Data & Society*, 6(1).
90. Hummel, P., Braun, M., & Dabrock, P. (2021). Own data? Ethical reflections on data ownership. *Philosophy & Technology*, 34(3), 545-572.
91. Data sovereignty is the concept that data is subject to laws and governance structures of the country where it is collected. It is closely linked with data security, cloud computing, network sovereignty, and technological sovereignty.
92. Couldry, N., & Powell, A. (2014). Big data from the bottom up. *Big Data & Society*, 1(2), 2053951714539277.
93. Aaronson, S. (2021). Data is disruptive: How data sovereignty is challenging data governance, Hinrich Foundation Report, August.
94. Data should be processed for specified purposes, which are consistent with the mandates of the organization concerned and take into account the balancing of relevant rights, freedoms and interests. Data should not be processed in ways that are incompatible with such purposes.

3. **Opportunity: technology should enable farmers to easily access and use data.**
   Though challenging, adopting new platforms provides an opportunity for farmers.
   Platforms can permit a data steward to bring a level of control to the aggregate data of
   farmer groups using the platform to work together with external actors. Some platforms
   ensure that the legitimate owners of the data, or data stewards, can easily maintain
   or update that data. For example, an online dashboard can offer users the ability to
   choose who gets access to what specific data, authorizes parties to use specific data for a
   predetermined goal, and allows parties to withdraw authorization at any time.

4. **Data sovereignty: local and communal data sovereignty can transform and uplift
   farming communities, especially when they collect it for their own use.** This process
   shifts access, control, and ownership over data, and collectively owned knowledge
   and information, directly to local, tribal, and Indigenous communities. It transforms
   relationships with local and national authorities so that they can participate directly in
   decision making and help end exploitative practices, which is immensely important to self-
   determination and justice.

5. **Power: information and power asymmetries have multiple dimensions, requiring
   an adaptive and holistic approach.** It is important that agtech and data institutions are
   willing to learn and unlearn their assumptions to adapt processes and platforms, shifting
   towards respectful and non-extractive interactions. Effective reform hinges on clear
   concepts, careful analysis, and continued monitoring to consider how imperatives shift
   data governance priorities.

4.3 Data stewardship

**Data stewardship describes the role of individuals and organizations processing and using
data on behalf of the people whom the data impacts.** The existence of data stewards is predicated
upon a rights-preserving governance paradigm that recognizes data as an extension of people and
a reflection of one's environment. Data stewards have a social mandate to use data for the benefit
of the owner, often described in the legal context as a trust-based "fiduciary" relationship where the
data steward has a responsibility to put people and society's interests ahead of their own individual
or organizational interests. While data stewardship is gaining greater visibility in literature, it remains a
relatively nascent concept in practice. To better understand its trajectory in agriculture and in LMICs,
and in relation to data governance models, more research on the demand for data stewardship and
on the journey to becoming a data steward is needed.

**Crucial components of data stewardship include building strong relationships between parties
and engaging with communities.** To maintain farmers' trust, efforts that collect and integrate
data need to clearly explain what activities are being undertaken, their benefits, associated privacy
measures, and clear guidelines for addressing farmers' questions and concerns. An important way for
data stewards to build trust with farmers and farmer organizations and to create collaborative data
spaces is communicating the value of data. As one actor stated, "[farmers] were fine with data being
monetized but they were eager to understand what the value would be. Part of our process was to
create an environment of data collaboration with the farmer organizations." In some instances, data
stewards used legal tools such as non-disclosure agreements (NDAs) to build trust in instances of
sharing data with the private sector.

As coined by the Aapti Institute, "ecosystem enablers" support data stewards and intermediaries in developing a better data environment.[95] They build tech infrastructure (e.g., via DAOs—see below) or assist others in navigating the data economy. The ecosystem enabler is not involved in the data governance, but can assist farmers and others in data-related decisions, nurture a space for tech providers to grow, and facilitate feedback generation from farmers. Data stewards can also explore new partnerships and use cases to strengthen efforts and share learnings. These ecosystem enablers "can advocate for, enable hosting and/or [share] capabilities for data stewards or intermediaries, [and they] are engaged in building technological infrastructure or helping individuals, communities or organizations better understand their position in the data economy."[96]

> **Decentralized autonomous organizations (DAOs) and distributed ledger technology (DLT)**
>
> DAOs are an emerging form of bottom-up governance that democratizes ideals among its members, but without a central authority. DAOs typically use blockchain and smart contracts to digitize and automate processes, which lends security and transparency to further trust and ease audits. However, for DAOs to function equitably and for users to take full advantage of these automated governance mechanisms, users must have equal access to digital tools and the internet. As a result, DAOs have many barriers to viability in rural areas, and it is unclear if farmers and others are equipped to host this.
>
> - Datafund offers decentralized solutions to help businesses build or transform practices that guard personal data, with safe storage and data exchange. Individuals create their "datafund" to reclaim, own, and manage their data, which can be "sold" to one's datafund. Datafund states that users are incentivized to give data back and participate in a fair and ethical exchange.
> - "Data Unions DAO" is a community-owned and -controlled data marketplace. Users join via smart contracts for the purpose of aggregating and monetizing data, with explicit governance protocols that require voting on how and where data is used by the DAO (similar to Pool, Streamr, and Swash). Long-term viability remains to be seen; this solution requires a critical mass of users to generate data for sale. It also seems to have a limited focus on matters relating to governance, participation, and representation.
>
> SSIs (self-sovereign identities) based on blockchain or distributed ledger technology (DLT) provide another user-centric way to authenticate data and democratize data ownership and control.[97] Its governance structure is strongly tied to its architecture, as SSIs transfer governance burdens from people to technology. The development sector largely accepts DLT use, yet caution is warranted[98] because of the risks, ideological overenthusiasm, and Western legacies associated with DLTs. With its democratic, market-based incentives, the data cooperative model discussed in Section 4 serves as a social and legal framework for activities that DAOs and other DLT projects seek to enable. This includes accepting small, early-stage investment from participants and distributing financial rewards. A growing number of DLT projects are incorporated as cooperative entities. "Distributed cooperative organizations" (DisCOs) can also incorporate DLTs and cooperative values to reward work and public goods that otherwise go unrecognized.[99]

95. See the Aapti Institute's Stewardship Navigator.
96. Ibid.
97. The idea behind SSI is the ability for the identity holders (e.g., data subjects) to have better control over their identity data, with strong emphasis on data ownership, data portability, and data minimization.
98. Jutel, O. (2021). Blockchain humanitarianism and crypto-colonialism. *Patterns*, 100422.
99. Decentralized data governance can bolster data sharing and collaboration within and across data ecosystems, creating a trust framework via increased access to and control of data. For example, the Human Colossus Foundation states that "[a]t the heart of the decentralization movement is a shift in data governance away from obscure centralized intermediaries to all network users."# They offer a new "privacy-by-design data sharing model" built for a "dynamic data economy" of "consensual data flows".

⚬- Guiding lessons on data stewardship

1. **Start strong: set up an independent data steward role and define their responsibility from the outset.** Many data-related initiatives rely heavily on personal relationships and establishing trust. Formalizing this role to maintain the sustainability of the work is often an afterthought, if at all. Data stewards, with fiduciary responsibilities, can easily be appointed at the beginning of each new initiative.

2. **Duty of care: data stewards assume a duty of care and accountability to operate in the farmers' best interests.** A data steward must act independently from the supply chain and be easily accessible, enforcing boundaries and creating meaningful accountability and safety mechanisms. Stakeholders in the data value chain must understand the data steward's roles and responsibilities. The collective partners usually set out terms to ensure that the steward's work for the community and its businesses does not conflict with the farmers' interests.

3. **Custodianship: stewardship extends beyond data management.** Stewards seek to empower individuals and communities and provide them with the ability to own, control, or make decisions regarding their data, allowing them to more directly benefit from its value. Their work needs to be free from interference, specifically from other non-farmer stakeholders. At the same time, data stewards must work together with external actors to exercise a level of control over aggregate data within digital platforms. As data custodians, stewards often provide services and help visualize important details and patterns that may otherwise not be noticed.

4. **Monitoring opportunities and risks: a steward must address key challenges around data and data governance experienced by farmers.** The steward usually does not have access to personal data. The steward must ensure confirmation of consent before sharing data and can audit for misuse of data. Stewards must be on top of the challenges faced, take responsibility for creating demand for data, planning and oversight of the purpose, and data use. In the end, the data steward should foster a data ecosystem that builds agency for the farmers.

5. **Responsible data governance: data stewards provide partners or members with ethics and responsible data use guidelines and [principles of digital development](#).** Data stewards can create usage policies to codify, for example, the types of data protection rules. Some data stewards see opportunities to promote open data sharing along value chains. The steward must have clear guidelines and agreed-upon criteria to collect or process the data.

