

DIGITAL AGRICULTURE ECOSYSTEM ASSESSMENT: TANZANIA

A REPORT FOR USAID/TANZANIA

September 2023



ACKNOWLEDGEMENTS

DISCLAIMER

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The authors of this report extend their appreciation to staff of USAID and DAI for their direction, guidance and support throughout the elaboration of this assessment. In particular, we extend our thanks to the following for their detailed review and feedback: Josh Woodart (USAID), C. Omar Kebbeh (USAID/Tanzania), Boniphace Marwa (USAID/Tanzania), Tor Edwards (USAID/Tanzania), Andrea Falso (DAI), and Julietn Terri (DAI).

This Digital Agriculture Ecosystem Assessment for Tanzania was authored by Amol Jadhav and Collins Kimaro with support and edits by Natalia Pshenichnaya.

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ACRONYMS USED

ACRONYM	DEFINITION
2G, 3G, 4G, 5G	second generation, third generation, fourth generation, fifth generation mobile networks
AAGF	Agriculture Africa Guarantee Fund
ADSI	African Digital School Initiative
AGRA	Alliance for a Green Revolution
AI	artificial intelligence
AMCOS	Agriculture Marketing Cooperative Societies
ASDP	Agriculture Sector Development Programme
ASTGS	Agricultural Sector Transformation and Growth Strategy
ATMIS	Agricultural Trade Management Information Systems
BBT-YIA	Building a Better Tomorrow-Youth Initiative for Agribusiness
CCARDESA	Centre for Coordination of Agricultural Research and Development for Southern Africa
CGAP	Consultative Group to Assist the Poor
CGIAR	Consortium of International Agricultural Research Centers
CO2	carbon dioxide
CTA	Technical Centre for Agricultural and Rural Cooperation
DAI	DAI Global, LLC
DECA	Digital Ecosystem Country Assessment
DFS	digital financial services
DMA	Digital Mobile Africa
EPA LAB	Electronics and Precision Agriculture Lab
FAO	Food and Agriculture Organization of the United Nations
FCDO	United Kingdom Foreign, Commonwealth & Development Office
FTF	Feed the Future
FTMA	Farm to Market Alliance
GCF	Green Climate Fund
GDP	gross domestic product
GNI	gross national income
GSMA	Global System for Mobile Communications Association
HDI	Human Development Index

ICT	information and communications technology
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IOT	Internet of Things
IRRI	International Rice Research Institute
IRP	Investment Readiness Programme
IVR	interactive voice response
KALRO	Kenya Agricultural Livestock Research Organization
KAOP	Kenya Agricultural Observatory Platform
KG	kilograms
KM	kilometers
KMD	Kenya Meteorological Department
KPI	key performance indicator
MNO	mobile network operator
MSMES	micro, small, and medium enterprises
NGO	non-governmental organization
NIDA	National Identification Authority
OBD	outbound dialer [an automated outbound phone call that delivers a pre-recorded voice message to the customer]
OEC	Observatory of Economic Complexity
OECD	Organization for Economic Cooperation and Development
PIATA	Partnership for Inclusive Agricultural Transformation in Africa
R&D	research and development
RFS	Bureau for Resilience and Food Security
SAIS	Scaling Digital Agriculture Innovations through Start-ups
SMS	short message service
SUA	Sokoine University of Agriculture
TACATDP	Tanzania Agriculture Climate Adaptation Technology Deployment Programme
TADB	Tanzania Agriculture Development Bank
TAHA	Tanzania Horticulture Association
TARI	Tanzania Agriculture Research Institutes
TARIC	TAHA Research and Information Resource Centre
TCRA	Tanzania Communications Regulatory Authority

TMA	Tanzania Meteorological Authority
TMX	Tanzania Mercantile Exchange
UNCDF	United Nations Capital Development Fund
UNDP	United Nations Development Programme
UNMA	Uganda National Meteorological Authority
USAID	United States Agency for International Development
US\$	United States dollar
USSD	Unstructured Supplementary Service Data
VBA	Village Based Advisor
VIDA	Village Digital Agent
WFP	World Food Program
WSHA	Westerwelle Startup Haus Arusha
YEESI LAB	Youth Empowerment through Establishment of Social Innovation Lab

EXECUTIVE SUMMARY

Tanzania's agricultural sector spans diverse agro-ecological zones, covering an extensive land area of approximately 885,800 sq. km.¹ It holds significant importance in the country's economic growth, contributing 26.1% to the GDP and providing employment to over 65.6% of the workforce.² Despite its prominence, the sector faces challenges, as evident in its cereal yield of 1,678 kg per hectare, which is only 43% of the global average (3,907 kg per hectare).³ These challenges are attributed to factors like limited input usage, inadequate adoption of modern agricultural practices, insufficient access to technology, and climate change, all of which contribute to low productivity in the sector.

Digital agriculture solutions have the potential to address these challenges, enhance agricultural outcomes, and uplift rural communities by providing access to critical information (e.g., crop advisories, weather forecasts and market prices), credit (e.g., short-term credit for inputs and long-term asset financing for farm equipment), and markets (e.g., for inputs and offtake) to further enable farming as a business. Through digital channels, farmers can access formal financial services to invest in their farms, while digital marketplace platforms connect farmers more efficiently with offtake markets. These services can enhance smallholder farmer livelihoods, increase profitability, and promote sustainable broad-based economic development in rural areas.

Digital agriculture services also present an opportunity to enhance the inclusion of vulnerable groups, such as women farmers and youth, in agricultural systems. These groups often face significant barriers to accessing credit, information, and markets. When digital innovations recognize and address their unique needs and challenges, they can bridge the information gap, improve market access, and empower marginalized farmers.

This report presents the findings of the Digital Agriculture Ecosystem Assessment in Tanzania commissioned by the United States Agency for International Development (USAID) through DAI. The assessment's key objectives include mapping relevant actors within the digital agriculture ecosystem in Tanzania, identifying challenges and opportunities for effective digital technology adoption in the agriculture sector, particularly aligned with USAID/Tanzania's priorities, and assessing the specific challenges and opportunities for Tanzanian women and youth in digital agriculture.

The assessment revealed that Tanzania's digital infrastructure and digital inclusion play foundational roles in the inception, scale-up, and sustainability of digital agriculture services. While there is a promising landscape for digital technologies, certain challenges need to be addressed to fully leverage their potential. These challenges include limited access to reliable digital infrastructure, affordable devices, and mobile services, as well as low digital literacy rates, especially in rural areas.

Furthermore, the report identifies key barriers facing each of the five farmer-facing use cases and proposes several sector-wide recommendations to promote the growth and scale of digital agriculture services in Tanzania.

1 CCARDESA (2022), [Digital Agriculture Country Study Annex: Tanzania](#).

2 World Bank national accounts data; OECD National Accounts data files; CCARDESA (2022), [Digital Agriculture Country Study Annex: Tanzania](#).

3 [World Bank Open Data](#).



01.

INTRODUCTION





INTRODUCTION

This Digital Agriculture Ecosystem Assessment for Tanzania was undertaken as part of an ongoing effort by USAID's Bureau for Resilience and Food Security (RFS) to conduct digital agriculture assessments in various countries.⁴ The primary objective of this assessment is to gain a comprehensive understanding of the digital agriculture landscape in Tanzania and identify opportunities for meaningful interventions for USAID and its programs.

While this report was prepared to support USAID and its partners in Tanzania, it is intended to provide valuable insights and analysis to the wider digital agriculture ecosystem to promote the adoption of digital solutions for enhancing the livelihoods and resilience of smallholder farmers in the country. This includes supply-side actors such as agtech companies, fintech firms, mobile network operators (MNOs), and technology companies, who can gain insights into the diverse range of solutions being implemented in Tanzania and the strategies employed to scale them. Investors, NGOs, and international development agencies can also benefit from the lessons learned to mitigate investment risks in the future.

1. **DEVELOP A CENTRALIZED AND OPEN FARMER DATABASE** under a government institution, along with guidelines for standardized data collection and management. This initiative aims to provide reliable and accessible farmer data for value chain stakeholders, enabling effective use by different actors.
2. **SUPPORT DIGITAL FINANCIAL SERVICES FOR SMALLHOLDER FARMERS**, including credit and leasing, through guarantees and blended finance mechanisms. This support will empower farmers to enhance productivity by investing in their farming activities.
3. **IMPROVE BUSINESS SUSTAINABILITY OF DIGITAL AGRICULTURE SERVICES** by fostering networking, knowledge sharing, and partnerships between agtechs and other stakeholders.
4. **SUPPORT THE STARTUP ECOSYSTEM IN THE DIGITAL AGRICULTURE VERTICAL BY BUILDING TECHNICAL CAPACITY** in collaboration with innovation hubs and accelerators, and by advocating for the establishment of a Startup Act in Tanzania.
5. **FACILITATE ESSENTIAL SKILLS TRAINING, INCLUDING DIGITAL AND FINANCIAL LITERACY**, for rural communities to reduce barriers to adoption.
6. **SUPPORT INNOVATION BY MAKING CATALYTIC AND GROWTH-STAGE FINANCING AVAILABLE** to scale agtech startups.
7. Continue to **INCLUDE GENDER AND YOUTH TARGETS IN INTERVENTIONS** to ensure their participation and empowerment.
8. **SUPPORT THE DEVELOPMENT OF DIGITAL RURAL INFRASTRUCTURE AND INCLUSION** through advocacy and targeted investments.
9. Include digital elements to **SUPPORT THE TRANSITION TO CLIMATE-SMART AGRICULTURE**.
10. **ACCELERATE SMALLHOLDERS ALONG THE PATHWAY TO INCREASED FINANCIAL INCLUSION** starting with the digitization of agriculture value chain payments and advancing to more advanced agri DFS use cases like credit, savings, and insurance.

⁴ DAI, "Digital Agriculture Ecosystem Assessments."



OVERVIEW

Sections 2 and 3 lay the foundation for our analysis of the digital agriculture landscape in Tanzania. **Section 2** examines the agricultural context, evaluating the sector's overall contribution to the Tanzanian economy and employment. **Section 3** focuses on the digital context, assessing the state of underlying infrastructure, digital literacy, and digital financial services, which are crucial for the successful adoption of digital agriculture services.

In **Section 4**, we explore the roles played by different stakeholders in the development of digital agriculture solutions. These include initiatives led by various actors from the public and private sectors, such as government agencies, academic and research organizations, donors and development agencies, incubators, accelerators, innovation hubs, and investors.

Section 5 provides an in-depth analysis of the current digital agriculture landscape in Tanzania, examining the diverse range of solutions available. We categorize these solutions by use case and highlight notable barriers, trends, and innovations within each category. We also explore how digital agriculture solutions can enhance farmers' resilience to climate change and reach underserved groups.

