Digital Agriculture Roadmap 2032

FOREWORD

Statement from Minister of Agriculture

Ethiopia is entering a transformative era in agriculture, aiming to revolutionize a sector vital to our economy and essential for our people. In 2022, we successfully began this transformation with the development of the Digital Agriculture Extension and Advisory Services (DAEAS) roadmap. The Digital Agriculture Roadmap (DAR) aims to accelerate our transformation efforts by expanding them beyond advisory to cover the entire agriculture value chain.

The Digital Agriculture Roadmap (DAR) provides clear recommendations on which digital use cases should be prioritized and the necessary initiatives in the enabling environment to ensure these use cases are impactful. The roadmap has prioritized 12 use cases and initiatives that are most feasible in the current context and are also projected to achieve the most impact on farmers and pastoralists.

Our goal is straightforward: to equip every Ethiopian farmer and pastoralist with the digital tools and resources to succeed. This includes, but is not limited to, developing strong digital infrastructure, enhancing digital literacy, and improving access to quality inputs and financial services. These steps will help our farmers and pastoralists become more productive and resilient as well as ready to face challenges like climate change and global market shocks.

This effort is a team endeavor, involving various stakeholders including government agencies, international partners, and local communities. I am grateful to everyone who has contributed to this roadmap. A special thanks to the members of the Technical Committee and Steering Committee for their input and support as well as the Bill and Melinda Gates Foundation that provided the financial resources necessary to develop the roadmap.

I urge all stakeholders—government bodies, private sector organizations, donors, and farmers—to invest, coordinate, and collaborate in digitalizing Ethiopia's agriculture sector. Together, we will make our farms more productive, our markets more accessible, and our food systems more resilient.

This roadmap is not just a plan, but a call to action to help create a digitally empowered future for Ethiopian agriculture. Let's tackle this challenge together with commitment and cooperation.

His Excellency Dr. Girma Amente
Minister of Agriculture
Federal Democratic Republic of Ethiopia

CONTENTS

TABLE OF FIGURES

1

Preface

1.1 GLOSSARY OF ACRONYMS

Acronym	Name
ATI	Agricultural Transformation Institute
MoA	Ministry of Agriculture
AGRA	Alliance for Green Revolution in Africa
EIAR	Ethiopian Institute of Agricultural Research
IFAD	International Fund for Agricultural Development
BMGF	Bill & Melinda Gates Foundation
DAR	Digital Agriculture Roadmap
CABI	Centre for Agriculture and Bioscience International
DAEAS	Digital Agricultural Extension and Advisory Services
AI	Agricultural Intelligence
aLIVE	A Livestock Information System Roadmap for Ethiopia
API	Application Programming Interface
AICCRA	Accelerating Impacts of CGIAR Climate Research for Africa
Clim-ARM	Climate Analytics into Agricultural Risk Management
DAIH	Digital Agriculture and Innovation Hubs
ECX	Ethiopian Commodity Exchange
EDACAP	Ethiopian Digital AgroClimate Advisory Platform
EthioSIS	Ethiopian Soil Information System
GNI	Gross National Income
IBM	International Business Machines
IVR	Interactive Voice Response
MinT	Ministry of Innovation and Technology
ML	Machine Learning

NMIS	National Market Information System
SSA	Sub-Saharan Africa
EWA	Early Warning Systems
SSHI	Supporting Soil Health Intervention
ICT	Information Communication Technology
GoE	Government of Ethiopia
INSA	Information Network Security Administration
CIAT	International Center for Tropical Agriculture
CGIAR	Consortium of International Agricultural Research Centers
MoE	Ministry of Education
CoW	Collision of the Willing
PDPP	Personal Data Protection Policy
ECA	Ethiopian Communications Authority
ODI	Open Data Institute
FAO	Food and Agriculture Organization
ATVETs	Agricultural Technical and Vocational Education Training
NRLAIS	National Rural Land Administration Information System
EDITS	Ethiopian Digital Inputs Tracking System
NSIS	National Soil Information System
NMA	National Meteorology Agency
LMICS	Low and Middle-Income Countries
GSMA	Global System for Mobile Communication Association

1.2 KEY DEFINITIONS

Term	Definition
Digital agriculture	The use of technologies and integrated digital systems to enable farmers and stakeholders within the agricultural value chain
Digital Farmer Services (DFS) Framework	The framework developed by the Bill and Melinda Gates Foundation that categorizes actions and initiatives into elements of the solution areas & use cases, the digital stack, and the enabling environment
Use case	A tangible activity with a clear beneficial result for the end user that can be facilitated or improved using digital tools, and ultimately supports the farmer or pastoralist. Examples of a use case include tracking and tracing of inputs and access to finance.
Digital stack	Architecture that integrates user interfaces, data processing, analytics, and infrastructure to power digital solutions. The digital stack also includes crucial data sets that digital use cases require for successful implementation
Enabling environment	Pre-requisites for digital agricultural transformation, that promote innovation and ensure sustainable growth within the agricultural sector. The Enabling Environment includes areas such as government policy, physical infrastructure, and digital infrastructure
Enabling initiatives	Recommended digital stack and enabling environment interventions that support the implementation and operation of digital agriculture use cases. Examples include creating a farmer profile and digital literacy training for farmers and DAs.
Solution area	A high-level grouping of digital agriculture use cases by the section of the value chain the specific use cases target
Initiative area	A high-level categorization of initiatives in the digital stack and enabling environment, based on the specific aspects of the supporting stack they target
Ag Datahub	An API enabled repository containing over 570 Ethiopian agriculture and soil agronomy related data sets, with tools for interoperability and consent (e.g., anonymization) in development
GSMA index	An index that accesses the performance of different countries against four key enablers[1] of mobile internet connectivity
Interactive Voice Response	An automated telephone system technology that enables callers to receive or provide information, or make requests using voice or menu inputs, without speaking to a live agent
Digital Public Infrastructure	A digital network that enables countries to deliver economic opportunities and social services safely and efficiently to all residents
Interoperable	The ability of different software products or systems to readily connect and exchange information seamlessly

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[1] These 4 key enablers are infrastructure, affordability, consumer readiness and content

Term	Definition
DAEAS roadmap	The Digital Agriculture Extension and Advisory Services Roadmap (2022) A comprehensive 10-year strategy aimed to provide high-quality, customized, and cost-efficient data and advisory information through a solutions pipeline supported by a digital stack, and enabling environment
Smallholder farmer	Small scale farmers, pastoralists, forest keepers, fishers who manage areas ranging between one and ten hectares
Open source	Software whose original source code is freely and publicly available and can be modified by anyone

1.3   ACKNOWLEDGEMENT

This Digital Agriculture Roadmap has been developed through a collaborative effort between the Ministry of Agriculture (MoA) and the Agricultural Transformation Institute (ATI) with inputs and reviews by stakeholders from across the Ethiopian agriculture ecosystem, including development partners, private sector companies and NGOs. We express our profound gratitude to the institutions and partners whose invaluable contributions have been pivotal in the development of Ethiopia's Digital Agriculture Roadmap (DAR). In particular, we are grateful to the Steering and

Technical Committees[2] that supported MoA and ATI to develop DAR.

We also acknowledge partners and collaborators who attended the National and Partner convenings[3]. Their inputs played a crucial role in shaping the comprehensive and sustainable approach that this roadmap embodies.

Special thanks to Bill & Melinda Gates Foundation (BMGF) whose financial and strategic support has enabled the development of the roadmap.

1.4   PURPOSE AND SCOPE OF THIS DOCUMENT

The Ministry of Agriculture (MoA) and the Agricultural Transformation Institute (ATI) have been working together to digitalize agriculture in Ethiopia, in order to increase production and change the livelihoods of farmers. In 2022, together they launched the Digital Agricultural Extension and Advisory Services (DAEAS) roadmap to digitalize the primarily in-person extension services provided in Ethiopia by ~50,000-60,000 government development agents. Following successful development and launch of the DAEAS roadmap, MoA recognized the need to expand the digitalization ambition for the agriculture sector beyond extension and advisory services to incorporate the entire agriculture value chain. The Digital Agriculture Roadmap (DAR) is thus a holistic framework that guides the development of digital agriculture solutions in a systematic and gradual way to enable targeted and phased resourcing towards priority use cases and initiatives.

This document lays out Ethiopia's Digital Agriculture Roadmap (DAR). It is structured in four main sections:

1. **Approach and objectives:** Provides an overview of the methodology used to develop the DAR and outlines the overarching objectives and target state for the roadmap.

2. **Context and ecosystem assessment:** Outlines the importance of the agriculture sector in Ethiopia and introduces digital agriculture in the country. The section also summarizes the results of the digital ecosystem assessment, an analysis used to establish the point of departure for the DAR.

3. **DAR recommendations:** Details the framework used to develop DAR recommendations and details out the digital use cases and digital stack and enabling environment initiatives that are included in the roadmap. The recommendations are also categorized into those prioritised for Phase 1 "Build the Digital Foundation" (2025-2029) and Phase 2 "Diversify and scale the ecosystem" (2030-2032).[4]

4. **DAR implementation plan:** Describes the governance structure for DAR moving forward and how progress on the roadmap will be monitored.

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[4] For more details on phasing, see Section 5.3

2

Executive Summary

Ethiopia is on the path to becoming a digital economy, and the agriculture sector has been identified by the Digital Ethiopia 2025 strategy as a strategic pathway for prosperity. This digital strategy has led to visible reforms in several other sectors (e.g., telecom, health), and is now being applied to agriculture.

The Ministry of Agriculture (MoA) in partnership with the Agricultural Transformation Institute (ATI) has developed the Digital Agriculture Roadmap (DAR) 2025-2032, aligned with the strategic objectives and timeline of the MoA ten-year strategy. The roadmap was developed in a highly collaborative manner with a diverse set of stakeholders, engaged through convenings and one-on-one interviews, and is aligned with the government's policies, strategies, and regulatory frameworks. The DAR has also been aligned to the DAEAS roadmap by incorporating DAEAS actions and ensuring recommendations support extension and advisory use cases.

A robust ecosystem assessment was undertaken to identify Ethiopia's progress in digital agriculture activities as well as the biggest gaps. Example areas that have been identified as in need of strengthening are digital infrastructure, including the cost and accessibility of smartphones and data, and human capital, including digital and financial literacy for farmers and pastoralists. Ethiopian and international best practices were also leveraged to inspire and support roadmap development.

The vision for the DAR is to build inclusive, affordable, sustainable and interoperable digital solutions, supported by a coordinated and aligned ecosystem, that transform the lives of farmers and pastoralists. The roadmap is organized in three areas – Solution Areas and Use Cases, the Digital Stack, and the Enabling Environment:

Solution Areas and Use Cases: Specific applications or sets of practices designed to address identified challenges within the agricultural value chain by leveraging digital tools.

Digital Stack: The necessary digital elements to support the product development and the use of farmer and pastoralist use cases (software infrastructure, data and analytics).

Enabling Environment: The environment required to enable and facilitate the digitalization of the agriculture sector -government and policy, digital and physical infrastructure, agricultural markets, human capital, and innovation and technology.

The solution areas and use cases area consists of prioritized actions to address the key challenges within Ethiopia. These priorities include creating national intelligence for better decision-making, enhancing market linkages, providing universal access to financial services, and leveraging technology for real-time supply chain solutions. By focusing on these targeted solutions, the DAR aims to empower Ethiopian farmers and pastoralists, fostering a digitally advanced, resilient, and prosperous agricultural sector. The DAR proposes 22 use cases to overcome the current challenges and deliver the roadmap vision, with 6 use cases identified as priority for Phase 1.

The digital stack and enabling environment areas consist of prioritized initiatives to support successful delivery of the 22 use cases. The data stack initiatives focus on providing interoperable, obtainable data sets for improved insights, reliable farmer profile data to enable use cases, and improved analytics. The enabling environment priorities include robust and inclusive data policy and guidelines to drive insights, data sharing and decision making, innovative device and connectivity solutions, a well-

resourced and empowered population to build and adopt use cases and an enabled private sector that allows for development of priority innovative tools. The DAR proposes 32 initiatives to enable the use cases, with 6 initiatives identified as priority for Phase 1.

The DAR also includes an implementation plan, including procure and distribute inputs and data stack with APIs business case deep-dives, proposed governance structure, and reporting routine to ensure successful implementation. The governance structure and reporting routine include a high-level Steering Committee for strategic oversight, a Technical Committee for expert guidance, and operational units within the Ministry of Agriculture and the Agricultural Transformation Institute for day-to-day management. Regular stakeholder engagement and a robust monitoring and evaluation framework with a dedicated Project Management Office ensure accountability and adaptability, fostering a collaborative environment for the successful digital transformation of Ethiopia's agricultural sector The roadmap looks in detail at the first phase use cases and initiatives to be implemented during the period 2025-2029. The second phase 2030-2032 is to be further detailed after a mid-term evaluation.

Figure 1 DAR Phase 1 Priorities
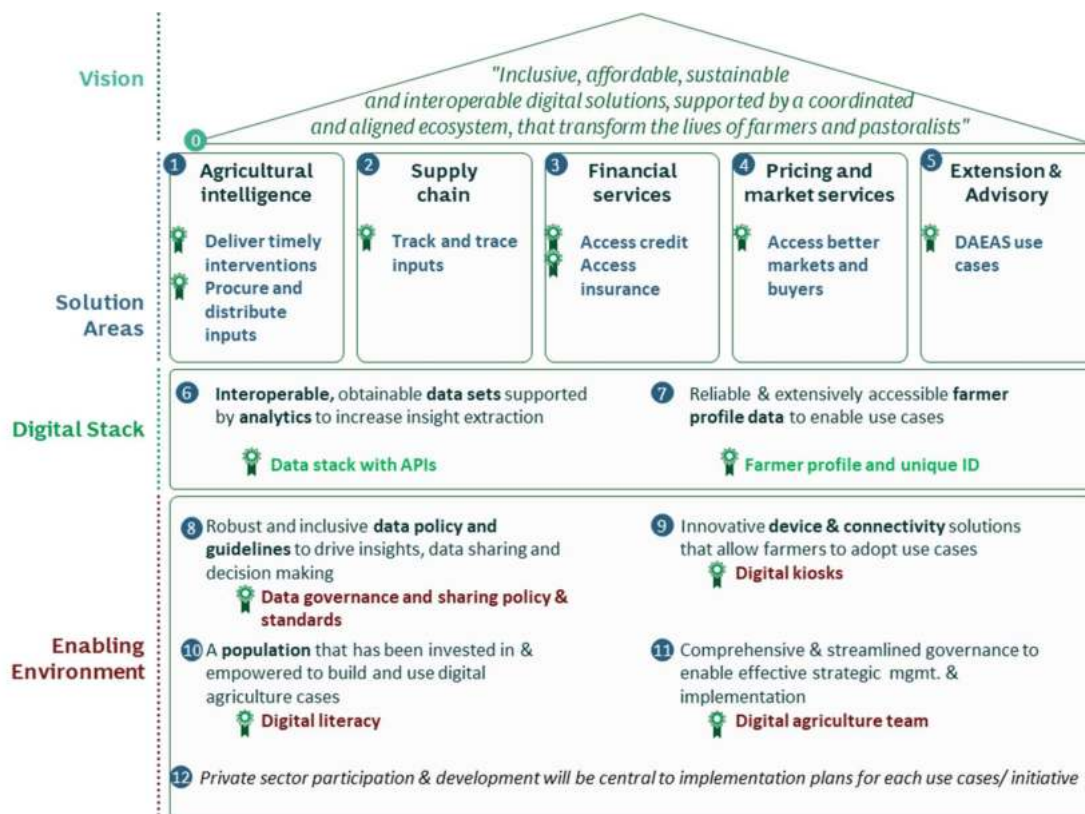
3

DAR's Approach and Target State

3.1 APPROACH FOR DAR

The Ethiopian Digital Agriculture Roadmap (DAR) was developed January to June 2024 and followed a highly iterative and strategic approach centered on stakeholder engagement and alignment with existing policies and government priorities. Key stakeholders, including government agencies, industry experts, and donor organizations, were identified and invited to participate in a series of workshops and convenings organized to gather input and ensure a broad range of perspectives were considered and included in DAR.

A Steering Committee, chaired by His Excellency, Dr. Girma Amente and comprising of the State Ministers of Agriculture in Ethiopia and select institutional funders led the strategic direction for the development of the roadmap[5].

A Technical Committee, chaired by Anteneh Legesse, director of ICT at MoA, was established and comprised of experts from various sectors, to provide specialized insights into the technical requirements and potential barriers of identified digital use cases. The Technical Committee met regularly throughout the development of the roadmap to provide feedback and played a crucial role in shaping the roadmap's practical development.

Stakeholders not included in the Steering or Technical Committees were consulted individually and collectively throughout the development process to ensure their feedback was incorporated into the roadmap, including at the National and Partner Convenings. This iterative process helped refine the goals, strategy and initiatives of the roadmap, making it more robust and comprehensive. A full list of stakeholders consulted for the development of DAR can be found in Appendix Section 8.2

Moreover, throughout the process, the roadmap's objectives were aligned with Ethiopia's national and agricultural policies and priorities to ensure consistency and support from government entities. A summary of key policies and documents consulted in the creation of DAR can be found below in Table 1Table 1 and a full list of policies and reports leveraged for DAR can be found in appendix section 8.3.

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[5] Full list of Steering and Technical Committee members available in the appendix 8.1

Table 1: Select key policies and documents consulted for development of DAR

Policy or Document	Year	Issuing institution/ entity	Relevance for DAR
Personal Data Protection Policy (PDPP)	2024	MinT	National, cross sectoral policy that governs how individual's data should be stored, used and shared. Policy is crucial for the management of farmer profiles and sharing information across digital platforms for agricultural purposes
Towards Digital Agriculture in Ethiopia: an overview of the status, challenges, enablers and prospects	2023	CIAT, CGIAR, Acatech, MoA	Comprehensive assessment of Ethiopian digital agriculture, with recommendations used for DAR ecosystem assessment and prioritization
National Digital Skills Country Action Plan	2021	MinT and MoE	Human capacity and capability recommendations, including for digital literacy; DAR human capacity initiatives are and will be aligned with the policy
National Digital Payments Strategy	2021	National Bank of Ethiopia	Digital payments recommendations, used and aligned with DAR financial services use cases and digital transaction initiatives
National Agriculture Strategy	2021	MoA	National strategic objectives, to which DAR is aligned to and will contribute to through implementation
National Financial Inclusion Strategy	2021	National Bank of Ethiopia	Financial services recommendations, used to inform DAR financial services use cases and digital transaction initiatives
Digital Ethiopia 2025	2020	GoE	Overall strategic direction for digital strategy and policy, including a focus on digitalizing the agriculture sector as a pathway to prosperity, to which DAR aligns
Ministry of Agriculture Ten-Year Plan	2020	MoA	MoA strategic objectives, to which DAR is aligned and will contribute to in the future
Ethiopia Country Strategic Plan	2020	GoE	Aligns with the UN Sustainable Development Cooperation Framework, aiming at economic growth and national development, which includes the agricultural sector, to which DAR is aligned

3.2 DAR TARGET STATE

Agriculture plays a pivotal role in Ethiopia's economy, contributing significantly to GDP, employment, and food security. However, challenges such as climate variability, resource scarcity, and traditional farming practices have hampered productivity and sustainability. The DAR addresses these challenges by making recommendations to integrate digital technologies that improve efficiency, productivity, and decision-making, ultimately leading to enhanced agricultural output and improved farmers' livelihoods. It aims to bridge the gap between traditional practices and modern technology, fostering a more robust agricultural ecosystem.

To achieve this aim, recommendations are designed with impact for the farmer or pastoralist at the center. The end target state for DAR will integrate digital solutions throughout Ethiopia's agricultural sector, transforming the sector by creating digitally empowered farmers and pastoralists. To achieve the target state envisioned in Figure 2Figure 2, the roadmap's recommendations are structured across three layers:

- **Solution areas and use cases:** The solution areas are where digital agriculture products and services (use cases) are applied by or to the end user. This layer contains digital agriculture use cases across six distinct solution areas that cover the entire value chain: Agricultural intelligence, supply chain management, financial services, smart farming, pricing and market services, and extension & advisory services. Within each of these solution areas, high priority use cases have been identified and phased throughout the roadmap.

- **Digital Stack:** The digital stack consists of the necessary digital elements to support the product development and the utilization of use cases. These elements are categorized into four areas: The user facing layer, the integration layer, the analytics layer, and data and content. In each of these areas, high priority initiatives have been identified and phased.

- **Enabling Environment:** This layer is the environment required to enable and facilitate the digitalization of the agriculture sector, and includes six enabling areas: Government and policy, digital infrastructure, physical infrastructure, agricultural markets, human capital, and innovation and technology. In each of these areas, high priority initiatives have been identified and phased.

Figure 2: DAR Target State

Solutions

Financing
Farmer is able to **access credit** through digital credit scoring & can **quickly receive payments** or pay for inputs through mobile money

Supply chain
Farmer can scan a code to **guarantee their inputs** are quality and untampered, and can **track inputs** to the farm door

Extension
Farmer receives **useful and customized** advisory based on the crops they grow, climate and their location, with **early warnings**

Price and market
Farmer gets **price alerts customized** to their own crops or livestock, with links to **e-marketplaces** both domestically and internationally

Farmer profile
Farmer can **define their land boundaries** clearly, and can use their profile to **apply for and verify** inputs, credit and other agricultural services

Digital Farmer

Farmer can check their yield data using **sensors and satellites** linked to platform

Smart farming
Farmer uses **IoT-enabled machinery,** with alerts for maintenance, on genome tested **improved crops,** as well as **smart irrigation** tools that automatically release water and alert for leakage

Enablers

Digital infrastructure
Farmer has a **smartphone,** with affordable **data packages** that enable use consistently

Capacity & capability
Farmer has learnt **digital literacy** through school, and has access to **well-trained, digitally skilled DAs**

Private sector
Farmer pays for **value-adding products from an empowered private sector** that has developed **innovative tools,** inc. targeted smart farming tools, at fair prices

Physical infrastructure
Farmer can **access electricity** to charge devices, and has **good roads** to quickly and cheaply transport goods

| Use cases | Enablers | Digital tools or data sets |

4

Ethiopia Context and Ecosystem assessment

4.1   IMPORTANCE OF AGRICULTURE IN ETHIOPIA

Ethiopia is a low-income country in East Africa with a population of 107 million[6]. The country has ambitions to reach lower middle-income status by 2025, which would require an 11% increase in GNI per capita from $1020 to over $1135 by 2025.[7] The agriculture sector plays a significant role in Ethiopia's economy and has been identified as one of the sectors to enable this transition. Agriculture contributes ~35% to Ethiopia's GDP, employs 70% of the population and is responsible for ~75% of the country's exports. Smallholder farmers dominate the production landscape with land size holdings smaller than 2 hectares and produce 95% of the country's agricultural products. These smallholder farms are managed without significant access to modern farming technology or methods, limiting productivity and efficiency[8].

The government has implemented policies aimed at enhancing agricultural productivity and sustainability such as the Agricultural Development Led Industrialization policy (1994), Industrial Development Strategy (2022) and the Growth and Transformation Plan I and II (2010-2020). Since 2010, implementation of GTP I and II have had a positive impact on the sector, including increasing the use of organic and inorganic fertilizer by ~20 percentage points and increasing production to result in a 1.4% decrease in food imports by 2020[9]. Government-led plans to improve agricultural productivity have included actions to strengthen cluster farming, increase R&D, enhance irrigation practices, and expand commercial farms. Collectively, these actions undertaken by the government have improved the adoption of farming technologies and strengthened food systems in the country.[10]

However, despite these improvements, agriculture productivity in Ethiopia still has room to grow and the sector has many opportunities for strengthening. Challenges or roadblocks to future growth in the sector include fragmented land holding, underdeveloped infrastructure, fragmented data sets, and limited integration of data into decision making. Furthermore, despite progress with 8028 and Farm Radio, the majority of farmers still rely on in-person extension methods which presents a challenge as these methods are constrained by time lapse in data collection and use, as well as challenges in reaching farmers who are widely dispersed and often located in remote areas. Digitalization of the agricultural sector offers significant potential to address some of these challenges and enable faster and more sustainable agriculture transformation.

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[6] Ethiopian Statistical Service 2023

[7] World Bank, 2022 (latest data), does not adjust LMIC target for inflation

[8] FAO 2020

[9] 10 years of the Ethiopian Agricultural Transformation Agency 2020

[10] Joffre OM, Poortvliet PM and Klerkx L; Agricultural systems 2019

4.2 INTRODUCTION TO DIGITAL AGRICULTURE IN ETHIOPIA

The government of Ethiopia is actively pursuing digital agriculture as part of its broader strategy to transform its agricultural sector. The government has set ambitious goals under the Digital Ethiopia 2025 strategy, which aims to integrate digital technologies across various sectors, with agriculture identified as a priority sector for digitalization. The strategy focuses on fostering inclusive growth through digitalization, improvements in education, economic development, and infrastructure.

The government is also undertaking significant efforts within the enabling environment that will support digital agriculture initiatives in the country. For example, efforts are underway to improve education by enhancing educational systems[11] through integration of digital tools and resources to improve access and quality of education. Infrastructure improvement efforts center on developing robust digital infrastructure to support connectivity across the country[12] and expand internet access. These efforts to improve digital infrastructure and education will strengthen the digital ecosystem and enabling environment in the country and support and accelerate the digitalization of the agriculture sector

In 2022, the Ministry of Agriculture (MoA) in partnership with Agricultural Transformation Institute (ATI) developed and launched the Digital Agriculture Extension and Advisory Services (DAEAS) Roadmap. The objective of DAEAS was to enhance the efficiency, quality, and impact of advisory services to farmers in Ethiopia through digital transformation of the extension and advisory processes within the country. DAEAS was broadly successful at aligning the ecosystem on digitalization priorities in agriculture and was able to catalyze funding for several of the roadmap's priority initiatives such as farmer profiles and digital kiosks, both of which are currently in the process of being implemented[13].

Early implementation of DAEAS highlighted the need for a comprehensive roadmap to guide broader digital transformation in agriculture beyond extension and advisory services. Implementing additional digital solutions throughout the value chain has the potential to significantly improve productivity and livelihoods for farmers and pastoralists. For example, digital solutions and interventions in areas such as supply chain management and digital financial solutions can increase farmers access to quality inputs (e.g., fertilizer) and the financing required to purchase these inputs. However, to make this possible, significant improvements are needed in the digital stack and enabling environment such as quality, up-to-date data on individual farmer land holdings, production, and yield. Digitalization of the entire value chain will also help farmers become more productive and resilient to the effects of climate change and help provide a pathway to better-paying markets to increase their income.

It is thus imperative that Ethiopia addresses digital agriculture challenges and prioritizes strategic areas that can foster a more integrated, efficient, and responsive agricultural ecosystem, significantly enhancing the

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[11] This includes initiatives such as the Digital Skills Country Action Plan targeting 800,000 students from 50 public universities with and aim of creating state of the art facilities and systems to enable online learning

[12] MNO efforts have enabled 85% of the population be covered by 3G (above the SSA average of 84%)

[13] The Farmer Profile pilot launched in 2024 and will aim to collate and clean 1.25m profiles in the next two years; the Digital Kiosk pilot is at the stage of location selection, content/service mapping, and kiosk procurement

sector's impact on the nation's economy and food security.

4.3 ECOSYSTEM ASSESSMENT SUMMARY

The DAR was developed to provide a holistic framework to guide the strategy and crowd-in investments into the digital agriculture ecosystem. Thus, a thorough assessment of the ecosystem and an in-depth understanding of the country's digital strengths and areas for strengthening was important to establish a point of departure for the DAR. A strong understanding of the ecosystem ensured that recommendations identified and prioritized as part of the roadmap were both high impact and implementable within the Ethiopian context.

To assess the ecosystem, the framework illustrated in Figure 3: DAR Digital Agriculture Ecosystem Assessment FrameworkFigure 3: DAR Digital Agriculture Ecosystem Assessment Framework was leveraged[14]. The framework is structured over three layers as shown in Section 3.2 describing the target state for DAR – Solution Areas and Use Cases, the Digital Stack, and the Enabling Environment. Each section of the framework is further divided into sub-sections, and it was at this level that the ecosystem assessment was conducted. Descriptions for each sub-section in the framework can be found in the appendix 8.6.

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[14] The ecosystem assessment framework was developed by the Digital Farmer Services (DFS) team at the Bill and Melinda Gates Foundation (BMGF)

Figure 3: DAR Digital Agriculture Ecosystem Assessment Framework

Solution Areas and Use Cases

End users
(Smallholder Farmers, Government & Public Sector, NGO & Multilaterals and SMEs & Private Sector)

Solution areas	Ag Intelligence	Supply Chain Management	Financial Services	Smart Farming	Pricing & Market Services	Advisory & Extension Services

Digital stack

User Facing Layer
(Applications & Tools)

Information (incl. crop, pricing, market, weather, etc.)	Transactions (incl. credit, input delivery, warehouse receipts, etc.)	Delivery Technologies (incl. IVR, SMS, Farm Radio, etc.)

Integration Layer
(Platforms & Pathways)

Integration Features (incl. secure gateway, standards & interoperability, etc.)	Analytics Layer	Functions (incl. enrollment patterns, credit algorithms, etc.)

Data & Content
(Agriculture & Adjacent)

Farmer Related (incl. farmer registries, financial history, etc.)	Productivity Related (incl. soil registries, weather data, etc.)	Market Related (incl. price data, trade data,, etc.)

Enabling Environment

Government and Policy
(incl. ICT policy, data policy, digital agriculture initiatives, farmer support, etc.)

Digital Infrastructure
(incl. mobile penetration, broadband, cloud services, etc.)

Human Capital & Infrastructure
(incl. gender and social structure, literacy levels, user engagement and trust, etc.)

Physical Infrastructure
(incl. roads, irrigation, cell towers, aggregation centers, etc.)

Agricultural Markets
(incl. inputs, value addition capabilities, trade barriers, etc.)