6. **Staying local: local and Indigenous knowledge and governance can help inform how data stewardship is put into practice.** This helps establish fair and equal access to data that reflects traditional rights and customs based on simple, transparent processes. This way, data stewards can value, share, and integrate traditional knowledge and solutions into decision making.

7. **Collaboration: data stewards work with communities and build governance structures** that can help them use data to inform and benefit the collective good. Data stewards can help farmers with market linkages and can connect them with other services, like the credit market. Data validation can support the adoption and sustainability of interventions. Data stewards can play an important role in obtaining bargaining power to renegotiate their position with authorities or other market players.

8. **Education: stewards have a responsibility to educate partner organizations or individuals** on the value of data and sensible data use, as well as identifying issues and following up with constant support and training. A data steward's role is also reflected in their commitment to increase literacy and create participatory governance structures.

9. **Trust: a steward provides a trusted environment through continued engagement.** Data stewards tend to be a neutral organization, always acting in farmers' best interest. Some may build trust via protocols that deliver data traceability, terms of use, and privacy protection in a decentralized data exchange. Directly building the capacity of data stewards within farmer organizations to maintain, validate, audit, and use data as an asset demonstrates to other stakeholders that the data is trustworthy.

10. **Power: information and power asymmetries have multiple dimensions, requiring an adaptive and holistic approach.** It is important that agtech and data institutions are willing to learn and unlearn their assumptions to adapt processes and platforms, shifting towards respectful and non-extractive interactions. Effective reform hinges on clear concepts, careful analysis, and continued monitoring to consider how imperatives shift data governance priorities.

4.4 Data sharing

Sharing accurate farm-level data is critical to creating financially viable and smallholder farmer engagement that improves farmer livelihoods. Those improvements depend on how farmers can participate in an equitable, participatory, and commercially viable way, while ensuring social and environmental outcomes. In this way, data stewardship and data sharing are conceptually linked: a data steward's revenue-generating structure is closely tied to safe, responsible sharing of data and the ways in which it imagines its relationship with individuals and communities.

Promoting data sharing requires working closely with farmers to understand their incentives and disincentives. User-centered data governance models should provide incentives for farmers to opt in to data sharing, including compensation, reciprocity of analyses and insights, or opportunities for close collaboration with third parties, though this approach requires aligning incentives with farmers' capacity and needs. One current disincentive is that agtech providers typically do not communicate the results of data sharing and aggregation to farmers. One actor expressed the importance of communicating the data insights in accessible, non-numeric ways: "Farmers don't understand what data means. We need people on the ground to explain this, to break things down and explain in the local language. We use [methods like] farmer meetings, radio, audio-visual animation to present the data in a format they understand."

> ➔ **Donors can exacerbate data sharing challenges in agriculture.**
> Donors maintain huge repositories of data from partner organizations and governments, but do not always grant access to farmers, nor do they utilize it efficiently—for themselves or within the community. Similarly, the structure of donor funding does not necessarily incentivize data sharing. The agtech grant funding space is designed to be competitive, not to create a collaborative alliance for grantees. As a result, data often remains siloed and development work is duplicative as a result.

FarmOS aims to unsettle established structures, enabling farmers to take control over data and software and empowering them via solidarity and co-learning in open-source tech.[100] FarmOS is supported by a loosely organized and transient group self-described as "non-hierarchical," with members including public sector researchers (e.g., USDA), academic researchers, and a variety of farmers. It is open to user modifications, in contrast to proprietary software, and can further integrate new tools. A variety of contributors have shaped the platform in interesting ways, distinguishing it from commercially developed tools.

> ➔ EU regulations encourage the creation of common [European Data Spaces](#) in an attempt to empower people and companies to stay in control of their own data. Data Spaces are an interconnected digital ecosystem that can guarantee the increasing availability of data, with safe and reliable access and sharing, via digital platforms and clear data governance. The Common European Data Spaces will ensure that as more data becomes available, the companies and individuals who generate that data remain in control of it.

💡 Guiding lessons on data sharing

1. **Reliable, consistent, and accessible data builds agency and resilience.** User-centric models present an opportunity and a requirement to incentivize farmers to willingly share their data, not extract it from them. These initiatives can build a system that gives farmers direct access to data and knowledge, making them more of a partner rather than a data source. Some initiatives have opted to compensate farmers as an incentive to share more and higher-quality data.

2. **Interoperability and defragmentation requires an understanding of data subjects and their context.** While a steward can merge disparate data from different actors into cohesive information and disseminate it to farmers and others, conversations on interoperability must come from those in power. This means a shift from extractive data practices towards an equitable sharing of resources and the meaningful inclusion of farmers to understand these conditions and better align actors and resources. Taking data out of silos, consolidating it into a shared platform, and translating it into useful information for local use helps encourage data sharing and ensure farmers are recognized and compensated as data custodians. Semantic description of data formats can provide the necessary infrastructure to enable decentralized and interoperable data governance.

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100. Supra at 189; Ettlinger, N. (2018). [Algorithmic affordances for productive resistance](#), *Big Data & Society*, 5(1), 2053951718771399.

3. **Safety and security underpin data governance, which helps ensure that data is shared securely and is not open to unauthorized use.** Many stewards do not own or store the data shared on their platform or any intellectual property derived from it. Instead, only the owners can use or modify the data, or distribute it from one party to another. Farmers can also manage their data-sharing authorizations and view their data streams. This could also mean that they set up their own data schema by choosing privacy settings and enforceable rules on PII, data localization, and encryption to create a baseline for access. Stewards should also audit the network for misuse of data.

4. **User-centric models aim to connect all parties, enabling farmers to gain maximum benefit and retain control over their own data and authorizations.** When all authorizations are brought together digitally on a platform farmers and tech providers know how their data is shared. It also gives farmers the option to manage their authorizations at any time.

5. **An environment that enables trust and cooperation among partners is a crucial component for successful data collaboration.** Programs and initiatives often deal with a lack of trust or a hesitancy to share data. Building and maintaining relationships with data stewards can open up a lot more data, though it also requires a shift to respectful and non-extractive interactions.

6. **Data governance should provide incentives for actors to move beyond their silos and understand the collective value of data sharing.** The current power dynamics within the digital economy of agriculture are centered around private actors. Some tools hold promise to shift power to farmers, for example, by helping overcome cumbersome procedures and provide access to a legal framework or identity documents required to gain access to credit. More research is needed to better understand the effects of this on the adaptability of actors and the supply chain. However, user-centric initiatives have demonstrated the ability to engage with the market from a more informed position, resulting in increased solidarity and cohesion among stakeholders.

7. **Governance models can incentivize agtech developers to create innovative applications** that give farmers and other parties more insights into their businesses. Data stewards can encourage innovations, which will eventually result in improved performance in terms of sustainability, profitability, and welfare.

4.5 Specific farmer-centric data governance approaches

Farmer-centric data governance approaches hold the potential to strengthen the position of farmers as equals, transition control over data to individuals and collectives, and build safeguards against privacy invasion, misuse, opacity, and other harms. These models can also generate better data sharing opportunities, counter fragmentation, increase data quality, and identify avenues for innovation. This section provides an overview of alternative farmer-centric data governance approaches: data collaboratives, data commons, data cooperatives, data fiduciary models and marketplaces, data trusts, and Indigenous data sovereignty. The Deep Dives address the building blocks set out above.

Data collaboratives

Data collaboratives are cross-sector, public-private collaborations aimed at data collection, sharing, and processing for societal benefit. They promote collaboration between diverse organizations, parties, and groups that move beyond data sharing to harness collective capacities and insights. Data collaboratives provide partners with the option to write their own rules on data exchange and stewardship, enabling trust and confidence between stakeholders. These can be initiatives where private-sector data is combined and shared with a data steward who manages access, which can enhance broad access to proprietary or siloed datasets that would otherwise fall outside their purview and help inform research or public sector decisions.

See Deep Dive on Data Collaboratives for more information.

- **Case study:** A Fertilizer Data Collaboration First Steps towards Farmer-Centricity
- **Case study:** A Multi-centric Data Governance Approach to Secure Land for Cocoa Farmers

Data commons

Data commons pool and share data as a resource with a high degree of community ownership and leadership. This approach addresses power imbalances by democratizing access to and the availability of data. They can be created with very different data and governance structures in mind, but a prerequisite is responsible stewardship (for which many refer to Ostrom's principles). In science communities, research data is often pooled within data commons to increase the impact of data held by any one individual. The discourse of data commons revolves around open access and new forms of data management. However, data commons are quite uncommon in agriculture.

See Deep Dive on Data Commons for more information.

- **Case study:** Farmer Cooperatives in Uganda United in a Data Collaborative

Data cooperatives

Data cooperatives (data co-ops) are a voluntary communal pooling of individuals' or organizations' data for mutual economic, social, and cultural benefit. They typically aspire to become a united, jointly owned, and democratically controlled autonomous association. Co-ops come in many forms, as they evolve out of their members' needs. This model works when stakeholders have a collective interest and are given an equal opportunity in governance and management. Data cooperatives grant farmers more control to manage, curate, and protect access to their data. At the same time, they offer an innovative approach to foster direct engagement and represent interests.