Section 6 presents key findings from our research, while **Section 7** outlines recommendations tailored to different stakeholders within the ecosystem, aiming to maximize their impact and drive positive change in the digital agriculture sector.

METHODOLOGY

The AgTech Network relied on a combination of desk research and primary research interviews with key stakeholders in the industry. The desk research phase took place from January to March 2023, during which an extensive range of secondary sources were consulted. These sources included academic journals, reports, news articles, press releases, social media, annual reports, websites, databases, and dashboards.

Based on the thorough review of secondary materials, The AgTech Network developed a comprehensive database of digital agriculture solutions implemented in Tanzania, along with the corresponding stakeholders involved. This database, consisting of more than 50 solutions, served as a foundation for identifying targets for primary research interviews.

To ensure a diverse range of experiences and perspectives, The AgTech Network sought interviews with various types of organizations, including government agencies, research institutions, NGOs, investors, farmer associations, agribusinesses, technology companies, agtechs, and fintechs. From March to June 2023, The AgTech Network conducted 33 interviews via video, and in-person meetings where possible. The interview guide was tailored to each stakeholder type. The complete list of interview participants can be found in the appendix.

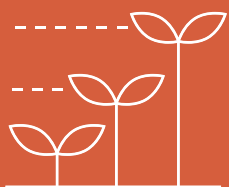
While The AgTech Network aimed to create one of the most comprehensive databases of digital agriculture solutions targeting smallholder farmers in Tanzania, it acknowledges that many solutions, particularly those developed in-house by smaller farmer groups and associations, may not be included due to limitations in reaching every stakeholder and limited coverage in local media.

It is important to note that much of the information provided on specific solutions, including active user numbers, distribution, farmer outcomes, pricing, and costs, is self-reported. The AgTech Network sought to validate this information through key informant interviews, publicly available sources, and insights obtained from implementation partners or investors. Efforts were made to standardize definitions across organizations, although this was not always feasible. In cases where contradictory information was encountered, further clarification was sought by revisiting interview targets.



02.

**TANZANIA'S
AGRICULTURE
SECTOR**





2. TANZANIA'S AGRICULTURE SECTOR

Tanzania, known for its rich natural resources, including minerals, agriculture, and tourism, and with a significant population of over 60 million, stands as one of the key markets in the East African region. Agriculture plays a crucial role in Tanzania's economy, employing over 65.6% of the workforce⁵ and contributing approximately 26.1% of the country's overall GDP.⁶

2.1. TANZANIA'S KEY SOCIOECONOMIC INDICATORS AND COUNTRY POSITION IN EAST AFRICA

In recent years, Tanzania has managed to successfully navigate the food insecurity challenges exacerbated by the triple impact of COVID-19, climate change, and the war in Ukraine, which attributed to the price surge of fertilizer, wheat, and edible oil (imports from Russia and Ukraine), inflation, currency pressure, and a debt crisis. The World Bank estimates that Tanzania's GDP growth in 2022 was 4.6%, only slightly higher than the 4.3% growth recorded in 2021. While most sectors have recovered to pre-pandemic activity levels, inflation has increased due to rising international commodity prices and severe drought, reaching 4.2% in the first nine months of 2022.⁷ This is a concern, as food prices constitute a significant portion of the country's consumer price basket.

Tanzania's socioeconomic indicators show both progress and challenges. While the economy has shown overall resilience, levels of poverty and income inequality remain persistent issues.



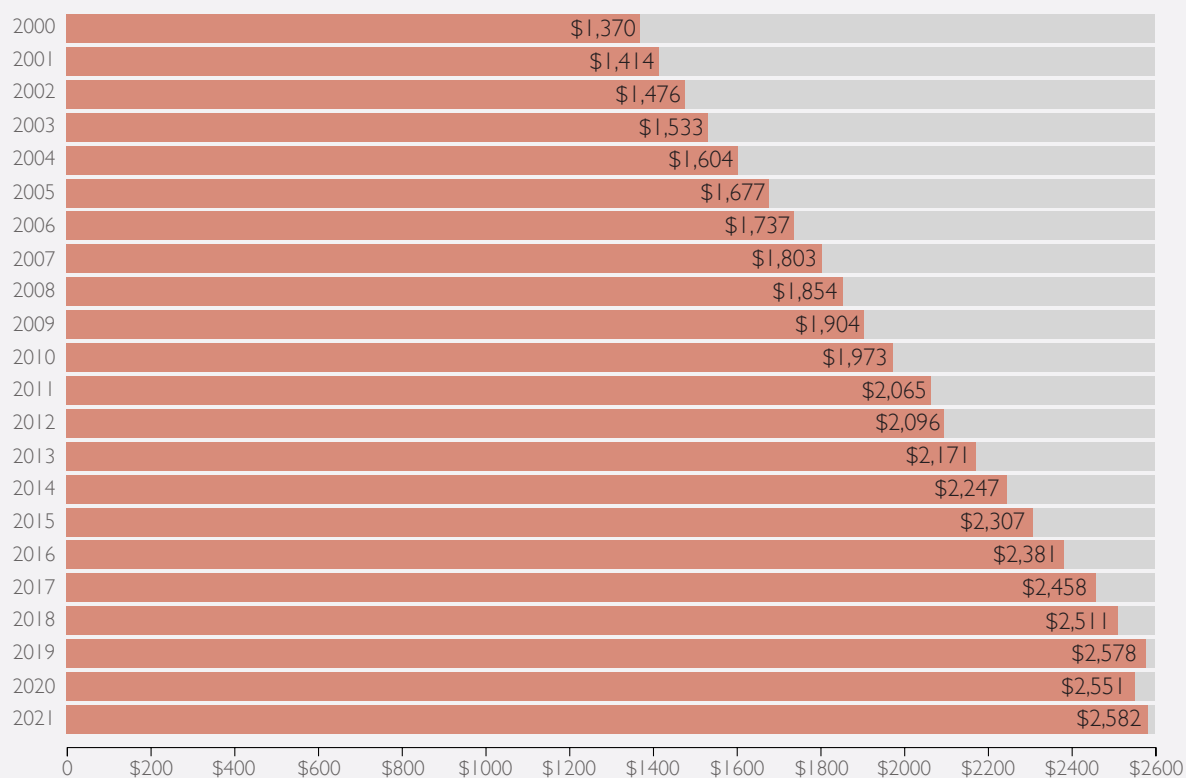
5 CCARDESA (2022), [Digital Agriculture Country Study Annex: Tanzania](#).
6 FAO (2022), [Status of Digital Agriculture in 47 Sub-Saharan African Countries](#).
7 CCARDESA (2022), [Digital Agriculture Country Study Annex: Tanzania](#).



KEY SOCIOECONOMIC INDICATORS IN TANZANIA:

1. **GDP growth:** Tanzania has experienced modest yet steady GDP growth in recent years. In 2021, despite the challenges posed by the COVID-19 pandemic, the country's GDP growth was estimated at 4.3%.⁸ This growth was mainly driven by sectors such as mining, construction, and telecommunications. Sustaining this growth and ensuring its inclusivity remain important goals, as poverty and income inequality persist.

FIGURE 1: PER CAPITA GDP (CONSTANT 2017 INTERNATIONAL \$)



SOURCE: [World Bank Open Data](#)

2. **POVERTY AND INCOME INEQUALITY:** Poverty reduction efforts have shown progress, but challenges remain. As of 2020, the national poverty rate in Tanzania stood at around 25.7%, a decrease from previous years. However, income inequality remains a concern.⁹ The Gini coefficient, which measures income inequality (0 representing perfect equality, while 100 implies perfect inequality), was estimated to be around 40.5 in 2019.¹⁰ This suggests that income distribution is relatively unequal, indicating the need for further measures to ensure more equitable economic growth.

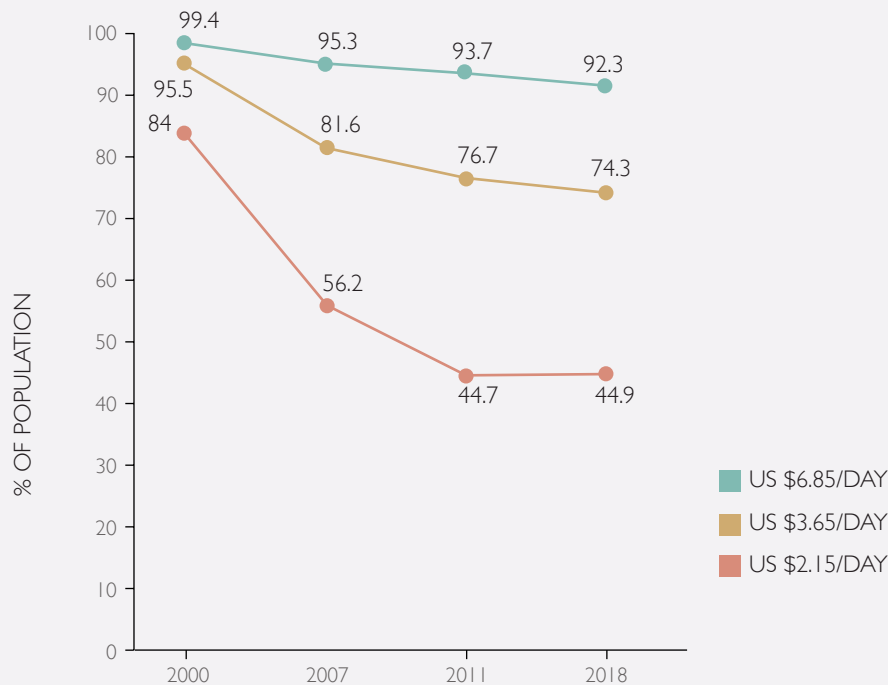
⁸ World Bank, "The World Bank in Tanzania."

⁹ [World Bank Open Data](#).

¹⁰ [World Bank Open Data](#).