Innovation & Technologies
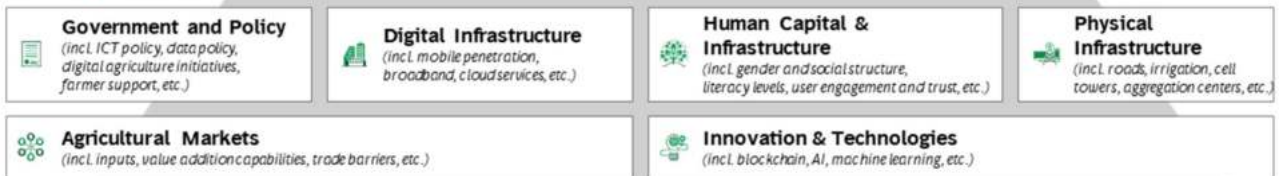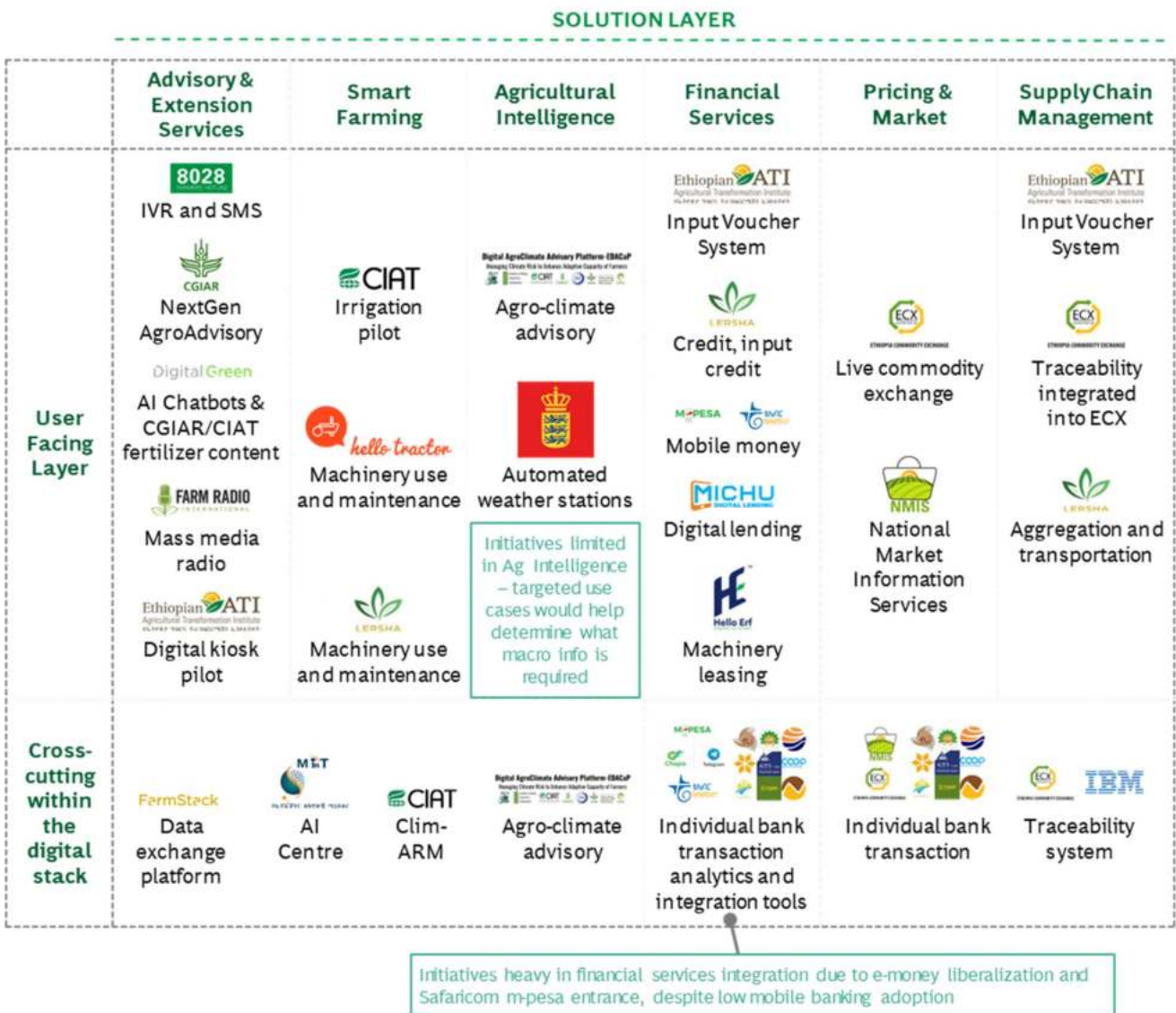(incl. blockchain, AI, machine learning, etc.)

Figure 4: Ethiopian Initiatives across 6 solution areas (non-exhaustive)

The results of the ecosystem assessment show that while Ethiopia's digital agriculture ecosystem is still relatively nascent with many areas to strengthen, there are areas of progress to highlight. Particularly, the country shows good progress in physical infrastructure, stakeholder participation, and the breadth of data in the ecosystem. Physical infrastructure is well-developed and on par with Sub-Saharan African peers with 85% 3G network coverage and satellite access[15], which together have laid a solid foundation for connectivity. Additionally, there is strong engagement in the ecosystem from

[15] GSMA The State of Mobile Internet Connectivity Report 2023

development partners and a growing private sector driving initiatives across various digital agriculture solution areas including finance, extension, and supply chain management (see Figure 3 above). There is also a wealth of agricultural data in Ethiopia, and in recent years, progress has been made towards developing open standards and increasing interoperability for this data. Initiatives in this space include the National Data Exchange Directive, aLIVE Roadmap, Coalition of the Willing and the Supporting Soil Health Initiative, the National Framework for Climate Services, Digital Green's FarmStack protocol, and the GIZ-funded Natural Resource Management System data lake.[16]

However, challenges in the ecosystem persist, particularly in the utilization and cost of digital infrastructure. The cost of digital data usage remains high, with charges amounting to 5% of the GNI per capita for higher usage baskets, and smartphone costs equating to ~100% of the GNI per capita[17]. These expenses prevent broader access to digital tools, especially amongst rural Ethiopians and smallholder farmers. Furthermore, while the Ethiopia digital ecosystem benefits from innovative pilots and stakeholder collaboration with regards to data aggregation (e.g., Coalition of the Willing), it suffers from significant gaps in analytic capabilities as decision-makers often operate without access to integrated, real-time, accurate data. Moreover, there is room to strengthen digital capabilities across the country as national adult literacy stands at 52%[18] and the country ranks low in terms of digital skills (119 out of 134 countries).[19]

Data governance and standardization are additional areas requiring strengthening. Despite new data policies, such as those for e-transactions, the recently ratified Personal Data Protection Policy (PDPP) and bottom-up initiatives such as Coalition of the Willing and aLIVE, there remains a need for standardization and better governance of data across the sector. Data governance challenges include numerous data silos, and reluctance to share data, coupled with legal and technological barriers to sharing, and the absence of robust policies and oversight mechanisms. The lack of structured data management hinders the potential to develop high impact and comprehensive digital agriculture solutions that rely on an enhanced digital stack and data governance framework. Addressing these data challenges is pivotal for enhancing agricultural productivity and sustainability in Ethiopia.

A high-level summary of the results of the assessment can be found below in Table 2Table 2. Each sub-section of the ecosystem was assessed to be at one of three different maturity levels: 1) Nascent, 2) Exists but needs strengthening/ not at scale, 3) Relatively strong / at scale. All sub-sections within Ethiopia were assessed to be either 'nascent' or 'exists but needs strengthening/ not at scale'.

Additionally, more details on the ecosystem assessment including recent improvements, areas to strengthen, and select ongoing initiatives for each sub-section of the framework are outlined in section 5 of this document.

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[16] A full list of existing initiatives within the ecosystem can be found in Section 8.7 in the appendix

[17] GSMA Mobile Connectivity Report 2023

[18] World Bank Development Indicators 2017

[19] Digital Skills Gap Index Wiley Report (2021)

Table 2: High Level Results of Ethiopia Digital Agriculture Ecosystem Assessment

	Solution / Initiative area	Maturity	Assessed improvement (past 5 years)	High Level Status Summary[20]
Solution Areas and Use Cases	Agricultural Intelligence	Exists, Needs strengthening / Not at Scale	No significant improvement	• Weather and soil (SSHI)[21] decision-making is functional, but these are the only use cases and have room to be strengthened
	Supply Chain	Exists, Needs strengthening / Not at Scale	No significant improvement	• Private sector led by Lersha is moving into aggregation, but no input tracing is still a challenged
	Financial Services	Exists, Needs strengthening / Not at Scale	Significant improvement	• Mobile money & banking is operational, but rural population remain underserved
	Smart Farming	Nascent	No significant improvement	• Limited activity, however, there are emerging irrigation solutions such as the Water Ways project by CIAT[22]
	Pricing & Market services	Exists, Needs strengthening / Not at Scale	No significant improvement	• ECX[23] and NMIS[24] are generally strong but limited in scope
	Extension & Advisory	Exists, Needs strengthening / Not at Scale	No significant improvement	• Low-tech delivery channels are strong (e.g., IVR)[25], but better integration with data is needed e.g., weather
Digital Stack	User Facing Layer	Exists, Needs strengthening / Not at Scale	Significant improvement	• Strong low-tech tools e.g., IVR 8028, improving market info & 30k tablets going to DAs, but high-tech tools e.g., Digital Green AI chatbot only in pilot stage
	Integration Layer	Exists, Needs strengthening / Not at Scale	No significant improvement	• Emerging solutions such as FarmStack provide strong middleware potential but need integration with further use cases; Limited presence of ag-specific mobile wallets solutions due to lack of mobile infrastructure and financial sector engagement

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[20] More details on the assessment of each sub-component of the ecosystem can be found in section 5 of this document where the roadmap's initiatives and use cases are detailed.

[21] Supporting Soil Health Initiative

[22] International Center for Tropical Agriculture

[23] Ethiopian Commodity Exchange

[24] National Market Information System

[25] Interactive Voice Response

	Solution / Initiative area	Maturity	Assessed improvement (past 5 years)	High Level Status Summary[20]
	Analytics Layer	Nascent	No significant improvement	• Some predictive weather and crop analytics at a national level through e.g. EDACAP[26]; and MinT[27] launched the AI R&D Centre of Excellence; lack of private sector activity presents challenges to ability to organically scale (e.g., Innovation Hub is an FAO[28] initiative)
	Data and Content Layer	Exists, Needs strengthening / Not at Scale	Significant improvement	• A lot of data is collected (570+ data sets in the Ag Datahub), but it is either limited in scope, poor quality, or not standardized or integrated SSHI trying to overcome this challenge; key focus for players e.g., CoW[29] and aLIVE[30] on standards; National/Farmer ID in pilot
Enabling Environment	Government & Policy	Exists, Needs strengthening / Not at Scale	No significant improvement	• Strong policies and frameworks, but limited governance or data standards
Enabling Environment	Digital Infrastructure	Exists, Needs strengthening / Not at Scale	Significant improvement	• Digital infrastructure available but cost is limiting accessibility; limited cloud and computing
Enabling Environment	Human Capital	Nascent	No significant improvement	• Low overall adult literacy is causing barriers to digital adoption, and digital skills ranked 119/134 countries[31]
Enabling Environment	Physical Infrastructure	Exists, Needs strengthening / Not at Scale	Significant improvement	• Existing physical infrastructure is semi-reliable, with satellites progressing towards more advanced physical infrastructure
Enabling Environment	Agricultural Markets	Nascent	No significant improvement	• Inputs are limited, and currently hard to track, while value addition and access to improved markets is nascent
Enabling Environment	Innovation and Technologies	Nascent	No significant improvement	• Limited innovation beyond government or NGOs, such as MinT or FAO's DAIH[32]

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[26] Ethiopian Digital AgroClimate Advisory Platform

[27] Ministry of Innovation and Technology

[28] Food and Agriculture Organization

[29] Coalition of the Willing

[30] A Livestock Information System Roadmap for Ethiopia

[31] Digital Skills Gap Index Wiley Report (2021)

[32] Digital Agriculture Innovation Hub

5

Digital Agriculture Roadmap
(DAR) 2032

5.1 DAR GUIDING PRINCIPLES

DAR's development and implementation is guided by four principles which have and will continue to be instrumental in achieving successful digital transformation in Ethiopia's agricultural sector.

DAR guiding principles

DAR has four guiding principles:

01	02	03	04
Leverage Existing Initiatives: Build off, scale, and align with existing initiatives, when possible, to accelerate implementation and impact of DAR	**Ensure Coordination:** Develop appropriate governance structures and processes for the ecosystem to facilitate alignment, coordination and cooperation amongst stakeholders	**Empower the Private Sector:** Attract private sector participation and partnership and leverage the private sector's capacity and capability to support in DAR implementation	**Prioritize and Phase Initiatives:** Focus on initiatives with that have the highest potential for impact and can be implemented within the current ecosystem first before pursuing those interdependent initiatives in later phases

These principles promote the optimization of resources by leveraging existing initiatives and institutional knowledge, which accelerates progress and prevents redundancy. Coordination is vital for maximizing limited resources by aligning stakeholders - including government bodies, NGOs, and the private sector – and ensuring that efforts work in synergy, and limit duplication. By empowering the private sector, the roadmap taps into innovative and scalable solutions that drive sustainability and economic viability. Finally, prioritizing and phasing initiatives allows resources to be focused on initiatives with the greatest impact and that are most feasible in the current ecosystem.

5.2   DAR'S INTEGRATION WITH DAEAS

In 2022, MoA and ATI worked to develop the Digital Agriculture Extension and Advisory Services (DAEAS) Roadmap 2030 for Ethiopia. The DAEAS Roadmap roll-out led to the view that Ethiopia's Digital Transformation efforts in agriculture needed to go beyond extension & advisory, and thus the Digital Agriculture Roadmap (DAR) was developed. The DAEAS Roadmap is a sub-set of the DAR, but has been integrated in three key ways: Solution areas and use cases, digital stack and enabling environment initiatives, and finally in lessons learned.

Solution areas and use cases: One of the DAR solution areas is 'Extension and Advisory'. Though the DAEAS Roadmap did not include use cases (rather what the DAR defines as underlying initiatives to support extension and advisory), the DAR has captured all extension and advisory activities and channels in a single use case called 'Extension and advisory'. Users of the DAR are recommended to consult the DAEAS roadmap for further details on recommendations for this use case. Furthermore, some of the DAEAS initiatives have been incorporated into use cases in other solution areas, such as 'Input demand and supply tracking', which part of the 'Procure and distribute inputs' use case, the 'track and trace inputs' use case, and the 'input demand and supply analytics' initiative. A full mapping of the DAEAS initiatives to DAR use cases

and initiatives can be found in 8.4 Mapping of DAEAS Recommendations to DAR.

The digital stack and enabling environment initiatives: All DAEAS initiatives that were not incorporated into use cases have been incorporated into the DAR digital stack and enabling environment, either as standalone initiatives, or aligned to other initiatives. Some of the DAEAS initiatives were adjusted or further detailed based on progress since 2022 (e.g., 'Off-grid electricity access expansion in rural areas' has been adjusted to 'Solar panels for FTCs[33] or OSSs[34]'). A full mapping of the DAEAS initiatives to DAR use cases and initiatives can be found in 8.4 Mapping of DAEAS Recommendations to DAR.

Lessons learned: The process of developing and implementing the DAEAS roadmap informed the methodology of the DAR development. This included early alignment on the vision and key objectives to drive consensus, tailoring the approach to the country context, with clear adherence to existing national strategies and policies, and a focus on farmer value and product output throughout. Finally, DAEAS demonstrated the need for continual engagement with implementing partners and donors to co-create sustainable, fundable and feasible business cases. DAR utilized these lessons throughout the development process.

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[33] Farmer Training Center

[34] One Stop Shop (ATI initiative)

5.3 DAR PHASING AND OBJECTIVES

Overall DAR Objective

The overarching objective for DAR as described in Section 3.2 DAR Target State is to digitally transform the entire agriculture ecosystem within Ethiopia, by digitally empowering Ethiopian farmers and pastoralists.

To achieve this objective, DAR recommendations are designed with impact for the farmer or pastoralist at the forefront and are structured across three layers of the digital agriculture ecosystem: 1) use cases 2) digital stack, 3) enabling environment.

DAR Phasing

Recommendations in the solution areas and use cases, digital stack, and enabling environment will be implemented over two phases to ensure efficient and effective use of resources.

Phase One "Build the Digital Foundation" (2025-2029) aims to lay the groundwork for a digitalized agricultural ecosystem through implementation of key enabling initiatives while developing high impact use cases to empower farmers and pastoralists. This phase of the roadmap has 12 objectives which are outlined below:

1. **Agricultural Intelligence -** National intelligence that improves decision making to get better services to farmer and pastoralists

2.   **Supply Chain -** Services that guarantee quality products on time for farmers, pastoralists, and off-takers

3. **Financial Services -** Universal access to financial services that improve input & machinery access, insure crops and make payments more efficient

4. **Pricing and Market Services -** Transparent and timely pricing and reliable market linkage with quality assurance measures

5. **Extension and Advisory -** Timely, demand-based, customized extension & advisory

6. **Integration Layer -** Interoperable, obtainable data sets supported by analytics to increase insight extraction

7. **Data and Content -** Reliable & extensively accessible data to enable use cases

8. **Government and Policy -** Robust and inclusive data policy and guidelines to drive insights, data sharing and decision making

9. **Digital Infrastructure -** Innovative device & connectivity solutions that allow farmers to adopt use cases

10. **Human Capacity -** A population that has been invested in & empowered to build and use digital agriculture cases

11. **Governance -** Comprehensive & stream-lined governance to enable effective strategic management & implementation

12. **Innovation and technologies -** An empowered private sector that allows for development of priority innovative tools

This first phase is critical to lay the foundation for a well-functioning digital ecosystem and to deliver the highest impact to farmers, pastoralists and value chain actors. The use cases and digital stack and enabling environment initiatives prioritized for Phase One are part of the comprehensive lists of solutions and enabling initiatives required to fully digitalize agriculture in Ethiopia.

Phase Two "Diversify and scale the ecosystem" (2030-2032) will continue to build use cases into the ecosystem and improve data collection. Phase Two of the roadmap aims to achieve five additional objectives while continuing to build upon and strengthen the objectives achieved in Phase One. DAR Phase Two targets to enhance the ecosystem by achieving the following 5 outcomes:
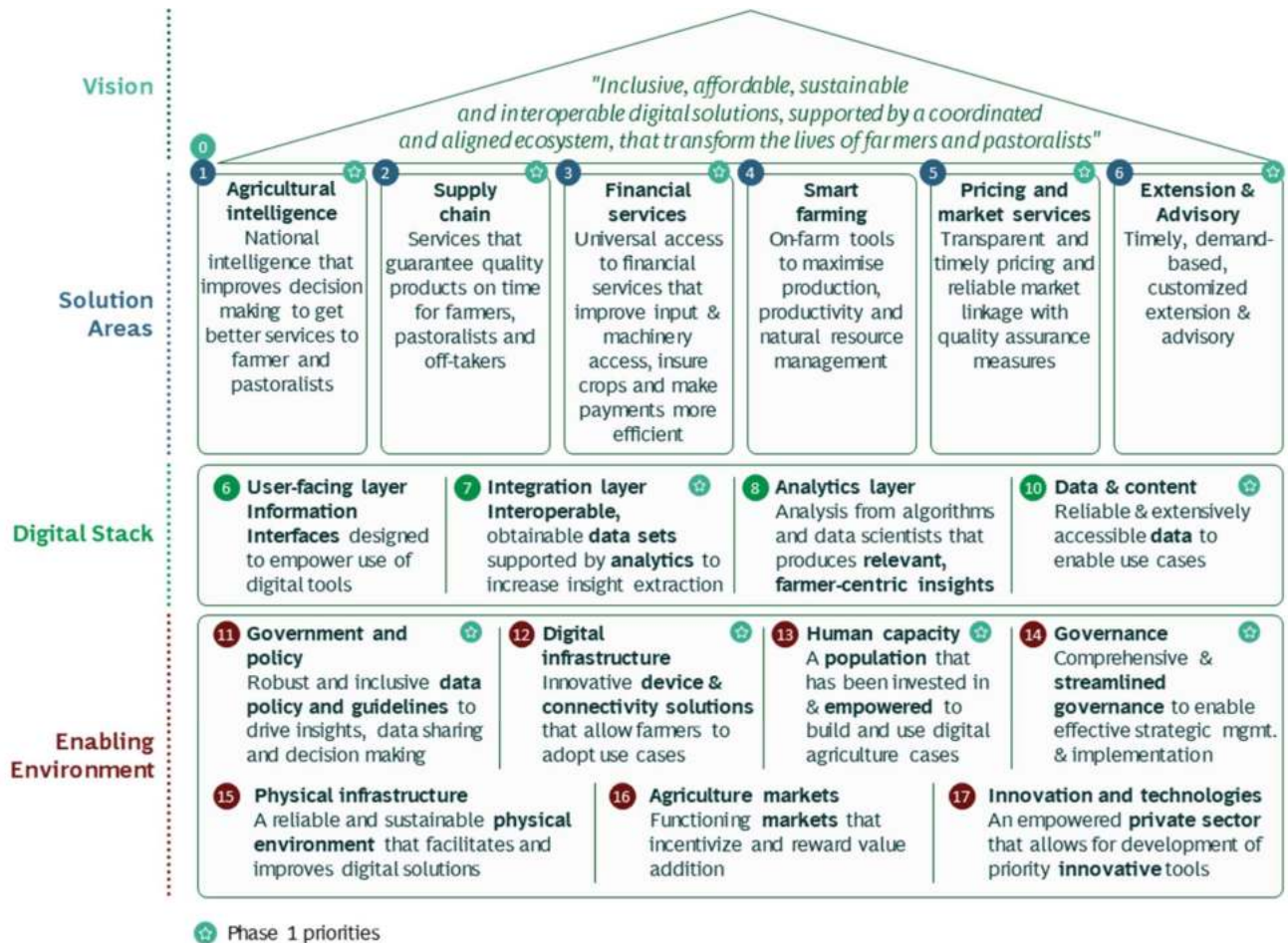
1. **Smart Farming -** On-farm tools to maximize production, productivity, and natural resource management

2. **User -Facing Layer -** Information interfaces designed to empower use of digital tools

3. **Analytics Layer -** Analysis from algorithms and data scientists that produces relevant, farmer-centric insights

4. **Physical Infrastructure -** A reliable and sustainable physical environment that facilitates and improves digital solutions

5. **Agricultural Markets -** Functioning markets that incentivize and reward value addition

Combined, these 17 objectives target to enhance and strengthen the entire digital agriculture ecosystem, with each objective linked to one of the ecosystem's sub-components.[35] These 17 strategic objectives are combined and outlined in Figure 5~~Figure 5~~ below.

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[35] As defined in Figure 3~~Figure 2~~ from section 4.3

Figure 5: DAR Strategic Objectives

Vision

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"Inclusive, affordable, sustainable and interoperable digital solutions, supported by a coordinated and aligned ecosystem, that transform the lives of farmers and pastoralists"

Solution Areas

1 **Agricultural intelligence**	2 **Supply chain**	3 **Financial services**	4 **Smart farming**	5 **Pricing and market services**	6 **Extension & Advisory**
National intelligence that improves decision making to get better services to farmer and pastoralists	Services that guarantee quality products on time for farmers, pastoralists and off-takers	Universal access to financial services that improve input & machinery access, insure crops and make payments more efficient	On-farm tools to maximise production, productivity and natural resource management	Transparent and timely pricing and reliable market linkage with quality assurance measures	Timely, demand-based, customized extension & advisory

Digital Stack

6 **User-facing layer**	7 **Integration layer**	8 **Analytics layer**	10 **Data & content**
Information Interfaces designed to empower use of digital tools	**Interoperable**, obtainable **data sets** supported by **analytics** to increase insight extraction	Analysis from algorithms and data scientists that produces **relevant, farmer-centric insights**	Reliable & extensively accessible **data** to enable use cases

Enabling Environment

11 **Government and policy**	12 **Digital infrastructure**	13 **Human capacity**	14 **Governance**
Robust and inclusive **data policy and guidelines** to drive insights, data sharing and decision making	Innovative **device & connectivity solutions** that allow farmers to adopt use cases	A **population** that has been invested in & **empowered** to build and use digital agriculture cases	Comprehensive & **streamlined governance** to enable effective strategic mgmt. & implementation

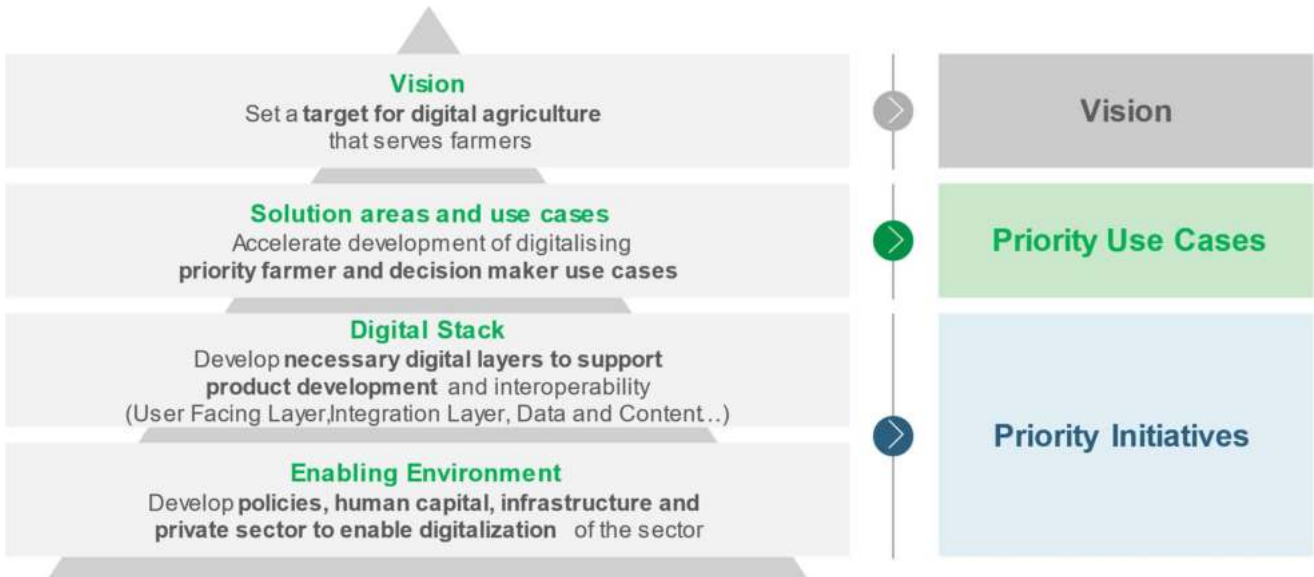| 15 **Physical infrastructure**	16 **Agriculture markets**	17 **Innovation and technologies**
A reliable and sustainable **physical environment** that facilitates and improves digital solutions	Functioning **markets** that incentivize and reward value addition	An empowered **private sector** that allows for development of priority **innovative** tools

⚙ Phase 1 priorities

5.4 DAR STRATEGIC FRAMEWORK AND VISION

DAR recommendations are guided by its vision statement and structured across the three layers of the ecosystem assessment framework– solution areas and use cases, the digital stack, and the enabling environment.

Figure 6: DAR Strategic Framework

DAR VISION

DAR's 8-year digital agriculture vision is

> " Inclusive, affordable, sustainable and interoperable digital solutions, supported by a coordinated and aligned ecosystem, that transform the lives of farmers and pastoralists"

This vision is guided by DAR's target state as described in Figure 2Figure 2 above and will help to inform the detailed design of DAR's identified digital use cases and digital stack and enabling environment initiatives that are described in the following sections.

5.5 SOLUTION AREAS AND USE CASES

The overall objective of the Digital Agriculture Roadmap is to digitally empower Ethiopian farmers and pastoralists across the entire agriculture value chain. In order to achieve this digital transformation, the DAR identified six solution areas within the agriculture ecosystem.

The six solution areas identified as part of DAR are:

1. **Agricultural intelligence –** National intelligence that improves decision making to get better services to farmer and pastoralists

2. **Supply chain management -** Services that guarantee quality products on time for farmers, pastoralists and off-takers

3. **Financial services –** Universal access to financial services that improve input & machinery access, insure crops and make payments more efficient

4. **Pricing and market services -** Transparent and timely pricing and reliable market linkage with quality assurance measures

5. **Smart farming -** On-farm tools to maximize production, productivity and natural resource management

6. **Extension and advisory services -** Leveraging technology to provide real-time information, best practices, and personalized guidance to farmers for improved agricultural outcomes[36]

DAR defines a digital use case as a specific application or set of practices designed to address identified challenges within the agricultural value chain by leveraging digital tools. A DAR use case must ultimately benefit the farmer or pastoralists but the farmer or pastoralists does not necessarily need to be the end user of the use case.[37]

A total of 22 use cases across these six solution areas have been identified through a comprehensive review of international and local reports, national strategy documents, and stakeholder interviews. DAR undertook a comprehensive and robust prioritization process based on the feasibility of implementation in Ethiopia and the potential for impact. This process determined which use cases would be prioritized for Phase One and which would be addressed in Phase Two of the roadmap.[38]

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[36] Extension and advisory services were initially addressed in the DAEAS Roadmap. All actions identified in DAEAS have been incorporated into the DAR roadmap

[37] E.g., the government is the end-user of the use case 'Procure and Distribute Inputs' as this use case aims to support the government in demand estimation of centrally procured inputs such as fertilizer. However, the farmer would ultimately benefit from the use case

because fertilizer would be distributed more accurately and effectively to farmers throughout the country

[38] Key inputs into the prioritization process were benchmarks from other geographies (to assess impact and feasibility) and stakeholder feedback from both 1-on-1 engagements as well as the National Convening. More details on the prioritization process can be found in appendix Section 8.5

5.5.1 Agricultural Intelligence

Solution area objective

National intelligence that improves decision making to get better services to farmers and pastoralists

Solution area description and use cases

Use cases in this solution area are focused on creating macro level data and decision support for businesses and government. This solution area consists of four use cases, two of which have been prioritized for Phase One of the roadmap. The table below shows the phasing, descriptions, and the target end users of each use case.

Table 3: Agricultural Intelligence Use Cases

	Use case	End user	Description
Phase 1	Deliver timely interventions to protect crops or livestock	Government, farmer	Support farmers by using data to track and monitor disease outbreaks, adverse weather events and pest attacks, and intervene directly or through advisory
	Procure and distribute inputs	Government	Support farmers by getting inputs to them more efficiently through top-down demand data assessment and smart procurement
Phase 2	Develop carbon and climate credentials for markets	Government	Support farmers by calculating the carbon footprint or sequestration of different agriculture projects (e.g., agroforestry) to link to and verify farmers for sustainable supply chains, and to provide targeted climate-related advisory
	Improve livestock management	Government, farmer	Support farmers by tracking and monitoring livestock data including location, breed and health to plan optimal water and pasture routes (delivered through EWS[39] or direct intervention), develop breed and health insights and improve breeds through artificial insemination

Ecosystem assessment – Improvements

In the past 5 years, the Ethiopian ecosystem has made limited progress in agricultural intelligence due to ongoing issues in data quality and availability. However, there are initiatives that have been developed to provide macro-level or national insights. For example, the EDACAP (Ethiopian Digital AgroClimate Advisory Platform) launched in 2019 and provides weather and climate forecasting and insights based on climate-informed crop modelling and has an API-enabled web layer to facilitate intelligence across the ecosystem. CIAT's Clim-ARM[40] project was launched in 2022 and is also operating in

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[39] Early Warning Systems

[40] International Center for Tropical Agriculture, Climate Agricultural Risk Management

this space, predominantly using climate analytics for macro-level risk management.

There have also been advancements in soil data, through the Supporting Soil health Initiative (SSHI), led by the Coalition of the Willing (CoW). This initiative has harmonized and standardized soil data sets so that they can be used for intelligence and decision-making on topics such as soil health, input use, production and crop varieties. This soil data is being used by initiatives such as CGIAR and CIAT's site-specific fertilizer recommendations. Livestock data is also progressing through the aLIVE[41] roadmap, which has made recommendations for livestock data and will begin implementation in 2024.