See Deep Dive on Data Cooperatives for more information.

- **Case study:** A Humanity-centric Journey Towards Digitally Empowered Fisheries
- **Case study:** A Farmer Data Cooperative for Cooperatives

Data fiduciary models and data marketplaces

Rooted in the concept of "duty of care," **data fiduciary models and marketplaces** are a governance model in which data stewards act as intermediaries to manage access to data among data subjects and data collectors. This creates a trusted environment between stakeholders and assists in addressing power imbalances. Relationship mediation via a data fiduciary allows for representative control, enabling individuals to gain more control over the use of their data. Similarly, data marketplaces are platforms where data providers (sellers) and data consumers (buyers) can meet, match, and trade their respective (data) assets and requirements. As such, the data marketplace itself

facilitates some of the fiduciary responsibilities described above. Marketplaces are emerging as new intermediaries and play an increasingly vital role in the data economy.

See Deep Dive on Data fiduciary models and marketplaces for more information.

- **Case study:** Building a Neutral Account Aggregator Data Ecosystem for Smallholder Farmers
- **Case study:** Enabling Farmers with a Farmer-centric Transparent Supply Chain and Premiums

Indigenous data sovereignty

Indigenous data sovereignty models shift access and control over data to Indigenous People. These approaches illustrate the importance of sovereignty, Indigenous knowledge, and cultural considerations to self-determination. Here, data stewardship entails governance on behalf of (and by a community) in the entire data lifecycle.

See Deep Dive on Indigenous Data Sovereignty.

- **Case study:** Indigenous Sovereignty in the Sacred Sierra through Carbon-neutral Coffee Cooperative
- **Case study:** When Traditional Stewards of Lands and Forests Become Stewards of their Data

Data trusts

Data trusts are legal mechanisms that provide independent stewardship of data for two or more parties. They can state their interests, needs, expectations, and desired outcomes for data use and mandate a trustee to pursue these aspirations. Trustees are required to act with undivided loyalty and dedication to the interests and aspirations of the beneficiaries. Almost any right can be held in trust, so long as the trust meets these conditions. These strong safeguards give data subjects confidence that their data rights are managed with care.

See Deep Dive on Data Trusts.

> ### Spotlight on financial sustainability for farmer-centric data governance approaches
>
> A critical challenge for agtech developers who apply a farmer-centric approach to data governance is financial viability, with some practitioners indicating that this was their biggest barrier to successfully develop their envisioned data governance approach. Many such initiatives are still exploratory and rely largely on donor funding. Setting up a sustainable business model that incentivizes data sharing and reuse may require:
>
> - **Alternative revenue streams** – Many farmer-centric initiatives have sought additional revenue streams, for example, by setting up a marketplace with commissions or a subscription fee model.[101] In theory, this allows the initiative to avoid co-optation and continue to pursue its aims. However, linking fiduciary responsibility to an incentive to sell products can be risky, in part because data stewards might need to run parallel businesses to make up for the cost. It is also not clear whether this approach will be viable and scalable in the long term.
> - **Data monetization** – Data monetization can work if members of a cooperative or any farmer organization are actively involved in collective decision making. It provides a fit-for-purpose revenue structure, and a data steward can also negotiate for better rights or a better bargaining position on behalf of its data subjects or members in this scenario.

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101. Most EU-based private sector initiatives generate revenue through subscription or membership models. Most private sector or cooperative (JoinData) initiatives generate revenue by incentivizing members to pay a small subscription fee for secure storage of and control over their data.

However, data monetization risks creating greater dependencies on data efficiency, as the final result might translate directly into the type of rewards that people receive. Applying property rights to personal data is also a concern, extending to the loss of privacy resulting from commercialization, expectations about the price for one's data, and undermining "personhood" because people "do not just own information; they are constituted by it."[102]

In 2019–2021, CABI led a proof-of-concept initiative to measure the value of data governance, with funding from the Bill & Melinda Gates Foundation.[103] Because determining the value of improved data governance is complex and difficult, the report applied a quantitative and qualitative model to create an innovative framework that provides insights on how and where value is created. The report demonstrated that it is possible to generate plausible and credible quantitative estimates of both the costs and benefits of data governance and access. The authors propose developing a practical tool to evaluate and implement good data governance practices by: (1) improving collection of effective information (see expert opinion early on) to inform the evaluation, and (2) embedding the Five Safes into strategic planning. They concluded that a new mixed-methods approach combining cost-benefit analysis with qualitative framing can generate insightful and meaningful results.

Farmobile claims to be the only company that offers farmers the option to sell their data. The farmer can share, download, and delete the data at any time. Farmers collect machine and agronomic data via a box in their tractors and a "passive uplink connection" (or "puck") that costs $1,250. Farmers can share this data with others—like employees, agronomists, consultants, or insurance agents—for their own benefit or sell it to interested buyers. Farmers certify the data and make it available for licensing as an additional revenue source that can be sold in their 'store'.[104]

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102. Hummel, P., Braun, M., & Dabrock, P. (2021). Own data? Ethical reflections on data ownership. *Philosophy & Technology*, 34(3), 545-572.
103. 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.
104. The farmer grants Farmobile "a royalty-free, perpetual, irrevocable, transferable, sublicensable, worldwide and non-exclusive license to access, reproduce, copy, distribute, aggregate, create derivative works of, adapt, translate, transmit, arrange, modify, host, bundle, and use the Farm Data for any or all of the following agree to purposes: (i) any internal purpose, including research and product development; (ii) create aggregate and/or de-identified information from Farm Data ("Aggregate Data"); (iii) offer personalized suggestions based on your Aggregate Data; and (iv) combine such aggregate and/or de-identified information with other de-identified Farm Data. [The farmer] further agrees that Farmobile is the exclusive owner of any Aggregate Data and, as such, has the exclusive right to use Aggregate Data for any purpose."

5. WAYS FORWARD: BEST PRACTICES AND ACTIONABLE RECOMMENDATIONS FOR DONORS, GOVERNMENTS, AND PRACTITIONERS

Section 5 provides a set of guidance tools for development actors on designing a user-centric, participatory data governance approach. In 5.1, the data governance journey map is a first attempt to capture these findings in actionable considerations. Section 5.2 is a first attempt to link the findings with an analysis of power to assess where each model fits and its ability to change or rebalance power dynamics. Lastly, 5.3 sums up the main findings in a set of actionable recommendations.

5.1 The data governance journey map

This section provides guidance to anyone in the development community looking to incorporate a user-centric, participatory data governance approach in their programs, projects, or activities. While this guidance can be used across programs, it is most appropriate for digital agriculture programs that work with farmers or farmer organizations and farmer data.

The journey map sets out recommendations and considerations at each stage of the data lifecycle to implement user-centric data governance. This will help data stewards and other actors working on data governance to consider and identify opportunities at each stage of the data lifecycle.

When commenting on farmer-centric data governance, one large donor representative stated, "This work could be particularly interesting if [staff] could think through the questions that I need to be asking when I'm thinking about data governance models. For example, if I have an agriculture program and a partner has an app for extension services,what are the types of questions I need to be asking before I greenlight this? What do I need to be looking for and monitoring to make sure there are no harms for farmers?"

The document identifies the key questions and considerations for designing a user-centric, participatory approach to data governance. This is not an implementation or prescriptive guidebook, nor does it provide for a one-size-fits-all type of solution. Data governance activities and models are contextual, dependent on many enabling factors, such as national regulation or cultural aspects, as well as other requirements and resources.

This document is intended to be a starting point for incorporating farmer-centric data governance models into digital agriculture programs and projects. It is divided into four main stages. This tool is meant to be flexible and can be reviewed or revised at any stage. **It is not expected that the program team will have clear answers to all these questions.** However, considering these questions will help clarify the expectations of a user-centric data governance approach, and how to design the same.