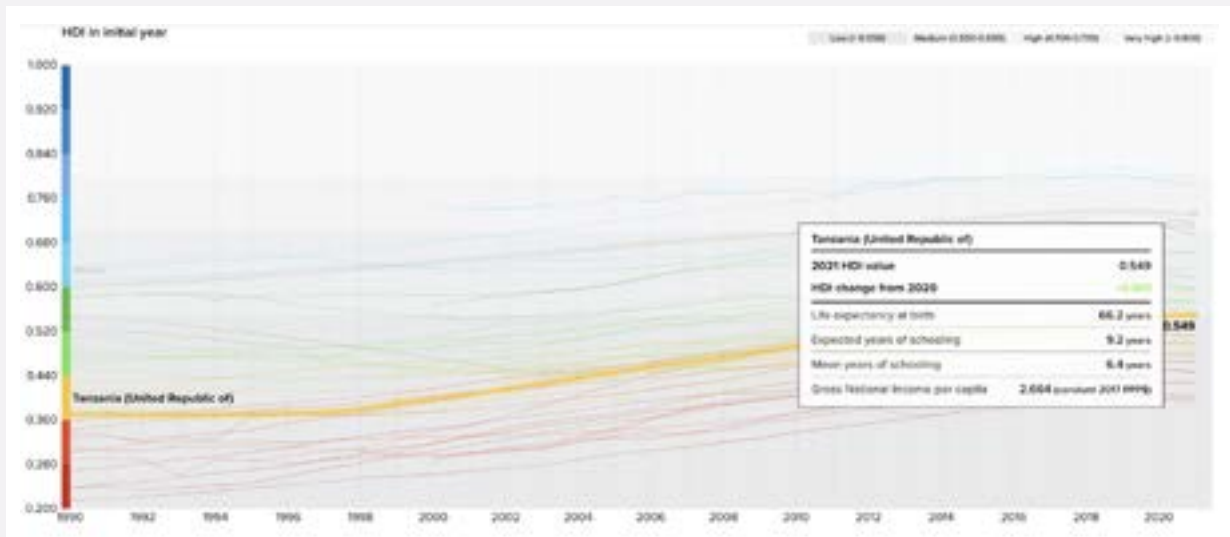
FIGURE 2: POVERTY HEADCOUNT RATIO



SOURCE: [World Bank Open Data](#).

- HUMAN DEVELOPMENT INDEX (HDI):** Tanzania's HDI, which measures key indicators such as life expectancy, education, and per capita income, has shown improvement over the years. For 2021, Tanzania's HDI was 0.549, positioning it in the low human development category (<0.550).¹¹ Efforts to improve access to education and healthcare have contributed to increased life expectancy and literacy rates. However, further investments are required to enhance the quality of education and healthcare services, particularly in rural and marginalized areas. Digital agricultural services aimed at equitable market participation of rural smallholder farmers can improve incomes.

FIGURE 3: HUMAN DEVELOPMENT INDEX FOR TANZANIA



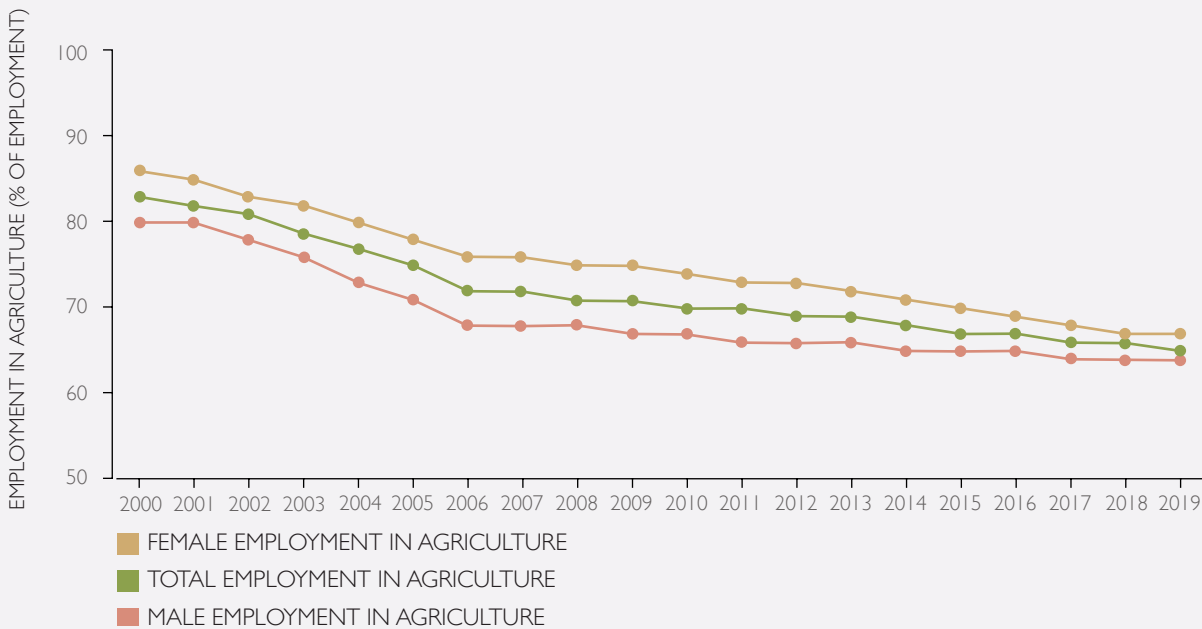
SOURCE: UNDP [Human Development Index](#).

11 UNDP, [Human Development Index \(HDI\)](#).



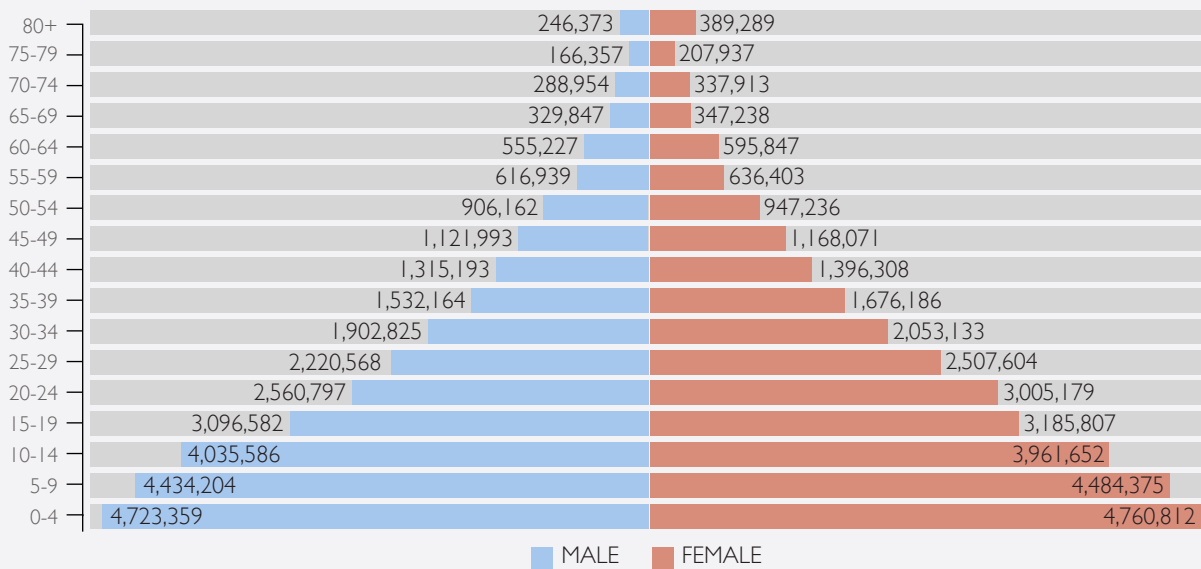
4. **EMPLOYMENT AND LABOR FORCE PARTICIPATION:** Overall employment in Tanzania stands at 81%, with 85% of men and 77% of women in employment. Despite a slow downward trend, agriculture still employs over 65% of the workforce, with a slightly higher percentage of women farmers employed in the sector compared to men (67% vs 64%). This demonstrates the importance of women's participation in the agriculture sector. Promoting job creation, particularly for youth and women in agriculture, remains a priority to harness the demographic dividend and drive sustainable economic development.¹²

FIGURE 4: EMPLOYMENT IN AGRICULTURE



SOURCE: [International Labour Organization](#).

5. **POPULATION AGE DEMOGRAPHICS:** Tanzania's population is characterized by its significant youth demographic: approximately 70% of the population is under 30 years old. This highlights the importance for youth inclusion in job creation, including in the agricultural sector. Engaging young people in agriculture is vital for several reasons. It offers an opportunity to harness the energy, creativity, and innovative thinking of youth, leading to the introduction of new ideas and approaches in the sector. Involving young people in agriculture can address the challenge of unemployment by creating sustainable livelihood opportunities. Finally, promoting youth inclusion in agriculture ensures the transfer of traditional knowledge and skills to the younger generation, preserving agricultural practices and promoting food security.


FIGURE 5: POPULATION DISTRIBUTION BY AGE AND GENDER


SOURCE: 2022 Tanzania census

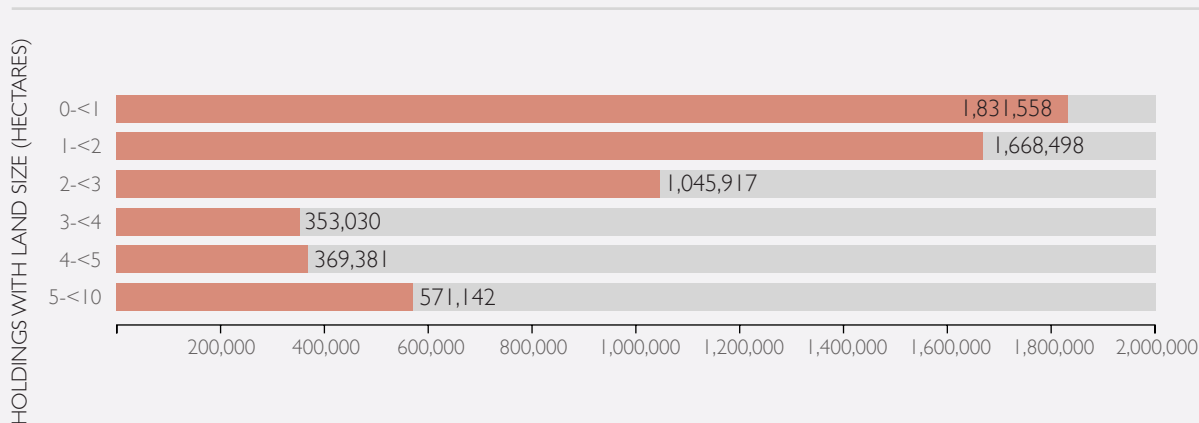
In comparison to its East African neighbors, Tanzania holds a somewhat unique position: it is the largest country in the region by land area and has the second-largest economy after Kenya. Tanzania's geographic location grants it strategic importance as a gateway to landlocked countries, particularly Uganda, Rwanda, Malawi, and Zambia. The country's stability and peaceful political environment have attracted multiple regional organizations, such as the East African Community and the African Court on Human and Peoples' Rights of the African Union, to establish their headquarters in Arusha, Tanzania.



2.2. TANZANIA'S AGRICULTURAL SECTOR

Tanzania's agricultural sector spans diverse agro-ecological zones and utilizes approximately 885,800 sq. km of land.¹³ In terms of export revenues, the sector contributes significantly, accounting for 21% of the total export earnings in 2021/2022, which amounted to US\$1.9 billion out of the overall US\$8.56 billion.¹⁴ Smallholder farmers, who contribute 80% of the country's agricultural production,¹⁵ play a crucial role in the sector's success.