Ecosystem assessment – Areas to strengthen

Despite some progress in weather and soil data, agricultural intelligence is still a relatively nascent solution area and will require significant work to enable decision making at a national level.

Data: For high quality agricultural intelligence, high quality data is required. There is currently limited quality data especially for foundational datasets, such as land data (size, use and ownership), farmer profile data (name, inputs used) and crop data (production, crop type and variety sown). There are initiatives or pilots ongoing to collect quality data (including the farmer profile pilot launched in 2024, the National Rural Land Administration Information System (NRLAIS) which has digitalized 60% of land registries and the Central Statistics Agency's production data, but these will need to be rapidly scaled or improved to support use-case specific insights. A robust mechanism for data exchange will also be needed, and so a data stack should be built,

leveraging existing infrastructure such as the Ag Datahub in MoA to optimize implementation.

Analytics: Once quality data has been collected, advanced analytics capability will be needed to produce relevant and use case-specific insights. The Ministry of Agriculture should develop an in-house analytical capability through recruitment, secondment and training, but should also work closely with research centers such as CIAT and CGIAR to build upon their predictive models in spaces such as climate (EDACAP) and inputs (site-specific fertilizer recommendations).

Private sector participation: There is currently limited opportunity for private sector integration in agricultural intelligence, but integrating the private sector would allow for better solutions and services across the ecosystem, and a richer data store. For example, an insurer would be able to provide better services if they had access to more accurate climate forecasting, and in turn could supply data collected from the farmer on their production to the data stack. The private sector could be encouraged to partake in the ecosystem by strengthening consent and sharing mechanisms for data, as well as developing awareness campaigns and training to highlight the business advantages of participation.

Infrastructure: A number of agricultural intelligence use cases, such as procure and distribute inputs, and deliver timely interventions, require a reliable distribution network for their success. Currently, only 22% of rural households in Ethiopia are less than 2km from a road, creating challenges in access to services.[42] These challenges could be addressed by a thorough road assessment in partnership with the Ministry of Transport of Transport and Logistics, with

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[41] A Livestock Information Vision Ethiopia

[42] RAI World Bank (2019)

improved roads developed in strategic routes for optimum distribution.

Table 4: Select Ongoing Agricultural Intelligence Initiatives

Organization	Initiative	Description
EIAR, AGP, CIAT, CIMMYT, IRI, CGIAR, CCAFS	EDACAP - Ethiopian Digital AgroClimate Advisory Platform	• Web platform designed to support decision-making and facilitate learning • Provides interactive AgroClimate information and advisory services based on crop-climate models to enhance crop management decisions and mitigate production risks from climate variability and change • Offers location-specific 3–10-day weather forecasts • Offers ENSO predictions, with seasonal climate phase forecasts for the upcoming three months
Supporting Soil Health (SSH) initiative	AI powered fertilizer decision support tool	• Addresses key soil and systemic issues in agriculture, such as problematic soils and nutrient depletion, limited institutional capacity, and lack of advanced technologies • Focuses on enhancing content dissemination • Develops data tools like the Fertilizer Decision Support Tool (DST) and high-resolution soil maps • Manages extensive soil data through national systems
MoA, Development Gateway, Livestock Improvement Corporation	aLIVE	• The project is working towards improving the accessibility, interoperability, reliability, and use of livestock data • The core component of the project is ensuring the interoperability of five key systems: two livestock health systems, a livestock market information system, a genetics data system, and a livestock identification and traceability system

Phase One priority use cases

1. Deliver timely interventions for crops and livestock

This use case will support farmers in tracking and monitoring disease outbreaks, adverse weather events, and pest attacks, and enable the government to intervene either directly (e.g., provide food to livestock) or through advisory. The main objective of this use case is to decrease agriculture and livestock losses from pest and disease outbreaks and increase resilience to climate and weather impacts.

Key activities for implementation:

• Identify necessary data requirements for the use cases (e.g., weather data from EDACAP) and evaluate whether existing data sources are fit for purpose.

- Define strategies for acquiring or developing required datasets.
- **Data Policy –** Develop and issue agriculture sector data policy, that aligns to national policy, and establishes a framework for collection and sharing of necessary datasets (e.g., climate data, farmer profile data)
- **Data Standards –** For each type of data (e.g., soil, livestock) needed for each intervention, develop and ensure proper data standards are used, leveraging existing data standard initiatives such as aLive when possible.
- Identify what specific interventions (e.g., drought on livestock routes, types of disease) the use case will target and prioritize and sequence interventions based on available data and potential for impact.

- Train and build advanced analytics and predictive model for early warning system for prioritized interventions with support of research centers and ongoing initiatives.
- Pilot the model in an area of Ethiopia most susceptible to the prioritized interventions, and ideally for both a livestock and crop intervention simultaneously.
  - Pilot will involve improved data collection, an MVP for data flow, a DA application and dashboard, and alignment with existing extension channels such as 8028.
- Scale system to other interventions, implementing the lessons learned from the pilot and build in other data flows from DAs and extension channels, such as pest and disease outbreaks.

Table 5: Dependencies to fully scale Deliver Timely Interventions use case

Use Case Dependencies	Ecosystem sub-component	Rationale
Data governance and sharing policy, standards, assurances, and incentives	Government and policy	Establishes a framework for collection, and sharing of demand input demand data as well policies concerning data privacy
Data stack with APIs	Integration layer	Ensures seamless integration and real-time data exchange, enabling quick response and coordination of interventions
Production, weather, and farmer data	Data & content	Provides crucial information and data to train models for anticipating and addressing issues such as pest outbreaks or adverse weather conditions
Devices for DAs	Digital infrastructure	Facilitates real-time data collection and dissemination, allowing DAs to quickly identify and respond to emerging issues in the field
Analytics capability for digital Ag team	Analytics layer	Allows for the rapid analysis of large datasets to identify trends and anomalies, ensuring timely and data-driven interventions
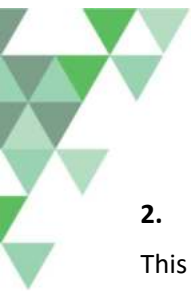
2. Procure and distribute inputs

This use case employs data (e.g., soil, land, weather, farmer) and advanced analytics to assess demand more accurately for inputs at the individual farmer or pastoralist level and to help guide procurement decisions. The legacy input procurement process faces challenges of lengthy and manual demand aggregation and limited site-specific data, causing uneven assessment of demand. The goal of this use case is to get inputs to where they are most needed, in the right blends, more quickly and efficiently, to ensure more productive crops and livestock and better use of government spend on inputs. The use case focuses on fertilizer to begin, as this is a government procured input with a large deficit and government-led distribution.

Key activities for implementation

- Build an analytics dashboard and DA/farmer-facing application to collect data.

- Recruit, second or train an in-house analytics team to produce predictive analytics.

- Build a data stack with APIs, building upon the existing Ag Datahub.

- **Data Standards –** For each type of data (e.g., production data, farmer data) needed for each intervention, develop and ensure proper data standards are used, leveraging existing data standard initiatives such as aLIVE when possible.

- Collect key datasets, including farmer profile, crop sown, production and land data.

- **Data policy -** Develop and issue agriculture sector data policy, that aligns to national policy, and establishes a framework for collection and sharing of necessary datasets (e.g., climate data, farmer profile data)

- Train DAs in data collection, app usage and fertilizer prediction validation, and onboard fertilizer vendors.

- Scale to other inputs such as seed, agrochemicals, and animal feed.

Table 6: Dependencies to fully scale Procure and Distribute Inputs Use Case

Use Case Dependencies	Ecosystem sub-component	Rationale
Data governance and sharing policy, standards, assurances, and incentives	Government and policy	Establishes a framework for collection, and sharing of demand input demand data as well policies concerning data privacy
Digital program in ATVETS	Human capital	Provides DAs the necessary training on digital tools, enhancing their capacity to effectively manage, understand and utilize digital systems for input procurement
Free access for DAs and farmers to key apps	Digital infrastructure	Ensures that DAs and farmers have access to the necessary tools for real-time data entry and access to information

Land & farmer-linked production data	Data and content	Offers detailed insights into production needs and capacities, enabling precise demand forecasting and targeted input distribution
Farmer profiles and unique ID	Data and content	Provides a reliable identification system for farmers, ensuring that inputs are distributed accurately and efficiently to the intended recipients

Procure and distribute fertilizer - use case deep-dive

The procure and distribute inputs business case has been designed to tackle key challenges across the fertilizer value chain. Currently there are three major challenges that the use case could solve for:

01

10% farmers have no access to fertilizer and 45% have insufficient access to fertilizer due to a lack of site-specific data resulting in uneven fertilizer assignments

02

40% farmers are receiving fertilizer late lengthy manual processes for demand submission and assessment have contributed to delays

03

10% farmers receive incorrect fertilizer as there is no digitalized data linking farmers to their land or demand assessment

To solve for these challenges, farmer or DA assessments will be supplemented with additional data that is analyzed using predictive modelling to build a more accurate demand picture. DAs will then be able to validate or query predictions through an app, and MoA will then use this information to deliver the right fertilizer in the right blends on time.

**Figure 7: Illustrative example of input demand dashboard**
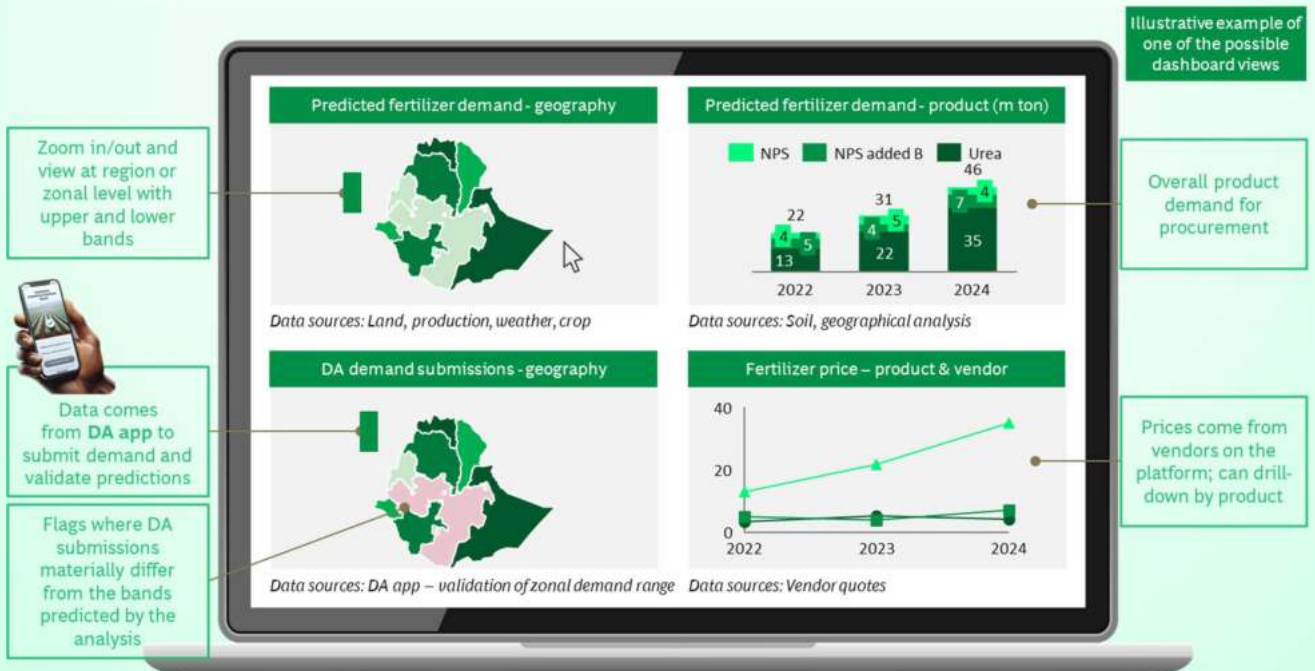
Insights will be visualized through a dashboard (see Figure 7~~Figure 7~~) that will show demand by geography, areas in which DAs have queried predictions, demand by product, and pricing by product. This will support effective decision making and procurement.

To ensure the success of this use case, the digital stack and enabling environment will need to be strengthened in five of the most nascent areas:

1. **Personalization:** Personal interfaces should be built using farmer profiles to deliver targeted information on fertilizer application either via DAs or digital solutions.

2. **Analytics:** Existing initiatives such as CIAT site-specific fertilizer and EDACAP climate analytics should be leveraged, while an in-house capability is developed.

3. **Human capital:** ATVETs training on data collection and digital solution use should be prioritized to empower and equip DAs.

4. **Agricultural markets:** Savings from the use case should be used to readjust foreign currency allocations to increase the amount of fertilizer available.

5. **Data:** Three foundational datasets should be scaled for the use case: land data, production and crop sown data, and farmer data (as weather and soil data are relatively strong).

Figure 8: Procure and distribute inputs target solution[43]
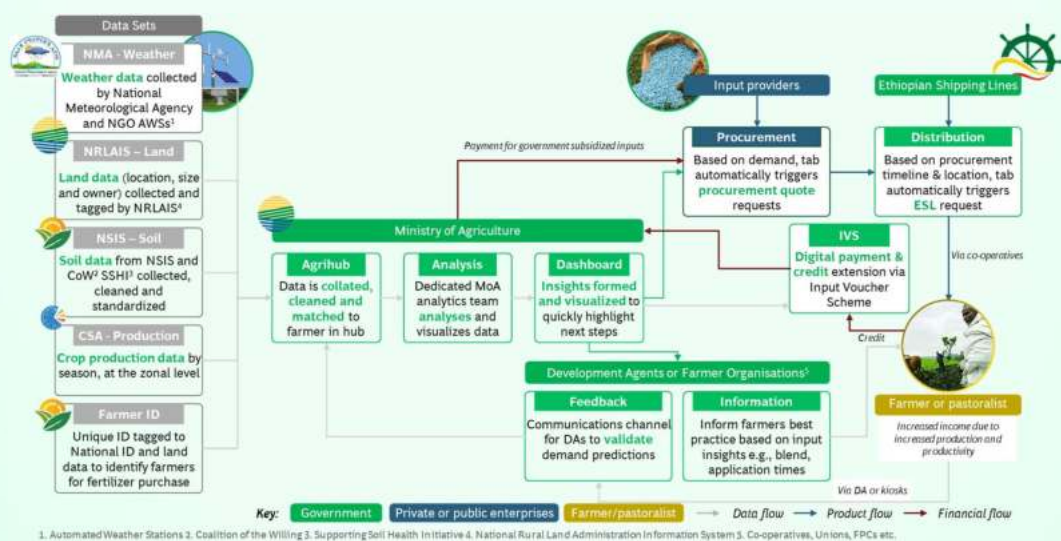
This use case will see significant social and economic impacts, with an estimated 30m farmers positively impacted (of which 14m are female), an 8% average income increase per farmer, an annual production increase of 30m quintals across crops, and increased climate resilience from improved blends, increased foreign currency from increased production and export, and more efficient procurement spend.

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[43] Data sets listed in the figure are non-exhaustive and require expanding from their current state to cover the entire target population

5.5.2 Supply Chain Management

Solution area objective

Services that guarantee quality products on time for farmers, pastoralists, and off-takers

Solution area descriptions and use cases

Supply chain management use cases are focused on creating safety and traceability for both inputs and outputs while enabling transport and storage optimization through digital solutions across the agriculture value chain. This solution area has three use cases, one of which has been prioritized for Phase One of the roadmap. The table below shows the phasing, descriptions, and the target end users of each use case.

Table 7: Supply Chain Management Use Cases

	Use case	End User	Description
Phase 1	Track and trace inputs	Government; logistics providers	Enhance support for farmers by accelerating input distribution and minimizing leakage through efficient, trackable, and transparent logistics via QR codes and NFC tags, with quality verification mechanism for farmers
Phase 2	Transport and store outputs safely	Farmers & pastoralists	Link farmers to storage and transport solutions that are well priced and safe
	Track and trace output inventory	Agriculture output buyers	Provide efficient, automated, and transparent logistics and distribution solutions at a fair price for output buyers, with well documented and verifiable history and quality assurances for output product

Ecosystem assessment – Improvements

In the past 5 years, the Ethiopian ecosystem has begun to make progress in the supply chain, with recent developments targeting traceability solutions for both inputs and outputs. The Ethiopian Digital Inputs Tracking System (EDITS) is a pilot currently be

There have also been some advancements for the private sector, as Lersha has begun to expand into input aggregation, but this is currently limited to

designed to track fertilizer from port to farm gate to support timely delivery and quality inputs, though this is still nascent and will require strengthening and scaling. For outputs, integration of traceability solutions into the Ethiopian Commodity Exchange via an IBM-enabled national system has been developed for select high-value export crops such as coffee.

aggregation to negotiate improved rates, rather than for access or quality control.

Ecosystem assessment – Areas to strengthen

Though progress has been made in supply chain management, advancements are relatively recent,

and therefore will require strengthening and scaling to create a robust supply chain. Furthermore, physical infrastructure will need to be strengthened to improve distribution and logistics so that farmers and pastoralists can reap the benefits of successful digital solutions.

Input tracing: The EDITS will require rapid scaling as input on-selling and tampering has been identified as a key pain point for farmers. The pilot launched in 2024 for fertilizer, but should be quickly scaled across regions and inputs such as agrochemicals based on lessons learned.

Livestock tracing: The ECX[44] traceability solution integration is applicable to specific outputs within the exchange, but traceability solutions are needed for a broader range of products, including increasingly for livestock for export markets. This will need a much-improved livestock database; the aLIVE[45] livestock roadmap makes specific recommendations for this, and should serve as guidance for the development of livestock traceability solutions.

Infrastructure: Transportation and distribution are key to supply chain management, and therefore, a reliable physical network is necessary for supply chain success. Currently, only 22% of rural households in Ethiopia are less than 2km from a road, creating challenges in access to services.[46] These challenges could be addressed by a thorough road assessment in partnership with the Ministry of Transport and Logistics and aligned to the World Bank funded Road Connectivity and Access Program (RCAP), with improved roads developed in strategic routes for optimum rural distribution. Furthermore, limited port and warehouse handling capacity is currently creating distribution delays, and so alternative options or optimized shipping should be explored to increase port and warehouse efficiency, including better utilization of cooperatives as distribution hubs.

Regulation: Quality, health and safety data is tracked via bar codes for inputs, but there are challenges today in capacity for regulation and enforcement that limit effectiveness of these measures. As tracking and tracing improves through digital solutions, capacity building will be needed to ensure inputs can be suitably regulated through digital mechanisms. Procedures for enforcement of regulatory standards should also be enhanced to ensure they are clear and consistent across regions.

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[44] Ethiopian Commodity Exchange

[45] A Livestock Information Vision Ethiopia

[46] RAI World Bank (2019)

Table 8: Select Ongoing Supply Chain Management Initiatives

| Organization	Initiative	Description
Lersha	Input aggregation	• Focus on improving the agriculture value chain through aggregation of inputs for farmers
Ethiopian Commodities Exchange (ECX)	Electronic Agriculture Transformation Traceability System (eATTS)	• Collaboration between Ethiopia Commodity Exchange (ECX) and IBM • Launched as a pilot in 2015 • Objective is to benefit over 5,000,000 smallholder farmers producing various commodities traded at the ECX • Initially focused on the coffee sector to enhance the export of high-quality Ethiopian coffee and improve market access for specialty coffee. • Supported by IBM and Frequenz IRIS technology, allowing for electronic tracking of bags • Linked to over 2,500 geo-referenced washing, hulling, and cleaning stations across various regions in Ethiopia
World Bank, Ministry of Finance, Ministry of Urban and Infrastructure	Ethiopia Rural Connectivity to Support Food Security Project	• The main objective of this program is to interconnect rural communities and isolated areas during all weather conditions • The program is expected to run from March 2024 to May 2029 • The project involves construction of roads and upgrading current roads to make them climate resilient along with construction of pedestrian and drainage structures

Phase One priority use cases

1. Track and trace inputs

This use case aims to ensure the efficient transportation of inputs from the country's point of entry, through various farmer unions and federations, and ultimately to the farmers in their respective kebeles. It also focuses on maintaining traceability and visibility for the farmer throughout the entire process.

The input supply chain currently faces challenges such as looting, reallocation of over and under stocked inventory and trade of illicit inputs which this use case aims to solve for by leveraging technologies such as QR codes and NFC[47] tags all linked to the profile of the farmer to whom the inputs have been allocated. This use case is currently being implemented and scaled by ATI under the Ethiopia Digital Input Tracking System (EDITS) projects.

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[47] Near-Field Communication
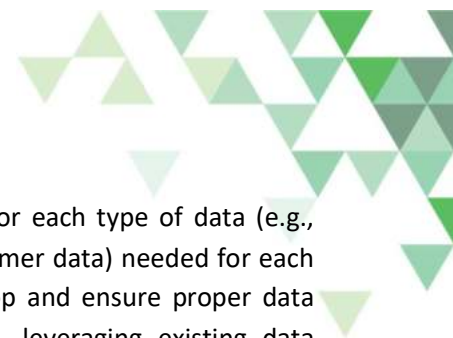
Key activities for implementation

- Assess software requirement and create ToRs for hiring software development firms.

- Carry out data collection and validation of initial requirements through visits to key locations such as the Djibouti port, warehouse, and local unions.

- Create a detailed budget and implementation plan for scaling beyond the in-progress pilot, ensuring alignment with other MoA programs such as the e-voucher system.

- **Data Standards –** For each type of data (e.g., production data, farmer data) needed for each intervention, develop and ensure proper data standards are used, leveraging existing data standard initiatives such as aLIVE when possible.

- Integrate the input tracking system with the e-voucher system, and update as relevant pending developments in digital payment systems and the National Rural Land Administration Information Service (NRLAIS), ensuring smooth implementation.

Table 9: Dependencies to fully scale Track and Trace Inputs Use Case

Use Case Dependencies	Ecosystem sub-component	Rationale
Farmer profiles and unique ID	Data & Content	Ensures accurate identification and that inputs reach the intended farmers efficiently
Input warehouses and distribution hubs	Physical Infrastructure	Provides centralized locations for storing and distributing inputs, facilitating efficient logistics, inventory management, and timely delivery to farmers
Digital kiosks for farmers and DAs	Digital Infrastructure	Offers accessible points for farmers to access real-time information, submit requests, and receive updates, enhancing transparency
Device access for extension workers	Digital Infrastructure	Ensures that extension workers have the necessary tools to collect data, monitor input distribution, and provide support to farmer

5.5.3 Financial Services

Solution area objective

Universal access to financial services that improve input & machinery access, insure crops and make payments more efficient

Solution area description and use cases

This solution area focuses on increasing access to financial services such as credit, financing, and insurance by leveraging e–vouchers, mobile payments and digital banking and insurance solutions. Five use cases have been identified in this solution area with two prioritized for Phase 1 of the roadmap. The table below shows the phasing, descriptions, and the target end users of each use case.

Table 10: Financial Services Use Cases

	Use case	End user	Description
Phase 1 (prioritized)	Access credit	Farmers & pastoralists	Enhance farmer and pastoralists access to loans by providing necessary data inputs for credit assessments, scaling the e-voucher for input credit, and supporting bundled access to credit for agriculture inputs, land or projects
	Access to insurance	Farmers & pastoralists	Enable subscription to different insurance packages, undergo value assessments, pay premiums individually or in groups, and receive timely compensation after an insurance event, by providing necessary data inputs and aligning and partnering with insurers and reinsurers
Phase 2	Lease or purchase machinery	Farmers & pastoralists	Support the establishment and spread of digital tools that provide access to credit services, deposit schemes, as well as leasing platforms that enable farmers to more easily access machinery
	Access investment	Farmers & pastoralists; Investors	Provide an enabling environment and agriculture-specific channel (e.g., a digital platform) for investors, donors and NGOs to fund agriculture projects by channeling funds directly to implementing partners on specific projects
	Access to mobile banking and mobile money	Farmers & pastoralists	Support the expansion of mobile money and banking applications to farmers and pastoralist and co-develop use cases with fintechs and banks, thus enabling them to make payments for inputs and receive payments for outputs quickly and cheaply

Ecosystem assessment – Improvements

In the past 5 years, the Ethiopian ecosystem has made significant progress in terms of digital financial services, particularly in user-facing digital financial services. For example, Telebirr launched in 2021 and has rapidly scaled to reach 40 million users (55% of adult population) and disbursed 9 billion ETB in digital credit. Telebirr has been joined by Safaricom's M-Pesa, which launched in Ethiopia in 2023 and is still scaling. Digital banking services have also grown with many Ethiopian banks launching their own digital banking apps such as Michu by the Cooperative Bank of Oromia and Apollo by Abyssinia Bank. Lersha has also recently developed a personalized 'expert scoring'[48] system to assess the potential creditworthiness of farmers and provide input loans to them.

Integration and interoperability of these payments systems are also developing, with private sector fintech startups such as Chapa and Afripay offering services such as payment gateways, payment APIs to allow for interoperability, and point of sale (POS) services. Mobile money services such as TeleBirr are also expanding their applications and services and integrating with services such as Deliver Addis, a food delivery app.

Ecosystem assessment - Areas to Strengthen

Despite progress in digital financial applications, much work needs to be done if largely rural farmers and pastoralists are to benefit from digital financial services.

Mobile banking: Mobile banking services still have low penetration in rural areas and with farmers and pastoralists due to low digital and financial literacy, lack of proper identification, unaffordable data plans and smart phone devices, as well as poor 4G connectivity in rural areas. Digitally equipped Development Agents (DAs) or Digital Kiosks at FTCs or one stop shops offer potential as a work around for expensive data and phones, but they still must overcome digital literacy, financial literacy, and connectivity challenges. Successful rollout and expansion of the Ethiopian National Digital ID Program (Fayda) should address identification issues that have kept farmers unbanked.

Financial and transaction data: Moreover, limited financial data (e.g., historical transaction data) and credit history for farmers and pastoralists hinders the ability of lending institutions to assess credit worthiness and provide financing. Limited transaction data is compounded by low quality or insufficient data on the farmer itself (e.g., farmer profile) such as production history, land data, average crop yield, etc. A farmer profile with accurate and comprehensive data on a farmer's production activities would greatly enable access to finance and insurance. A pilot for a farmer profile is underway as of 2024, but should be rapidly scaled.

Agriculture-specific services: Data availability challenges are compounded by traditional finance institutions often having limited experience and expertise in providing loans to the agriculture sector. This challenge could be addressed by embedding more agronomists within banks to assess risks in the agriculture sector or by creating an agriculture

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[48] Called an Expert score because data required for a traditional credit score (e.g., transaction history) is not available and instead 19 available data points are used as a proxy for credit worthiness

development bank with a clear mandate to support the sector's development.

Input access: Separate from access to financing, a small domestic manufacturing base for farm equipment (e.g., tractors) and inputs, combined with

an unfavorable macroeconomic environment that limits the availability of foreign currency for imports, is a major challenge. This hinders availability and access to machinery and farm inputs (e.g., fertilizer) within the country.

Table 11: Select Ongoing Financial Services Initiatives

Organization	Initiative	Description
MoA & JICA	Indexed-based Crop Insurance Promotion (ICIP)	• Launched in 2019 with the objective to expand access to insurance among farmers in Ethiopia • As of 2023, the project has increased digital financial literacy among over 57,000 smallholders with approximately 10,000 farmers purchasing insurance schemes and more that 2,500 receiving payouts • Proposed and organized the Dialogue Platform Meeting for Supporting Agricultural Insurance in Ethiopia, in partnership with the MoA and WFP, to discuss policies and coordinate efforts
Hello Erf & Hello tactor	Machinery Leasing Platforms	• Hello Erf is an Ethiopian agritech solution enhancing smallholder farmers' productivity by connecting them with mechanization service providers through a central call center, ensuring access for all, and providing real-time tracking and order aggregation • Hello Tractor, is a Kenya-based agritech startup that recently entered the Ethiopian market and is expanding its operations
ATI	Credit for Inputs Digital E-voucher System	• E-voucher System was developed by ATI and the MoA to help smallholder farmers access credit for inputs, transitioning from paper to electronic format to streamline processes, reduce errors, and save costs. • The system collaborates with local microfinance institutions and rural savings and credit cooperatives • Vouchers can be redeemed at nearby cooperative stores

Phase One priority use cases

1. Access to credit

This use case aims to enhance farmers' and pastoralists' access to loans by providing and analyzing the necessary data for credit assessments. The results of these assessments will be shared with banks and microfinance institutions to determine the appropriate loan amounts and interest rates.

Additionally, it involves providing inputs to farmers on credit, which can be repaid after harvest through systems such as the e-voucher system.

In addition to collaboration with MinT and INSA for digital, data, and cybersecurity expertise and regulatory alignment, this use case will require close collaboration between MoA, the National Bank of Ethiopia, commercial banks, microfinance

institutions, local fintechs, and mobile money providers to support the delivery of credit and loans to farmers and pastoralists. Lersha is also an ecosystem partner to engage as they recently developed their own 'expert scoring system' in collaboration with JICA. Lessons learned from Lersha's experience could potentially be leveraged for this use case.

Key activities for Implementation

- Build partnerships with commercial banks and microfinance institutions to gather input and collaborate on developing usable credit scoring algorithms to help de-risk lending to farmers.

- **Data policy -** Develop and issue agriculture sector data policy, that aligns to national policy, and establishes a framework for collection and sharing of necessary datasets (e.g., farmer profile data)

- Create credit scoring algorithms by enhancing data on farmers and piloting the algorithm with the digital e-vouchers or select bank and microfinance institutions.

- Ensure back-end compatibility of the credit scoring algorithm through APIs with private sector players such as Lersha.

- Refine and scale the use case, embedding other features such as insurance functionality and optionality.

Table 12: Dependencies to fully scale Access to Credit Use Case

Use Case Dependencies	Ecosystem sub-component	Rationale
Digitized payments through rural service points and other channels	User facing layer	Ensures secure and efficient disbursement and repayment of loans, facilitating financial transactions for farmers and reducing the risks associated with cash handling
Data stack with APIs	Integration layer	Enables seamless integration and exchange of data between various systems, providing a comprehensive view of farmers' financial and agricultural activities necessary for accurate credit assessment
Transaction data	Data layer	Provides essential insights into farmers' financial behavior and transaction history, helping to evaluate creditworthiness and tailor loan products to individual needs
Data governance and sharing policy and guidelines	Government and policy	Ensures that data is managed securely and shared responsibly, protecting farmers' privacy and maintaining data integrity

2. Access Insurance

The objective of this use case is to increase the accessibility of insurance products to farmers and pastoralists by enabling them to subscribe to different insurance packages, undergo value assessments, pay premiums individually or in groups, and receive timely compensation after an insured event. MoA will achieve this by improving the quality and availability of key data points (e.g., historical production data) through scaling the farmer profile initiative and working with the National Meteorology Agency (NMA) to improve weather data for risk

assessments. Partnerships and policy and technical support for insurers and reinsurers to reach farmers are also important for the implementation of this use case.

The success of this use case will depend on close collaboration across the Ethiopian ecosystem, potentially including local insurance companies, microfinance institutions, and mobile money operators.