THE DATA GOVERNANCE JOURNEY MAP				
Steps	**Ask yourself**	**If the answer is**	**Take the following action**	**Resources**
Step 0	Does your program include data collection, data sharing, data analysis, data processing or data storage of information from or about farmers or farms or farm-related data, or do you work with service providers or partners that focus on any of these elements.	No	No further action is required	
		Yes	Please move to Step 1	
Step 1 A User-Centric Data Governance	**Understanding data governance** The following questions will help think through what kind of data governance activities and approaches will be relevant for your program, and how data ownership is managed. It is expected that answering these questions will help develop a more thoughtful approach to data governance within your program. Answering these questions should also help you consider whether user-centric data governance is relevant for your program. **Data collection** • **From whom will data be acquired? Who is the data subject?** A data subject is the person/object about whom/which data is being collected. This could be individuals (if data is collected about the farmer), communities (if data is collected about farming communities and practices), organizations (if data is collected about farmer organizations, their business practices, market prices, etc), governments (if data is collected about government pricing, government supplied inputs, training programs, etc.), businesses, through machines/sensors (in this case, the data may be collected through drones, from farm machines, etc.). The type of data subject might have an impact on the relevant data governance approach. Data governance approaches that deal with communities, rather than individuals, will need different structures and processes. To learn more about the data governance approaches, consider: • **How will informed consent be requested?** This could be written, verbal, or requested through digital means. • **What type of data will be collected?** This could include data that is personal, non-personal (e.g., related to the farm), de-identified personal, or sensitive. The type of data collected will have an impact on how data needs to be governed; e.g., personal data is tightly regulated in most jurisdictions, as compared to non-personal data. **Data storage** • **Who will store the data? Where will it be stored?** This could be the individual farmer themself, a data collector or enumerator, donor organization, the data steward, or another party. It could be stored, for example, on local servers, in the cloud, or on government servers. Data storage policies for a program may also be influenced by national data sovereignty or data localization laws. If you are unaware whether these exist in the country where you are working, it is best to do some research.			[USAID guidance on mapping your stakeholders](#) [Considerations for using data responsibly at USAID](#) [Who owns farmer data?](#) [Does data mean power for smallholder farmers?](#)

Steps	Ask yourself	If the answer is	Take the following action	Resources
Step 1 A User-Centric Data Governance	**Data ownership** • **Who owns this data?** This could be the data subject (the person whose data is being collected), the data collecting agency, the implementing agency, the program, or the government. In some cases, different parties may have different interpretations of ownership, so it is best to clarify with all involved parties upfront. For example, a digital service provider may consider any data submitted to its service by users to be its data, rather than that of the user. **Data sharing** • **Who will the data be shared with?** This could include individuals, tech providers, donor organizations, researchers, governments, civil society, businesses, or multiple different organizations. • **What type of data will be shared?** This could include data that is personal, non-personal (e.g., farm data), de-identified personal, or sensitive. **Relevant regulations** • **Are there any data regulations that would be relevant to the data collection, data storage, and data sharing process?** This could include data privacy laws, data localization norms, data protection regulations, etc. It is recommended that a preliminary analysis of the relevant national data laws be carried out at the beginning of the program.			
Step 1 B Farmer-Centric Data Governance	**Farmer-centric approaches to data governance** place farmers at the center of data initiatives, as beneficiaries, granting farmers and their communities greater agency over their outputs and meaningful participation shaped by their immediate need. These models hold the potential to strengthen the position of farmers and transition control over data to the data generators, rather than data collectors. These approaches safeguard against privacy invasion, data misuse, opacity, and other harms. They can also generate better data-sharing opportunities, counter data fragmentation, increase data quality, and identify avenues for innovation. **Based on the answers in Step 1A, is user-centric data governance relevant to your program?** In answering this question, please consider the following sub-questions: • *Is it important for your program to create more agency for farmers individually or as a collective?* • *Does your program intend to collect more credible, accurate data directly from farmers?* • *Is it important for your program to incorporate meaningful participation from farmers in the data collection, sharing, and processing?*	No	No further action is required However, please consider articulating why this is not important to your program.	
		Yes	Please move to Step 2	
		Maybe or unsure	Please move to Step 2	

Steps	Ask yourself	If the answer is	Take the following action	Resources
Step 2A Data Stewardship	**Understanding existing data governance norms** The following questions will help you better understand how data governance is currently being approached in the program. This will help you identify existing processes and structures, if any, that can help moderate data governance and if there is a need for an external party to steward data governance for this program. • **Does your program or any of its partners have processes/structures in place to govern data?** This could include an internal data steering committee, data sharing protocols, or a data review committee. Any pre-existing guidance on how to govern data within the program could be included here. • **Is there an existing system that facilitates data sharing while protecting individual rights?** This could include pre-existing data infrastructure that moderates data sharing or an organization through which data is collected and shared.			[USAID's policy on development data](#)
Step 2B Data Stewardship	**Data stewardship** is the responsible use, collection, and management of data in a participatory and rights-preserving way. A steward can create valuable patterns of data sharing, holding, privacy, and control across parties. Data stewards generally have four main responsibilities: (1) building data opportunities to unlock the value of data; (2) data management to ensure representation, usability, and quality; (3) defining guidelines for quality, usability, safety, and transparency; and (4) intermediating on behalf of individuals and communities to protect their data rights. Stewards ensure the quality of data sharing between parties, providing data collectors with more consistent and reliable data. **Does the program require a data steward?** In answering this question, please consider the following sub-questions: • *Are existing data governance systems sufficient to facilitate a user-centric data governance approach?* • *Is there a need for a third party (organization or individual) to ensure that individual data rights are protected while unlocking the value of data?* This could be a party who facilitates the sharing of data. Invariably, they work on behalf of the data subjects and can often hold fiduciary responsibilities towards the users.	No	No further action is required However, please consider articulating how you will develop a user-centric data governance model without a data steward.	[Trustworthy Data Stewardship Guidebook](#)
		Yes	Please move to Step 2	
		Maybe or unsure	Please move to Step 2	

| Steps	Ask yourself	If the answer is	Take the following action	Resources
Step 3 Designing a Data Stewardship	Once it is confirmed that a data steward is needed, there are different models of stewardship that might be relevant for the program. Answering these questions will help unpack the key elements of a data steward that will be relevant for this program. The answers to these questions will also help inform the commissioning of an organization to implement the data stewardship program. This stage has been further divided into four sections: objective/purpose, participation and accountability, services provided, and safeguards. **Step 3.1: Objective/Purpose** The following questions will help define the core objective of the data stewardship and its primary beneficiaries. This is not an exhaustive list, and there may be other categories of data use that may be relevant for the program. • **What is the core purpose of data stewardship?** This is the primary function of the data steward. Responsibilities could include user-driven research, collective bargaining, individual data empowerment, creation of commercial value, etc. • **Who is expected to primarily benefit from the data steward's functions?** Identify the individuals, collective, or organization(s) who will directly benefit from the functions of the data steward. • **Are there additional beneficiaries?** Identify the other parties involved in this governance model and what they gain from this model. • **Which organization will be leading the efforts of data stewardship?** This could be a farmer organization, academic institute, private company, community organization, civil society organization (CSO), or government agency. In some circumstances, this could be the individual farmer or a collective community. • **What is the primary value that will be received by sharing data?** Economic (ability to monetize data or data-based insights), social value (data shared by the individual or collective helps contribute to a common good, such as identifying better farm practices, identifying yield patterns, etc), research, data management (data shared allows data generators to better understand their farming patterns and allows them to use it to inform their practices), privacy, or other. **Step 3.2: Participation/Accountability** • **What level of participation might be requested from the data subjects?** Participation can range from keeping data subjects informed to consulting them, directly involving them, collaborating with them, or empowering them. This can be through direct representation (voting), delegated representation (through a fiduciary or representative organization), through consultation forum, merely informative (only inform the data subjects of what is being done without seeking their active inputs), etc. • **How will decisions related to data governance be made?** This can be via the data steward, direct voting, or an independent entity, through a representative body, such as a cooperative, or some other mechanism.			**To learn more about the different governance models, see the following reports:** [Exploring legal mechanisms for data stewardship](#) [Shifting power through data governance](#) [The Data Economy Lab](#)

Steps	Ask yourself	If the answer is	Take the following action	Resources
Step 3 Designing a Data Stewardship	• **What accountability or feedback mechanisms will be put in place?** This could include review processes, grievance redressal forums, ethics committees, or other mechanisms. **Step 3.3: Services Provided** • **What are the technical services that the data steward will provide?** This could include: • Technical infrastructure: steward hosts the data on a platform • Data access management: steward manages data access and use in a way that the data generator has greater control over data sharing • Insights and visualization: steward analyzes the data shared and provides insights that can be used to inform policy/group/individual decisions • Data protection: steward ensures data security • **Are there non-technical services that the data steward will provide?** This could include: • Data literacy and participation: provides training to the data generators on data rights and the value of the data • Collaboration between stakeholders: steward facilitates conversations between common entities to encourage data conversations and data sharing • Advocacy: steward provides a forum for data generators to discuss and voice their concerns/questions • Develop community structures for governance: steward facilitates community structures that can be used to collectively share data and bargain for better rights for the data generators **Step 3.4: Safeguards** • **What kind of data privacy measures will the data steward have to consider?** This can depend on the type of data shared, the regulations in the country, agreements with the data generators and the objective of the data sharing. • **How will the data steward address questions of data misuse/data breach?** This involves the legal obligations of the data steward in cases of misuse. Again, this can depend on the type of data being shared, the regulations in the country, the agreement with the data generators.			
Step 4 Monitoring and Evaluation (M&E)	The following section outlines the key considerations to keep in mind while designing a scope of work/terms of reference for the data steward and the consequent M&E plan. The goal here is to ensure that the M&E plan tracks the processes followed by the data steward and ensures they are in alignment with the project plan and implementation strategy. It should also capture the key impact areas of the data steward. This is not a guide to a comprehensive M&E plan. However, the list below will help clarify the expectations from the data steward and help the implementing organization think of key M&E metrics for a data steward.			