FIGURE 6: AGRICULTURE LAND HOLDINGS BY LAND SIZE (2007–2008)



SOURCE: FAOStat.

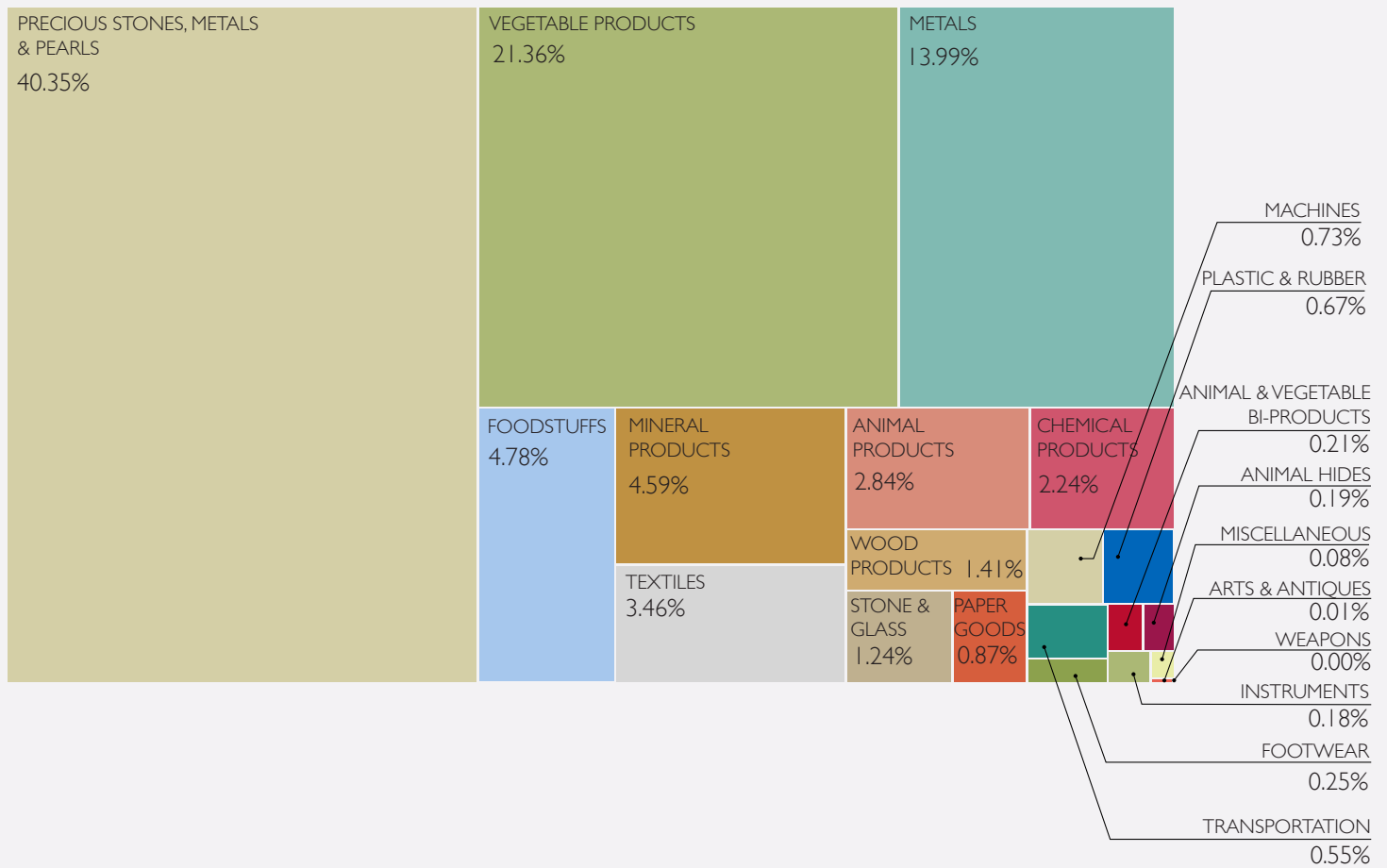
Tanzania is also known for producing cash crops, such as coffee, tea, and tobacco, as well as staple foods critical for food security, such as maize, rice, and bananas. Notably, Tanzania ranks fourth among African countries in cashew production and eighth worldwide. Cashew exports alone contribute 10–15% of the country's foreign exchange earnings.¹⁶

¹³ CCARDESA (2022), [Digital Agriculture Country Study Annex: Tanzania](#).

¹⁴ [OEC](#).

¹⁵ FAO (2022), [Status of Digital Agriculture in 47 Sub-Saharan African Countries](#).

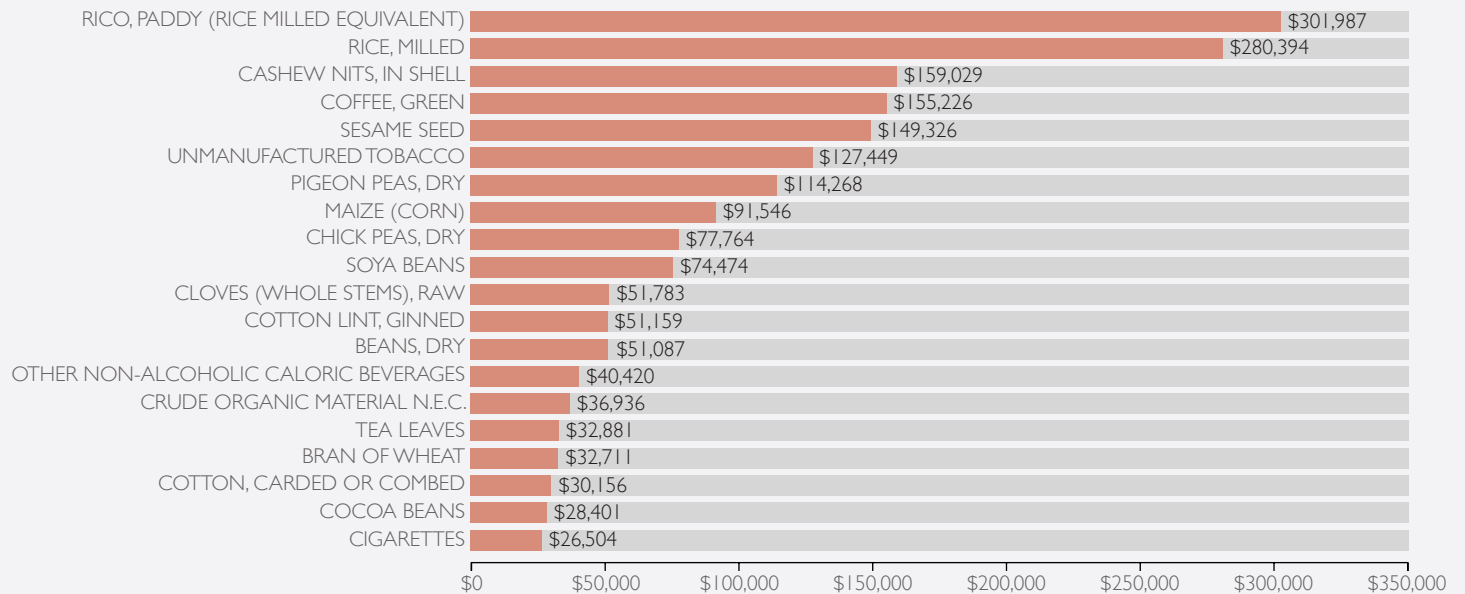
¹⁶ Africa Business (2014), ["Tanzania: Going Nuts over Cashew"](#).


FIGURE 7: TANZANIA EXPORT REVENUES


SOURCE: [OEC](#).

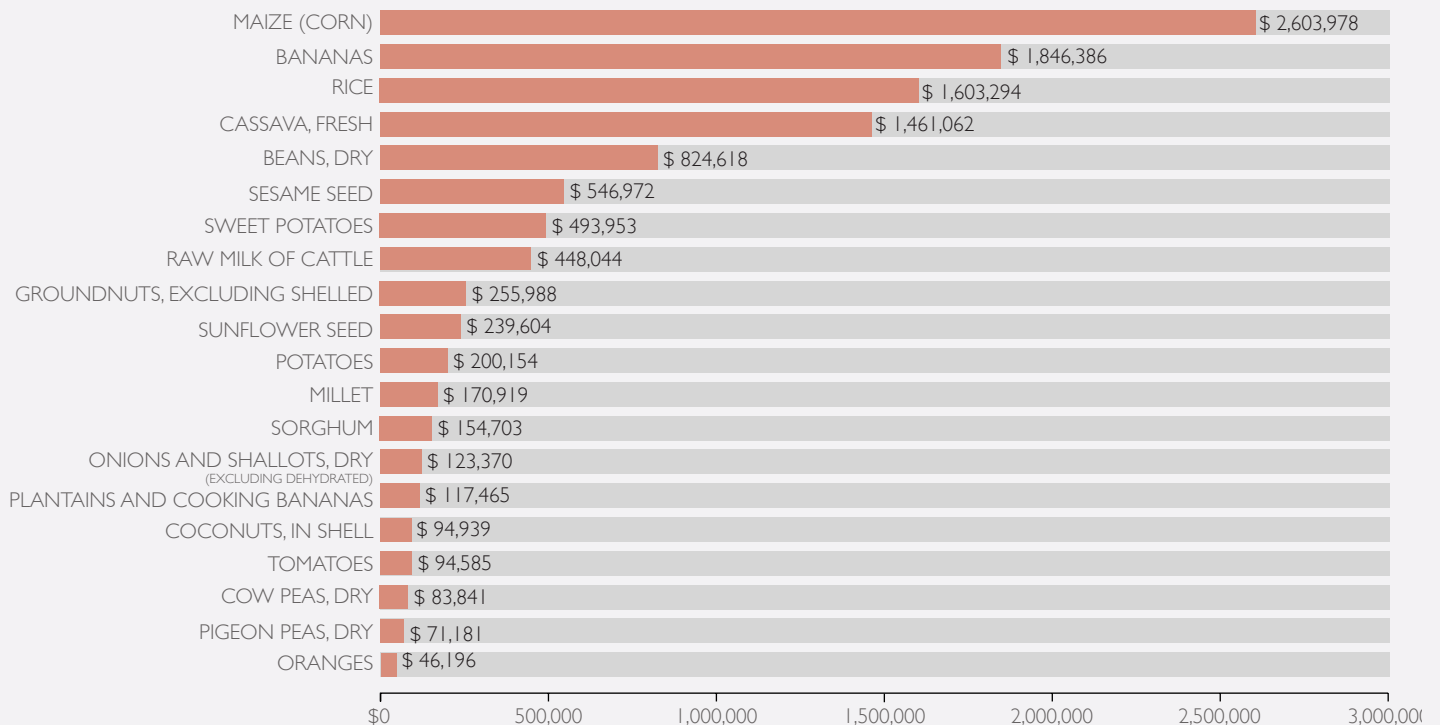
KEY CROPS IN TANZANIA

Rice—processed and unprocessed—is the backbone of agricultural exports. Other major cash crops important for Tanzania's US\$1.9 billion in agricultural exports are cashew, coffee, sesame, and tobacco. Notably, these types of cash crops are typically dominated by older male farmers and tend to exclude youth and female farmers.¹⁷

**FIGURE 8: KEY CROPS BY EXPORT VALUE**

SOURCE: [FAOStat Crops and Livestock database](#).