Key Activities for Implementation

- Build partnerships with reinsurers and microfinance institutions to understand requirements for offering (re)insurance

- **Data policy -** Develop and issue agriculture sector data policy, that aligns to national policy, and establishes a framework for collection and

sharing of necessary datasets (e.g., farmer profile data)

- Create risk assessments and identify premium amounts by working with research centers and weather forecasters, and by building advanced analytics on this data

- Pilot the use case bundles with existing credit facilities such as the input voucher system covering losses due to adverse weather conditions, pest, and disease attacks to enable farmers and pastoralists pay off loans and have income in the case of poor yields

- Digitize payouts and approvals through partnerships with mobile network operators, banks, and fintechs offering mobile money and by using AI-powered digital claim assessment tools

Table 13: Dependencies to fully scale Access to Insurance Use Case

Use Case Dependencies	Rationale	Ecosystem sub-component
Access credit	Use Case	Use Case potentially bundled with credit applications and the same data sets to assess credit risk (e.g., land, production, etc.) are important for insurance products.
Digitalized payments through rural service points and other channels	User facing layer	Ensures secure and efficient farmer compensation payment of principle, and reduces the risks associated with cash handling
Data stack with APIs	Integration layer	Enables validation of farmer information such as land and crop data and can also be used to register insurance products and validate receipt of insurance payouts
Weather and production data	Data Layer	Critical for accessing climate risk while pricing different products and triggering payouts due to adverse weather events
Data governance and sharing policy and guidelines	Government and policy	Ensures that data is managed securely and shared responsibly, protecting farmers' privacy and maintaining data integrity

5.5.4 Pricing and Market Services

Solution area objectives

Transparent and timely pricing and reliable market linkage with quality assurance measures

Solution areas description and use cases

Use cases in this solution area focus on providing farmers access to live pricing as well as other important pieces of market information such as price forecasting and expected demand. They also focus on matching supply of agricultural output to demand. This solution area has five use cases, one of which has been identified as priority for Phase One of the roadmap. The table below shows the phasing, target end users, and descriptions for each use case.

Table 14: Pricing and Market Services Use Cases

	Use case	End user	Description
Phase 1	Access better markets and buyers	Farmers & pastoralists	Link farmers with markets via digital platforms domestically and abroad to reduce middlemen and maximize sales volume and revenues, thus increasing farmer income
Phase 2	Manage farm business activities	Farmers & pastoralists	Support farmers' business operations by enabling or providing digital solutions in bookkeeping, inventory, and farm resource management to improve accuracy and reduce costs
	Understand up-to-date transparent pricing for products	Farmers & pastoralists	Support farmers' crop and livestock planning and selling decisions by providing improved access to live and predictive pricing for a broad range of crops and livestock
	Assure quality of outputs	Farmers & pastoralists, off-takers	Provide farmers standardized digital quality certifications for their produce, serving as verifiable proof of quality of output during interactions with buyers
	Sort and grade output	Farmers & pastoralists	Support farmers to get a measure of the quality of their output both in general and in relation to the overall harvest of that particular season, to enable targeted market linkage and advisory

Ecosystem assessment – Improvements

In the past 5 years, advancements especially through the Ethiopian Commodity Exchange (ECX) and the National Market Information Service (NMIS) have progressed the digitalization of pricing and market services. The ECX is the first Sub-Saharan African electronic commodity exchange and has integrated data orchestration tools as well as a secure payment system. There is also a predictive analytics element for ECX quality control, that has improved output quality.

The NMIS platform has grown from 2 commodities to 19 and from 31 markets to 311 since 2019, with 1.2m callers for up-to-date pricing. The National Livestock Market Information Service (NLMIS) was also launched in 2019 and now covers 56 market centers up from 47.[49] Both platforms use mobile push services with daily market information via text message or interactive voice response (IVR).

Ecosystem assessments – Areas to strengthen

Despite progress in digital pricing and marketing applications, there is still opportunity to better connect farmers, pastoralists and markets, as well as to optimize pricing and value addition.

Scope: Despite clear progress for the ECX, NMIS and NLMIS, the geographical and commodity reach is still limited, meaning few farmers are able to benefit from timely, location specific pricing for their chosen crop. Supporting initiatives to scale the NMIS is recommended, as this existing channel is already used by farmers due to the optionality of low-technology interfaces such as voice call.

Forecasting: While analytics on the Ethiopian Commodities Exchange have advanced in recent years, there is still limited use of advanced price forecasting, especially to support farmer decision making for crop scheduling or livestock rearing cycles. Predictive price forecasting can also help farmers make improved market decisions; by understanding likely pricing in different markets, farmers can optimize and limit the involvement of middlemen.

Price data: All price information currently comes from Development Agents (DAs) and government NMIS agents, meaning that price submission processes are relatively manual and a wealth of price data from the private sector is lacking. Improved access to devices and subsidized data packages for DAs would improve the efficiency of DA interaction with the NMIS and NLMIS platforms. To increase the amount of data on pricing from the private sector, incentivization and robust safety and consent mechanisms will be required. A business case for private enterprises that highlights the financial benefits of removing middlemen through increased price visibility could overcome the challenge of limited data sharing, while consent tools in the data stack can reassure data providers that their information is being securely shared with the correct stakeholders.

E-commerce: A private sector led e-commerce platform is missing for marketing of commodities. An e-commerce data proclamation is in the process of ratification by MinT, which may go some way to encouraging the development of an agriculture-specific platform. Furthermore, the proposed data stack with APIs will create an ecosystem that will allow for private sector actors to build and engage with e-commerce platforms, by improving data access and software functionality. This should be prioritized to facilitate an efficient market with clear pricing and market visibility.

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[49] NMIS and NLMIS materials (2024)

Table 15: Select Ongoing Pricing and Market Services Initiatives

Organization	Initiative	Description
ATI & Ministry of Trade and Industry	National Market Information System (NMIS)	• Launched in 2019, the system gathers, processes, and disseminates timely and accurate market information on agricultural commodities such as wheat, maize, tef, sesame, and haricot beans • Intended to assist smallholder farmers and other market actors in making informed market decisions, including where and when to buy or sell commodities • The information is disseminated through various channels including a 6077 hotline, email subscriptions, website, and radio broadcasts
ATI & Ministry of Trade and Industry	National Livestock Market Information System (NLMIS)	• Launched to address the lack of market information, improve access to market data across 47 monitored livestock markets, and enhance market linkages for domestic and export opportunities • Price and volume data is collected via SMS-enabled cell phones and a data coding system, making information accessible through SMS queries and an internet portal • System benefits include linking producers with traders, reducing broker influence, and enhancing market transparency
MinT	Electronic Transaction Proclamation	• This proclamation was adopted in 2020 and partially regulates e-commerce in Ethiopia • It clearly defines e-commerce operators, e-commerce platform operators and e-commerce intra platform operators and jointly classifies them as e-commerce service providers • It also legally differentiates between the middle men and actual product and service providers on e-commerce platforms

Phase One priority use cases

1. Access better markets & buyers

This use case aims link farmers to off-takers, both locally and internationally, who can purchase their output at fair prices. The main objective is to transition from an informal, middleman-dominated market to a more regulated aggregator market, ensuring that most of the value flows to the farmers through transparent pricing. This is achievable through collaborations and partnerships with various output off-takers, farmer unions, and across government with involvement from various ministries.

Key activities for implementation

- Carry out a comprehensive demand-side stakeholder mapping, both locally and internationally, to understand current and potential Ethiopian output off-takers, and categorize them in terms of interest.

- Engage high-interest off-takers to understand their priorities, build business relations, and co-create the use case with them to ensure alignment with needs.

- Design and implement awareness and socialization campaigns for farmers on the benefit of clustering in cooperatives and unions and develop incentives to drive formation and participation of unions and cooperatives.

- Develop transparent price discovery mechanisms for agriculture output based on

demand & supply or transparent auctioning through farmer unions and cooperatives.

- Leverage cooperatives and unions as well as digital technologies such as NMIS and 8028 to disseminate up-to-date and predictive pricing information to farmers.

- Collaborate with logistics providers to ensure smooth transportation of output from the farmer clusters where output is aggregated to the buyers.

- **Data Standards –** For each type of data (e.g., price and market data) needed for each intervention, develop and ensure proper data standards are used, leveraging existing data standard initiatives such as aLIVE when possible.

Table 16: Dependencies to fully scale Access Better Markets and Buyers Use Case

Use Case Dependencies	Ecosystem sub-component	Rationale
Digitized payments through rural service points and other channels	User facing layer	Critical to ensure farmers and pastoralists receive payment for the sale of their output to different off-takers
Price data	Data and content	Critical for farmers and pastoralist to make informed decisions on which crops to plant or which livestock to rare based on the potential income their output could fetch
Incentivized cooperative and union aggregation and value addition	Agricultural markets	Enables farmers to have one voice and stronger bargaining power when negotiating with potential buyers, also easing aggregation of output for off-takers

5.5.5 Smart Farming

Solution area objective

On-farm tools to maximize production, productivity, and natural resource management.

Solution area description and use cases

Use cases in this solution area focus on developing precision, on-farm technology to enhance production, including management, tracking, and varietal development. This solution area has four use cases, all of which will be targeted in Phase Two of the roadmap. The table below shows the phasing, descriptions, and the target end users of each use case.

Table 17: Smart Farming Use Cases

	Use case	End user	Description
Phase 2	Improve crop varieties	Researchers	Support researchers in improving data quality and interoperability to help develop advanced crop varieties for farmers, and introduce digital tools such as digital testing, predictive analytics, and genome sequencing
	Use and maintain farm machinery	Farmers	Support farmers in accessing machinery and enable the development of digital tools sch as IoT to ensure timely and effective maintenance
	Irrigate crops	Farmers	Provide access to data and an enabling environment that will support the development of tools to improve irrigation efficiency and accuracy, reducing water consumption
	Dispose of and manage farm waste	Farmers & pastoralists	Ensure safe and cost-effective management of waste, including using waste in other industries

Ecosystem assessment – Improvements

Progress in smart farming has remained relatively stagnant over the last five years, but there have been some improvements to highlight. For example, a CIAT pilot launched in 2021 is working on irrigation with some digital functionality.[50] Another example is Hello Tractor which has developed elements of machinery maintenance and use into their offerings, such as the internet of things (IoT) in Hello Tractor vehicles which alerts users to predictive maintenance requirements.

Furthermore, some improvements have been made in data that could be relevant to on-the-farm decisions, such as the Ethiopian Digital AgroClimate Advisory Platform (EDACAP), CIAT's Clim-ARM[51] project and the Supporting Soil Health Initiative that

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[50] Small-scale irrigation with youth by Alliance Bioversity and CIAT

[51] Climate Analytics into Agricultural Risk Management

were highlighted in section 5.1.1. This data could be packaged to better support farmers in their activities, especially for crop planning.

Ecosystem assessment – Areas to strengthen

In the past 5 years, there has been limited progress in smart farming use cases. High cost barriers of on-the-farm digital solutions and low mobile internet penetration, especially in rural areas, have hindered progress. Furthermore, as in agricultural intelligence, the lack of quality data is preventing relevant insights from being developed and ultimately translated into actionable solutions. Therefore, three areas will need to be strengthened for success in smart farming use cases.

Mobile data access: There is low mobile internet penetration in rural areas and with farmers and pastoralists due to low digital and financial literacy, unaffordable data plans and smart phone devices, and poor 4G connectivity. This means many on-farm digital solutions such as smart irrigation, are inaccessible to farmers. Digitally equipped Development Agents (DAs) or Digital Kiosks at FTCs[52] or one stop shops offer potential as a work around for expensive data and phones, but they still must overcome digital literacy, financial literacy, and connectivity challenges. Awareness campaigns around the financial benefits of smart farming solutions may also incentivize farmers to invest in

both device and internet access, but also their own digital literacy training.

User facing solutions: Currently, any insights produced from agricultural data remain at the governmental level, or are highly local and communicated in person, from DA to farmer. This means that farmers and pastoralists do not have a full suite of information at their disposal to make decisions on what is best for their farm. Once mobile data access increases, and there is a clear market, enterprises should be encouraged to produce digital solutions for farmers through incentives such as tax breaks, as well as access to quality agriculture data through the data stack ecosystem.

Machinery access: A small domestic manufacturing base for farm equipment (e.g., tractors or irrigation equipment), combined with an unfavorable macroeconomic environment that limits the availability of foreign currency for imports, is a major challenge. This hinders availability and access to machinery within the country and means machinery rental or purchase is too expensive for many smallholder farmers. A thorough assessment of the machinery value chain can identify potential interventions to improve access and affordability and will likely reveal the need to build up Ethiopia's own local manufacturing and industry.

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[52] Farmer Training Centre

Table 18: Select Ongoing Smart Farming Initiatives

Organization	Initiative	Description
CIAT	Small scale irrigation farming	• This was piloted in Angolela Kebele and engaged 12 youth in small-scale irrigation farming, utilizing existing water harvesting ponds to cultivate crops such as beans, potatoes, onions, and carrots, generating significant income and providing employment • Following the successful pilot, plans are in place to scale up the scheme to other areas within the region, map and analyze existing small-scale irrigation schemes, and develop optimal irrigation practices to enhance food and nutrition security for smallholder farmers
Hello Tractor	Pay on demand mechanization	• Hello Tractor matches demand for mechanization in a woreda to tractor operators through their network of agents • This enables farmers to pay for mechanization as a group as and when they require the service as opposed to each farmer owning a tractor • Hello Tractor leverages IoT technology to deliver predictive maintenance alerts to its clients, ensuring timely servicing and optimal performance of their farm equipment

5.5.6 Extension and Advisory

Solution area objective

Timely, demand based, customized extension & advisory services

Solution area description and use cases

The ambition to digitalize extension and advisory services was addressed extensively in Ethiopia's Digital Agriculture Extension and Advisory Services (DAEAS) roadmap. The DAEAS roadmap and its initiatives have been fully integrated into DAR as described in section 5.2. In this section, the roadmap just provides an updated overview of the ecosystem assessment for extension and advisory services within Ethiopia.

Ecosystem assessment – Improvements

Although extension and advisory is still predominantly in-person, through a network of ca. 50,000 - 60,000 government Development Agents, there has been progress towards digital initiatives. The ATI 8028 hotline, which operates through both Interactive Voice Response (IVR) and Short Message Service (SMS), reaches 6 million farmers annually with its free extension and advisory services. Digital Green is also piloting an AI-enabled extension chatbot called FarmerChat, which provides personalized, real-time advisory.

Ecosystem assessment - Areas to Strengthen

Despite progress in extension, and the momentum created by the DAEAS Roadmap, there is still opportunity to better connect farmers and pastoralists to improved extension and advisory services.

Pluralistic extension: The engagement of domestic private enterprises is still nascent with a limited number operating extension services for farmers. Moreover, regulatory challenges are preventing market entry for international private sector companies, with the average time to register and establish a DAEAS business reported to be around a year.[53]

Device and data costs: The ability to access the internet is currently too expensive for many in the country, with data costing 5% of the GNI per capita in Ethiopia vs 3% for LMICs[54] and a smartphone costing 96% GNI per capita vs 34% in Kenya.[55] These prices mean many of rural farmers and pastoralists are unable to afford internet access, and thus do not have the ability to access many of the recommended digital services.

Data: The lack of accessible and interoperable data across the ecosystem is currently preventing the development of more targeted, automated and personalized advisory. There are major gaps in key foundational data sets, such as the farmer profile (which would allow for personalization), and crop sewn data. Existing data sets are hard to use due to the lack of consistent standards and limited accessibility, especially for the private sector. Data sharing also remains a critical challenge due to limited incentives and regulatory framework.

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[53] DAEAS stakeholder interviews

[54] Lower Middle-Income Country; ITU price baskets data (2022)

[55] Alliance for Affordable Internet (2021)

Select ongoing initiatives

Table 19 Select Ongoing Extension and Advisory Services Initiatives

Organization	Initiative	Description
Digital Green	Video based extension and advisory	• Digital Green has developed a video-based extension advisory service that organizes farmer groups to watch a pre-recorded video on agricultural best practices and discuss and learn through a facilitator
Farm Radio International	Radio-based extension advisory	• Farm Radio uses radio to share information with farmers, amplify their voices, and support positive changes • The organization collaborates with development partners and local radio stations to develop content tailored for farmers and broadcast useful farming-related programs to farming communities
Sasakawa Africa Association (SAA)	Talking Book audiovisual - based extension service	• SAA uses an audio-enabled device, known as Talking Book, to enable SHFs to listen to prepared audio messages on improved agricultural technologies • In addition, they provide video-based training to farmers using the Digital Classroom System (DCS) on improved agricultural practices along the value chain • The DCS can be interfaced with Digital Green's video-based extension advisory service

5.6   DIGITAL STACK

The digital stack refers to the layered structure of technology components that enable digital agricultural solutions. This includes key data sets, analytical solutions and features to enhance data integration and interoperability. The stack ensures solutions are interoperable, scalable, and adaptable to technological changes and farmer needs.

The digital stack has four layers or sub-components:

- **The user facing layer** - Interface between the digital solution and its end-users

- **The integration layer** - Middleware that facilitates the smooth flow and integration of data across different systems and services

- **The analytics layer** - Core component that manages and processes data, ensures integrity and accessibility and develops insights

- **The data and content layer** – Information and data sets required to enable digital agriculture use cases e.g., crop information, weather data, market trends, and educational resources

The phasing of digital stack initiatives for the roadmap involved a two-step process. First, a long list of initiatives relevant for Ethiopia was developed using inputs from the national convening, stakeholder interviews, and the DAEAS roadmap, resulting in a list of 13 digital stack initiatives. These initiatives were then prioritized based on the Ministry of Agriculture's implementation feasibility, alignment with relevant Ethiopian strategy and policy documents, and stakeholder priorities resulting in two priority Phase One initiatives. More details on the prioritization methodology and results can be found in section 8.5.2 Enabling Initiatives Prioritization within the appendix of this roadmap.

Additionally, an assessment of the ecosystem's improvements and areas to strengthen have been left out the Digital Stack analysis, as these topics have been addressed extensively in section 5.5 Solution areas and use cases.

5.6.1 User facing layer

Layer objective

Interfaces designed to empower use of digital tools

Layer description and enabling initiatives

The user-facing layer consists of initiatives that help end users interact with digital solutions. This includes the required capabilities to develop user facing tools and visualisations, payment mechanisms that enable users to engage with digital financial services, and delivery channels for use cases and solutions. The table below shows the phasing, and descriptions of each initiative.

Table 20: User Facing Layer Enabling Initiatives

	Initiative	Description
Phase 2	Software development curriculum to build capability for user-facing layer	Develop curriculum for schools, universities, and vocational education to increase capacity and capability of agriculture software developers in Ethiopia
	Digitalized payments through rural service points and other channels	Enable payments digitally through partnering with payment tools from Telcos and banks to catalyze uptake of digital payment in agriculture by supporting farmer service points such as merchant cooperatives, coops and village kiosks
	Decision-making dashboard for MoA	Build an interactive digital platform that aggregates and visualizes critical agricultural data such as farmer data, crop data, weather patterns, market prices, land data as well as resource allocation to provide real-time insights and analytics to support informed decision-making and streamline operations

Select ongoing initiatives

Table 21: Select Ongoing User Facing Layer Initiatives

Organization	Initiative	Description
MoA, ATI, EIAR, EthioTel	8028 hotline	• An innovative agricultural extension service launched by ATI in collaboration with the MoA, EIAR, Ethio Telecom • This service provides smallholder farmers with agronomic advice and information through an Interactive Voice Response (IVR) and Short Message Service (SMS) system • Available for free, it offers information on various crops and farming activities in regional languages • The hotline's two-way functionality allows farmers to receive real-time advice and customized content based on their specific needs

Organization	Initiative	Description
Digital Green	Farmer. CHAT - AI powered chatbot for extension and advisory	• This AI-powered chatbot acts as a content retrieval and delivery mechanism, providing customized content and addressing location-specific issues • The platform includes a protocol for secure data sharing, allowing continuous improvement of localized advisory services • External data sources such as research, weather, and soil databases are dynamically updated to provide the most current information
Telebirr	Mobile payments and digital financial ecosystem	• EthioTelecom's Telebirr is a mobile money wallet and ecosystem of financial services • The app has a user-friendly interface for digital payments and products • The app launched in 2021 and has rapidly scaled to reach 40 million users (55% of adult population) and disbursed 9 billion ETB in digital credit

5.6.2 Integration layer

Layer objective

Interoperable, obtainable data sets supported by analytics to increase insight extraction

Layer description and enabling initiatives

This layer consists of initiatives created to facilitate the smooth flow, integration, interoperability, and access of data across different systems and services. DAR contains two initiatives within the integration layer, one of which is prioritized for Phase One of the roadmap. The table below shows the phasing and descriptions of each of these two initiatives.

Table 22: Integration Layer Enabling Initiatives

	Initiative	Description
Phase 1	Data stack with APIs	Create a digital ecosystem for facilitating the delivery of digital services to farmers, including APIs, consent, and data standards
Phase 2	Digital Agriculture Forum to promote interoperability	Establish and govern a platform designed to facilitate the seamless integration and compatibility of various digital agriculture tools and systems, bringing together stakeholders from across the ecosystem to share knowledge, establish common standards, and foster cooperation

Select ongoing initiatives

Table 23: Select Ongoing Integration Layer Initiatives

Organization	Initiative	Description
MoA Ag Datahub		• The datahub collates and stores 570+ data sets and will allow for visualization, exploration, analytics, and querying of the data • The Hub has built APIs which can be made fully accessible pending policy decisions • Data standardization has been developed for some data and is being expanded to other datasets as part of the development process with key stakeholders
Digital Green	FarmStack	• FarmStack powers the secure transfer of data through an open-source protocol • Enables organizations to exchange data securely, informing tailored solutions for farmers and reducing costs • Ensures that personal identifiable data and proprietary information are protected, giving organizations and farmers confidence in data handling • Allows farmers to consent to data use, ensuring their data is used only for permitted purposes and not shared without their knowledge

Organization	Initiative	Description
		• This initiative is still nascent in Ethiopia
NRDS[56] Management Information Systems Data Lake		• Links 13 different systems by standardizing data and building interoperability between the different natural resource data sets • The data lake will eventually be integrated with the Agri Data Hub

Phase One priority initiatives

1.   Data stack with APIs

This initiative aims to develop a digital public infrastructure (DPI) asset for the agriculture sector in Ethiopia to facilitate the delivery of digital services to farmers. The initiative proposes to build an integration software that will pull from the wealth of datasets currently in the country, leveraging the work already done to build the Ag Datahub. The stack will be built on open standards that will support the standardization of these data sets and make the data and insights extracted from the datasets accessible to the entire ecosystem through open APIs. The objective of this initiative is to enable stakeholders across the ecosystem to safely share, access and analyze data to produce better insights, innovations and solutions for farmers and pastoralists.

Key activities for implementation

Implementation will be completed in four phases, modelled on the Government of Odisha's phased approach to their GO-SUGAM data stack:

- Phase 0 - Data
    - **Data Policy –** Develop and issue agriculture sector data policy, that aligns to national policy, and establishes a framework for collection and sharing of necessary

datasets (e.g., climate data, farmer profile data)

    - **Data Standards –** For each type of data (e.g., soil, livestock) needed for each intervention, develop and ensure proper data standards are used, leveraging existing data standard initiatives such as aLive when possible.

- Phase 1: Systems
    - Ensure 13 systems are integrated in Ag Datahub
    - Build additional back-end infrastructure required (inc. reviews and processes)

- Phase 2: Develop ecosystem
    - Integrate private sector via a single accessible API & platform
    - Get feedback from the private sector and refine

- Phase 3: Create consent mechanisms
    - Develop robust consent mechanisms for data sharing

- Phase 4: Scale insights
    - Build a decision-making center leveraging the procure & distribute inputs use case

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[56] National Resource Development Sector

– Create data flows to develop more use case insights

Table 24: Dependencies to fully scale the Data Stack with APIs Enabling Initiative

Use Case Dependencies	Ecosystem sub-component	Rationale
Farmer profiles and unique ID	Data and content	Critical foundational dataset to form the data stack to link data to specific farmers to services and extension personalization
Land & farmer-linked production data	Data and content	Critical foundational piece of data to form the data stack (land use, crop sown and crop produced all required for majority of use cases)
Decision making dashboard for MoA	User facing layer	Will form visualization of data stack insights
Dedicated analytics unit within MoA	Analytics layer	Will develop the insights from the data in the data stack
Data governance and sharing policy, standards, assurances, and incentives	Government and policy	Critical to boast interoperability of the different data sets being access through the datahub
Digital agriculture team	Human capital	Will require well-equipped personnel to build and run the data stack
Digital training platform	Human capital	Will train the entire ecosystem to use the data stack and adopt standards, and encourage adoption and data sharing

Data Stack with APIs deep-dive:

The data stack with APIs business case has been designed to facilitate the five high priority use cases to begin, and to facilitate the entire digital agriculture ecosystem. The data stack will be a key piece of Digital Public Infrastructure (DPI), and will build on principles such as open standards and policies, iterative development, and interoperable data. It will leverage the work started by the Ag Datahub, and build more functionality to develop this platform into DPI.

A best practice data stack includes seven elements, as seen below in Table 25Table 25.

Table 25: Data stack elements

| Element	Description	Examples
Data sets	• Collection of data across topics • Includes database management and storage	• Supporting Soil Health Initiative (SSHI) soil data • NASA database
Accessible APIs	• System that allows different software applications to communicate, possibly via middleware	• Deliver Addis (integrates maps, directory, payment) • Apple Store
Data standards	• Clear rules and models to better submit and share quality data consistently • Accessible and replicable	• Common models for soil data collection in the SSHI • XML or HTML
Data policy	• Documented, ratified agreements to better publish, access, share and use better quality data	• MinT's personal data policy • GDPR
Privacy and consent	• Explicit methods to understand and agree to what data is being shared and with whom	• USSD technology with agreement • Accepting cookies on websites
IT systems	• Servers, storage and analytics tools to enable data collation, management and use	• Agri Data Hub • Amazon Web Services
Innovation support	• System with easy-to-use software, formal or informal feedback mechanisms and open data	• Telebirr (encourages innovative mobile banking solutions) • Agri Stack India

The Ethiopian agriculture data stack is nascent or developing in all of these areas except for data sets, as there is a wealth of agricultural data of varying quality in Ethiopia, and data policy, as policies such as the Personal Data Protection policy have recently been ratified by MinT. Despite the amount of data,

three foundational data sets will need to be strengthened for the success of the data stack: land data, production and crop sown data, and farmer data (as weather and soil data are relatively strong).

The data stack proposed will therefore develop each of these seven elements, building upon the Ag Datahub, to unlock multiple use cases and augment the entire agricultural ecosystem to provide benefits to farmers. The data stack will operate as shown in Figure 8

Figure 9: Agricultural data stack flow
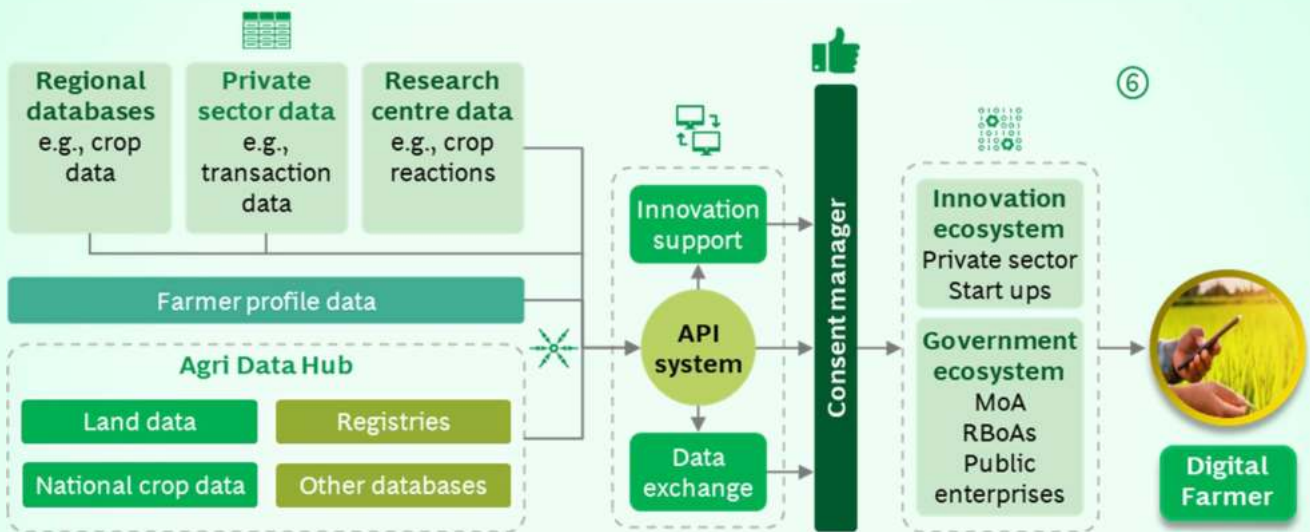
The use case will unlock impact in every use case, as well as improve government decision making resulting in more effective services for farmers, increase data sharing due to safe authentication, lower costs and risks across services through improved data, and accelerate innovation.

5.6.3 Analytics layer

Layer objective

Analysis from algorithms and data scientists that produces relevant, farmer-centric insights

Layer description and enabling initiatives

This layer consists of initiatives focused on deriving actionable insights form agriculture data to support decision making processes of different ecosystem stakeholders such as government, input suppliers, off-takers and agribusinesses. This layer consists of two initiatives which will be implemented in Phase Two of the roadmap. The table below shows the descriptions of these two initiatives.

Table 26: Analytics Layer Enabling Initiatives

	Initiative	Description
Phase Two	Input demand and supply analytics[57]	Develop capabilities to derive insights from input demand and supply data to inform decision-making on optimal quantities, varieties and blends of inputs to procure for specific farmers, and to determine the optimal pricing for these inputs
	Dedicated analytics unit within MoA	Create a team within MoA with the relevant skills to derive insights from agriculture data that will support the decision-making process for the sector

Select ongoing initiatives

Table 27: Select Ongoing Analytics Layer Initiatives

Organization	Initiative	Description
CIAT	Clim-Arm	• Clim-ARM leverages scientific and technological advances to link actionable predictions about hazards with risk management strategies, addressing some of the risk in agricultural value chains
CIAT, CGIAR	Site sLpecific fertilizer recommendations	• This project leverages predictive analytics to develop site-specific fertilizer recommendation for wheat, maize, barley, and teff • Implemented with support of the Supporting Soil Health Initiative

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[57] Limited capabilities for fertilizer will be developed as part of the implementation of the procure and distribute inputs business case. This imitative in phase 2 will focus on building off of the foundational capabilities developed through that use case.