Steps	Ask yourself	If the answer is	Take the following action	Resources
Step 4 Monitoring and Evaluation (M&E)	**Key Considerations for a data steward M&E plan** • Measuring representation and participation in the operations of the data steward • Adherence to the project plan and implementation strategy • Adherence to the data handling strategy and data security protocol • Presence of effective accountability mechanisms for proper handling and storage of data • Risk management • Evaluation of the data steward›s relevance, impact, and sustainability • Documentation of lessons that can inform future data stewardship designs • Responses and feedback from the community of interest			
Step 5 Implementation	You may now use the information gathered above to guide your data governance approach. You may also use this to guide the design of any scope of work, terms of reference, or solicitation to invite an external party to help you implement user-centric data governance approaches, as well as to guide your program strategy and your M&E plan.			

5.2 Shifting power with farmer-centric data governance

Power is particularly important when talking about participation. Participatory approaches tend to be created top-down, and they are absorbed and reshaped by the contexts of power in which they reside. Before one can address the nature of power, one has to understand it better—especially how power influences how data is collected, analyzed, shared, and used. Given the geographical relations of power, it must increasingly be understood not only at the local, the national, or the global level, but also in their inter-relationship, with multiple intersecting actors, arenas, and stakeholder networks. Understanding how power influences any data affairs helps to deepen the understanding of the issue and construct more profound solutions. Whose knowledge is seen as legitimate affects how issues are constructed and how power is experienced. How one sees power is influenced by one's own position and identity. The entire donor community is part of this puzzle.

The powercube is a model to analyze levels, spaces, and forms of power, and their interrelationship.[105] It is a useful method to explore various aspects of power and how they interact. It can be used to think about the openings, levels, and strategies for farmers to exercise agency, e.g., to strengthen the power to act.
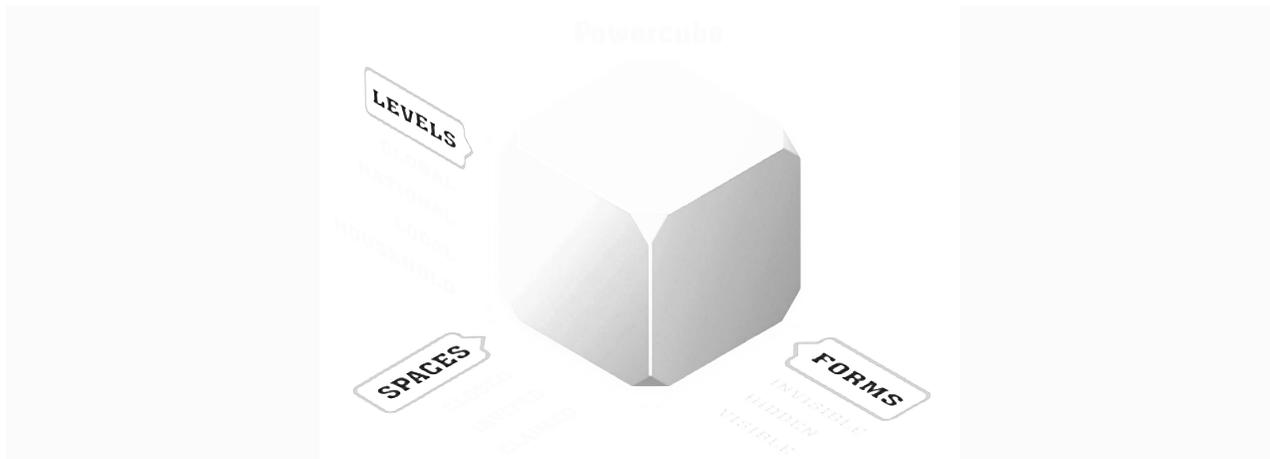
The powercube explores levels, spaces, and forms.[106] The powercube visually represents where change can happen and helps to plan entry points for action. This is drawn out in different interrelated dimensions.
- Forms refer to the ways in which power manifests itself, including its visible, hidden, and invisible forms.
- Spaces refers to the areas for participation and action—in other words closed, invited, and claimed spaces.
- Levels refers to the vertical layers of decision making and authority, including the local, national, and global.

This three-dimensional cube can be modified to fit the different continuums applied to farmer-centric, participatory data governance approaches used in this report. As such, the above diagram illustrates a first attempt at this.

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105. The powercube was created through the work of a number of people and builds on Steven Lukes (1974), Power: A Radical View. John Gaventa applied his work in Power and Powerlessness: Quiescence and Rebellion in an Appalachian Valley.
106. Gaventa, J. (2019). Applying power analysis: using the 'Powercube' to explore forms, levels and spaces. In *Power, Empowerment and Social Change* (pp. 117-138). Routledge.

5.3 Actionable recommendations

1. **Farmer-centric models should be integrated into digital agriculture programs** given their immense potential to shift the current paradigms of information imbalances to benefit farmers, communities, and societies. Farmer-centric models can empower farmers to gain more control and ownership over their data, create individual or collective agency, obtain negotiation power, and protect against data misuse.

2. **Trust needs to be fostered throughout the data lifecycle.** If digital agtech and data are to transform agrifood networks, establishing and maintaining trust is foundational for success in any engagement. Efforts that integrate data analysis and data collection tools must clearly explain what activities are being undertaken, their benefits, privacy measures, the process for asking questions, and how concerns are addressed and resolved. These issues should be addressed not only at the start of an engagement, but as a continuous and iterative process and service throughout the data lifecycle. Data insights must be communicated in a manner that is accessible to farmers.

3. **Farmer-centric, participatory data governance pursues more consistent, high-quality data sharing, interoperability, and defragmentation.** Its impact is dependent on design, deployment, and implementation done collaboratively and built on a foundation of trust. Trust creates true incentives and can overcome the increasing unwillingness of farmers to share data.

4. **Meaningful participation must strongly tie farmers to data governance.** Farmers, their communities, and especially women and Indigenous People should have visibility into practices and avenues of data governance. Feedback should contribute to decision making and strategic direction. This requires close monitoring to ensure that these requirements are met and sustained throughout the entire engagement. Participation in designing farmer-centric models will help ensure their relevance and fit to the particular context.

5. **The vital role of data stewards as trusted intermediaries within programs requires better understanding** between farmers, data collectors, and data subjects. Establishing a data steward enables farmers to have more controlled access over their data, to be shared for broader social benefit. Providing clarity on exact roles and fiduciary responsibilities requires more research.

6. **The local context, culture, and practices should determine which governance model is used.** Context helps define which data governance approaches are appropriate; user-centric models should not be rolled out in generic fashion. Governance models should also focus on existing social relations rather than suggesting ideal mechanisms. Communities often know best how to organize and govern; learning and implementation should follow systematic observation of communities, with different vantage points.[107] Often, information and knowledge sharing in agriculture often happens via less formal constructs. Communal data governance requires a lot more report.

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107. See the Deep Dive on Indigenous Data Sovereignty.

7. **Farmer-centric models should not be seen as a panacea "one-size-fits-all" solution.**
    Applications of farmer-centric models tend to be hybrid, iterative, and adaptive. The practical implementation of data governance or technology is a lot more ambiguous and variable than theory often suggests. A meaningful farmer-centric data ecosystem should be built on a range of approaches. It is important to not get carried away by any hype and focus on identifying exactly what is needed.

8. **More research is needed to identify training and capacity-building needs and sustainability of user-centric data governance initiatives.** The models described in this paper are prominent examples in a growing field of opportunities, with new organizations specializing in navigating these avenues. There is a need to develop data governance skills training aimed at practitioners and farmers to assess, implement, refine, and continue to share best practices of data governance initiatives. Revenue streams, like a fee structure that aligns money with interests, should be explored further.

6. CONCLUSION

For a long time, Indigenous Peoples and local communities stewarded farmlands using their governance, cultures, and traditional knowledge arrangements. As demonstrated, their ability to pursue their chosen progress and priorities is threatened more than ever by the accelerating drive for resources. Securing critical community-based ownership rights can accelerate local and global progress towards development goals. It can ensure that farmlands are sustainably and equitably managed, used, and protected. Fostering strong collaboration between farmers, community organizations, and other stakeholders is imperative to shift the paradigm. Securing data rights of local communities and women, and prioritizing ownership and agency over their rights with the use of user-centric, participatory data governance approaches, represents one of the most effective ways to ensure food security, equity, and climate-resilient prosperity.

Whether it is program implementation or data governance, those affected have the greatest understanding of the challenges and opportunities and must be actively involved in order to develop effective solutions. Who controls data governance approaches and their meaning has implications for how people are represented and included in processes and decisions. This affects what gets attention, by whom, and ultimately how the data is collected, analyzed, interpreted, and presented. The enabling environment, purpose, and bias of those in charge affect how data governance is designed. Agricultural data governance can therefore either reinforce or rebalance power relations in society. When farmers and their communities, especially those who have been historically excluded from decision making, actively participate in decisions about data governance, they gain greater access to the benefits of data.