Contrary to the export crops hierarchy, most local production is centered on maize, bananas, rice, beans, and cassava — crops that contribute most to the country's food security.

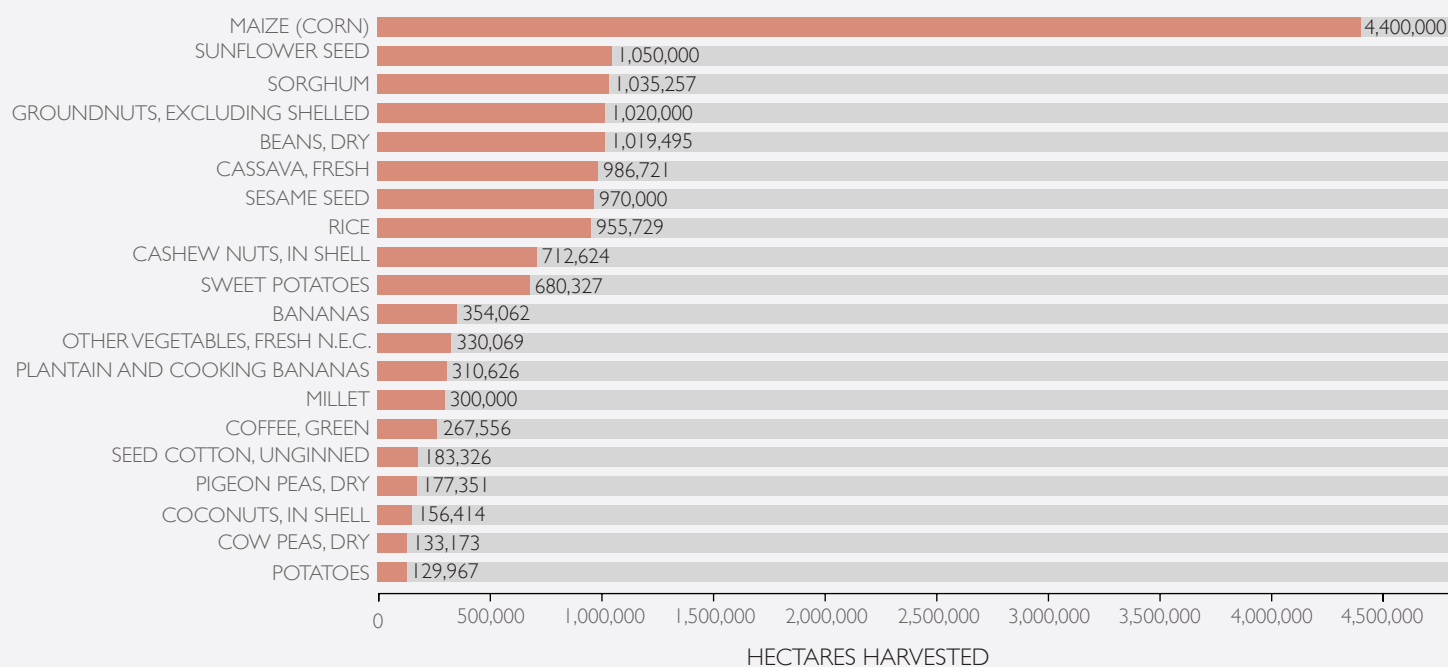
FIGURE 9: KEY CROPS BY GROSS PRODUCTION VALUE

SOURCE: [FAOStat Crops and Livestock database](#).



Most of the land in the country is dedicated to maize production, a staple crop for the majority of smallholder families. Such significant dependence on maize cultivation and this crop's predicted significant reduction in yield due to climate change (10% reduction in yield in Sub-Saharan Africa by 2050) pose risk to future food security and call for a rapid transition to climate-smart agriculture and overall innovation in climate resilience space.¹⁸

FIGURE 10: KEY CROPS BY AREA HARVESTED

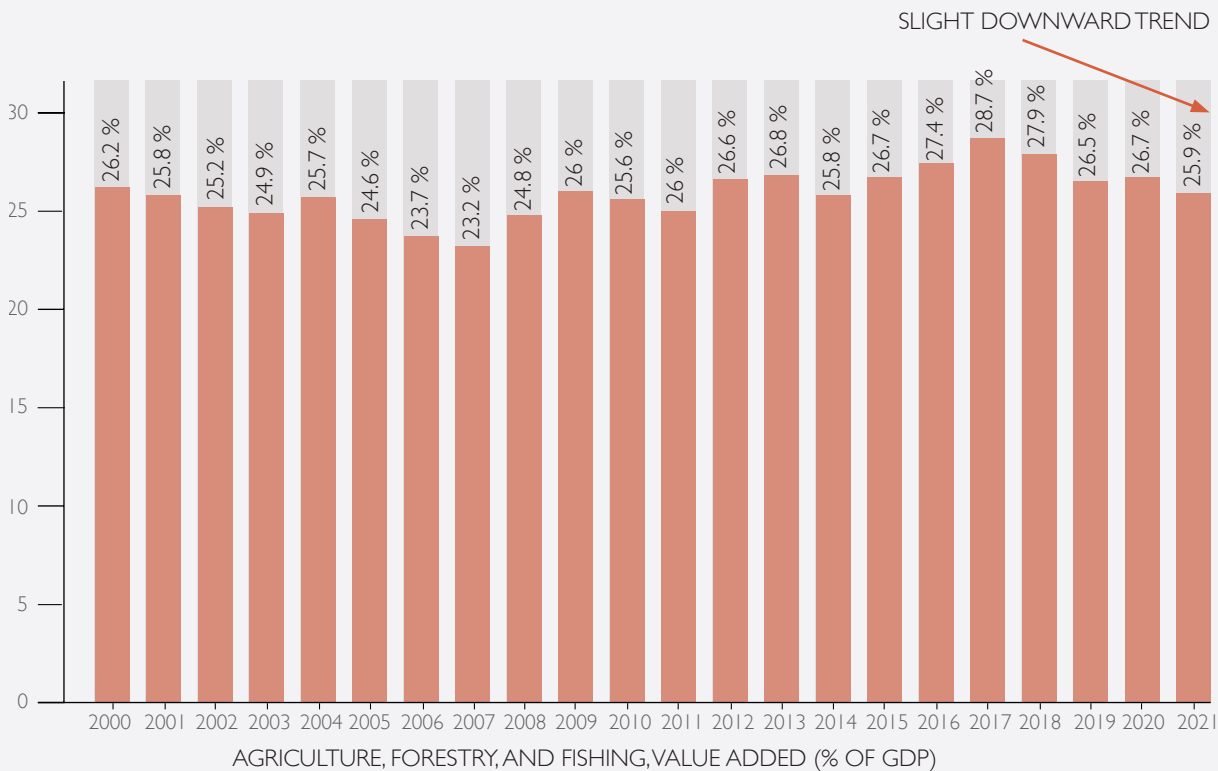


SOURCE: FAOStat Crops and Livestock database.

Over the last several years, Tanzania has experienced a slight reduction in the agricultural share of the GDP, primarily due to the impact of the COVID-19 outbreak. However, when compared to the rest of the East African region, Tanzania's economic reliance on the agricultural sector remains the highest (25.9%).¹⁹ This emphasizes the significance of the agriculture sector in the country's overall economic structure.

¹⁸ IFPRI (2009), *Climate Change Impact on Agriculture and Costs of Adaptation*.

¹⁹ World Bank national accounts data; OECD National Accounts data files.

**FIGURE 11: AGRICULTURE SHARE OF GDP IN TANZANIA****FIGURE 12: AGRICULTURE SHARE OF GDP ACROSS THE REGION**

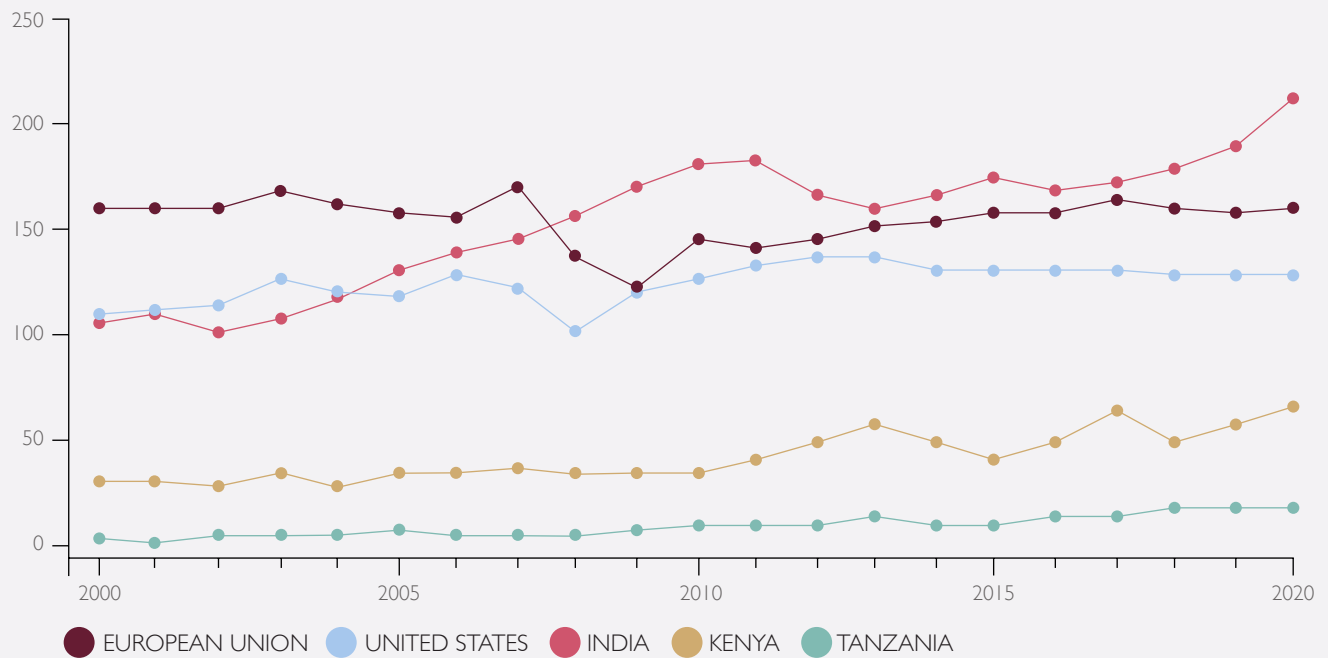
SOURCE: World Bank national accounts data; OECD National Accounts data files.