5.6.4 Data and Content

Layer objective

Reliable & extensively accessible data to enable use cases

Layer description and enabling initiatives

The initiatives in this layer are focused on core data sets and registries that will provide the information required for use cases. This layer provides accurate, relevant, and timely data to support various applications and decision-making processes and 6 initiatives, two of which are priority for Phase One of the roadmap and four to be implemented in Phase Two of the roadmap. The table below shows the phasing of the initiatives as well as their respective descriptions:

Table 28: Data and Content Enabling Initiatives

	Initiative	Description
Phase 1	Farmer profiles and unique IDs	A database with information about individual farmers, such as their personal details, farming practices, and crop and livestock history with unique identifier for each farmer to ensure accurate tracking and personalized service delivery, facilitating targeted support and efficient management of agricultural programs
	Land & farmer-linked production data[58]	Data on historic crop and livestock production as well as a crop sown registry that connects specific parcels of land or livestock production to individual farmers and their agricultural activities
Phase 2	Transaction and warehousing data	Records of all transactions related to the purchase, sale, and storage of agricultural inputs and outputs with details on quantities, prices, dates, and parties involved, providing insights into supply chain efficiency, inventory levels, and market dynamics
	Weather data	Real-time, historical and forecasted information on weather conditions such as temperature, precipitation, humidity, and wind speed
	Soil data	Detailed information about soil properties, including composition, moisture levels, pH, nutrient content, and fertility essential for determining suitable crops, planning fertilizer strategies, and improving soil health management practices
	Price data	Market information on the current, historical and forecasted prices of agricultural inputs and outputs including prices at various stages of the supply chain, from farmgate to retail, and helps farmers and stakeholders make informed decisions about selling, buying, and investing in agricultural activities

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[58] Land and farmer production data was added to Phase 1 as it is closely linked with the farmer profile initiative and improving this data within the country is required for successful implementation of key use cases and initiatives (e.g., procure and distribute inputs, data stack with APIs). This initiative was not initially prioritized as a result of the DAR prioritization process described in detail in appendix Section 8.5

Select ongoing initiatives

Table 29: Select Ongoing Data and Content Initiatives

Organization	Initiative	Description
MoA	NSIS	• A comprehensive soil assessment initiative that has covered 748 woredas and 62 confluence points, and gathered hundreds of thousands of soil samples from the entire country to develop 22 different soil property maps and fertilizer recommendations for each region • The dataset contains 70,000+ records of the Ethiopian soil property data
Prime Minister's Office	National ID Program Fayda	• The Ethiopian National ID program is being built off MOSIP's open-source identification platform • The National ID will incorporate 3 agriculture facing features; a land administration system, enrollment to the rural productive safety net programs and farmer IDs
MoA	National Rural Land Administration Information System (NRLAIS)	• NRLAIS is working towards digitalization of formally paper-based land records • The information system is built off international open -source standards such as the Land Administration Domain Model (LADM)

Phase One priority initiatives

1. Farmer profiles with unique IDs

This initiative aims to build a comprehensive database of farmer-specific information that will be tagged to a unique individual through a distinct farmer ID number. The farmer profile will track essential data such as the farmer's name, unique identification number, crops sown and produced, and livestock reared. Additionally, it will integrate with land ownership data from the NRLAIS system, and livestock data as defined in the aLIVE roadmap to link specific farmers and pastoralists to parcels of land and livestock. This initiative will serve as a cornerstone for multiple use cases and enabling initiatives within the roadmap, and the expansion of the farmer profile project will also enable the collection and utilization of better land and production data.

Effective implementation of this initiative will require collaboration across Regional Agriculture Bureaus and other Ministries and government departments, including the National ID Program (Fayda) under the Prime Minister's office. The initiative could be scaled by leveraging existing registration through schemes and subsidies run by development partners, thus increasing adoption for limited incremental cost.

Key activities for implementation

• Hire HQ and regional staff, including project leads and officers, to coordinate and manage

the implementation at both federal and regional level.

- Access and consolidate farmer data from various initiatives, involving short-term staff for data standardization, harmonization, and quality assurance.

- Collaborate with key stakeholders to prioritize use cases aligned to the DAR priority use cases for the pilot phase and outline relevant data indicators.

- Develop the necessary data governance and policy with other government agencies so that personal data is stored and used compliantly and safely.

- Prioritize pilot areas, install necessary software on devices, onboard data collectors and validators, and conduct initial data collection and analysis to test and refine collection methods and visualization tools.

- Conduct awareness and training sessions for target farmers and relevant stakeholders to ensure understanding and effective use of the farmer profiles, and incorporate feedback for continuous improvement.

- Acquire laptops, servers, and devices to scale data collectors, and secure data connection services to support the infrastructure.

- **Data Policy -** Establish policies and guidelines for data collection, sharing, and use,

- **Data Standards –** Establish clear data standards to enable integration with other relevant databases to ensure comprehensive and accurate farmer profiles.

Table 30: Dependencies to fully scale the farmer profile Enabling Initiative

Use Case Dependencies	Ecosystem sub-component	Rationale
Device access for extension workers	Digital Infrastructure	Critical to aid the data collection process
Improve DA management	Human capital & Infrastructure	Critical to aid the data collection process as DAs may support collection or maintenance and updates of data
Land & farmer-linked production data	Data and content	Data sets from sources like the NRLAIS are critical to like farmers to specific parcels of land
Data stack with APIs	Integration layer	Critical for linking land information and crops planted on that land with the identities of the farmers and their FAYDA numbers, ensuring accurate and comprehensive farmer profiles
Telco service targets and incentives for rural areas	Digital infrastructure	Network connectivity in rural areas is critical for data collection

5.7   ENABLING ENVIRONMENT

The enabling environment refers to the pre-requisites for digital agricultural transformation, and the initiatives under this layer will promote innovation and ensure sustainable growth within the agricultural sector. It is focused on the development of policies, human capital, infrastructure, and private sector to enable digitalization of the sector. An effective enabling environment is crucial for overcoming barriers to technology development and adoption and for ensuring that digital solutions reach their full potential in transforming agricultural practices.

The enabling environment has six areas:

- **Government and Policy** - Robust and inclusive data policy and guidelines to drive insights, data sharing and decision making

- **Digital Infrastructure** - Innovative device & connectivity solutions that allow farmers to adopt use cases

- **Human Capital & Infrastructure** - A population that has been invested in & empowered to build and use digital agriculture cases

- **Physical Infrastructure** – A reliable and sustainable physical environment that facilitates and improves digital solutions

- **Agricultural markets -** Functioning markets that incentivize and reward value addition

- **Innovation & Technologies -** T An empowered private sector that allows for development of priority innovative tools

The phasing of enabling environment initiatives for the roadmap involved a two-step process. First, a long list of initiatives relevant for Ethiopia was developed using inputs from the national convening, stakeholder interviews, and the DAEAS roadmap, resulting in an extensive list of 19 enabling environment initiatives. These initiatives were then prioritized based on the Ministry of Agriculture's implementation feasibility, alignment with relevant Ethiopian strategy and policy documents, and stakeholder priorities resulting in four Phase One priority initiatives. More details on the prioritization methodology and results can be found in section 8.5.2 Enabling Initiatives Prioritization within the appendix of this roadmap.

5.7.1 Government and Policy

Area objective

Robust and inclusive data policy and guidelines to drive insights, data sharing and decision making

Area description and enabling initiatives

This layer encompasses the rules, guidelines, and initiatives established by authorities to enable the growth of digital innovations within the agricultural sector. It also shapes the ecosystem in which digital solutions operate by providing a supportive framework that includes data governance and sharing policies, standards, assurances, and incentives. This layer has three initiatives, one of which has been prioritized for Phase one of the roadmap. The table below shows the different initiatives, their phasing, and descriptions.

Table 31: Government and Policy Enabling Initiatives

	Initiative	Description
Phase 1	Data governance and sharing policy, standards, assurances, and incentives	The MoA should develop and implement an overarching, principles-based data governance, to ensure that different agriculture sub-sectors agree appropriate commonalities throughout their respective data sharing and management rules and protocols.
Phase 2	Support market entry of international products to Ethiopia (with local partner)	Support international companies through policy and process interventions to launch their products in Ethiopia in partnership with local stakeholders to widen the product ecosystem in Ethiopia. Such frameworks should be co-created with relevant stakeholder consultations and engagement to ensure fairness and balancing of competing interests.
	Streamline extension content approval process	Reduce the time taken to approve extension and advisory content in the Ministry of Agriculture and research institutions by assessing and adjusting the process

Ecosystem assessment – Improvements

Overall, there are strong non-digital agricultural policy frameworks with improvements made since 2019. These include policies around natural resource management, market liberalization for inputs such as agrochemicals and commodities such as sugar, and the poverty reduction program.

There are also new cross-sectoral digital and data policies that have started to enable advancements in the agricultural sector. For instance, Digital Ethiopia, 2025 sets out a vision for how digitization is expected to take place across the Ethiopian economy to augment output and benefits within the country. There are also more focused policies and laws including the Personal Data Protection Proclamation (PDPP) by MinT which was ratified in April 2024, and recently endorsed policies for e-transaction data and rural connectivity and banking. There is also a draft National Data Sharing Policy that is a work in progress, being spearheaded by the Ministry of Innovation and Technology (MinT).

Within agriculture, MoA has also started to develop data governance strategies and policy, particularly through the Agri Data Hub. This has been established to collate and consolidate data, with data governance and policies being prepared by the Ethiopian Communications Authority, and through engagement with non-governmental actors such as CAB International (CABI), the Coalition of the Willing (CoW) and GIZ. An example of this community-based effort is the SADS Directive, which was co-created through a Coalition of the Willing (CoW), to create specific data sharing mandates around the soil and agronomy data. This co-creation model has been acknowledged for its success in bridging diverse stakeholders and building trust which in turn has facilitated data access and sharing. Similarly, the aLIVE project in collaboration with Development Gateway is helping MoA to improve data quality, accessibility and standardization of livestock data.

Ecosystem assessment - Areas to Strengthen

Although there has been progress in agricultural policy and data policy, there has been fragmentation, overlap, and limited work at the cross-section of the two. This has manifested in three major challenges.

Digital agriculture policy: As there has not been a comprehensive digital agriculture policy to-date, the DAR will aim to set a path for progression. The DAR will work towards all ecosystem actors aligning on digital agriculture strategy and policies, not only by developing clear policy and guidelines for specific use cases, but also by outlining and socializing strategic priorities. This participatory approach to digital ag policy and data governance will increase

collaboration, reduce the duplication of effort, and unite the ecosystem around a common vision.

Data storage and integration: Though the MoA Agri Data Hub has seen significant progress, there are still outstanding issues for data storage. Personal data that would be included in creating comprehensive and secure farmer profiles, will need secure storage and regulatory oversight. Additionally, to ensure compliance with laws like the recently ratified data protection proclamation, and any future laws, a safe and consent-driven mechanism to store, access and share, process and use this personal data will need to be built with approval from MinT and INSA, and any other relevant governmental agencies. Furthermore, a clear plan of action and steps will be required to create interoperability between the databases and systems in MoA, as well as make them accessible to the broader ecosystem with suitable governance.

Regional policy: As there is no digital agriculture policy, there is limited consistency in both activity and the enforcement of existing policy across regions[59]. The DAR should be advocated and supported amongst Ethiopia's regions, to ensure alignment with its recommendations for use cases and initiatives. This alignment will aid in ensuring buy-in with the overall objectives of DAR, and yet, be developed with recognition and understanding of regional differences and subjective contexts which will shape how it is implemented on the ground. The data stack will also aim to bring some harmonization and increase consistency with respect to adherence to policy between the center and regions due to the

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[59] Regional Bureaus of Agriculture within Ethiopia are autonomous and close alignment and cooperation within

them on data policy and DAR is essential for the roadmap's success

ability to access the same data and decision-making tools.

Select ongoing initiatives

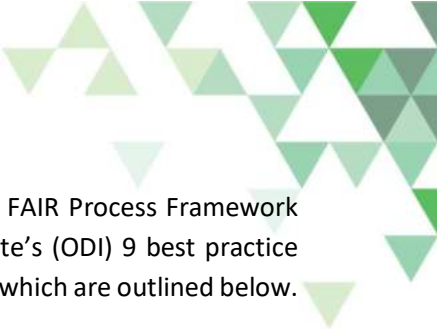**Table 32: Select Ongoing Government and Policy Ongoing Initiatives**

Organization	Initiative	Description
MinT	Personal Data Protection Proclamation (PDPP)	• A comprehensive legal framework designed to fortify individual privacy and regulate the management of personal data within Ethiopia • Lays out protections for individual rights over data including right to access, rectify, erase, and restrict the processing of data • Outlines responsibilities and rules for organizations handling data and collecting data (e.g., consent based) • The data protection law is enforced by the Ethiopia Communications Authority
CIAT, GIZ, EIAR	Coalition of the willing (CoW)	• The CoW works towards better soil and agronomy data access, management and sharing in Ethiopia • CoW's goal is to increase the usability of data while protecting security, privacy, and data rights by providing guiding principles and rules to the soil and agronomy community • CoW managed to collect 20,000 legacy soil profile data and over 38,000 crop responses to fertilizer data and create a data set that can be leveraged for building data driven solutions such as site-specific fertilizer recommendations
MoA, GIZ, CABI, CoW	Soil and Agronomy Data Sharing Directive (SADS Directive) Soil and Agronomy data collection and management standards/guidelines	• SADS is a joint initiative to ensure FAIR[60] and responsible data practices for soil and agronomy data in Ethiopia to reduce waste & loss of data, as well as duplication of effort • The standards aim to improve data collection, data quality, data standardization and interoperability, data management, sharing and use

Priority Phase One Initiative

1. **Data governance and sharing policy, standards, assurances, and incentives**

As identified, there are some sub-sectoral data governance frameworks which exist (like the SADS Directive) or are being developed (as with aLIVE). Each priority use-case under the DAR can be

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[60] Findable, Accessible, Interoperable and Reusable

considered a sub-sectoral ecosystem which will require its subjective data sharing and data management rules, protocols, and technical standards. However, to do this consistently and in a manner that the pan-agriculture governance is cohesive and not fragmented or duplicative, it is imperative that the MoA create a principles-based, light touch Data Governance Guidance. This guidance should clearly articulate the minimum expectations within each of the practice areas and how these practices link to compliance with the wider legal requirements of Ethiopia. There is no 'one size fits all' or 'off the shelf' process because of the complexity of the agricultural ecosystem. As a result, the overarching guidance needs to be strategic and agile enough to sufficiently cover all MoA activities and provide enough nuance that adequately guides sub-sectors on key issues of data governance, facilitating meaningful addressing of subjective challenges within their respective ecosystems. It is also important that any MoA data policy and framework be developed in alignment with MinT and national data policies such as the recently ratified PDPP. Successful implementation of this policy will enhance data quality, improve data sharing, and support better decision-making processes, thereby enabling DAR and the development of more effective and efficient digital agricultural products and services.

With this overarching Guidance in place, sub-sectors in agriculture can formulate more specific data policies and frameworks. These would cover data standards to facilitate the integration and interoperability of datasets across the sector, provide guidelines for the collection and use of data, and govern access and sharing of agriculture data.

The MoA's overarching Data Governance Guidance can draw upon global best practice such as that contained within the CABI FAIR Process Framework and the Open Data Institute's (ODI) 9 best practice data governance practices which are outlined below.

1. **Accountability** – open and transparent oversight and accountability structures with clear roles and responsibilities for data.

2. **Privacy** – open and transparent processes for handling and sharing personal information legally.

3. **Security** – open and transparent processes for handling and sharing information securely.

4. **Standardization** – open and transparent processes outlining why and how data is collected, used, and shared.

5. **Resourcing** – open and transparent plans and funding for the ongoing management and maintenance of data.

6. **Capability** – open and transparent ability to implement data processes, including both technological and human.

7. **Engagement** – open and transparent approaches to engagement and participation with data providers and users.

8. **Ethics** – open and transparent processes that outline how data is handled in accordance with a defined ethical framework.

9. **Permissions** – open and transparent processes for managing the permissions under which data is consumed and shared.

Key Activities for Implementation

- Convene various sub-sectors and relevant stakeholder
  - Understanding of sub-sectoral requirements (enablers and blockers) regarding data governance and policy.

- Co-developing and aligning on a shared vision of data governance incorporating FAIR principles.
- Draft initial Data Governance Guidance
  - Create step-by-step implementation plan, including FAIR and responsible data practices.
  - Validate and iterate through workshop engagements.
  - Iterate and refine through engagement with other Ministries (especially MinT on the national data sharing policy).
- Publishing Guidance and capacity building
  - Clarity in roles and responsibilities
  - Periodic reviews and amendments to the Guidance as needed.

Moreover, even before sector data governance policy is established, it is important that all digital agriculture use cases and initiatives that have a data component ensure full compliance with the policy. It is recommended that the team implementing DAR as well as ecosystem stakeholders developing digital agriculture use cases follow a checklist to ensure alignment with the policy and proper data governance. This checklist should include but is not limited to the following components:

- Conduct a comprehensive Data Privacy Audit for the use case to ensure that a privacy-by-design approach is followed and that the use case is aligned with national privacy and data regulations such as the PDPP. A privacy audit is particularly relevant for use cases and initiatives that handle a lot of personal data such as the farmer profile.
- Clearly define which entities are responsible for ensuring proper data ownership and management of all data assets necessary for implementation the use case/ initiative.
- Complete a thorough need and gap assessment for data to understand key requirements and how fit-for-purpose existing data assets in the country are to implement each use case / initiative.
- As part of the data assessment, owners for the necessary data assets should be identified and then engaged to develop and implement best practice data sharing principles.

5.7.2 Digital Infrastructure

Area objective

Innovative device and connectivity solutions that allow farmers to adopt use cases

Area description and enabling initiatives

The digital infrastructure area encompasses the foundational elements that support connectivity and the use of digital tools, such as smartphones, tablets, and data packages. This infrastructure is critical for enabling farmers and extension workers to access and utilize digital resources and solutions effectively. This layer consists of five enabling initiatives, one of which has been prioritized for Phase One of the road map. The initiative descriptions and phasing are shown in the table below:

Table 33: Digital Infrastructure Enabling Initiatives

	Initiative	Description
Phase 1	Digital Kiosks for Farmers and DAs	Provide farmers and DAs with internet access through publicly accessible standing computer terminals in accessible locations such as FTCs, cooperatives, and administration offices to enable access to digital extension and advisory content, and services such as online input marketplaces, input tracking, and digital financial services
Phase 2	Device access for extension workers	Provide extension workers and development agents access to smartphones or tablets to facilitate digital solutions for DAs
	Free access for DAs and farmers to key apps	Provide free or subsidized access to essential applications and websites for digital agriculture solutions (e.g., extension platforms or financial services) for farmers and development agents
	Phone payment plan for farmers	Provide farmers access to mobile devices on credit and create dynamic farmer specific payment plans based on farmer specific metrics such as land size, predicted yield (national and individual) and historical income
	Telco service targets and incentives for rural areas	Work with and incentivize mobile operators to create internet, calls, and SMS packages for people in rural areas to make internet access affordable

Ecosystem assessment – Improvements

Digital infrastructure has made progress in the last five years, with 85% of the population now covered by 3G networks, slightly above the Sub-Saharan average of 84% (Figure 10Figure 10).[61] Ethiopia now also has 70% of the population covered by 4G networks. [62] Moreover, network performance is favorable compared to Sub-Saharan African counterparts; Ethiopia's network performance outperforms Kenya as assessed by the GSMA in 2023.

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[61] GSMA Mobile Connectivity Index (2023)

[62] GSMA Mobile Connectivity Index (2023)

Figure 10: Network coverage in Ethiopia (EthioTelecom and GSMA)

Network coverage and geographic density

2G = 97%   3G = 85%
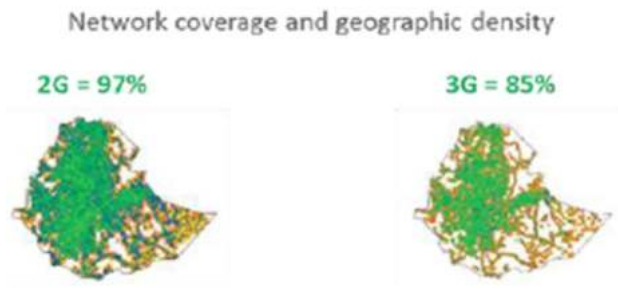
The introduction of Safaricom in addition to EthioTelecom has resulted in improvements in coverage and performance, and is expected to lower data, voice and text prices due to increased competition once Safaricom has been fully established in the country.

Ecosystem assessment - Areas to Strengthen

Despite these improvements, digital infrastructure needs strengthening in three key areas, as today there are only weak levels of base digital use, with only 59% mobile ownership vs. 93% in Kenya[63] and only 17% internet penetration vs 43% in Sub-Saharan Africa.[64]

Price: The ability to access the internet is currently too expensive for many in the country, with data costing 5% of the GNI per capita in Ethiopia vs 3% for LMICs[65] and a smartphone costing 96% GNI per capita vs 34% in Kenya.[66] These prices mean many of rural farmers and pastoralists are unable to afford internet access, and thus do not have the ability to access many of the recommended digital services (see Figure 11Figure 11).

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[63] Usage and penetration Ecofin (2023)
[64] GSMA Mobile Connectivity Index (2023)
[65] ITU price baskets data (2022)
[66] Alliance for Affordable Internet (2021)

**Figure 11: Comparison of Ethiopian data and smartphone prices vs. peers**

Prices of larger mobile data packages are high vs. peers (+1ppts vs LMICs)

Mobile data & voice price as % of GNIpc[1]
(2022)

High usage: India 1, LMICs 4, Ethiopia 5

Low usage: India 1, LMICs 3, Ethiopia 2
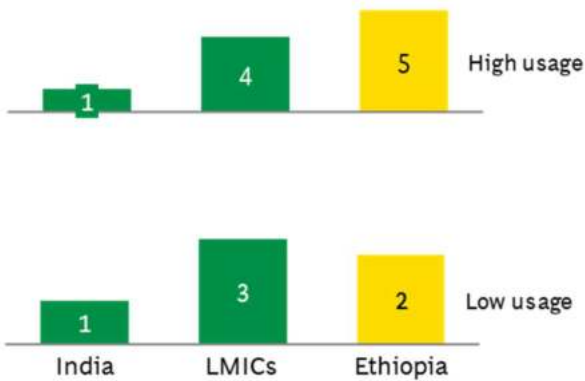
Price of mobile devices is >2X vs. peers for smartphones

Mobile device price % of GNIpc[3]
(2021 latest data)

Smartphone: Kenya 34, India 42, Ethiopia 96

Feature phone[3]: Kenya 15, India 25, Ethiopia 35
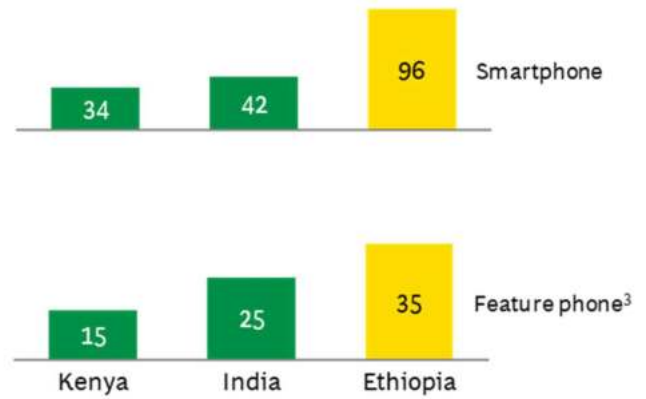
Conflict: Ongoing conflict in in certain areas of Ethiopia has resulted in sporadic internet access even for those who can afford it. The political and social climate should be considered when developing solutions so that those in areas without internet access for prolonged periods of time can still access new digital solutions; examples may be developing low-tech channels (such as radio, IVR or text) or community accessed agriculture-specific channels (such as digital kiosks).

Private sector infrastructure: There is limited private sector presence of strong advanced computing capabilities or cloud infrastructure, which restricts the ability for the private sector and especially SMEs from engaging or innovating within the agriculture ecosystem. There are two small known advanced computing companies – Sun Data World and HomeLink – and while cloud infrastructure is present, server space is still highly cost-restrictive for small businesses at between $50-100 p.a..[67] Cross-governmental engagement on incentivization in this space is necessary to build the required domestic capacity for a functioning ecosystem.

Table 34: Select Ongoing Digital Infrastructure initiatives

Organization	Initiative	Description
MoA, ATI	Digital Kiosks	• ATI, in collaboration with MoA, is working to roll out digital kiosks to provide farmers with access to extension and advisory content. • These kiosks will also serve as a mechanism for farmers to access market linkages, make input purchases, and access mechanization services, all leveraging the internet.

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[67] Quotes from Ethiopian server and hosting services

		• The kiosks will be stationed at farmer training centers, farmer cooperatives, and Kebele administration offices.

Phase One priority initiatives

1. Digital Kiosks for Farmers and DAs

Digital Kiosks are standing digital terminals in rural areas that are pre-loaded with applications and connected to the internet. Digital Kiosks facilitate the delivery of extension and advisory services, as well as access to mechanization services, credit options, and other agricultural services via the internet. It will also enable DAs without internet access to perform tasks that require online connectivity, such as data collection, more effectively. These kiosks will be strategically placed in central locations where farmers and DAs frequently gather, such as FTCs, cooperatives, and Kebele administration offices.

Effective implementation of this initiative will require collaboration across MoA, particularly at the Regional Bureau level, and among agricultural service providers, including extension content creators, mechanization service providers, banks, and off-takers. Additionally, support from development partners will be essential to enhance digital literacy among farmers and DAs, ensuring the usability of the kiosks.

Key activities for implementation

- Define the technical specifications and features needed for the digital kiosks to ensure they meet the requirements for extension and advisory services, market linkages, and other agricultural applications.

- Create partnerships with different agriculture service providers to socialize the kiosks and encourage onboarding of their services on the kiosks.

- Select suitable FTCs, cooperatives, and Kebele administration offices, that will serve as pilot locations ensuring accessibility and convenience for farmers and DAs.

- Develop and implement digital literacy programs to train farmers and DAs on how to effectively use the kiosks and leverage the internet for agricultural services.

- Conduct procurement processes for the kiosks, ensuring the acquisition of high-quality devices, and oversee their installation at the selected pilot locations.

- Establish a comprehensive maintenance plan to ensure the kiosks remain functional and accessible, including regular updates, repairs, and technical support.

- Scale up the kiosks targeting more remote areas with less device penetration.

Table 35: Dependencies to fully scale Digital Kiosks Enabling Initiative

Use Case Dependencies	Ecosystem sub-component	Rationale
Streamline extension content approval process	Government and Policy	Critical to ensure a wide variety of extension content on the digital kiosks and that the content is promptly updated

Telco service targets and incentives for rural areas	Digital Infrastructure	Ensure reliable access to the internet for the digital kiosk
Digital literacy for farmers and DAs	Human capital and infrastructure	Critical to ensure usability of the kiosks by farmers and DAs
Solar panels for FTCs or OSSs	Physical infrastructure	Cheap and sustainable energy source for the kiosks in areas with electricity access is unreliable
Competitive incubation / product dev. environment with forum	Innovation and technology	Enables development of farmer facing digital agriculture products and services that can leverage the kiosks as a channel to reach farmers

5.7.3 Human Capital & Infrastructure

Area objective

A population that has been invested in and empowered to build and use digital agriculture cases

Area description and enabling initiatives

This area focuses on developing the digital skills, knowledge, and expertise required for the effective adoption and utilization of digital products and services in the agricultural sector. Human Capital encompasses human resources and the initiatives necessary to improve digital literacy to drive digital transformation in the sector. It has five enabling initiatives, two of which will be priority for Phase One of the roadmap, the other three being priority for Phase Two of the roadmap. Table 36 below illustrate the phasing and outlines the descriptions of these initiatives:

Table 36: Human Capital & Infrastructure Enabling Initiatives

	Initiative	Description
Phase 1	Digital literacy for farmers and DAs	Deliver digital and financial literacy campaigns to farmers, pastoralists and DAs focused on tools that will drive adoption and optimal use of digital solutions (e.g., use of smartphones or digital kiosks)
	Digital agriculture team	Create a dedicated team with the right digital, policy and strategy expertise to support digital agriculture development in Ethiopia and deliver the DAR
Phase 2	Digital training platform for MoA/RBoA	Develop a digital platform offering tailored agricultural digital skills courses and certifications for Ministry of Agriculture and Regional Bureau of Agriculture staff
	Digital program in ATVETS	Develop digital agriculture courses and ATVETS and formulate and provide a digital curriculum that focuses on areas such as data collection methods and standards, digital financial services, and use of precision agriculture tools
	Improve DA management	Develop platforms and tools that improve visibility of the activities of extensions workers and development agents, and enable them to work more efficiently

Ecosystem assessment – Improvements

There have been limited advancements in human capital in the last 5 years. Some progress has been seen through campaigns such as Mastercard Foundation and National Bank of Ethiopia's training modules on digital financial literacy, as well as Mastercard Foundations Agriculture-focused Dignified Employment for Youth (ADEY) in Ethiopia program, though this is less focused on digital capacity building.

Ecosystem assessment - Areas to Strengthen

There are two main areas to strengthen for human capital in Ethiopia: Improving digital literacy to increase adoption and developing human capital to build and run use cases.

Digital literacy: Low overall adult literacy is causing barriers to digital adoption, as adult literacy rates are only around ~52% with women 10-15% less literate

than men.[68] These statistics are relatively low compared to Sub-Saharan African peers and prevent the adoption of on-screen digital solutions (versus, for example, interactive voice response, or radio). Furthermore, Ethiopia ranked 119 out of 134 countries on digital skills, which provides barriers to scaling more robust digital technologies such as mobile apps.[69] Campaigns across segments can improve this, as well as alignment with national policies on digital education in schools.

Human capital: There are also no existing digital agriculture training or educational pathways; ATVETs do not deliver digital agriculture specific curricula according to a recent MoA assessment. Furthermore, MoA have not traditionally hired software engineers, data scientists or IT professionals given the relatively recent shift of focus to digital agriculture. A combination of training in ATVETs, recruitment, secondment and international knowledge exchange could boost the digital capacity and capability to build and run use cases

Table 37: Select Ongoing Human Capital & Infrastructure Initiatives

Organization	Initiative	Description
World bank, Ministry of Science and Higher Education	Digital Skills Country Action plan (DSCAP)	• The DSCAP is a structures approach to develop digital skills in Ethiopia and targets 50 public universities, 800,000 students, and 35,000 instructors, with the goal of establishing state-of-the-art facilities and systems for reliable online education in higher education in Ethiopia
Prime Minister's Office, MinT	Digital Ethiopia 2025	• Digital Ethiopia 2025 is a digital strategy developed by the Ethiopian government to leverage digital opportunities and propel Ethiopia towards a knowledge-based and innovative economy • Digital literacy programs around training, device penetration, and relevant local content were designed • Aim to help 70% of Ethiopia become digitally literate by 2025
Mastercard Foundation, National Bank of Ethiopia	Digital Financial Literacy training module	• The goal of this module is to elevate financial literacy among youth and Micro, Small, and Medium-sized Enterprises (MSMEs) with a goal of achieving 75% awareness by 2025 • The module encompasses topics like savings, digital banking, and business planning, with a distinctive focus on supporting women entrepreneurs

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[68] World Bank Development Indicators (2020)

[69] Digital Skills Gap Index Wiley Report (2021)

Phase One priority initiatives

1. Digital Literacy for Farmers and DAs

This two-part initiative aims to deliver digital and financial literacy campaigns to farmers, pastoralists, and DAs. Farmer and pastoralists will be targeted with digital literacy campaigns that will include training on the use of smartphones, digital kiosks and other devices as well as how these devices can be leveraged to access agriculture use cases. These campaigns will be delivered through media (radio, television and social media), by DAs and in Farmer Training Centers. Tailored digital and financial literacy training will enable farmers to effectively interact with DAR use cases.