Stronger mechanisms for data governance can give farmers the right to decide how their data will be used, without necessarily requiring them to take ownership. Data can only be empowering when it truly affords great control over its use and governance. User-centric, participatory data governance can take many shapes. For example, data stewards can maximize the individual or collective benefit and unlock many opportunities through these data governance approaches. Data stewards should owe their farming members their undivided loyalty and should not engage in conflicting activities without consent. User-centric, participatory data governance can take many shapes. Where possible, decisions around data governance should involve the members of the communities affected, and strive to reach the top of Arnstein's ladder of participation (see Section 3.1).

Farmer-centric, participatory governance improves the understanding of ethical and practical concerns regarding data collection, sharing, and use. It can also inform and affect the data quality within a program and strengthen the governance of the technology itself through information from diverse perspectives and experiences. Farmer-centric models can adapt and manage more easily to address risks associated with complex and sensitive data. Participation can also reduce the long-term costs for technology developers and designers.

It is important to note that while farmer-centricity and participation may take different forms or have different outcomes, they are usually not mutually exclusive and can often complement each other. There is no single "right" way to do this, and effective data governance is not a "one-size-fits all" solution or model. The complexity of local contexts and current data governance paradigms

can't be resolved by an "off-the-shelf" approach. There are different types, approaches, methods or means that afford very different levels of power. More testing, development, investment, and knowledge building is needed. More practical implementation of each approach, research, trialing, and guidance production for practitioners is also needed.

Data is the output of collective knowledge and interrelational networks. As more digital technologies permeate and inform agricultural activities, enabling more detailed analysis and services, the need for farmer-centric, participatory governance models and deliberation on the use of data will only increase significantly. This must incorporate genuine knowledge sharing, transparency, and acknowledgement of the myriad networks of labor that are required to develop these digital and data systems. Community-based data governance has highlighted the need to be multi-centric and human-centric,[108] to enable data flows and empower individuals and communities to make informed decisions about their data, especially in LMICs, where relationships are often marked by unequal power and agency. In unequal environments, user-centric, participatory data governance approaches are required to seek the required change in which the interests of farmers and their communities will be incorporated.

108. User- vs. human- vs. humanity-centricity. User-centricity focuses on individual users, usually in relation to user-friendly designs, products, and useful, relevant, profitable outcomes. Human-centricity adds people as its central focus, which lends itself more to "social problem solving" and takes a systematic view. Humanity-centered approaches focus on benefiting humanity, society, and communities at large. It goes beyond the others as it includes the entire ecosystem of people and the physical environment.

APPENDICES

Appendix I. Case studies on farmer-centric data governance approaches

Below follows a brief overview of all the case studies developed in this report.

A Fertilizer Data Collaborative's First Steps Towards Farmer-Centricity in Nigeria

Public and private partners in the Visualizing Insights on Fertilizer for African Agriculture (VIFAA) program, led by Development Gateway and the International Fertilizer Development Center (IFDC), have been working together since 2017 to co-design dashboards and tools to improve, manage, and visualize fertilizer data in Nigeria.[109] VIFAA was developed to address the supply, demand, and use of fertilizer data. The program involves a data collaborative governance approach with the aim to increase access to accurate quality data owned by fertilizer companies, farmers, and public agencies; build trust and create data sharing opportunities; and improve national and local public-, private-, and farm-level decision making for the purpose of sector-wide benefit. The case study provides further insights into private sector collaboration, trust building, and data stewardship.

A Humanity-centric Journey Towards Digitally Empowered Fisheries

Abalobi and PescaData are two initiatives aimed at supporting sustainable fishing communities by co-creating a digital ecosystem for smallholder fishers and key stakeholders and achieving marine conservation outcomes in South Africa, Mexico, and beyond. The unique, innovative approach of a data and platform cooperative for fisheries aims to collect data, establish a knowledge base, digitally support fishing communities, create market opportunities, and better inform public decision making. The tools are built through extensive participatory, iterative design to create a usable solution, resulting in empowered fishing communities, with agency and ownership over data and data governance. This case study provides insights into data stewardship, participation and collaboration, knowledge sharing, and platform and data cooperatives.

A Multi-centric Data Governance Approach to Secure Land for Cocoa Farmers

As part of several large consortiums, including industry partners,[110] Meridia has taken up important data stewardship activities to secure land rights and tackle issues related to agroforestry for cocoa farmers and cooperatives in West Africa and Indonesia. The process applies data collaborative governance and data stewardship activities between key actors in the cocoa supply chain to achieve agency, control, and ownership for smallholder farmers over their land rights and documentation. The case study provides insights into various public-private data collaborative approaches, "multi-centric" data governance, data ownership, and data stewardship.

An Agricultural Data Cooperative for Farmers and Farmer Cooperatives

JoinData began in 2017 as the first data cooperative, dedicated to Dutch farmers, with the aim to make sure that any farmer can pool, control, connect, and share data, in a safe, secure and fair way, with agribusiness and innovation partners and to make sure the data and benefits flow back to the farmer. The data cooperative facilitates the exchange of data in a safe and transparent way. JoinData has

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109. "Vifaa" means "tool" in Swahili, but this program will go beyond delivering dashboards—it will also strengthen data supply and support improved policies and investments to increase fertilizer affordability, availability, and quality.
110. Such as Mondelēz International, Cargill, The Hershey Company, Unilever, Barry Callebaut Group, Cocoa Horizons Foundation, the German Cooperation (implemented by GIZ GmbH), Ferrero, and national governments.

created an independent platform where farmers are able to take full advantage of digital innovations in agriculture, sharing data safely, fairly, and above all, with the farmer himself at the helm. The case study provides insights into data cooperativism and its governance structure, data fragmentation, and value chain development, as well as transparency and control over data.

Building a Neutral Account Aggregator Data Ecosystem for Smallholder Farmers

Digital Green launched FarmStack in 2021 as a data platform dedicated to fostering coordination and data sharing across the agricultural ecosystem in India and Ethiopia—between farmers and agribusinesses—via a fiduciary model that ensures the data and benefits flow back to the farmer. The account aggregator model creates data collaborative ecosystems designed to build agency for farmers. The case study provides insights into data exchange layers, score cards or marketplaces, data ownership, data defragmentation, and value chain development.

Enabling Farmers with a Farmer-centric Transparent Supply Chain and Premiums

Fairfood and Verstegen Spices & Sauces started a collaboration in 2019 to contribute to a transparent and meaningful nutmeg spice supply chain from farmer to consumer in North Sulawesi, Indonesia. The initiative takes an inclusive, farmer-centric data collaborative approach through digitization and data governance, with the aim to improve the position and livelihoods of smallholders and their communities. The fiduciary data stewardship role played by Fairfood has resulted in increased trust and confidence in data sharing, better communication of data claims and benefits to stakeholders, improved consent and understanding of data ownership, as well as a stronger negotiating position for farmers and ensuring that farmers' voices are heard in the use and collection of their data. The initiative developed a traceability platform called Trace and a Quality and Data Premium product to achieve these goals. This case study provides insights into developing transparent value chains; incentives for data sharing; a first step to human, digital, and financial inclusion; data ownership; and data monetization.

Farmer Cooperatives in Uganda United in a Data Collaborative

A consortium of public and private organizations carried out a pilot in 2019–2022 with the Ministry of Trade, Industry and Cooperatives (MTIC) in Uganda aiming to build a coordinated National Cooperative Database with effective data governance, ultimately to professionalize farmer cooperatives. The governance structure resembles and aspires to be that of a data commons approach.[111] For now, the database is structured more as a data collaborative data governance approach, aiming to help actors understand the value of harnessing the power of data, create a sense of empowerment, and establish negotiation power and agency for farmer organizations. This case study provides insights into data commons, the challenges of multistakeholder data collection, participation with farmer cooperatives, and data ownership and control.

Utilizing Coffee Supply Chains to Protect Coffee and Sacred Lands and Sequester Carbon

The ANEI (Association of Indigenous and Campesino Agroecological coffee producers), with help from Ethos Agriculture, applied an approach where ecocentric values, bio-cultural identity, and Indigenous knowledge are woven into governance, value chain improvement, and conservation in order to reclaim sustainability from externally imposed paradigms or pre-determined governance activities.

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111. Data commons co-locate data as a digital resource, to store, manage, share, access, and interact with collectively owned data, with and by a community. Data commons are a specific type of commons, for a field or discipline, to accelerate access and discoverability to increase the impact and benefits of the data. For more information, see the Deep Dive on Data Commons.