However, despite vast natural resources and agricultural potential, Tanzania's crop productivity remains low. The sector is projected to grow at a compound annual growth rate (CAGR) of 4.5% between 2022 and 2027.²⁰ Nevertheless, the country's cereal yield is only 43% of the global average, standing at 1,678 kg per hectare compared to the global average of 3,907 kg per hectare.²¹ Factors such as limited input usage, inadequate adoption of modern agricultural practices, and insufficient access to technology contribute to low productivity challenges.

FIGURE 13: FERTILIZER CONSUMPTION (KG PER HECTARE OF ARABLE LAND)

²⁰ Research and Markets (2023), *Agriculture Market in Tanzania - Growth, Trends, and Forecasts*.

²¹ [World Bank Open Data](#).



SOURCE: FAOStat

2.3. GOVERNMENT PRIORITIES FOR THE AGRICULTURAL SECTOR AND KEY AGRICULTURAL DEVELOPMENT PROGRAMS

Recognizing the pivotal role of the agricultural sector in driving economic growth, reducing poverty, and ensuring food security, the Tanzanian government has set clear priorities and key programs to drive agricultural development and transformation. These priorities are outlined in multiyear, multi-sectoral strategies such as the third National Five-Year Development Plan (FYDP III), Pathways for Sustainable Food Systems 2030, Agenda 10/30, and the Agriculture Sector Development Programme (ASDP II).

Key to realizing the government's transformational ambitions for agriculture is a Presidential High-Level Council for Food and Agriculture Delivery Compact to drive action and deliver results at scale to meet set targets. The compact focuses on four value chains and four key investment areas.²²

KEY VALUE CHAINS:

1. **WHEAT:** Tanzania aims to reduce its dependence on wheat imports by closing the significant deficit of over 90% between the country's demand and local production. The goal is to produce enough wheat domestically to meet the annual local demand of approximately 1,000,000 tons, which would reduce the import bill of around US\$221 million.



2. **EDIBLE OILS (SUNFLOWER AND SOYBEAN):** Tanzania has set a target to increase the production of sunflower to 3 million tons by 2025. The aim is to meet the domestic demand of over 650,000 tons per year and reduce the import bill of more than US\$183.3 million. This would create opportunities for processing and selling locally and in export markets.
3. **HORTICULTURE (FRUITS AND VEGETABLES):** The government plans to increase horticulture production by 40% from the current level of 7,560,010 tons in 2019/2020. The main focus in horticulture is boosting avocado production from 190,000 tons in 2018 to 290,000 tons by 2025.
4. **LIVESTOCK (BEEF AND DAIRY):** Tanzania aims to increase beef production to meet the growing consumer demand and reduce the current deficit. The target is to produce 742,000 tons of red meat per year. Additionally, the government plans to double the annual domestic supply of milk and dairy products to reduce the import bill and enhance self-sufficiency and food security.

TO SUPPORT THESE TARGETS, THE COMPACT EMPHASIZES FOUR PRIORITY AREAS:

1. **IRRIGATION AND MECHANIZATION:** The government aims to increase the area under irrigation from 727,280.6 hectares to 1.2 million hectares by 2025. This requires substantial investment of US\$2.6 billion, with a focus on improving access to irrigation infrastructure. This focus on irrigation is particularly important, given only 1.5% of the arable land is under irrigation and the threat of climate change on rainfed irrigation.²³
2. **QUALITY INPUTS (CERTIFIED SEEDS AND FERTILIZERS):** The target is to significantly scale up the production and delivery of certified seeds and increase fertilizer use. The goal is to produce 200,000 metric tons of certified seeds and increase fertilizer use to 1 million metric tons within five years.
3. **VALUE ADDITION, AGRO-PROCESSING, LOGISTICS, AND STORAGE:** The Compact seeks to accelerate the implementation of the Tanzania Agro-Industrialization Development Flagship program. The total budget estimate for the program is US\$2,989 million, with contributions from the government, development partners, and the private sector.
4. **BUILDING A BETTER TOMORROW (BBT-YIA):** The government's flagship youth and women agriculture initiative is the BBT Program, targeting 200,000 beneficiaries between 2022 and 2030. As part of the training provided in the program, alongside access to land for block farming, youth will be sensitized and trained on how to use digital solutions to grow and manage their agribusinesses. The program aims to establish 12,000 profitable enterprises across 12,000 villages in Tanzania, with an estimated cost of Tanzania Shillings 356,199 billion (equivalent to US\$148,416,167).²⁴

CASE STUDY: AGRICULTURE SECTOR DEVELOPMENT PROGRAMME (ASDP II)

ASDP II is the primary program driving agricultural transformation in Tanzania from 2017/18 to 2027/28, aligned with the Tanzania Agriculture and Food Security Investment Plan and the Tanzania Development Vision 2025. It builds on the achievements and lessons learned from the first phase, with a focus on value chain development, agribusiness promotion, and climate change adaptation.

OBJECTIVE: "Transform the agriculture sector towards higher productivity, commercialisation level and smallholder farmer income for improved livelihood, food security and nutrition."

TARGETS:

- Inclusive and sustainable agricultural growth of 6% per year.
- Reduction of rural poverty from 33.3% to 24%.
- Improved food security and nutrition, with rural households below the food poverty line reduced from 11.3% to 5%

²³ CGIAR (2017), *Climate-Smart Agriculture in Tanzania*.

²⁴ Ministry of Agriculture (2022), *Building a Better Tomorrow: Youth Initiative for Agribusiness (BBT-YIA)*.



Development partners play a crucial role in supporting the government of Tanzania in further developing the agricultural sector. The involvement of development partners aligns with priority area 4 of the ASDP II, which emphasizes the engagement of different stakeholders as partners to provide technical and financial resources to successfully implement the government's objectives. Several key partners are actively involved in capacity building, strengthening value chains, promoting good agricultural practices, and enhancing market linkages. Examples of development partners and their contributions include:

1. **Feed The Future Tanzania (FTF):** USAID's Feed the Future initiative is a US government program that addresses global hunger and poverty by promoting agricultural development, improving nutrition, and supporting sustainable food systems. The FTF initiative in Tanzania is composed of nine programs aimed at enhancing agricultural productivity, nutrition, and livelihoods, while promoting sustainable development and resilience in Tanzania's rural communities:
 1. Advancing Youth: Empowering youth in agribusiness with over US\$2.3 million in grants, benefiting over 42,000 youth-led agribusinesses.
 2. Kilimo Tija: Strengthening horticulture market systems to support 2,500 MSMEs achieve 15% annual revenue growth, creating at least 7,400 new jobs, and facilitating agriculture-related financing of US\$30 million.
 3. Sera Bora: Supporting agricultural policy adoption, establishing a Market Intelligence Unit, and addressing policy constraints affecting private sector investment.
 4. Lishe Endelevu: Addressing malnutrition, benefiting over 1.5 million women of reproductive age, 1.1 million children under 5, and 330,000 adolescents in 4 target regions.
 5. Lishe Mtambuka: Promoting optimal nutrition-related behaviors and enhancing health services, water, sanitation, and hygiene in targeted regions.
 6. Tuhifadhi Chakula: Reducing post-harvest losses and improving food security and livelihoods, with a focus on functional market systems and policy reforms.
 7. Maji na Usafi wa Mazingira (MUM): Expanding and sustaining water, sanitation, and hygiene services, benefiting approximately 340,000 people for drinking water and 619,200 people for sanitation.
 8. Mara River: Improving water access and supply for over 20,000 people, conserving freshwater ecosystems, and enabling sustainable livelihoods in the Mara River basin.
 9. AGRA (PIATA programme): Strengthening the local seed industry with a focus on sunflower and wheat production in nine breadbasket regions in the Southern Highlands and Western regions of Tanzania.
2. **United Nations World Food Program (WFP):** WFP supports Tanzania's agricultural sector by strengthening capacity along value chains through public and private collaborations. This collaboration involves an estimated investment of US\$400 million from 2022 to 2027. The focus is on enhancing the efficiency and effectiveness of value chains, improving productivity, and ensuring food security in the country.
3. **Food and Agriculture Organization (FAO):** FAO is actively engaged in Tanzania, facilitating evidence-based agriculture policies, promoting good agricultural practices, establishing market linkages, and enhancing agricultural resilience. With an estimated investment of US\$17 million, FAO's initiatives aim to improve agricultural productivity, support sustainable land management, and enhance the overall resilience of Tanzania's agricultural sector.



2.4. CURRENT AND FUTURE IMPACT OF CLIMATE CHANGE ON THE AGRICULTURAL SECTOR PRODUCTION AND FARMING COMMUNITIES.

Climate change has already created adverse impacts on Tanzania's agriculture system, and its future implications are even more significant. Increased variability in rainfall patterns, reduced water volumes in rivers and lakes, saltwater intrusion in coastal areas, including Zanzibar, and shifts in agricultural ecological zones and ecosystems are only a few of the observed consequences.