For DAs, a digital curriculum and module will be added to learning in ATVETs and Agricultural Universities, and will improve digital and financial skills.

Effective implementation of this initiative will require engagement across the ecosystem with input from the MoA extension department as well as collaboration with relevant educational institutions. The initiative will also aim to learn lessons and build off the success of similar digital and digital financial literacy campaigns in the country.

Key activities for implementation

Farmers and pastoralists :

- Segment farmers into profiles, identify skill gaps and upskilling required for each profile

- Develop partnerships with MNOs (EthioTel and Safaricom), IVR providers, and major TV channels and leverage these partnerships as alternative medium for delivering content to target learners.

- Taking a human centric design approach, develop a digital literacy and digital financial literacy curriculum that would be most impactful for each target learning segment. Similarly, identify what digital use cases would add the most value for each target learning segment and design the literacy campaign to be attached to learning or availing that digital use case.

DAs:

- Partner with potential physical learning centers such as ATVETs and agricultural universities to serve as locations to deliver training curriculum.

- Identify skills gaps to design the new curriculum using a human centric approach.

Table 38: Dependencies to fully scale Digital Literacy for Farmers and DAs Enabling Initiative

Use Case Prerequisite/ dependencies	Rationale	Ecosystem Area
Digital kiosks	Critical avenue for delivery of digital literacy trainings for farmers and DAs	Digital Infrastructure
Digital program in ATVETS	Platform for delivery of digital literacy to DAs	Human Capital & Infrastructure

2. Digital Agriculture Team

This initiative involves the creation of a digital agriculture delivery unit to drive DAR forward and oversee the implementation of priority digital agriculture use cases and enabling initiatives. This unit will require capabilities in product and project development, data analytics, policy and strategy creation, and the design and execution of digital literacy campaigns. Additionally, the unit will work with development partners and the private sector to coordinate ecosystem efforts, prevent duplication and ensure alignment with national and ministerial priorities.

More Detail on the Digital Agriculture Team's role in overseeing DAR can be found in section 6.1 Governance

Key activities for implementation

- Socialize and gather input on digital agriculture governance, reach out to potential candidates for the steering committee and subcommittees, and integrate in relevant regional entities such as RBoAs and regional ATI offices.

- Evaluate existing capabilities and conduct a gap analysis, develop a recruitment strategy to fill missing capacities, and establish processes to integrate the existing analytics team.

- Assess financial resource needs and internal funding capacity, hold bilateral meetings with potential funders to secure funding commitments for secondments and to acquire required expertise.

- Clearly define the roles and responsibilities for the Digital Agriculture Team as well as the related governance entities to support the team – the steering committee, data governance, and external coordination subcommittees. Details on the roles and responsibilities of the Digital Agriculture Team as well as its interactions with other Ethiopian Government agencies can be found in below in Section 6.1 Governance.

5.7.4 Physical Infrastructure

Area objective

A reliable and sustainable physical environment that facilitates and improves digital solutions

Area description and enabling initiatives

The physical infrastructure area encompasses the essential assets and facilities needed to support agriculture. This consists of two initiatives, both of which will be implemented in Phase Two of the roadmap. The table shows the enabling initiatives and their descriptions.

Table 39: Physical Infrastructure Enabling Initiatives

	Initiative	Description
Phase 2	Input warehouses and distribution hubs	Set up smart warehouses and distribution centers either owned by MoA or through partnership with cooperatives or unions and digitalize input distribution logistics at warehouses through integrated technology solutions
	Solar panels for FTCs or OSSs	Provide solar electricity to areas underserved by grid electricity to power devices such as digital kiosks

Ecosystem assessment – Improvements

Physical infrastructure has progressed primarily through increased storage facilities, including federal, regional and co-operative or union owned warehouses. There are a few central storage facilities that are largely concentrated in Addis Ababa, but more have been built in agricultural centers such as Bishoftu. Moreover, the ACC and FPC programs, along with co-operative programs, have enabled the development of improved warehousing and storage for farmer groups.

A Chinese-backed satellite was also launched in 2019 and is owned by the Ethiopian government. This key piece of physical infrastructure can provide free remote sensing data, relevant to use cases requiring crop, forestry and land use data.

Ecosystem assessment - Areas to Strengthen

Despite these advancements and a relatively mature physical infrastructure landscape, three areas could be strengthened.

Road transportation: Transportation and distribution are key to supply chain management for both inputs and outputs, and therefore a reliable physical network is necessary for supply chain success. Currently, only 22% of rural households in Ethiopia are less than 2km from a road,[70] and road quality in Ethiopia is assessed as 3 out of 7 in the 2023 road quality index (below the global average of 4.05), with no overall changes since 2019.[71] These challenges could be addressed by a thorough road assessment in partnership with the Ministry of Transport and Logistics and aligned to the World Bank funded Road Connectivity and Access Program

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[70] RAI Index (2019)

[71] World Population Review Road Quality Index (2023)
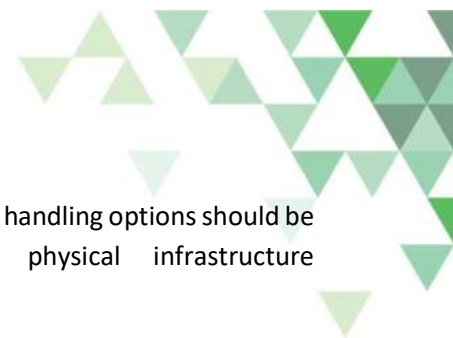
(RCAP), with improved roads developed in strategic routes for optimum rural distribution.

Warehousing: Despite advancements, the quantity and quality of storage facilities could be strengthened further. Programs that focus on co-operative development should be expanded, and initiatives such as financial support for building storage solutions should be scaled. Furthermore, limited port and warehouse handling capacity is currently creating input and output distribution delays, and so alternative handling options should be explored to increase physical infrastructure efficiency and utilization.

Cell towers: Though coverage in Ethiopia is in line with Sub-Saharan Africa for 3G, at 85% of the population,[72] cell tower coverage should be reassessed following conflict to quickly repair damaged towers and consider population distribution changes that may impact coverage and cell tower locations.

Select ongoing initiatives

Table 40: Select Ongoing Physical Infrastructure Initiatives

Organization	Initiative	Description
ATI	Cooperative storage pilot	• A few central storage facilities have been setup largely in Addis Ababa, but more have been built in agricultural canters such as Bishoftu
Ethiopian Space Science and Technology Institute	Satellite crop monitoring	• In 2019 Ethiopia launched with support from China launched a satellite into space which monitors crops and weather
World Bank, Ministry of Finance, Ministry of Urban and Infrastructure	Ethiopia Rural Connectivity to Support Food Security Project	• The main objective of this program is to interconnect rural communities and isolated areas during all weather conditions • The program is expected to run from March 2024 to May 2029 • The project involves construction of roads and upgrading current roads to make them climate resilient along with construction of pedestrian and drainage structures

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[72] GSMA Mobile Connectivity Index (2023)

5.7.5 Agricultural Markets

Area objective

Functioning markets that incentivize and reward value addition

Area description and enabling initiatives

This area focuses on the development of tools and platforms that connect farmers with markets, facilitating the buying and selling of agricultural products. This layer has one initiative in the roadmap which shall be prioritized for Phase Two of the roadmap, its description is available in the table below

Table 41: Agricultural Markets Enabling Initiatives

	Initiative	Description
Phase 2	Incentivized cooperative and union aggregation and value addition	Create initiatives to incentive farmers to cluster into cooperatives and unions to improve market power and to increase value addition activities

Ecosystem assessment – Improvements

The agriculture market has begun to see improvements in line with the Ministry of Agriculture's objective of market-oriented crop and livestock production. Value addition capabilities are growing for some commodities such as oil seeds, although this is still limited. There are burgeoning roles for cooperatives and unions in output aggregation as well as input demand collection and distribution, though links between MoA and cooperatives could be formalized or strengthened.

Ecosystem assessment - Areas to Strengthen

There are four areas to strengthen to develop agricultural markets.

Equipment access: A small domestic manufacturing base for farm equipment (e.g., tractors) and inputs, combined with an unfavorable macroeconomic environment that limits the availability of foreign currency for imports, is a major challenge. This hinders availability and access to machinery and farm inputs (e.g., fertilizer) within the country. Exploring other options for input procurement or international business policy may increase the ability to access inputs.

Input tracking: The lack of an input tracking system currently leads to looting or on-selling, increasing the price of inputs and creating an uneven distribution profile compared to demand. The development of the Ethiopian Digital Input Tracking System should be well resourced in order to better track fertilizer, and lessons learned can be applied to other relevant inputs.

Value addition: As noted, despite some value addition, capabilities are low for the majority of outputs. Market-oriented extension and advisory, as well as the empowerment of cooperatives, farmer groups and unions can increase value addition capabilities.

Sales channels: Sales are still almost exclusively through physical market channels, with a significant presence of middlemen, limiting farmer bargaining power and increasing prices for the end consumer. Moreover, physical channels do not incentivize aggregation, or linkage to international or export markets. E-commerce platforms or improved digital market linkage would allow farmers to improve their income and increase value chain efficiency.

Select ongoing initiatives

Table 42: Select Ongoing Agricultural Markets Initiatives

Organization	Initiative	Description
ATI	Ethiopian Digital Input Tracking System (EDITS)	• Pilot is being designed in 2024 to track fertilizer from port to farm gate to support timely delivery and quality inputs • Uses QR codes and NFC tags[73] to track inputs
ATI	Cooperative support initiatives e.g., Cooperative-Based Seed Production	• Cooperative warehousing support as well as seed supply initiatives that help cooperatives move beyond aggregation to value addition

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[73] Near Field Communications

5.7.6 Innovation & Technologies

Area objective

An empowered private sector that allows for development of priority innovative tools

Area description and enabling initiatives

The innovation and technologies area focuses on the adoption and development of cutting-edge technologies and practices within the digital agriculture ecosystem. This initiative area has three enabling initiatives, all of which will be implemented in Phase Two of the roadmap. The enabling initiatives and their descriptions are available in Table 43~~Table 43~~ below.

Moreover, as aligned with DAR's third guiding principle to empower the private sector, innovative technologies and private sector participation will be central to the development and implementation of all DAR digital use cases and enabling initiatives when appropriate to do so.

Table 43 Innovation and Technologies Enabling Initiatives

	Initiative	Description
Phase 2	Competitive incubation / product dev. environment with forum	Set up incubators and innovation hubs to nurture digital agriculture application software developers' and device manufacturers' talent and give them visibility to investors in the industry to scale innovations
	Working space & training for ag techs	Offer office space to select digital agriculture startups in hubs to foster learning and efficiency through industry exposure and knowledge sharing
	Digital agriculture curriculum	Create courses and programs to be used in non-ATVET settings designed to impart knowledge and skills necessary for delivery of agriculture products and services via digital channels

Ecosystem assessment – Improvements

The Digital Economy 2025 strategy has encouraged the development of innovation over the past 5 years. One example of this is the Ministry of Innovation and Technology's AI Research and Development Centre for analytics which was launched in 2021 following the Digital Economy Strategy recommendations. This center has already produced innovations in the agricultural sector, including a coffee leaf disease detection and severity estimation analytical tool.

Donors have also supported innovation and technology progress, with FAO establishing a Digital Agriculture and Innovation Hub in Ethiopia which is exploring drone technologies for agriculture and water resource management. There are also innovative private companies such as Lersha or Hello Tractor, but private sector innovation is still limited.

Ecosystem assessment - Areas to Strengthen

Despite these improvements, innovation and technologies are still nascent in Ethiopia in the agricultural sector, hindered by two main challenges.

Private sector enablement: There are ongoing initiatives within MinT to encourage and incentivize small businesses and entrepreneurship, ultimately enabling innovation. These include paperwork support, tax relief and advisory services. This is still nascent however, and cross-governmental engagement is required to align on agri-tech-specific incentives or enablers.

Cost barriers: Technology is still largely cost-prohibitive for many farmers and pastoralists, meaning the agricultural technology market is small. The small domestic manufacturing base for agricultural technologies and equipment (e.g., smart sensors or digitally enabled tractors), combined with an unfavorable macroeconomic environment that limits the availability of foreign currency for imports of key products required in relevant technologies create major cost barriers for innovators, manufacturers and farmers and pastoralists. This hinders availability and access to technologies, and does not incentivize innovation within the country.

Table 44: Select Ongoing Innovation & Technologies Initiatives

Organization	Initiative	Description
Private Sector	Digital agriculture innovations	• Private sector companies such as Lersha, Hello Erf and different commercial banks have come up with various farmer facing agriculture products addressing ecosystem challenges such as market access, access to financial services and access to inputs
MinT	AI R&D center	• MinT launched an AI R&D Centre for analytics in 2021, which has produced a coffee leaf disease detection and severity estimation analytics tool
FAO	Digital Agriculture Innovation Hub	• Co-working space and financial support to enable innovation and entrepreneurship in the agriculture sector

6

Implementation plan

6.1 GOVERNANCE

A well-organized governance structure is essential for effectively overseeing DAR's key recommendations during their implementation. This structure should ensure accountability, transparency, and responsiveness among the diverse group of stakeholders participating in the DAR Roadmap implementation. The DAR's governance structure as outlined below in Figure 12Figure 12 aims to address these key criteria while enhancing coordination across the digital agriculture ecosystem.

Figure 12: Proposed DAR Governance Structure
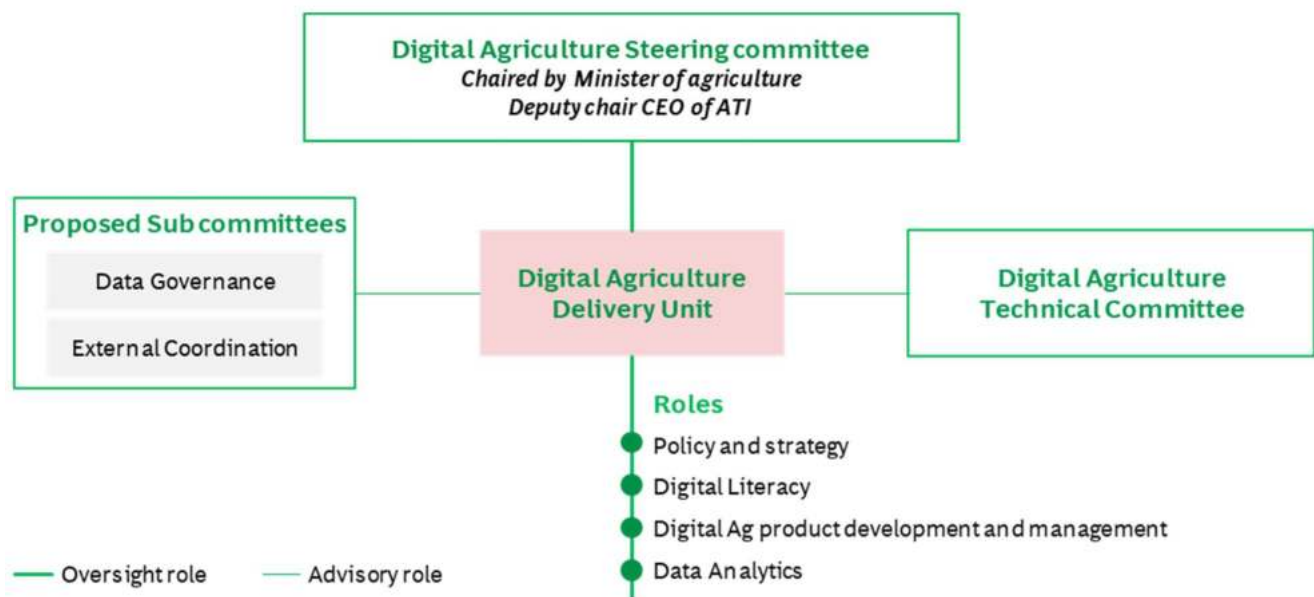
Digital Agriculture Delivery Unit

As described in section 5.7.3 on Human Capital and Infrastructure above, the proposed digital agriculture team will take the form of a project delivery unit or PDU. This Digital Agriculture Delivery Unit is central to DAR governance and will be the team driving and coordinating implementation of the DAR on a daily basis. In the long-term, it is intended that this delivery unit will sit within the Ministry of Agriculture.

Typically, project delivery units in public sector governance structures are responsible for the planning, coordination, development and management of projects from inception to completion. PDUs also ensure that projects align with government priorities, align with regulations and help to oversee stakeholder engagement.

The proposed Digital Agriculture Delivery Unit will take on these traditional PDU responsibilities within the digital agriculture realm, while also providing

digital agriculture expertise support to the government on topics such as data analytics, digital literacy, policy development, and digital agriculture strategy. More details on the Digital Agriculture Delivery Units proposed roles and responsibilities are outlined below.

Digital Agriculture Delivery Unit Roles and Responsibilities

1. **Policy and Strategy –** Support MoA in developing digital agriculture policies (e.g., data standard policy) as well as advising on any future updates to the DAR or other relevant digital agriculture strategies.

2. **Digital Literacy –** Support in the development and implementation of campaigns to improve digital literacy amongst farmers, DAs, government stakeholders and other ecosystem players.

3. **Digital Agriculture Product Development and Management –** Coordinate and oversee the end-to-end development of digital agriculture products for which the government should take a central role in developing. Once established, support in the ongoing management of digital agriculture products and services until they can be transferred to a more appropriate long-term owner.

4. **Data Analytics –** Provide data analytics supports to MoA to help inform decisions and inform planning.

The DAR PDU would be overseen by the DAR Steering Committee, which is recommended to meet quarterly (or more often as needed). The Steering Committee will provide. The Steering Committee would be chaired by His Excellency Minister of Agriculture Dr. Girma and deputy chaired by CEO of ATI, DR. Mandefro. The Steering Committee will be responsible for strategic decision-making, making investment choices and resolving issues that arise during implementation.

The Steering Committee and the Digital Agriculture Delivery Unit will be supported by the DAR Technical Committee. The Technical Committee is also recommended to meet at minimum once per quarter and will serve as an advisory group for the Digital Agriculture Delivery Unit and the Steering Committee.

DAR also proposes that the Digital Agriculture Delivery Unit be supported by two sub-committees, one dedicated to data governance and one dedicated to partner coordination. The Data Governance Sub-Committee would provide input and advise on any data governance and standards issues that arise during the implementation of DAR. The External Coordination Sub-Committee would serve as a platform to inform development partners and key ecosystem stakeholders on the implementation progress of the DAR and also ensure ecosystem resources are maximized by reducing duplication of initiatives and efforts. Permanent members of each committee should be determined by the Digital Agriculture Delivery Unit upon establishment.

Finally, the DAR recognizes that successful implementation use cases and enabling initiatives identified in the Roadmap will require close collaboration and communication with entities from across the whole of Ethiopia Government. Table 45Table 45 below highlights the role other government entities in the country have in supporting the agricultural sector and ensuring successful implementation of DAR. It will be the

responsibility of the Steering Committee and the Digital Agriculture Delivery unit to ensure close coordination with the listed entities for the identified use cases and initiatives.

Table 45: Ethiopian Government Entities and their role in supporting agriculture sector and DAR

Govt. Entity	Role related to Agriculture Sector	Relevant Phase 1 Priority Use Cases & Initiatives
Prime Minister's Office	Responsible for guiding the country's agricultural and digital policies and strategies (e.g., Digital Ethiopia 2025) through policy formulation, coordination, linkage, monitoring, and evaluation Responsible for the National ID, to which the farmer profile will align	• Overall digital strategy • Farmer profile
Ministry of Agriculture	Responsible for designing and implementing agricultural and rural development policies in Ethiopia.	• All use cases
Ministry of water Irrigation and Energy	Responsible for managing water resources, water supply, sanitation, and electricity. The ministry contributes to quality water and energy supplies, enhancing food security.	• Deliver timely interventions • Digital kiosks
Ministry of Transport and logistics	Responsible for the expansion of transport services, ensures equitable regional distribution, and regulates maritime and transit services. The logistics of agricultural inputs are under the mandate of the Ministry.	• Procure and distribute inputs • Track and trace inputs • Access better markets and buyers
Ministry of Innovation and Technology	Responsible for digital innovation and technology adoption in the country through policy support.	• Access better markets and buyers • Data governance and sharing policy, standards, assurances and incentives • Farmer profile • Digital financial literacy
Ministry of Labor and Skill (MoLS)	Responsible for training professionals, including increasing the number of qualified Agricultural professionals through the federal Agricultural TVET colleges.	• Digital financial literacy (DAs) • Digital agriculture team
Ministry of Education (MoE)	Responsible for expanding standardized education throughout the country, as well as complementing and leveraging education sector development interventions with strategic communications and public awareness.	• Digital financial literacy (farmers, pastoralists and DAs) • Digital agriculture team
Ministry of Trade and Regional Integration	Responsible for promoting regional integration, trade, and economic growth in Ethiopia.	• Access better markets and buyers • Procure and distribute inputs

Govt. Entity	Role related to Agriculture Sector	Relevant Phase 1 Priority Use Cases & Initiatives
Ethiopian Agricultural Transformation Institute (ATI)	ATI is a strategy and delivery-oriented government agency created to help accelerate the growth and transformation of Ethiopia's agriculture sector. The Agency's mandate is focused solely on improving the livelihoods of smallholder farmers across the country.	• Track and trace inputs • Access better markets and buyers • Farmer profile • Digital kiosk
Ethiopian Agricultural Research Institute (EIAR)	EIAR conducts research that provides market-competitive agricultural technologies. These technologies contribute to increased agricultural productivity, improved nutrition quality, sustainable food security, economic development, and conservation of natural resources and the environment.	• Deliver timely interventions • Procure and distribute inputs
Ethiopian Statistics Service	The Ethiopian Statistics Service (ESS) collect and compile data from sample surveys, censuses, and administrative records, and analyze data and deliver report for various sectors including agriculture.	• Farmer profile • Land and production data
Ethiopian Space Science and Geospatial Institute (ESSG)	ESSG uses satellite technology to track and manage farm resources, evaluate the impact of interventions, and provide spatial analysis.	• Procure and distribute inputs • Land and production data
Ministry of Finance	Responsible for financial management and economic policy of the country, in addition to the allocation of economic assistance.	• Funding for all use cases • Access credit • Access insurance
National Bank of Ethiopia (NBE)	NBE plays a crucial role in promoting agricultural finance and financial inclusion in Ethiopia. It regulates and supervises financial institutions, provides financial support, and promotes market development	• Access credit • Access insurance
Institute of Ethiopian Standards (IES)	IES sets and enforces standards for agricultural products. IES also provides development of standards, training, and technical support on the implementation of standards.	• Data governance and sharing policy, standards, assurances and incentives • Access better markets and buyers • Track and trace inputs

6.2 MONITORING PLAN
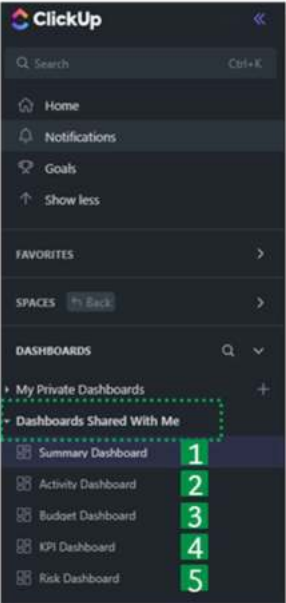
A robust monitoring strategy is essential to ensure that the DAR is both executed effectively and produces the intended outcomes. The purpose of the monitoring plan is to assess whether the DAR is effectively enhancing the livelihoods of farmers and pastoralists, and thus contributing to the vision and progressing towards the target state. By tracking Key Performance Indicators (KPIs), the tangible impacts of the strategy can be evaluated, and adjustments can be made to redirect towards impact if and where required.

KPIs will be monitored at various levels including for Phase 1 overall, for use cases and initiatives in Phase 1, and at a more granular level within these use cases and initiatives. The DAR's contributions to MoA 10-Year Strategy objectives will also be monitored. A cadence will be developed in conjunction with the DAR Project Management Office (PMO) or Project Delivery Unit (PDU) in which use case or initiative teams will provide updates on activities and monitor their KPIs to record the progress of their implementation. The DAR PMO or PDU will then gather and integrate updates and KPIs at all levels to provide insights, directional changes and recommendations. The DAR Steering Committee will then review these updates at an agreed cadence.

For tracking and evaluating the implementation performance, it is recommended that the DAR uses a cloud-based platform, ClickUp (see Figure 12), that was implemented by DAEAS monitoring. This tool will facilitate real-time collaboration and serve as a unified source of truth for tracking progress. It also enables automated progress reports and provides a public-facing version of the roadmap to ensure visibility for all involved parties, including implementing partners, donors, MoA and external stakeholders.

Figure 13: Example ClickUp monitoring features

7

Conclusion

Ethiopia is on the path to becoming a digital economy, and the Digital Agriculture Roadmap presents a comprehensive and strategic blueprint for the digital transformation of Ethiopia's agriculture sector. This roadmap is built on four guiding principles: leveraging existing initiatives, ensuring coordination among stakeholders, empowering the private sector, and prioritizing phased implementation. These principles will optimize resource use, foster innovation, and ensure the scalability and sustainability of digital solutions as the roadmap moves from strategy to implementation.

The DAR emphasizes the importance of integrating digital technologies across various facets of the agricultural value chain. By focusing on 22 priority use cases in the solution areas of agricultural intelligence, supply chain management, financial services, pricing and market services, smart farming, and extension and advisory services, the roadmap aims to address the most pressing challenges faced by Ethiopian farmers and pastoralists. These 22 critical use cases, phased until 2032, will significantly enhance productivity, resilience, and sustainability within the agricultural ecosystem.

The DAR also highlights the importance of building a robust enabling environment. The 32 priority enabling initiatives, including improving digital infrastructure, enhancing digital literacy, and developing comprehensive farmer profiles are pivotal to the success of the priority use cases. This includes establishing supportive government policies, enhancing physical and digital infrastructure, fostering innovation, and building human capital. The roadmap's phased implementation plan ensures that foundational initiatives are addressed first, laying the groundwork for more complex digital solutions. This approach minimizes risks and maximizes the impact of each initiative, creating a solid foundation for long-term success.

Stakeholder engagement has been a cornerstone of the DAR development process. The roadmap was created through extensive consultations with government agencies, industry experts, donor organizations, and local communities, and we acknowledge and thank all participants for their expertise and support. This collaborative approach has ensured that the DAR is not only aligned with national policies and strategies but also reflects the on-the-ground realities and needs of farmers. The involvement of a broad range of stakeholders will also be crucial for the successful implementation and sustainability of the roadmap.

Ultimately, the DAR is more than just a plan—it is a call to action. It sets a clear path forward for transforming Ethiopia's agricultural sector through digital innovation. The successful implementation of this roadmap will require continued commitment, strategic investment, and adaptive management. By working together, government bodies, private sector partners, development agencies, and local communities can achieve the vision of a digitally empowered agricultural sector, ensuring improved livelihoods for farmers and pastoralists across Ethiopia. This collective effort will make Ethiopian agriculture more productive, resilient, and ready to face future challenges, paving the way for a prosperous and sustainable future.

8

Appendix

8.1   DAR STEERING AND TECHNICAL COMMITTEES

Table 46: Steering Committee Composition

No	Name	Organization	Position
1	Girma Amente (Chair, PhD)	MoA	State Minister
2	Mandefro Nigussie (Deputy Chair, PhD)	ATI	CEO
3	Eyasu Elias (PhD)	MoA	State Minister (NRM)
4	Fikru Regassa (PhD)	MoA	State Minister (Livestock and Fishery)
5	Meles Mekonnen (PhD)	MoA	State Minister (Agriculture and Horticulture)
6	Sofia Kassa (PhD)	MoA	State Minister (Input and Investment)
7	Efa Muleta (PhD)	MoA	State Minister
8	Stewart Collis	BMGF	Senior Program Officer
9	Parmesh Shah (PhD)	World Bank	Global Lead for Rural Livelihoods and Agricultural Jobs
10	Mawira Chitima (PhD)	IFAD	Country Director for Ethiopia
11	Erik Slingerland	Netherlands Embassy	First Secretary - Food and Nutrition Security for Netherlands Embassy in Ethiopia
12	Beker Shale (PhD)	ESS	Director General

Table 47: Technical Committee Composition

No	Name	Organization	Position
1	Anteneh Legesse	MoA	Director of ICT
2	Abreham Endrias	Lersha	CEO
3	Beza Bogale	Digital Green	Digital Product Lead
4	Zemen Haddis (PhD)	USAID	Deputy Director
5	Brenda Gunde	IFAD	Regional ICT 4D specialist
6	Fernando Rodrigues	ATI	Director of Analytics
7	Dawit Philipos	ATI	Senior Director
8	Girma Mamo (PhD)	EIAR	Climate, Geospatial and Biometrics Research Directorate

No	Name	Organization	Position
9	Lulseged Desta (PhD)	Alliance Bioversity & CIAT	Director
10	Efrem Tesfaye (PhD)	Development Gateway	Project Manager for aLIVE
11	Martin Parr (PhD)	CABI	Director
12	Nixon Gecheo(PhD)	AGRA	Senior Programme Officer
13	Melkamu Beyene (PhD)	AAU	Assistant Professor
14	Yosef Getachew	MoA	Deliver Unit
15	Degefie Tibebe (PhD)	Alliance Bioversity & CIAT	Spatial Analyst

8.2   STAKEHOLDERS CONSULTED FOR THE DEVELOPMENT OF DAR

Table 48 below includes a list of all stakeholders engaged throughout the roadmap development process. These stakeholders were either consulted during interviews or attended the National or Partner Convening.
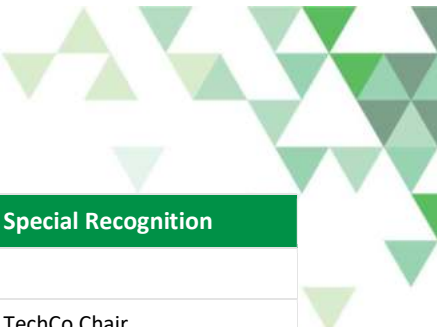
The National Convening was a workshop held on the 11th and 12th of March 2024 in Addis Ababa, bringing together local agriculture ecosystem participants, development and implementation partners, and government institutions to socialize the concept of DAR and gather input on prioritizing digital agriculture use cases and enabling initiatives.

The Partner Convening was a workshop held on the 21st of May 2024 in Addis Ababa bringing together various local and international digital agriculture ecosystem participants, development & implementation partners, and government institutions to socialize the draft roadmap and give input on the draft implementation plans for priority Phase One use cases and initiatives of the roadmap.

All other stakeholders were consulted through group discussions or one-on-one interviews. The DAR project team is thankful for their contributions.