This involves aspects of Indigenous data governance and data cooperatives aiming to demonstrate a process for smallholder farmers and their communities in the Sierra Nevada, Colombia, to gain agency in defining their digital paths, data governance, and sustainability priorities and future goals. This "co-design" allows for an alignment of values to better coordinate resources. The case study gives insights into participatory processes, eco-centricity, carbon trading, data co-ops, and Indigenous data governance.

When Traditional Stewards of Lands and Forests Become Stewards of their Data

The Cadasta Foundation, Waatavaran, and Esri work together to create a fiduciary and communal data governance approach based on Indigenous and traditional knowledge governance with the aim to secure land and forest rights of Indigenous and local communities in West India and Indonesia. The process covers a data stewardship model where the local community stewards and owns their data. The case study provides insights into data stewardship, communal data control and ownership, meaningful deliberative participation, and Indigenous data governance.

Appendix II. Methodology

Key Interviews. To further our insights we have held **54** semi-structured, 1-on-1 interviews (of 45 min.). The interviews have helped us gain insights from internal and external stakeholders, and actual practitioners. We interviewed a diverse set of people across regions and in different capacities in the agri-business cycle to ensure that unique issues faced by each set of stakeholders are highlighted (government officials, ngo's, donors, private sector actors, agtech developers). The interviews helped identify and connect to other ongoing policy related processes, partners and projects of relevance to USAID/BMGF.

Literature review. We have adopted an iterative methodology to the literature review that allows redefinition of the literature search criteria as we become more conversant with the extant literature. The five-step scoping methodology framework developed by Arksey and O'Malley and the Preferred Reporting of Items for Systematic Review and Meta-Analysis ([PRISMA](#)) methodology served as guides to structure this review process. To ensure we comprehensively capture publications relating to our research query, an iterative methodology was adopted by cross-referencing keywords related to the review topic: digital agriculture*, data governance*, data ownership*, data sharing*, alternative data governance*, data cooperatives*, data collaboratives*, data trust*, data commons*, etc. Keyword search was performed using the following bibliographic databases: JSTOR and Google Scholar.

Discourse analysis. The engagement with experts and the case studies in this report have guided our perspectives beyond engaging with literature. This allowed our findings to identify and speak to and with the relevant literature rather than being passively identified by it. We took a discourse analysis (DA) approach and interrogated the status quo and the prevailing norms and values driving decisions with impacts on farmers and wider society.[112] DA is an examination of language and its implicit implications. It is important to be aware of language and implications of terms used, on framing and ideas, and DA brings these to attention. More often, DA examines issues of power and ideology. The method chosen in this report identifies key language, rules, norms, and values and assumptions.

- Key language—words that are used frequently, or in multiple ways, or laden with implicit value positions
- Rules—what should or should not be done and what is right and wrong
- Norms—what is accepted as usual
- Values and assumptions—unconscious ideas and associations and what is valued and prioritized in decision making

DA can reveal how simple and innocent language can actually have powerful effects on perceptions of good or bad, right or wrong, or who is included and excluded, which would otherwise be normalized and invisible and unable to be challenged. DA challenges the fundamental framing of ideas that may otherwise lead to the continuation of the status quo and perpetuating existing inequalities, issues which have held back agriculture in the past, especially in terms of adoption of new technologies that did not fully account for heterogeneous farmer styles, values, experiences, histories, and needs. Our aim was to be attentive to specificity and difference, which means resisting any urge to cleanly sum up epochs. Instead, this study offers a series of concrete examples that, when combined with and overlaid alongside other observations, reveal dimensions of data governance approaches that operate outside the conventional literature.

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112. Jørgensen, M., Phillips, L. (2002). [Discourse analysis as theory and method](#). Sage.

Database of agtech actors. The research team, in its review of the landscape of companies, organizations, platforms, governance systems, and others in the agtech sector, compiled its findings into an extensive database. This database consists of 462 records. Breakdown by category shows most companies representing extension and advisory services (167), followed by market linkages (92), precision agriculture (91), digital procurement (46), financial access (42), and other/unclassified (50) (with some companies representing more than one category). The breakdown of organizations across 15 unique governance models show the majority categorized as agtech (343), data marketplaces (34), and data collaboratives (20). The database also includes a breakdown of organizations across 69 unique types (including some multiple associations), with most representing as agricultural marketplace (86), farm data MIS/decision support tool (83), market information (73), finance services (55), and extension services (55).

Additionally, the database poses the following questions:
- What do they do?
- Primary or secondary data collection?
- Do they collect data from users?
- Who owns/controls the data?
- Data protection/privacy statement?
- Geographic location
- What are the [user-centric] models and use cases?
- What is their business model?

Limitations of the approach and future research

Some seminal work has been done in unpacking opposing or alternative models of governance, and it is worth acknowledging their relevance.[113] This research has laid out, consolidated, and provided many individuals working on data governance and related subjects, in the development sector and beyond, with better theoretical understanding of the possibilities and opportunities. That is not to imply that the general community involved in these subjects has created a crystallized understanding of these models. A lot more deliberation (around definition and meaning, for example) and exploration (outside anglophone discourse) is still needed.

Beyond the theory, what certainly needs more study, is a better understanding and awareness of the practical application of data governance approaches that try to oppose the above-mentioned paradigms, especially in LMICs. As some have noted, translating theoretical data governance concepts into the real world is nearly always inconceivable.[114] Part 3 of this report is an attempt to bridge the theory into practice, while doing justice to the real-world application of governance by practitioners who are the change makers of paradigms.

LMICs present a reality that often stands further from the theory that is based on Western governance and ideology. This following section is an attempt to collect the most essential elements and enabling factors that make up the different user-centric, participatory data governance models and environment. The lens on agriculture makes this report more seminal, as this is often an easily overlooked sector, usually dominated by traditional practices and players—although we have seen this is rapidly changing.

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113. By the likes of the Aapti Institute, the Open Data Institute, the Mozilla Foundation, the Ada Lovelace Institute, and the NYU Govlab.
114. Baack, S., Maxwell. M., (2020). Who is Innovating? | Global Landscape Scan and Analysis of Initiatives, Mozilla Insights.

It can be argued that many studies and analysis remain stuck in generalities. Concluding often that certain approaches or institutions are "participatory," "inclusive," "bottom-up," or create "agency" and change "power dynamics." Understandably, this is hard to quantify or define accurately. Lingering within these notions or generalizations is certainly not helpful. Section 3 is not irreproachable in that sense, but it offers an attempt to make some measurable and practical guidance. Words like "empowerment," "collaboration," or "control" are used often without deliberate, accurate, or representative thought. They quickly become hollow, without meaning, and can have adversarial effects beyond their own space.

Appendix III. Report on Stakeholder Consultations

Main Research Topic	Key Takeaways
Importance of Farmer-centric Data Governance	• Data governance was identified as an important tool in ensuring better quality of data, ensuring transparency, and facilitating informed consent. • User-centric data governance can help build trust amongst the different stakeholders. • Tools such as data sharing agreements, consent forms, and robust technical solutions can help facilitate good data governance. • Farmer-centric data governance helps to provide farmers with clear ownership and tangible value for data and better understanding of the supply chain.
	More data is needed to become farmer-centric, and better farmer-engagement is needed to collect better data.
	• Farmer-centric data governance can help farmers turn data into an asset that they can use and manage themselves to create value. • A multi-centric approach balances and considers local, farmer-specific needs and agency, up to larger, global infrastructures, needs for interoperability and data standardization, and tries to avoid the tension between those in the entire value chain. • Stakeholders need to consider a multinational perspective—including, but perhaps also in opposition to a focused, farmer-centric response—to address the entire supply chain. While a farmer-centric approach does focus on agency for farmers, it may become a blind spot to the regulatory, policy, or business model requirements for larger organizations to participate.
	To involve all stakeholders and become more participatory, it is needed to move from user-centric, to human-centric, to humanity-centric data governance. There is an opportunity and, in every case, a requirement to incentivize fishers to share their data—who are already doing this in an already extractive industry—and build toward a system that more immediately gives them access to that data and knowledge as a means to make them more partners than beneficiaries and respond to the pressing social and environmental concerns faster than policy might.
	Farmer-centric data governance allows farmers and cooperatives to maintain control of access and distribution of their data. This could positively shift away from known issues of survey fatigue, inefficiency, cost saving, and conflicted narratives. In this paradigm shift, cooperatives can create a business model around this access, control, and distribution of data. The question is if new modalities would be required inside private institutions, such as third-party auditors or changes to certification and other compliance models currently handled internally on data they captured?
	Community engagement, control, and ownership of data is central to many farmer-centric data governance approaches.
Key Components for Success	• Farmer-centric data governance helps to build trusted partnerships across supply chains. • Open dialogue, informed consent, and building the capacity of partners to participate in the data value chain helps build trust and engagement.