The increased frequency and severity of extreme events, such as droughts and floods, combined with lower predictability in rainfall patterns will result in increased difficulty for the farming community to plan both seasonally and in the short term. While overall precipitation levels are expected to rise, the distribution across regions will be uneven, with the northwest, central, and northeast regions anticipated to experience the most substantial increases, reaching up to 7% in some cases.²⁵

FIGURE 14:
CHANGE IN TOTAL PRECIPITATION (%)

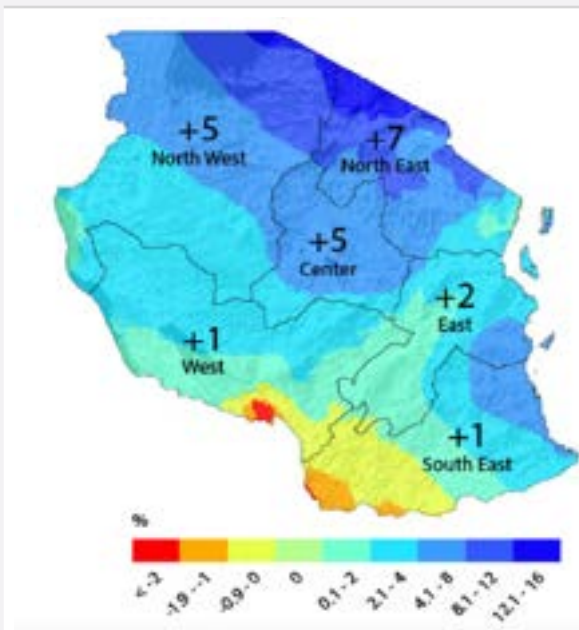
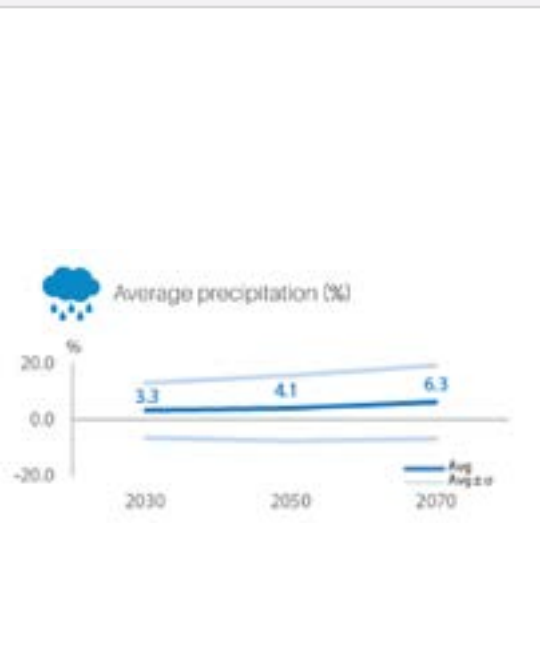


FIGURE 15:
CHANGE IN AVERAGE PRECIPITATION (%)



SOURCE: CGIAR.²⁶

²⁵ CGIAR (2017), *Climate-Smart Agriculture in Tanzania*.

²⁶ CGIAR (2017), *Climate-Smart Agriculture in Tanzania*.



Looking ahead to 2050, it is estimated that between 4 and 7 million people in Tanzania will likely experience drought, while around half a million people could face regular flooding.²⁷ This changing pattern of rainfall poses challenges for agricultural planning and water management, as farmers need to adapt to the shifting availability of water resources. It is also critical for the agricultural sector to be prepared for drought and for farming communities to enhance their overall climate resilience. Given that 95% of agriculture in Sub-Saharan Africa, including in Tanzania, relies on rainfed farming, smallholder farmers are particularly vulnerable to the impacts of climate change.²⁸

FIGURE 16: CHANGE IN ABSOLUTE NUMBER OF PEOPLE EXPOSED TO RISK BY 2050

	PESSIMISTIC SCENARIO	OPTIMISTIC SCENARIO
Flooding	+ 1,015,995	+ 424,339
Coastal flooding	+ 141,895	+ 95,399
Drought	+ 6,917,803	+ 4,101,485

SOURCE: INFORM.²⁹

Climate change also influences the frequency of incidence of pests and diseases in the agricultural sector. Rising temperatures and increased rainfall in some parts of the country would create favorable conditions for pests and diseases, leading to increased crop losses and reduced productivity. Furthermore, as smallholders compete for scarce resources like water and land, social conflicts are likely to escalate, further straining communities already grappling with the challenges posed by climate change.

As crops fail and livestock face water scarcity and heat stress, smallholders experience a loss of livelihoods, income, and food production. Insufficient food production would not only affect farmers themselves but also have wider implications for food security in Tanzania. When smallholders are unable to produce enough food to meet their own needs, this leads to increased reliance on external sources and potential food shortages in the country overall.

The impacts of climate change also extend to increased vulnerability and poverty among smallholders. Limited access to finance and insurance products specifically tailored to cope with climate risks leaves smallholders fully exposed to losses from climate-related disasters.

Rural women, who account for 67% of the agricultural labor force, are disproportionately affected by the impacts

²⁷ European Commission INFORM (climate change risk ratings index).

²⁸ Stockholm International Water Institute (2018), *Unlocking the Potential of Enhanced Rainfed Agriculture*.

²⁹ European Commission INFORM (climate change risk ratings index).



of climate change and underserved by service providers.³⁰ They face additional vulnerabilities, compared to their male counterparts, due to limited access to essential resources such as land, credit, and inputs. These constraints hinder their ability to adapt to and mitigate climate risks effectively. Moreover, gender roles and norms can influence women's adaptive capacity, with cultural factors and limited decision-making power further compounding the challenges they face in responding to climate change impacts.

The implications of climate change for women extend beyond agriculture. As women often take on the responsibility for household diets, changes in crop yields and food availability have a direct impact on their ability to fulfill this role. Additionally, rural women already dedicate a disproportionate amount of time to domestic duties and tasks like fetching water and accessing fuel (e.g., wood for cooking), which will be further exacerbated by the effects of climate change.³¹ This increased workload reduces their time for existing responsibilities and limits their capacity to pursue new income-earning opportunities.

Addressing these gender-related implications is crucial to ensure equitable and sustainable agricultural development in Tanzania in the face of climate change. There is a growing need for targeted interventions, policies, and investments that promote gender equality, increase women's ability to make informed decisions, improve their access to resources and critical services such as finance, insurance, and advisory, among others. By recognizing and addressing the unique challenges faced by women smallholders, Tanzania can build a more resilient and inclusive agricultural sector that benefits both men and women and strengthens overall food security.

There are further barriers to rural communities' climate resilience, including limited access to accurate and timely weather information, as well as inadequate availability of modern inputs such as drought-resistant seeds and farming assets like irrigation or greenhouse equipment. Lack of financial instruments, equipment, inputs, and critical infrastructure, such as storage and transport, hampers their ability to mitigate the effects of extreme weather events and adapt to the changing climate.

2.5. RECENT MACROECONOMIC IMPACTS

In addition to climate change, Tanzania continues to face the challenges of the COVID-19 pandemic and geopolitical tensions. Each of these elements exerts pressure on food prices and inflation. Among the key commodities affected include petroleum, fertilizer, wheat, and edible oil. Food constitutes a significant portion of household budgets (up to 60%), especially in rural areas, and the rising prices of essential commodities disproportionately impact them.³²

The agriculture sector saw growth projections decline from 5% in 2019 to 2% in 2020 due to the combined effects of locust infestation and the COVID-19 pandemic. The pandemic also posed the risk of pushing an additional 500,000 Tanzanians into poverty, further compounding the socioeconomic challenges faced by smallholders.³³

Furthermore, the impacts of the war in Ukraine have also affected Tanzania's agriculture sector: Global fertilizer prices rose by 199% between May 2020 and the end of 2022.³⁴ Although prices fell in the first quarter of 2023, this was partly due to a drop in demand as farmers in developing nations were not able to afford fertilizer. The price fluctuations are attributed to supply-side issues, including production crunches in Europe, disruptions due to sanctions on Russia and Belarus, and trade restrictions in China. As a result, fewer smallholder farmers in Tanzania were able to afford fertilizers for the 2023 growing season, leading to a predicted lower yield across smallholder farms and posing a serious threat to food security in the region.

30 S. S. Yadav and Rattan Lal (2018), "[Vulnerability of Women to Climate Change in Arid and Semi-arid Regions: The Case of India and South Asia](#)," *Journal of Arid Environments* 149.

31 IRRI (2022), "[Climate Change and Time Poverty Trap Women in a Vicious Cycle](#)."

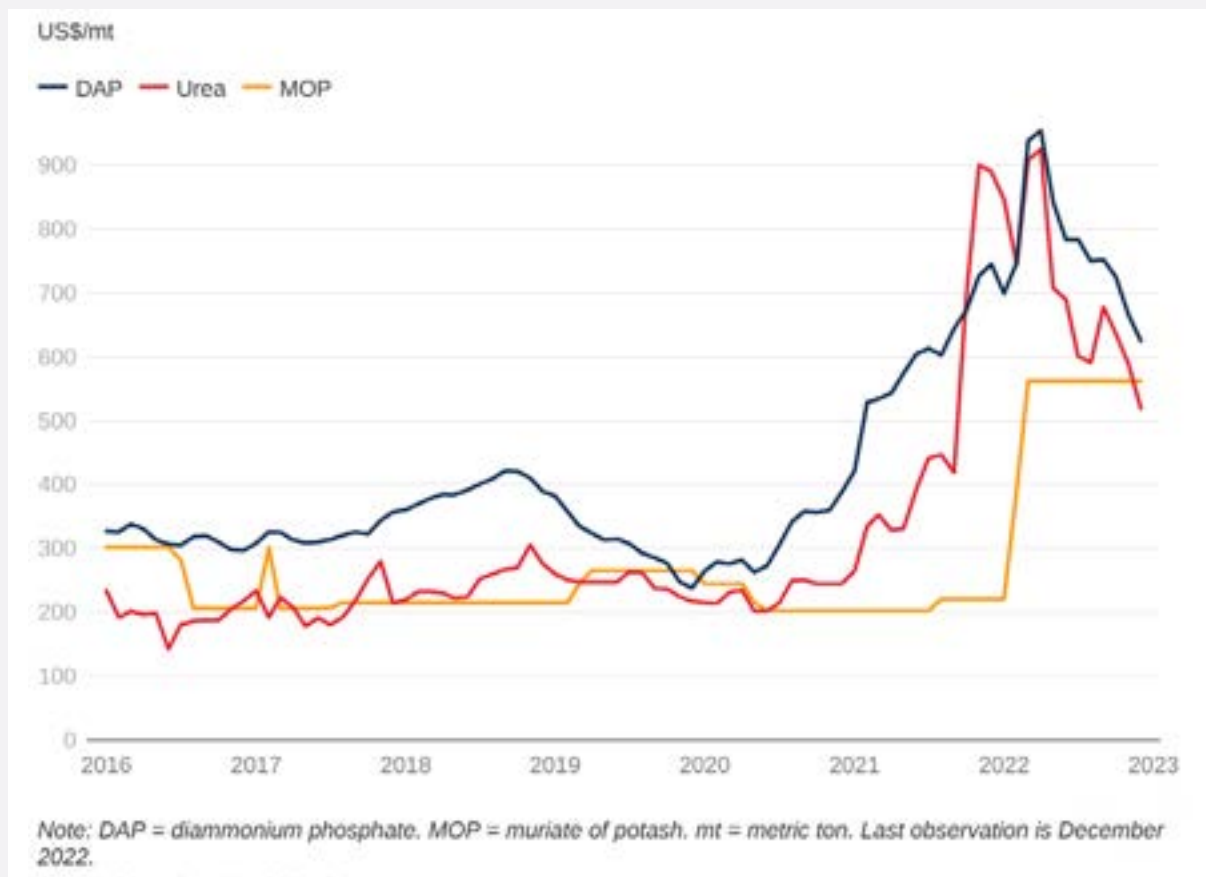
32 Sera Bora Project (2022), *Food Security Brief: The Triple Impact of Climate Change, the Post-Covid-19 Pandemic, and the Russian-Ukraine War on Tanzania's Food Security*.