Table 48: List of Stakeholders Consulted for the Development of DAR

No	Type	Organization Name	Name	Special Recognition
1.	Government	MoA	Girma Amente (PhD)	SteerCo Chair
2.	Government	ATI	Mandefro Nigussie (PhD)	SteerCo Deputy Chair
3.	Government	MoA	Prof. Eyasu Elias	SteerCo Member
4.	Government	MoA	Fikru Regassa (PhD)	SteerCo Member
5.	Government	MoA	Meles Mekonnen (PhD)	SteerCo Member
6.	Government	MoA	Sofia Kassa (PhD)	SteerCo Member
7.	Government	MoA	Efa Muleta (PhD)	SteerCo Member
8.	Government	ESS	Beker Shale	SteerCo Member
9.	Government	CIAT	Lulseged Desta (PhD)	TechCo Member
10.	Government	AUU	Melkamu Beyene (PhD)	TechCo Member
11.	Government	MICT	Yosef Getachew	TechCo Member
12.	Government	ATI	Fernando Rodrigues	TechCo Member
13.	Government	ATI	Dawit Phillipos	TechCo Member
14.	Government	MoA	Esayas Lemma	
15.	Government	MoA	Mengistu Tesfa	
16.	Government	MoA	Yenenesh Egu	

No	Type	Organization Name	Name	Special Recognition
17.	Government	MoA	Melake Assefa	
18.	Government	MoA	Anteneh Legesse	TechCo Chair
19.	Government	MoA	Andualem Walelegn	
20.	Government	MoA	Thomas Cherenet (PhD)	
21.	Government	MoA	Chala Wordofa Bonse (PhD)	
22.	Government	MoA	Keberu Belayneh	
23.	Government	ATI	Chimdo Anchala	
24.	Government	ATI	Temesgen Gebeyehu	
25.	Government	ATI	Awet Tekie	
26.	Government	ATI	Habtamu Hailemariam	
27.	Government	ATI	Bereket Gebrewahid	
28.	Government	MinT	Fekade Getahun (PhD)	
29.	Government	MinT	Minda Feleke	
30.	Government	MinT	Abiyot Bayou (PhD)	
31.	Research Institute	EIAR	Feto esimo (PhD)	
32.	Research Institute	EIAR	Tadesse Anberbir	
33.	Research Institute	EIAR	Girma Mamo	
34.	Government	EthioTelecom	Mohammed Abdusemed	
35.	Government	National ID Ethiopia	Yodahe Zemichael	
36.	Government	AI Institute	Mohammed Edris	
37.	Government	AI Institute	Amanuel Kumsa	
38.	Government	Geospatial Information Institute	Tulu Besha (PhD)	
39.	Development Partner	MasterCard Foundation	Haile Dolango	
40.	Development Partner	World Bank	Elliot Mghenyi	
41.	Development Partner	BMGF	Stewart Collis	SteerCo Member
42.	Development Partner	BMGF	Amsale Mengistu	
43.	Development Partner	BMGF	Wanjiku Kiragu	
44.	Development Partner	World Bank	Parmesh Shah (PhD)	SteerCo Member
45.	Development Partner	IFAD	Mawira Chitima (PhD)	SteerCo Member
46.	Development Partner	REDFS	Erik Slingerland	SteerCo Member

No	Type	Organization Name	Name	Special Recognition
47.	Development Partner	USAID	Zemen Haddis	TechCo Member
48.	Development Partner	FAO	HageAli, Maya	
49.	Development Partner	GIZ	Berhanu Genzebu	
50.	Development Partner	IFAD	Brenda Gunde	TechCo Member
51.	Development Partner	DANIDA	Tigist Kebede	
52.	Development Partner	World Bank	Elliot W. Mghenyi (PhD)	
53.	Development Partner	IFC	Desta Damena	
54.	Development Partner	IFC	Selamawit Hailemichael Tumebo	
55.	Development Partner	BMGF	Haddis Tadesse	
56.	Development Partner	AfDB	Abdul Kamara (PhD)	
57.	Development Partner	GIZ	Markus Koerner	
58.	Development Partner	GIZ	Melaku Tadesse	
59.	Development Partner	UNCDF	Ibrahim M. Hussein	
60.	Development Partner	UNCDF	Melat Mebratu	
61.	Development Partner	UNCDF	Endashaw tesfaye	
62.	Development Partner	JICA	Yuhi Miyauchi	
63.	Development Partner	Master Card Foundation	Samuel Yalew Adela	
64.	Development Partner	Master Card Foundation	Mekdes Girmaw	
65.	Development Partner	USAID	Yirgalem Gebremeskel	
66.	Development Partner	AFD	Sonia Lioret	
67.	Development Partner	EU	Mercedes Marin	
68.	Development Partner	EU	Roberto Schiliro	
69.	Development Partner	EU	Maxime Heyndrickx	
70.	Development Partner	FAO	Dejan Jakovljevic	
71.	Development Partner	FAO	Hailu Eregnaw	
72.	Development Partner	AGRA	Nixon Gecheo (PhD)	TechCo Member
73.	Development Partner	AGRA	George Marechera	
74.	Development Partner	FCDO	Edward Barney	
75.	Development Partner	Embassy of Ireland - Irish Aid	Niall Cremen	
76.	Development Partner	GEAAP	Enas Abdulmalik	

No	Type	Organization Name	Name	Special Recognition
77.	Development Partner	Embassy of Sweden /sida	Girum Bahri	
78.	Development Partner	Embassy of Norway	Fikirte Regassa	
79.	Development Partner	Embassy of Finland	Meseret Mengistu	
80.	Development Partner	Italian Agency for Development Cooperation	Andrea Limiroli	
81.	Development Partner	Swiss Development Cooperation	Renate Lefroy	
82.	Development Partner	UNDP	Selamawit Alebachew	
83.	Development Partner	KOICA	Yosef Tesfaye	
84.	Development Partner	IGAD	Edmealem shitaye	
85.	Development Partner	Norway Embassy	Mari Martinsen	
86.	Development Partner	WFP	Jennifer Bitonde	
87.	Development Partner	UNDP	Samuel G. Doe	
88.	Development Partner	European Union Delegation	Teriessa Jalleta	
89.	Development Partner	WFP	Allan Mulando	
90.	Development Partner	Swiss Development Cooperation	Daniel Valenghi	
91.	Development Partner	Swiss Development Cooperation	Amsalu Andarge	
92.	Development Partner	Global Affairs Canada	Selamawit Enna	
93.	Development Partner	Embassy of Ireland - Irish Aid	Hiwot Mebrate	
94.	NGO	SNV	Yetnayet Girmaw	
95.	NGO	Precision Agriculture for Development	Habtamu Yesigat (PhD)	
96.	NGO	Development Gateway	Efrem Tesfaye (PhD)	TechCo Member
97.	NGO	CABI	Negussie Efa	
98.	NGO	Farm Radio International	Zelalem Nega	
99.	NGO	Sasakawa Africa Association	Fentahun Mengistu (PhD)	
100.	NGO	Digital Green	Kebede Ayele	
101.	NGO	Digital Green	Beza Bogale	
102.	NGO	Mercy Corps	Ferhana Jelaludin	
103.	NGO	TechoServe	Belayneh Nekatibeb	

No	Type	Organization Name	Name	Special Recognition
104.	NGO	OXFAM	Tibebu Koji	
105.	NGO	Self Help Africa	Wubshet Berhanu	
106.	NGO	Agriterra	Hailet Berhane	
107.	NGO	BENEFIT	Helen Getaw	
108.	NGO	GAIN	Ton Haverkort	
109.	NGO	CARE	Zegeye Bante	
110.	NGO	Farm Africa	Shewit Emmanuel Kidane Mariam	
111.	NGO	OXFAM	Yilma Muluken	
112.	NGO	Alliance2015 ETHIOPIA	Sara Worku	
113.	NGO	GAIN	Wubet Girma	
114.	NGO	SNV	Mahlet Yohannes	
115.	Research Institute	CIMMYT	Kindie Tesfaye Fantaye (PhD)	
116.	Research Institute	ICRISAT	Mezegebu Getnet	
117.	Research Institute	CIAT	Sintayehu Alemayehu	
118.	NGO	AGRA	Bisrat	
119.	NGO	CABI	Martin Parr (PhD)	TechCo Member
120.	NGO	CIAT	Degefie Tibebe (PhD)	TechCo Member
121.	NGO	Precision Agriculture for Development	Habtamu Yesigat (PhD)	
122.	Private Sector	Hello Erf	Gezachew Mesfin	
123.	Private Sector	Safaricom Telecommunications	Girum Ketema	
124.	Private Sector	Hello Tractor	Mao Yohannes	
125.	Private Sector	Lersha	Abrhame Endrias	SteerCo Member
126.	Research Institute	EIAR	Girma Mamo (PhD)	TechCo Member
127.	Strategic Support	BCG	Chris Mitchell	SteerCo Member
128.	Strategic Support	BCG	Zoe-Karl Waithaka	SteerCo Member
129.	Technical Support	BCG	Michael Custer	Working Team Lead
130.	Technical Support	BCG	Rosalind Parr	Working Team Member
131.	Technical Support	BCG	Jonathan Sentomero	Working Team Member
132.	Technical Support	BCG	Lunah Njeri	Working Team Member

No	Type	Organization Name	Name	Special Recognition
133.	Development Partener	JICA	Abera Awano	
134.	Government	MoA	Addis Mulugeta	
135.	NGO	CABI	Ameen Jauhar	
136.	Development Partener	UNDP	Asmare Adegeh	
137.	NGO	Sasakawa Africa Association	Binyam Tesfaye	
138.	Private Sector	Laesk Net Trading PLC	Birhanu Muluneh	
139.	Development Partener	IFC	Bruck Sewnet	
140.	Government	ATI	Dagachew Seyoum	
141.	Private Sector	Acatch Technology	Daniel Yilma	
142.	Government	National ID Ethiopia	Dawit M. Dam	
143.	Government	EIAR	Liyuneh Gebre (PhD)	
144.	Development Partener	GIZ	Teklu Erkossa(PhD)	
145.	Private Sector	Laesk Net Trading PLC	Eskinder Teshome	
146.	Government	ATI	Ezedin Abdella	
147.	Private Sector	Acatch Technology	Fikru Kebede	
148.	Private Sector	RE Technology Solutions PLC	Hanna Kifle	
149.	Private Sector	Lersha	Hanna Mulugeta	
150.	NGO	Digital Green	Hawinet Bekele	
151.	Private Sector	Kifiya	Henock Chanyalew	
152.	Government	MoA	Israel Solomon	
153.	Development Partener	IFAD	Kadre Kadei	
154.	Government	MoA/GIZ	Kebebew Ababu	
155.	Development Partener	JICA	Keiko Ota	
156.	Farmer		Nigussie Akalu	
157.	Farmer		Kisu Geremew	
158.	Farmer		Yitages Kasaye	
159.	Farmer		Shibere Mengesha	
160.	Farmer		Belete Alemu	

No	Type	Organization Name	Name	Special Recognition
161.	Farmer		Abera Workineh	
162.	Farmer		Kebede Tulu	
163.	Farmer		Sidisu Moju	
164.	Farmer		Genet Fiseha	
165.	Farmer		Shewaye Zewdie	
166.	Farmer		Megertu Yadicha	
167.	Farmer		Sisay Mekasha	
168.	Farmer		Moti Gadisa	
169.	Farmer		Engidashet Abdi	
170.	Farmer		Deribe Jema	
171.	Farmer		Dejene Daba	
172.	Farmer		Gisa Tefera	
173.	Farmer		Martha Mulugeta	
174.	Farmer		Dereje Kebede	
175.	Farmer		Solomon Lema	
176.	Farmer		Alemayehu Terefe	
177.	Farmer		Etagegnehu Terefe	
178.	Farmer		Zewdua Wolde	

8.3 POLICIES AND REPORTS LEVERAGED FOR DEVELOPMENT OF DAR

Table 49: Policy Documents and Sector Reports Leveraged for DAR

Policy/ Document (year)	Year	Issuing institution/ entity	Document type	Relevance for DAR
Personal Data Protection Proclamation (PDPP)	2024	HPR	Legislation	The personal data protection proclamation is a comprehensive legal framework designed to protect individual privacy and regulate the management of personal data in Ethiopia. As such any data generated by Ethiopian farmers must be held in a manner that complies with the law.
Towards Digital Agriculture in Ethiopia an overview of the status, challenges, enablers, and prospects	2023	CIAT, CGIAR, Acatech, MoA	Report/ strategy	The document examines the current landscape, challenges, and opportunities of digital agriculture. The document also outlines strategic directions to follow for advancing digital agriculture in Ethiopia.
Agriculture 10-in-10 Strategy	2023	MoA	Ministerial Strategy	The document summarizes the 10 priority programs in agriculture to significantly improve food supply over the next 10 years. Therefore, special attention is given to raise production and productivity levels beyond the targets in the 10-year prospective plan.
Digital Farmer Services (DFS) Roadmap	2023	BCG	Report/ strategy	This document details out the development of a digital farmer solutions roadmap for a state government in India which prioritised 3 "Big Plays" to reach 40 to 45 million farmers and create a 15 – 25% boast in the farmers' income
Ethiopia Start Up Eco-System Report	2023	JICA	Report/ strategy	The document reviews the Ethiopian startup ecosystem and startups, providing a detailed look into their growth, success, failures, and sectors. One of the startup sectors detailed out in the document was Agri-tech, diving into the startups found at different points along the agriculture value chain
State of Mobile Internet Connectivity and Indices	2023	GSMA	Report/ strategy	The GSMA report gives insights into the global state of mobile internet connectivity and the challenges that remain. The insights we can get from the report include coverage area, regional variations, and digital inclusion

Policy/ Document (year)	Year	Issuing institution/ entity	Document type	Relevance for DAR
Price Baskets Report	2023	ITU	Report/ strategy	The document monitors and reports on global ICT prices. The ITU collects prices for three main ICT services - mobile-cellular, fixed-broadband, and mobile-broadband. The price data are used for international comparisons of affordability and access to ICT services.
Ethiopia DAEAS 10-Year Roadmap	2022	MoA	Ministerial Strategy	The roadmap aims to provide high-quality, customized, and cost-efficient data and advisory information. The roadmap also tries to deliver initiatives through a solutions pipeline (digital innovations), digital stack (necessary digital elements), and enabling environment (policies, human capital, and private sector).
National Digital Skills Country Action Plan	2021	MoE	National Strategy	The action plan has a goal of preparing students in Higher Education and TVET institutions with the right level of digital skills that the future work environment demands. This also requires making ready the necessary policies and strategies, designing the appropriate curriculum, enhancing the teaching learning process to be supported by ICTs, developing the necessary infrastructure and resources.
National Financial Inclusion strategy	2021	NBE	National Strategy	The Inclusion strategy highlights a set of interventions that need to be completed, ranging from building financial infrastructure to promoting financial education. These interventions are very useful for the agriculture sector in Ethiopia.
National Digital Payments Strategy	2021	NBE	National Strategy	The strategy outlines a robust and responsible digital payment ecosystem in Ethiopia. Farmer-facing digital payment initiatives need to follow the directions outlined in the document.
a Livestock Information Vision Ethiopia (aLIVE) Program	2021	MoA, BMGF & Development Gateway	Report/ Strategy	A roadmap for a livestock information system for Ethiopia to support better use of data for decision-making in the Ministry of Agriculture.It incorporates an interoperable national livestock information and analytic system that will define critical data needs and standards and guidelines to enable interoperability of data systems
Ten Years Plan of MoA	2021	MoA	Ministerial Strategy	The Ethiopian agricultural plan for the next 10 years aims to reduce poverty by meeting specific goals, which state that areas such as nutrition, farmer income, or exports will be prioritized for the coming decade. The document

Policy/ Document (year)	Year	Issuing institution/ entity	Document type	Relevance for DAR
				clearly outlines the direction the government wants to reach within the next decade.
Digital Ethiopia 2025	2020	PMO	National Strategy	It is a comprehensive digital transformation initiative with objectives of inclusive digital transformation, in agriculture, manufacturing, IT services and Tourism
Technical Centre for Agriculture and Rural Cooperation	2019	CTA	Report/ strategy	The report highlights the potential of digital technologies to transform African agriculture and improve the livelihoods of smallholder farmers and pastoralists.
Digital Ag in Rural areas Briefing Paper	2019	UN FAO	Report/ strategy	The document delves into how digital technologies can improve agricultural productivity, efficiency, and sustainability. It also discusses the digital tools and platforms that can be utilized for digital agriculture transformations.
Agricultural Extension Strategy of Ethiopia	2017	MoA	Ministerial Strategy	The strategy aims to improve the Ethiopian farmer extension system with digital communications to improve knowledge and management of agricultural resources.
USAID Digital Farmer Services (DFS) for Ag	2017	USAID	Report/ strategy	The primary objective is to increase access to financial services for smallholder farmers, addressing chronic challenges in the agricultural value chain, such as limited access to credit, savings, insurance, and payment channels
ICT Strategy of MoA	2005	MoA	Ministerial Strategy	The strategy looks to create an enabling environment for the digitalization of the extension and advisory services in Ethiopia by focusing on six themes and five action plans

8.4   MAPPING OF DAEAS RECOMMENDATIONS TO DAR

Each initiative on the DAEAS Roadmap has been integrated into DAR. The following table demonstrates how DAEAS initiatives have been mapped to DAR use cases and initiatives.

Initiatives were mapped and incorporated into DAR in the 5 methods defined below:

- **1-1 Mapping -** Initiative is included in DAR as a standalone initiative
- **Combined –** Initiative was included within DAR by being combined with another DAR or DAEAS initiative
- **Adjusted –** Initiative was included but the scope and name of it was changed
- **Reworded –** Initiative was included in DAR but name of the initiative was reworded
- **In use cases –** Initiative was included in DAR but incorporated in one of the use cases
- **Part Combined –** Initiative was partially included in a DAR initiative
- **Not Included –** Initiative was not included in DAR as it only supports extension uses cases covered by DAEAS governance
- **Multiple –** Initiative was included as part of more than 1 DAR initiative

Table 50: Mapping of DAEAS recommendations to DAR

Number	Action item in DAEAS	Mapping	Mapped to DAR
1	Competitive incubation / product dev. environment with forum	1-1	Initiative: Competitive incubation / product dev. environment with forum
2	Partner with Mobile Network Operator (MNO) to create a farmer facing DAEAS	1-1	Use case: Partner with Mobile Network Operator (MNO) to create a farmer facing DAEAS
3	Support market entry of international products (in partnership with local players)	1-1	Initiative: Support market entry of international products (in partnership…)
4	Device access for extension workers (DAs, woreda experts)	1-1	Initiative: Device access for extension workers
5	Free access for DAs to key apps	Combined	Initiative: Free access for DAs and farmers to key apps
6	Phone payment plan for farmers	1-1	Initiative: Phone payment plan for farmers
7	Free access for farmers to key apps	Combined	Initiative: Free access for DAs and farmers to key apps
8	Telco service targets and incentives for rural areas	1-1	Initiative: Telco service targets and incentives for rural areas
9	Off-grid electricity access expansion in rural areas	Adjusted	Initiative: Solar panels for FTCs or OSSs

Number	Action item in DAEAS	Mapping	Mapped to DAR
10	Internet kiosk at FTC run by women/youth groups	Reworded	Initiative: Digital kiosks for farmers and DAs
11	Farmer profiles and unique ID	1-1	Initiative: Farmer profiles and unique ID
12	Input demand & supply tracking	In use cases	Use cases: Procure and distribute and track and trace inputs, plus analytics initiative
13	Integrated ag. data access point (decentralized data hub)	Adjusted	Initiative: Data stack with APIs
14	Data sharing incentives	Combined	Initiative: Data governance and sharing policy, standards, assurances and incentives
15	Ag. data quality standards and assurance system	Combined	Initiative: Data governance and sharing policy, standards, assurances and incentives
16	Fast-track pluralistic extension and ag. data sharing policies ratification	Part combined	Initiative: Data governance and sharing policy, standards, assurances and incentives
17	DAEAS National Forum linked to PMO	Not included	Only supports extension use cases, covered by proposed governance
18	Streamline content approval process	1-1	Initiative: Streamline content approval process
19	Working space and targeted training for ag techs	1-1	Initiative: Working space & training for ag techs
20	Digital training platform for DAs	Combined	Initiative: Digital & financial literacy for farmers and Das
21	Digital skills at ATVETs	Reworded	Initiative: Digital program in ATVETS
22	Improve DA management	1-1	Initiative: Improve DA management
23	Financial and digital literacy for farmers	Combined	Initiative: Digital & financial literacy for farmers and DAs
24	Expand dig. capacity MoA extension team	Combined	Initiative: Digital agriculture department in MoA
25	MoA & EIAR ICT human capacity building	Adjusted	Initiative: Digital training platform for MoA/RBoA
26	Digital training platform for MoA/BoA	1-1	Initiative: Digital training platform for MoA/RBoA
27	Digitize payments at rural service points	Adjusted	Initiative: Digitize payments at rural service points and other channels
28	Scale warehouse receipt financing	Multiple	Initiatives: Transaction and warehouse data, Input warehouses and distribution hubs
29	Digital contract farming platform	In use cases	Use case: Access better markets and buyers, Access to credit

Number	Action item in DAEAS	Mapping	Mapped to DAR
30	Support innovative digital finance products targeting farmers	In use cases	Use cases: Financial services use cases

Note that the only initiative that has not been included is the Digital Agriculture Forum with PMO, as this will be revisited when a dedicated digital agriculture team has been established. It will either be subsumed into the larger DAR governance structure, or linkages will be made to ensure ongoing alignment with the rest of the DAR implementation.

8.5 DAR USE CASE AND INITIATIVE PRIORITIZATION PROCESS AND RESULTS

8.5.1 Use case prioritization methodology

This process consisted of two broad steps. The first step was to identify a list of 22 use cases across 5 solution areas[74]. The second step was to prioritize these use cases based on their estimated impact and feasibility. Use cases that were prioritized would be addressed in the Phase One of the roadmap and the non-prioritized use cases would be addressed in Phase Two of the roadmap.

The initial 21 priority use cases were identified through the following three steps:

1. **Referencing –** Thorough review of local and international reports, national strategies, and stakeholder interviews, which resulted in 138 use case examples.

2. **Consolidation –** the 138 use case examples were then deduplicated and categorize then as either use cases as initiatives. This process narrowed the list down to 26 use cases.

3. **Applicable to Ethiopian Context -** These consolidated use cases were then sense checked for their applicability to the Ethiopian context through stakeholder interviews. The result was a final list of 22 use cases for the roadmap.

The 22 priority use cases were then prioritized to determine Phase One and Phase Two priorities for the roadmap. This prioritization process involved three inputs: Stakeholder feedback during the National Convening, one-on-one stakeholder interviews, and an assessment of impact metrics from local and international metrics. Across all three inputs, the prioritization considered both the potential impact of the use cases and the feasibility of implementation in Ethiopia. The results from the three inputs are outlined below.

Prioritization Input 1 - National Convening

During the national convening, attendees were asked to rate the 21 use cases (excluding extension and advisory use case) from 1 – 5 on impact and feasibility, with 1 being the lowest and 5 being the highest score. These use cases were then categorized as either high priority or medium priority based on the scoring matrix below in Figure 14Figure 14. The top 5 use cases coming out of the national convening were: access credit, access better markets, track and trace inputs, deliver timely interventions and procure and distribute inputs.

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[74] Excluding extension and advisory

Figure 14: Convening Use Case Prioritization Results

Impact and feasibility scores for prioritizing use case:

☐ <4 on impact and <4 on feasibility

☐ 4 on impact and 4 on feasibility

☐ 5 on impact and 5 on feasibility

Prioritization Input 2 - One-on-One Stakeholder Interviews

The DAR project team conducted over 30 interviews with stakeholders across the ecosystem to gather input on use case prioritization. During these interviews, stakeholders were asked to highlight their top three priority use cases based on their assessment of the use case's feasibility and impact. The number of times a use case was prioritized in one-on-one interviews was then aggregated across all interviews conducted, the results of which are shown in Table 51 below.

Table 51: Results of use case prioritization from one-on-one stakeholder interviews

Smart farming	Financial services	Pricing and market services	Supply chain management	Agricultural intelligence
Use and maintain farm machinery	Access credit	Access better markets and buyers	Track and trace inputs	Deliver timely interventions to protect crops or livestock
Improve crop varieties	Access to insurance	Manage farm business activities	Track output inventory	Procure and distribute inputs
Irrigate crops	Lease or purchase machinery	Understand up-to-date transparent pricing for products	Transport and store outputs safely	Develop carbon and climate credentials
Dispose of and manage farm waste	Access investment	Assure quality of outputs		Improve livestock management
	Access to mobile banking & money	Sort and grade output		

Number of stakeholders prioritizing use case:

☐ 0-3 times prioritized ☐ 4-5 times Prioritized ☐ 6+ times prioritized

Prioritization Input 3 – Metrics from benchmarks

Metrics from 21 international and local case studies were used to produce impact and feasibility scores. In cases where quantitative data was not available for the assessment, a qualitative assessment was made or the criteria was not leveraged for the analysis. For the assessment, the 4 impact criteria and 2 feasibility criteria outlined below were leveraged.

Impact Metrics

1. Income – estimated percent increase in farmer income from the benchmark use case

2. Production – Estimated percent increase in production from the benchmark use case

3. Number of impacted farmers – estimated percent of total farmers in a country reached from the benchmark use case and geography

4. Climate resilience and impact – Estimated resilience improvement or sequestration from the benchmark use case

Feasibility Metrics

1. Number of farmers onboarded per year for the benchmark use case

2. Number and scale of initiatives for the benchmark use case

Based on the results of the assessment of benchmark use case, each DAR use case was classified has high or medium priority through placement on the matrix figure 14 below. The top 4 use cases according to this input were: improve crop varieties, access credit, deliver timely interventions, and procure and distribute inputs.

SF1. Improve crop varieties
SF2. Use & maintain farm machinery
SF3. Irrigate crops
SF4.Dispose of & manage farm waste
FS5. Access credit
FS6. Lease or purchase machinery
FS7. Access to insurance
FS8. Access investment
FS9. Access to mobile banking & money
PM10. Manage business activities
PM11. Access better markets and buyers
PM12. Understand up-to-date transparent pricing for products
PM13. Assure quality of outputs
PM14. Sort and grade output
SC15. Track and trace inputs
SC16. Transport & store outputs safely
SC17. Track output inventory
AI18. Deliver timely interventions to protect crops or livestock
AI19. Develop carbon and climate credentials for markets
AI20. Improve livestock management
AI21. Procure and distribute inputs

Impact and feasibility scores for prioritizing use case:
☐ <4 on impact and <3 on feasibility
☐ 4 on impact and 3 on feasibility
☐ 5 on impact and 4 or 5 on feasibility

Aggregating the outcome of all three of these inputs resulted in the following 5 use cases being prioritized for Phase One of the roadmap, with the reaming 15 use cases to be addressed in Phase 2. Detailed overall prioritization results can be found in Table 52. The 5 phase one priority use cases are;

1. Access to Credit and Insurance[75]

2. Procure and Distribute Inputs

3. Track and Trace Inputs

4. Deliver Timely Interventions to Protect Crops or Livestock

5. Access Better markets and buyers

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[75] Given similar data requirements and distribution channels, access to credit and insurance were combined in Phase 1 of the roadmap

Table 52: Overall Use Case Prioritization Results

No.	Use case	Convening priority	Stakeholder priority	Metric priority	Overall priority
SF1	Improve crop varieties			✅	
SF2	Use and maintain farm machinery		🟡	🟡	
SF3	Irrigate crops				
SF4	Dispose of and manage farm waste				
FS5	**Access credit**	✅	✅	✅	✅
FS6	Lease or purchase machinery	🟡			
FS7	Access to insurance		🟡	*Note: Bundled with credit*	
FS8	Access investment				
FS9	Access to mobile banking and mobile money				
PM10	Manage farm business activities				
PM11	**Access better markets and buyers**	✅	🟡		✅
PM12	Understand up-to-date transparent pricing for products	🟡		🟡	
PM13	Assure quality of outputs				
PM14	Sort and grade output				
SC15	**Track and trace inputs**	✅	✅	🟡	✅
SC16	Transport and store outputs safely				
SC17	Track output inventory				
AI18	**Deliver timely interventions to protect crops or livestock**	✅	✅	✅	✅
AI19	Develop carbon and climate credentials for markets				
AI20	Improve livestock management				
AI21	**Procure and distribute inputs**	✅	✅	✅	✅

✅ High priority 🟡 Medium priority ✅ Overall height priority

8.5.2 Enabling Initiatives Prioritization

The Phase One priority enabling initiatives for the roadmap were determined through a comprehensive two-step process. The first step was to compile different enabling initiatives with input from the national convening, stakeholder interviews, and the DAEAS roadmap. This process resulted in a long list of 32 enabling initiatives. The second step was to prioritize initiatives based on their feasibility for implementation by the MoA, their alignment with existing Ethiopian digital and agriculture strategies, and stakeholder and & expert priorities.

For MoA implementation feasibility, an enabling initiative was categorized either high or medium as follows;

- High priority – Initiative can be fully implemented by MoA
- Medium priority - Initiative implementation is dependent on input from other government institutions

For alignment to Ethiopian strategies, an enabling initiative was categorized as either high or not categorized as follows;

- High priority – Initiative is aligned with MoA or Ethiopian digital strategy or policy document

Table 53: Enabling Initiative Prioritization Based on MoA Implementation Feasibility and Strategic Alignment

	Area	Initiative	MoA implementation	Strategic alignment
Digital stack	User facing	Software dev curriculum to build capability		✓
		Digitized payments		✓
		Decision-making dashboard for MoA	✓	
	Integration	Digital Agriculture Forum for interoperability	✓	
		Data stack with APIs	✓	✓
	Analytics	Input demand and supply analytics	✓	
		Dedicated analytics unit within MoA	✓	
	Data & content	Farmer profiles and unique ID	✓	✓
		Land and farmer-linked production data	✓	
		Transaction and warehousing data	✓	
		Weather data	✓	
		Price data	✓	
		Soil data	✓	

Area		Initiative	MoA implementation	Strategic alignment
Enabling environment	Innov. & tech	Competitive incubation/product dev. environment	✓ (yellow)	
		Working space & training for ag techs	✓ (yellow)	
		Digital agriculture curriculum		✓
	Digital infra	Device access for extension workers	✓	
		Free access for DAs and farmers to key apps		
		Telco service targets and incentives for rural areas		
		Phone payment plan for farmers		
		Digital kiosks for farmers and DAs	✓	✓
	Ag markets	Incentivized aggregation & value addition	✓	
	Physical infra	Input warehouses and distribution hubs	✓	✓
		Solar panels for FTCs or OSSs	✓	✓
	Human capital and infra	Digital agriculture department in MoA	✓	✓
		Digital program in ATVETS		✓
		Digital training platform for MoA and RBoA	✓	✓
		Farmer digital & financial literacy campaign	✓ (yellow)	✓
		Improved DA management	✓	
	Gov & policy	Data governance and sharing policy, standards, assurances	✓	✓
		Support market entry of international products		
		Streamline content approval process	✓	

✓ Full MoA implementation   ✓ Stakeholder dependencies   ✓ Strategic alignment

For stakeholder input, an enabling initiative was categorized as either high or medium priority as shown in Table 54 and Table 55 below:

Table 54: Stakeholder Digital Stack Initiative Prioritization Results

Digital stack			
User facing layer	**Integration layer**	**Analytics layer**	**Data and content**
Software dev curriculum to build capability	Data stack with APIs	Input demand and supply analytics	Farmer profiles and unique ID
Digitized payments	Digital Agriculture Forum for interoperability	Dedicated analytics unit within MoA	Land &farmer-linked production data
Decision-making dashboard			Soil data
			Weather data
			Transaction and warehousing data
			Price data

Number of stakeholders prioritizing initiative:

☐ 0-4 times prioritized ☐ 5-9 times Prioritized ☐ 10+ times prioritized

Table 55: Stakeholder Enabling Environment Initiative Prioritization Results

Enabling environment					
Innovation & tech	**Digital infra**	**Ag markets**	**Physical infra**	**Human capital**	**Gov & policy**
Competitive incubation/ product dev. env.	DA device access	Incentivized aggregation & value addition	Input warehouses and distribution hubs	Farmer digital & financial literacy campaign	Data governance and sharing policy
Working space & training ag techs	Phone payment plan for farmers		Solar panels for FTCs and OSSs	Digital program in ATVETS	Support market entry of international products
Digital ag curriculum	Digital kiosks			Digital training platform for MoA and RBoA	Streamline content approach process
	Telco service targets and incentives for rural areas			Digital agriculture department in MoA	
	Free access for DAs and farmers to key apps			Improved DA management	

Number of stakeholders prioritizing initiative: ☐ 0-4 times prioritized ☐ 5-9 times Prioritized ☐ 10+ times prioritized

The results of this prioritization were then aggregated. Enabling initiatives that were categorized as medium priority in at least two of the three prioritization steps and as high priority in the third step were classified as Phase One priority enabling initiatives[76] and were; A Data stack with APIs, Farmer profiles & unique IDs, Digital kiosks for farmers and DAs, Digital agriculture department in MoA, Farmer digital & financial literacy campaign, Data governance and sharing policy, standards, assurances. All other enabling initiatives were categorized as Phase Two priority enabling initiatives.