Main Research Topic	Key Takeaways
Key Components for Success	The myriad of stakeholders have slightly different viewpoints, yet their capacity differs quite extensively. The companies have taken it upon themselves to collect data and train and sensitize farmers to become more digitally and data literate, as this is also in their own interest. All stakeholders seem to do their part in data collection and advocacy, be it not in a very collaborative and coherent manner.
	Success means underscoring the need for data that is fit for purpose and available, increasing farmer buy-in, and capacity building, but not losing sight of what is desirable for and required of larger organizations and actors from a business purpose and regulatory perspective.
	These fisher communities and collectives are not homogenous. Increasing buy-in is not about applying successes from elsewhere but connecting with them from the very first stages to understand their context and how to craft incentives and build trust.
	We have to be clearer between external actors with differing tools, objectives, and goals, about our collective definition of «farmer-centric.» Does this only mean delivering more control and data ownership to the farmers over their personal information, or should it include more avenues for or at least pathways toward financial viability and sustainability? What additional metrics and rewards could data collectors and companies provide for continued use?
Challenges and Pitfalls	• Resource constraints such as limited internet, stability of the technical application, etc., pose a challenge to implementing advanced data solutions. • Aligning complexity of the technology with the limited data literacy and training of farmers poses implementation problems.
	Emphasis on squaring the international regulatory requirements that larger actors are beholden to with the "fit for purpose" data points for farmers
	At the core of a much-needed push for interoperability is understanding that local context. Those conversations must come from a place of those in power being willing to both learn from fishers and unlearn their own assumptions to adapt processes and platforms.
	Many resources—in terms of capacity building, certification, and general engagement—are needed to collect reliable, high-quality data. The digital data collection tools are not on par to overcome some of the challenges. Engagement with farmers can be improved by being more clear about the purpose and process, and can help avoid data fatigue.
	• Building digitization processes at the community level is difficult, both from an administrative and community angle. Everyone wants to discuss concepts of data policy, however, it is difficult to implement that when there is limited digitisation, capacity, and adoption at the local level. • Determining how to access and use data to guide macro-level decisions, while respecting data privacy and data ownership norms, can be quite difficult.

Main Research Topic	Key Takeaways
Role of a data steward	• Data stewards play an important leadership role in guiding equitable data solutions. • A data steward must provide clarity on the data management process, their roles and responsibilities. • At the same time, flexibility and accessibility of the data steward is important to respond to evolving needs of the stakeholders. • The different actors in the value chain must understand the role and responsibilities of the steward. The steward must act independent from the supply chain.
	Formalizing and establishing an organization that can do this work is essential. This steward needs to be able to involve all stakeholders (private and public sector, as well as farmers). The steward has important responsibilities in regards to data collection and security. A foundation for collaboration and involvement of all stakeholders needs to be fostered, based on sincerity.
	The data steward is responsible for planning and oversight of data purpose and use, as stated in the terms set out by the collective. The steward creates demand for the data. The importance of the data steward is not just as the owner or controller of data, but the owner of setting and enforcing boundaries.
	• Trust, education, and development of public goods emerge as key themes for the data steward. A data steward provides a trusted environment within which better access to data is facilitated, and this is used to inform decision making support systems. • As a data steward, they work with the community to support them and build governance structures that can help use data in a way that informs and benefits the collective good.
Data Ownership and Control	• Control over collection, use, and analysis of data is important; it must include ability to visualize data collected, awareness of the analysis and use of data, and flexibility to modify or delete data or opt out of data collection as required. • Informed consent is crucial to data collection.
	Based on the type of data, farmers should be able to be the custodian of their data and should be able to understand what their data means. Data that is not held by farmers should flow back to them.
	Ownership is not just about who stores and decides how the data is shared but who takes on the full role of governance, especially including oversight of rules and boundaries.
	In trying to move to a more cooperative approach, carefully defining agency and sovereignty can help us distinguish between «mine» and «ours»—in other words, how to create value for fishers (or farmers) in a way that can more freely contribute to similar initiatives and local collectives. Conversations on data ownership should therefore include how data is generated and used, how value is created and shared, and what other opportunities they provide for the owner (i.e. sovereignty, control and agency).
	Ideally the farmer and co-op have ownership and responsibility of the data. Ownership handed over to farmers would benefit the company. Data ownership and the meaning of it depends partially on the type of work that is being done. The data providers/farmers/farmer cooperatives need to have access to the data first of all. It includes being able to understand the data and the processes.

Main Research Topic	Key Takeaways
Sustainability	• Developing collaborative incentives which add business value for all partners is important for financial viability. • Clarity on the roles of different partners and investments in capacity building helps build operational sustainability.
	• Defining what is the most appropriate governance structure must not stop at simply greater agency for the farmers, but utility for them and the other actors in the supply chain. • Any farmer-centric model will need to meet and align with the business need if it is to collaborate with the private sector. There should be a sector-wide public-private movement towards more public-driven data models. The system today is not sufficient, nor appropriate. A multi-centric approach is not a "nice-to-have,"—it is a change we need to make industry-wide and in collaboration with governments. • Viability and sustainability is connected to trust and ownership of farmers.
	Funding in this space is limiting growth. Most grants create temporary value, and there aren›t many, if any, grants for creating interoperability between teams and platforms, so data remains siloed and the work duplicative as a result. That duplicity creates harm for future initiatives.
	It is still hard to comprehend the financial viability of these initiatives. While many investments are made in collecting better data and providing services for farmers, there still are questions about how this translates to viability and sustainability. Work is being done with sustainability premiums and incentivizing better data sharing. The market may need to find a way to pay for it and contribute to financial sustainability.
	Development actors need a justice perspective, especially for the indigenous/tribal communities to whom the state owes a huge debt. Focusing on market viability may not be ideal—there is some opportunity, but this is not the focus.

Appendix IV. Report on Policy Dialogue

Policy Dialogue #1

Participants identified farmer-centric data governance as an area of great interest, yet with limited guidance and practical knowledge. Participants were eager to learn more about building consent, ownership models that empower farmers, and how to acknowledge the importance of individual farmers and their communities, in developing equitable models of data collection, analysis or use. **Power, consent, trust, incentives,** and **effective communication** emerged as important themes across all conversations.

Key Takeaways

- Ensuring **equitable power dynamics** in data sharing, collection, and access was highlighted as an important concern. Farmer participation without improving unequal power equations has limited value. Higher involvement of farmers, improved data literacy among farmers, ensuring greater control by farmers over data use, and better communication of incentives of data use/sharing were mentioned as possible ways to tackle this concern. Consent alone might not be enough; participants expressed interest in better understanding what kind of consent is valuable and recognising the limits of individual consent as the bedrock of participation.

- While there was a lot of interest in **data stewardship**, there was limited clarity on the implementation, and the types of capacities needed for a data steward. Participants acknowledged that a one-size-fits-all approach would not work, and stewardships would need to be designed keeping context, resources, and data in mind. While some participants identified existing organizations that could potentially act as data stewards, there was limited data literacy or capacity to carry out that role in their current form.

- **Trust** emerged as an important factor to foster meaningful participation and in designing data stewardship. A data steward needs to foster the trust of all stakeholders; both formal and informal trust building mechanisms/processes need to be built into the data stewardship.

- Creating and communicating the right **incentives for data sharing, collection,** and **use** was identified as an important lever for improved sharing and interoperability. Merely collecting more data is not enough—the focus needs to be on collecting good-quality data that informs decision making in the private or public sector. Participants shared examples of data sharing as a paid service that helped produce better quality data. There was also interest in creating common standards/language around the value of data.

Policy Dialogue #2

Similar to the earlier policy dialogue, here too there was an acknowledgement for more clarity and guidance on farmer-centric data governance as an area of interest and an area of growing importance for all present. **Consent, incentives, user-based design, participation,** and **practical models of engagement** emerged as important themes.

Key Takeaways

- **User-centric design** is necessary for building data models and products that farmers would be actively involved in. Current models are developer-focused, with community participation as an afterthought. Many participants felt strongly that this paradigm needs changing. One participant

expressed concern that the language around incentives and capacity development sees the farmer as external to, or the recipient of, the data process. Examples of farmer cooperatives in India were used to highlight products that were developed by, with, and for farmers and which the data community needed to model itself on.

- The role of the **data steward** is acknowledged as a complicated one—with the need to represent different interests, communicate with and convene various stakeholders, defining standards and certifications, promoting transparency, etc. Participants identified different needs for the data steward depending on the context and the nature of data they were working with. This reiterates that a variety of stewardship approaches need to be developed, each of which value the principles of transparency, stakeholder management and guidance, fiduciary duty, communication, data discovery, etc.

- While **consent** is an important theme, questions are raised on its impact. Data collection, data models, and products can impact farmers who choose not to participate also—there is limited engagement on the ethical and practical questions surrounding these individuals.

- The group identified **development of common policies, standards** and **taxonomy** as a key lever for better data sharing and interoperability. Open source dashboards that could promote re-use of data; use of low-cost apps, such as ODK; inter-organizational collaboration; core data registries;and focus on sharing best practices across organizations were mentioned as possible ways to develop a common understanding of data-sharing standards and practices.