Table 56: Overall Enabling Initiatives Prioritization Results

	Area	Initiative	MoA implementation	Strategic alignment	Stakeholder priority	Nera-team priority
Digital stack	User facing	Software dev curriculum to build capability		✓		
		Digitized payments		✓		
		Decision-making dashboard for MoA	✓			
	Integration	Digital Agriculture Forum for interoperability	✓			
		Data stack with APIs	✓	✓	✓	✓
	Analytics	Input demand and supply analytics	✓			
		Dedicated analytics unit within MoA	✓			
	Data & content	Farmer profiles and unique ID	✓	✓	✓	✓
		Land and farmer-linked production data	✓		✓	
		Transaction and warehousing data	✓			
		Weather data	✓			
		Price data	✓			
		Soil data	✓			
Enabling environment	Innov. & tech	Competitive incubation/ product dev. environment	✓			
		Working space & training for ag techs	✓			
		Digital agriculture curriculum		✓		

[76] An exception was made for the Digital Agriculture team, which was prioritized for Phase One of the roadmap due to the dependency on this initiative for successful use case implementation

Area	Initiative	MoA implementation	Strategic alignment	Stakeholder priority	Nera-team priority
Digital infra	Device access for extension workers	✅(H)		✅(H)	
	Free access for DAs and farmers to key apps			✅(H)	
	Telco service targets and incentives for rural areas			✅(M)	
	Phone payment plan for farmers			✅(H)	
	Digital kiosks for farmers and DAs	✅(H)	✅(H)	✅(H)	✅(O)
Ag markets	Incentivized aggregation & value addition	✅(H)			
Physical infra	Input warehouses and distribution hubs	✅(H)	✅(H)		
	Solar panels for FTCs or OSSs	✅(H)	✅(H)		Dept. prioritized due to dependencies
Human capital and infra	Digital agriculture department in MoA	✅(H)	✅(H)		✅(O)
	Digital program in ATVETS		✅(H)		
	Digital training platform for MoA and RBoA	✅(H)	✅(H)		
	Farmer digital & financial literacy campaign	✅(M)	✅(H)	✅(M)	✅(O)
	Improved DA management	✅(H)			
Gov & policy	Data governance and sharing policy, standards, assurances	✅(H)	✅(H)	✅(H)	✅(O)
	Support market entry of international products				
	Streamline content approval process	✅(H)			

✅ High priority ✅ Medium priority ✅ Overall height priority

8.6   DAR ECOSYSTEM ASSESSMENT – SUB-SECTION DESCRIPTIONS

	Solution / Initiative area	Description
Use Cases	Agricultural Intelligence	Creating high level data and decision support for businesses and governments
	Supply Chain	Creating safety and traceability while enabling transport and storage optimization through digital solutions
	Financial Services	Getting credit and financing to farmers, through e–vouchers, mobile payments and digital credit and risk solutions
	Smart Farming	Developing precision technology to better produce, including management, tracking and varietal development
	Pricing & Market services	Enabling live pricing linkages and information services, as well as digitally linking supply and demand
	Extension & Advisory	Leveraging technology to provide real-time information, best practices, and personalized guidance to farmers for improved agricultural outcomes
Digital Stack	User Facing Layer	Interface between the digital solution and its users
	Integration Layer	Middleware that facilitates the smooth flow and integration of data across different systems and services
	Analytics Layer	Core component that manages and processes data, ensures integrity and accessibility and develops insights
	Data and Content Layer	Information in many forms e.g., crop information, weather data, market trends, and educational resources
Enabling Environment	Government & Policy	Rules and guidelines set by authorities that enable the growth of digital innovations, shaping the ecosystem in which these solutions operate
	Digital Infrastructure	Infrastructure supporting connectivity and digital tool use, such as smartphones, tablets, and data packages
	Human Capital	Digital skills, knowledge, and expertise as well as human resources, and the digital literacy required for adoption of tools
	Physical Infrastructure	Refers to the essential physical assets and facilities needed to support agriculture, including cell towers, roads, warehousing, and farmer centers
	Agricultural Markets	Encompasses platforms and tools that connect farmers with markets, as well as the markets and economic structure themselves
	Innovation and Technologies	The development and adoption of cutting-edge technologies and innovative practices within the digital agriculture ecosystem

8.7 MAPPING OF ONGOING DIGITAL AGRICULTURE INITIATIVES

Table 57: Ongoing Initiatives by Development Partners

Type	Organization	Description
Development Partner	African Development Bank (AfDB)	The AfDB is a key development partner that supports various initiatives in Ethiopia, including those related to agriculture, technology, and economic development. The AfDB plays a crucial role in financing and promoting sustainable development projects across the continent.
Development Partner	Bill & Melinda Gates Foundation (BMGF)	BMGF supports health, nutrition, agriculture, and gender empowerment programs in Ethiopia. Their goal is to enable people to lift themselves out of poverty and live healthy, productive lives. Specifically, in the agricultural sector, they work with Ethiopia's Agricultural Transformation Institute (ATI) to scale up agricultural extension services, combat crop and livestock diseases, support the development of the horticulture sub-sector, improve breeding practices, boost agricultural product markets, support women in agriculture, enable small holder farmers gain access to financial services, improve income of pastoralists, modernize crop improvement practices with EIAR. They also focus on strengthening Ethiopia's primary health care system and strengthening HR systems at MoA.
Development Partner	Food and Agricultural Organization (FAO)	FAO aims to achieve universal food security by ensuring consistent access to sufficient, high-quality food. In Ethiopia, FAO advises and assists the Ethiopian government in three key areas: crop production and productivity, livestock and fisheries production, and sustainable natural resource management, by combining innovative international best practices and global standards with national and regional standards.
Development Partner	French Development Agency (AFD)	AFD, a French government agency, fights poverty and promotes sustainable development in developing countries. In Ethiopia, AFD operates in fields such as energy, water, urban planning, agriculture, and private sector development.
Development Partner	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)	GIZ partners with the MoA in more than 15 projects on agriculture, conservation and sustainable use of natural resources, and rural economic development as well as e- learning initiatives. Many of these projects are active in developing digital solutions, from surveying and data capture through data management to farmer-facing solutions in extension and agricultural services. GIZ also offers a 'Learning Experience Design Academy" for young professionals

Type	Organization	Description
Development Partner	European Cooperative for Rural Development (EUCORD)	EUCORD is a Brussles-based non-profit organization that is working to increase farmers' capacity to sustainably grow quality crops matched to the commercial needs of the agribusiness sector. EUCORD, with its partners, is currently implementing a project that aims to enhance malt barley supply of farmer organizations to malters through capacity building, access to finance, enterprise, and value chain development. It is also implementing a project related to PULSE crops to complement the Malt Barley project with crop rotation practices and promotion of climate smart agriculture.
Development Financier	International Finance Corporation (IFC)	IFC, a member of the World Bank Group, is the largest global development institution focused on the private sector in emerging markets and developing economies. IFC works in more than 100 countries, using its capital, expertise, and influence to create markets and opportunities for better lives. IFC contributes to Ethiopia by supporting the private sector to create markets and open opportunities for all through investing, providing advice, and mobilizing finance for private financial institutions and companies. IFC products and services are tailored to meet specific needs of clients by introducing them to better ways of doing business and new sources of capital.
Development Partner	International Fund for Agricultural Development (IFAD)	IFAD is an international financial institution with a focus on the rural poor people to enhance their productive capacity, benefits from market participation and strengthening the climate resilience of their economic activities. In Ethiopia, IFAD's key areas of investment include: (i) small-scale irrigation development; (ii) sustainable natural resource management; (iii) rural financial inclusion; (iv) community-driven development among pastoral groups; and (iv) knowledge exchange through partnerships with the private sector, research institutions and other stakeholders.
Development Partner	Japan International Cooperation Agency (JICA)	JICA is the government of Japan agency that assists economic and social growth in developing countries. It operates in more than 100 countries on six continents. In Ethiopia, JICA has focused on (i) agriculture and rural development, (ii) industrial promotion, (iii) infrastructure development, and (iv) education. Some of the key initiatives of JICA include index-based crop insurance promotion, nutrition-oriented community-based fish farming, issues-based trainings for commercialization, for productivity and stability improvement, etc. The initiatives are under three programs (i) agricultural commercialization, (ii) agricultural productivity and stability improvement, and (iii) natural resource management.

Type	Organization	Description
Development Partner	Mastercard Foundation	Mastercard Foundation is an international charity established by Mastercard in 2006 to advance education and financial inclusion to enable young people in Africa and in Indigenous communities in Canada to access dignified and fulfilling work. The foundation is active in Africa with its flagship initiative called Young Africa Works and the Mastercard Foundation Scholars Program. Young Africa Works has been implemented in Ethiopia since 2019 in the agriculture, manufacturing, tourism, and digital technology sectors with a goal of enabling 10 million young people to access dignified and fulfilling work by 2030.
Development Partner	Mercy Corps AgriFin	Mercy Corps AgriFin, a program within Mercy Corps Humanitarian NGO, works with a network of more than 180 partners across Africa to support the development of digitally enabled products and services for smallholder farmers (SHFs) to increase their productivity, incomes, and resilience by 50% while reaching at least 40% women. AgriFin helps its partners to design, test, and scale digitally enabled services, de-risking innovation and supporting inclusive service delivery. Since 2015, AgriFin has completed more than 200 engagements with partners, now reaching more than 16 million smallholders.
Development Partner	United States Agency for International Development (USAID)	The USAID is Ethiopia's largest development partner, working to enhance health, food security, and nutrition. Feed the Future Strategy, one of its flagship programs in Ethiopia, USAID has assisted the GoE's Agriculture Growth initiatives. The program has three components: (i) agriculture-led economic growth that is inclusive and sustainable, (ii) building people's and institutions' resilience, improving nutrition, and (iii) fostering a regulatory environment and private sector conducive to economic growth.
Development Partner	World Bank	The World Bank is one of the biggest development partners in Ethiopia. With respect to DAEAS, the bank has been funding projects including video mediate extension services of DG, under its Second Agricultural Growth Project (AGP2) that promotes digital agriculture extension to deliver agronomic advice to farmers.
Development Partner	European Association for International Education (EAIE)	EAIE is a non-profit member-led organization that serves as a center of expertise, networking and resources in the internationalization of higher education. It is also invoved in Agriculture content translation from other languages, development of data driven early warning systems, deployment of high-quality data capturing devices, data infrastructure for big data systems as well as implementing biotechnologies
Development Partner	REDFS	The Rural Economic Development and Food Security (RED&FS) Sector Working Group was established in 2008 in Ethiopia. It serves as a platform that brings together the Government of Ethiopia and its Development Partners who are active in the Agriculture Sector. . The group aims to address issues related to rural economic development and food security in Ethiopia.

Type	Organization	Description
Development Partner	CABI	CABI is an international, intergovernmental, not-for-profit organization that improves people's lives worldwide by providing information and applying scientific expertise to solve problems in agriculture and the environment. As a member, Ethiopia benefits from input into CABI's global development agenda, links to its international network of partners, and regular consultations to address members' needs.
Development Partner	AFD	The Agence Française de Développement (AFD) Group funds, supports and accelerates the transition to a fairer and more sustainable world. AFD is supporting Ethiopia in the fields of energy, water, urban planning and also supports the private sector.
Development Partner	United Nations Capital Development Fund (UNCDF)	The UN Capital Development Fund supplements capital assistance to developing countries, primarily the least developed, through grants, loans, and guarantees to support their economic development. UNCDF is engaged in Ethiopia in financial inclusion activities.

Table 58: Ongoing Initiatives by the Government of Ethiopia

Type	Organization	Description
Government	Ministry of Agriculture (MoA)	MoA oversees and leads agricultural and rural development in Ethiopia and is responsible for driving the digitilization of agriculture. It will collaborate with ATI and others on DAR initiatives. MoA is the primary owner and implementer of this roadmap.
Government	Ministry of Innovation and Technology (MinT)	MinT is mandated to lead Ethiopia's digital economy through policy formulation and implementation. MinT also manages projects related to digital infrastructure, digital skills, AgriTech startups, agriculture market information, national data center, and more.
Government	Ministry of Trade and Regional Integration (MoTRI)	MoTRI is responsible for formulating and implementing trade, investment, and industrial policies. MoTRI also developed digital platforms that link agricultural producers with customers.
Government	Ministry of Water and Energy (MoWE)	MoWE manages water resources, water supply and sanitation, large and medium-scale irrigation, electricity, and natural and man-made energy resources. MoWE implements projects related to rural electrification.
Government	National Bank of Ethiopia (NBE)	NBE is the central bank of Ethiopia. It is responsible in ensuring price stability and soundness of financial institutions. NBE prepared the national digital payments strategy (NDPMS) which includes building a digital agricultural platform that integrates new and advanced technologies to enhance food and livestock production

Type	Organization	Description
Government	Information Network Security Agency (INSA)	INSA safeguards the country's information and communication network technologies. It supports public and private institutions in crafting and implementing information security policies, standards, and procedures. Regarding DAR, INSA plays a crucial role in ensuring data sharing governance and policies that prioritize data security.
Government	Agricultural Transformation Institute (ATI)	ATI is a strategy and delivery-oriented institute created to accelerate the growth and transformation of Ethiopia's agriculture sector and impact the livelihoods of smallholder farmers across the country. ATI has four key Digital Agriculture initiatives: (i) 8028 farmer Hotline, an IVR and SMS based platform that provides advisory services to farmers;(ii) National Market Information System (6077 hotline) provides price and volume information of major crops in selected markets via IVR, SMS, web and email; (iii) Ethiopian Soil Information System (EthioSIS), a digital soil property map with fertilizer recommendations and (iv), Electronic voucher system, which is introduced to ensure that smallholders have access to credit and financial tools to obtain the agricultural inputs electronically. ATI is also implementing key initiatives from the DAEAS roadmap such as Ethiopian Digital Inputs tracking system (EDITS), development of farmer ID, deployment of digital kiosks providing device and internet access.
Government	Ethiopia Institute of Agricultural Research (EIAR)	EIAR is a federal agricultural research institute accountable to the Ministry of Agriculture (MoA). Its primary responsibility is to generate, develop, and adapt agricultural technologies that cater to the needs of agricultural development and its beneficiaries. Currently, EIAR is actively involved in various digital agriculture practices, including wheat rust early warning and advisory systems, Agro-climate advisory platforms, and the establishment of an agricultural data hub.
Government	Ethiopian Statistical Service (ESS)	ESS collects, compiles, analyzes, and disseminates sectoral data from sample surveys, censuses, and administrative records. As the official data source for the Ethiopian government, ESS provides critical data related to crops, livestock, horticulture, agricultural markets, extension services, and advisory services. Their reports are available in both hard and soft copies, and raw data can be obtained upon request.
Government	Artificial Intelligence Center (AIC)	AIC is responsible for formulating and implementing national AI policies, strategies, and regulatory frameworks. Its focus areas include AI robotics, big data, machine learning (ML), natural language processing, and computer vision. The center is actively working on enhancing crop productivity through AI applications that target disease management and crop data labeling.

Type	Organization	Description
Government	Ethiopian Electric Power	It is a state-owned electric producer engaged in development, investment, construction, operation, and management of power plants, power generation and power transmission in Ethiopia. As per the National Electrification Program of the Country, universal electrification is targeted by 2025 (65% from grid and 35% off-grid) and to increase the grid coverage to 96% by 2030.
Government	Ethiopian Space Science and Geospatial Institute	The institute coordinates research and development activities in the field of geospatial science and technology with the socio-economic needs of the focus areas of the country. the goal is to ensure access to geospatial information at the national level, including rural and urban land registration, land use planning, environmental conservation, agriculture, urban development, water resources conservation, natural resource conservation, biodiversity conservation and conservation, climate change, supports for mapping,etc.
Government	Ethiopian Electric Utility	Public interprise responsible for the distribution of electricity across the country. It provides various online services related to electricity supply, billing, meter reading, and customer care through their web portal3.
Government	Ethiopian Communications Authority	The Ethiopian Communications Authority (ECA) is an independent regulatory authority established with a mandate, to regulate the communications sector which includes telecommunications, postal and courier services, with the objective to promote the development of high quality, efficient, reliable and affordable communications service in the Federal Democratic Republic of Ethiopia.
Government	Ethiopia Commodity Exchange	The Ethiopia Commodity Exchange (ECX) is a commodities exchange established April 2008 in Ethiopia with the objective of to ensuring the development of an efficient modern trading system that would protect the rights and benefits of sellers, buyers, intermediaries, and the general public.
Regional Government	Oromia Trade Bureau	Oromia Trade Bureau is a regional trade bureau responsible for promoting and regulating trade activities within the Oromia National Regional State of Ethiopia. It has developed a digital platform to access agricultural market information.

Table 59: Ongoing Initiatives by Learning and Research Institutions

Type	Organization	Description
Higher Learning Institute	Addis Ababa University (AAU)	AAU, the oldest public higher education and research institution in Ethiopia, serves as a premier center for teaching, learning, research, and community service. Within AAU, several colleges, departments, and study centers conduct research in areas such as GIS, geospatial analysis, big data, remote sensing, and artificial intelligence (AI) at both graduate and postgraduate levels.

Type	Organization	Description
International Research Institute	International Center for Tropical Agriculture (CIAT)	CIAT is a CGIAR research centre and supports smallholders to be more competitive, inclusive, and market oriented through research-based solutions. CIAT is working on bundled digital tools and the agricultural data hub. Digital agricultural advisory tools have four components: (i) fertilizer advisory, (ii) climate advisory, (iii) pest and disease advisory, and (iv) market intelligence. CIAT is active in setting up an agricultural data hub and data sharing among stakeholders and plans to start insurance related advisory.
International Research Institute	ILRI	The International Livestock Research Institute (ILRI) is a non-profit institution with projects that have delivered positive R&D outcomes in the livestock and agriculture sector. ILRI's research in Ethiopia is focused on poultry, dairy genomic evaluation, animal and human health, and sheep and goats. One of the digital solutions they have developed is the ClimMob platform for on-farm comparisons of technologies, part of an Africa RISING-funded research project to digitally improve crop production.
Research Institute	One CGIAR (Consultative Group on International Agricultural Research) - ILRI	One CGIAR is a global partnership that brings together international organizations engaged in food security research. In Ethiopia, One CGIAR collaborates with its member entities under ILRI's Accelerating the Impact of CGIAR Climate Research for Africa (AICCRA) program. Their focus is on promoting climate information services and climate-smart agriculture for both crop and livestock systems, to build resilience and adaptive capacity in Ethiopia's agri-food systems. To date, AICCRA Ethiopia has benefited 420k smallholder farmers and extension agents by accessing climate information services and validated climate-smart innovations and technologies. AICCRA Ethiopia collaborates with the Ministry of Agriculture (MoA), ATI, the Ethiopian Institute of Agricultural Research (EIAR), national universities, private sector partners, and NGOs.
Research Institute	International Maize and Wheat Improvement Center (CIMMYT)	CIMMYT is one of the CGIAR research for development centers working on helping farmers to achieve higher yields and incomes through agricultural research. One of the key initiatives of CIMMYT in Ethiopia is its contribution to development and operation of the Ethiopian Digital for Agricultural Climate Advisory Platform (EDACAP). The platform provides seasonal (3-6 months) and operational (1 to 15 days) climate agro-advisories to users using SMS, IVR, DAs, mobile application, website, and mass media. In collaboration with its partners, CIMMYT is also contributing to the development of the National Agriculture Data Hub.

Type	Organization	Description
Research Institute	International Crops Research Institute for the Semi-Arid Tropics (ICRiSAT)	The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a global organization that conducts research for development in Asia and sub-Saharan Africa, including Ethiopia. They focus on improving farming systems and agri-food value chains, addressing challenges of hunger, malnutrition, and environmental degradation. ICRISAT's work in Ethiopia involves collaborating with local institutions to enhance agricultural productivity and resilience to climate change, particularly for key crops like chickpea, pigeonpea, and sorghum.

Table 60: Ongoing Initiatives by MNOs and Private Companies

Type	Organization	Description
Mobile Network Operator	Ethio Telecom	Ethio-Telecom offers telecom and mobile banking services, including mobile, mobile payment, and internet services. They have a vast subscriber base, covering 98% of the population. Their payment solution, Tele birr, serves over 34 million customers. The 5G capacity can now accommodate 440 thousand customers.
Mobile Network Operator	Safaricom	Safaricom joined the Ethiopian Telco Industry in 2021 and expected to enhance the quality, affordability and coverage of mobile services, digital payment system, and internet access over time. The company has received approvals for tower development and Safaricom's most renowned SMS-based mobile payment and micro-credit service M-PESA, has been made operational.
Private Company	Debo Engineering	Debo Engineering is a startup private company that leverages AI, ML, IoT, image processing, and big data analysis in the agriculture sector. They have developed an application capable of detecting and classifying plant diseases through image detection. Additionally, the application provides recommendations for addressing these diseases. Their digital solution aims to enhance agricultural productivity and sustainability[4].
Private Company	EthioChicken	Ethio Chicken produces and sells day-old chicks and chicken feed. Their goal is to improve nutrition, rural farmer livelihoods, and create income opportunities. They provide poultry management and business skill training to farmers engaged in poultry farming, along with advisory services through their agents.
Private Company	Hello Erf	Hello Erf links farmers with mechanization service providers and all types of farm machinery by combining IoT technology, call center, and mobile apps. Their goal is to increase productivity, reduce post-harvest loss, and create more rural jobs by making mechanization services easily accessible for smallholder farmers and profitable for service providers.
Private Company	Hello Tractor	Hello Tractor provides a digital platform that connects farmers in need of tractors with tractor owners who offer their tractors for rental. The platform also monitors tractor usage for farmers.

Type	Organization	Description
Private Company	Armada	Armada is an agritech startup that provides agricultural mechanization services, offering machinery rental, mechanization personnel training, and spare parts. Farmers can access these services by registering through a mobile application, call center, or through agents.
Private Company	Lersha-Green Agro Solution PLC	Lersha is a local private company that provides three intertwined services to small holder farmers using a mobile application, call center, and agents. Its services are (i) farm inputs sale, (ii) access to mechanization service, and (iii) agro-climate advisory and crop extension. The farm inputs sale is bundled with advisory services on how, where, and when to use the inputs. Lersha currently reached more than 100 thousand farmers with 1000+ Lersha agents and 172 mechanization providers.
Private Company	Viamo	Viamo is a private company specializing in digital training, digital campaigns, digital surveys, and digital marketing via mobile devices. The company works with NGOs, government agencies, donors and businesses and operates in more than 90 countries including in Ethiopia.
Private Company	WeFarm	Wefarm is a company that uses a digital platform to connect smallholder farmers in developing countries. The platform enables farmers to (i) share advice, ask questions and learn about agricultural topics; (ii) see product information and buy inputs or products online; and (iii) understand price information and sell their products online. The platform can be accessed via SMS for free, or online.
Private Company	iCog Labs	iCog Labs is a research and development company based in Addis Ababa, Ethiopia, collaborating with international AI research groups and serving customers around the world. They specialize in artificial intelligence, including machine learning based data analysis, computational linguistics, computer vision, mobile robots and cognitive robotics, cognitive architectures and artificial general intelligence. They contribute to international AI development teams, as well as software and hardware development projects on Ethiopian government and industry projects.
Private Company	Ethio Red Fox	Ethio Red Fox Agricultural Spraying Drone Company is a start-up company based in Ethiopia. It aims to provide fast and efficient Agricultural Technology solutions mainly using high-level drone technology for millions of smallholder farmers, cluster-based farms, commercial farms, and Governmental & nongovernmental Organizations. Once operationa the business aims to start providing its drone services on wheat rust monitoring, spraying, and advisory services.
Private Company	COOP	Cooperative Bank of Oromia (Coopbank) in Ethiopia is a unique institution owned by farmers' cooperatives. It offers a range of services including retail, cooperative, institutional, and diaspora banking. Coopbank also has a digital lending platform, Michu, for Micro, Small, and Medium Enterprises (MSMEs), and provides Sharia-compliant banking services.

Type	Organization	Description
Private Company	ebirr	E-Birr is a telecom value-added and Mobile Financial Service provider established in 2016 in Ethiopia by Safaricom. It offers a range of mobile financial services including utility payments, bank transfers, remittances, merchant payments, and airtime recharges1. E-Birr uses the Safarifone Mobile Financial Services technology, customized to fit the Ethiopian market. It also collaborates with the Cooperative Bank of Oromia under the brand COOPay-E-Birr.
Private Company	Kacha	Kacha is a digital financial platform in Ethiopia, offering services like mobile money, bill payments, remittances, and merchant payments. It's the first private payment instrument issuer licensed by the National Bank of Ethiopia. Kacha is committed to promoting financial inclusion and digital transformation in Ethiopia, with features like an agent portal for cash transactions, business and merchant portals for financial transactions, and a crowdfunding service.
Private Company	Pula	PULA is a Kenyan-based insuretech provider that offers agricultural insurance and technology services. PULA works to help farmers better prepare, plan, and respond to extreme weather events, pests, and other risks. Their goal is to transfer the climate risks affecting food production away from the smallholder farmer and place it with professional risk-takers, i.e., the insurance sector. This is part of their broader mission to create value for all stakeholders and promote financial inclusion
Private Company	Kifiya	Kifiya Financial Technology PLC is a technology and services company that develops scalable and secure technology platforms and has a distribution network that covers the whole of Ethiopia through 16 regional offices. In 2019, Kifiya transitioned into a technology ventures holding company focused on launching an ecosystem of vertically integrated digital businesses across various sectors. One of the digital solutions they have developed is Michu, Ethiopia's first uncollateralized digital lending product developed in partnership with the Cooperative Bank of Oromia and powered by Kifiya's Qena, an AI-driven digital lending platform. The company is dedicated to improving people's lives by leveraging innovative digital solutions, with a particular focus on improving the lives of farmers, women, youth, and MSMEs.
Private Company	Apollo	Apollo is a digital banking platform in Ethiopia powered by the bank of Abyssinia
Private Company	Chapa	Chapa is an Ethiopian Financial Service and Data Engineering Company.
Private Company	Ethswitch	EthSwitch is Ethiopia's National Switch owned by all banks (Private and Public) the National Bank of Ethiopia, MFIs, PIIs and PSOs. They provide interoperable, affordable, secured, and efficient e-Payment Infrastructure, clearing, dispute resolution and risk management services, to payment service providers in Ethiopia. They have also enabled interoperability of Digital Wallet, Mobile & Internet Banking systems run by banks, Microfinance Institutions (MFIs) and E-money issuers.

Table 61: Ongoing Initiatives by NGOs

Type	Organization	Description
NGO	Alliance for a Green Revolution in Africa (AGRA)	AGRA works to uplift Africa's smallholder farmers by transforming their struggles into thriving enterprises. It promotes digital solutions to connect agricultural ecosystems, integrating governments, markets, and villages. AGRA's services include digital finance, digital extension, e-commerce, and e-vouchers for seeds, fertilizer, and insurance.
NGO	Digital Green (DG)	Digital Green is a global development organization that aims to empower farmers through technology and data. They work on initiatives such as FarmStack, which enables secure data sharing across the agricultural ecosystem, Video Enabled Extension Services, where farmers watch pre-recorded community videos on best agricultural practices, and Farmers' Registry, an application used by DAs to register farmers' profiles and input demands. They are also developing AI enabled extension chatbots.
NGO	Precision Development (PxD)	PxD is a global development non-profit providing evidence-based, and life-improving services to people living in poverty by delivering personalized information to households (small holder farmers) via mobile phones and applications there by enable them to make informed decisions. As one of its key initiatives, PxD is collaborating with ATI to evaluate the impact and effectiveness of 8028 farmer Hotline and suggest improvements.
NGO	Sasakwa Africa Association (SAA)	SAA is an international NGO that provides agricultural extension services to help smallholder farmers increase productivity, income, and food security. SAA's activities are centered on promoting regenerative, sustainable, and resilient agriculture that is also nutritionally sensitive and market-oriented. It provides digital extension and capacity building to farmers, extension agents, youth, women, the disadvantaged, and other actors along the value chain.
NGO	SNV	SNV's work extends to more than 600 woredas implementing projects that build and sustain the agri-food system. They contribute to improving affordable access to basic services by ensuring safe and sustainable access to clean energy and water, thus enabling equitable lives for all. They facilitate job opportunities with a special focus on women and young people and work on food and nutrition security challenges, supporting sustainable markets, and building climate change resilience for smallholder farmers.
NGO	Farm Radio International (FRI)	FRI is an international non-profit organization that uses ICT enabled/ interactive radio to help farmers by sharing information, amplifying their voices, and supporting positive changes. The organization collaborates with local radio stations, develops content, provides training to broadcasters, and broadcasts farming related programs to farming.

Type	Organization	Description
NGO	ICCO Terrafina Microfinance	ICCO Terrafina Microfinance is a Dutch NGO that specializes in agricultural microfinance. In Ethiopia, they work with local Microfinance Institutions (MFIs) and Savings and Credit Unions (SACCOs) to boost agriculture and improve the livelihoods of smallholder farmers. They facilitate a guarantee fund for MFIs, link producers with MFIs, and projects aimed at increasing food security. They also provide capacity building for MFIs and SACCOs and develop tools to facilitate value chain financing.