33 IFAD (2021), "[Tanzanian Small-scale Farmers Receive Support to Improve Food Security in the Face of the COVID-19 Pandemic](#)," *Food Ingredients* 1st (2023).

34 "[Ukraine War Hampers Fertilizer Supplies and Threatens Global Food Security, Warns World Economic Forum](#)."



FIGURE 17: GLOBAL FERTILIZER COMMODITY PRICES



SOURCE: World Bank.³⁵

As Tanzania's agricultural sector continues to play a vital role in the country's economy, it stands at a crucial juncture that demands innovation and transformative solutions. With the challenges of improving productivity, enhancing climate resilience, and creating inclusive livelihoods (e.g., for women and youth), the sector requires dynamic approaches to address these pressing issues. The advent of digital technologies and the growing digital ecosystem present compelling opportunities to revolutionize agriculture.

35 World Bank Blogs (2023), "[Fertilizer Prices Ease but Affordability and Availability Issues Linger](#)."



3.

**DIGITAL ECOSYSTEM
AND DIGITAL SERVICES
ADOPTION IN THE
MARKET**





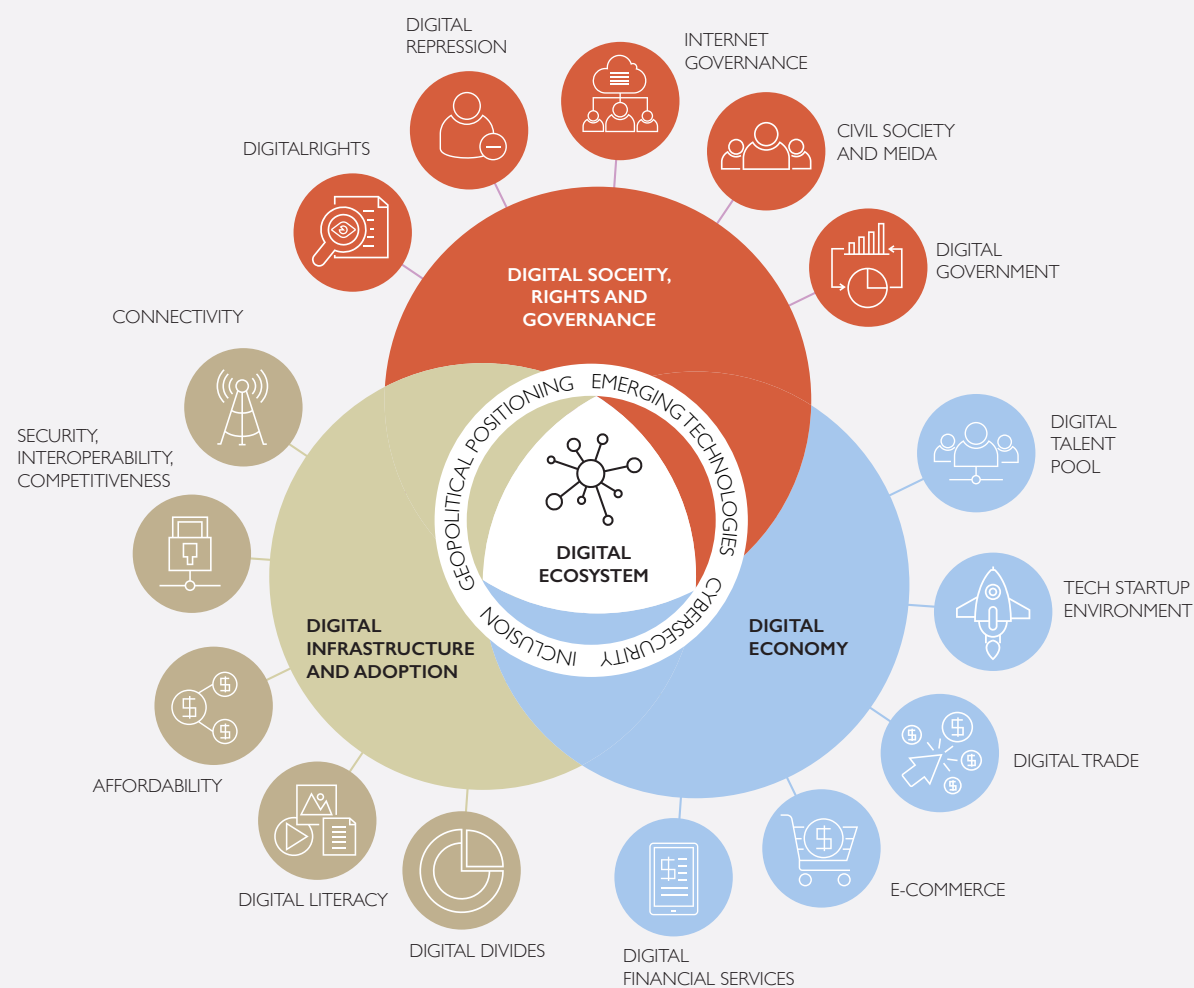
3. DIGITAL ECOSYSTEM AND DIGITAL SERVICES ADOPTION IN THE MARKET

In assessing the digital agriculture ecosystem in Tanzania, it is important to recognize the fundamental role of an enabling digital infrastructure. Digital infrastructure not only facilitates effective communication but also unlocks access to critical information and services such as credit/loans and markets for inputs or offtake that would otherwise remain inaccessible to many smallholders.

This section delves into the foundational role digital infrastructure plays in facilitating the scale and adoption of digital agriculture by adapting and examining the three key pillars outlined in the [Tanzania Digital Ecosystem Country Assessment \(DECA\) for Tanzania](#) and how they pertain to the digital agriculture context:

1. Digital infrastructure and adoption
2. Digital society, rights, and governance
3. Digital economy

FIGURE 18: DIGITAL ECOSYSTEM COUNTRY ASSESSMENT FRAMEWORK



SOURCE: DAI.³⁶

The DECA for Tanzania, commissioned by USAID, involved desk research, consultations, and interviews with various stakeholders.

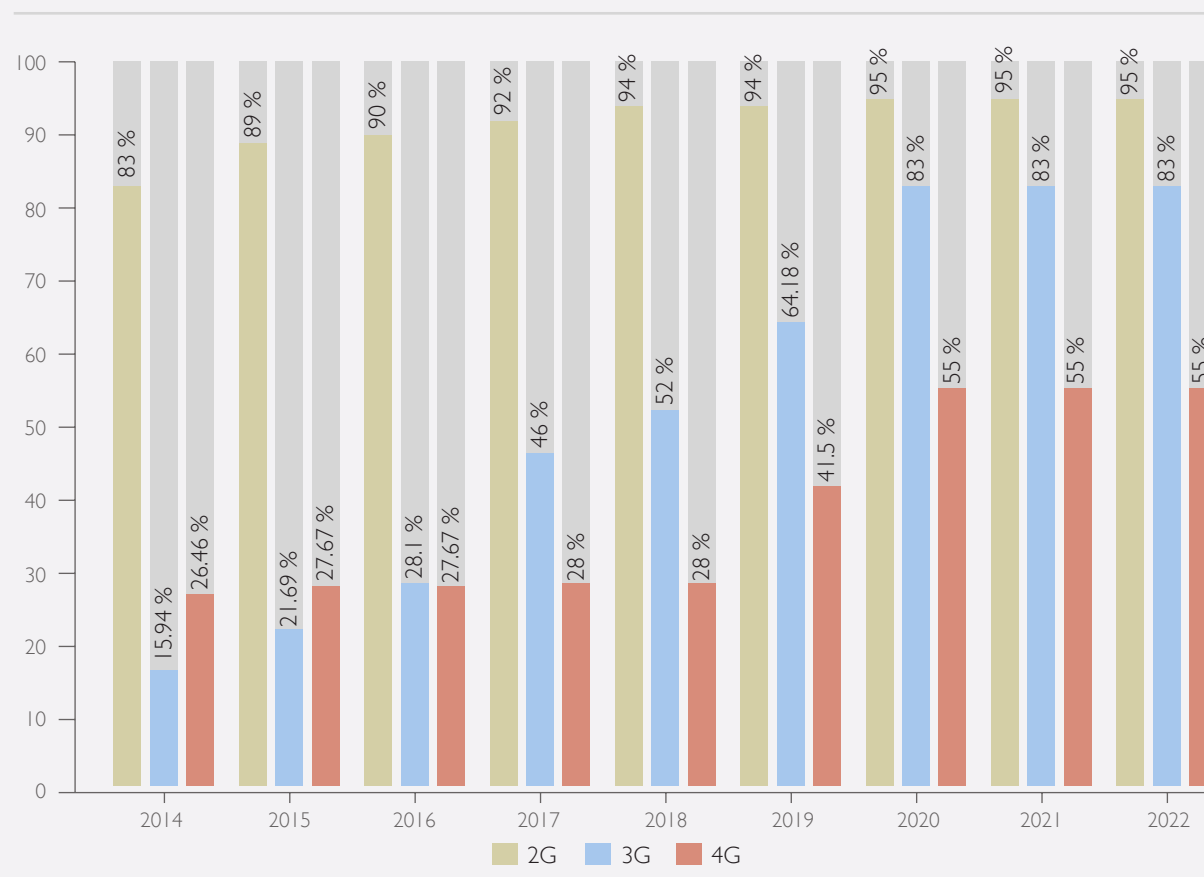
36 DAI (2023), "The Digital Ecosystem Country Assessment (DECA) has Spurred Innovative Digital Development Around the World!"



3.1 DIGITAL INFRASTRUCTURE AND ADOPTION

Tanzania has made notable progress in expanding access to mobile services, including basic 2G coverage (required for voice calls, SMS and USSD-based services, including mobile money), advanced 3G and 4G service required for mobile broadband, and even introducing 5G service. The availability of 2G networks is relatively high, covering 95% of the population, and enables rural populations to benefit from voice- and text-based communication services. The availability of 3G and 4G network coverage, required for mobile broadband services, has significantly expanded in both urban and rural areas, with 3G networks covering over 83% of population, offering faster internet connectivity to mobile users, including rural communities³⁷ Finally, 5G service was recently introduced in the country in Dar Es Salaam, with gradual plans to expand coverage.³⁸

FIGURE 19: PERCENTAGE OF POPULATION COVERED BY 2G, 3G, AND 4G



SOURCE: GSMA.³⁹

37 GSMA, [Mobile Connectivity Index](#).

38 Vodacom (2022), "[Vodacom Switches on Tanzania's First 5G Network](#)"; Ericsson (2023), "[Tigo Tanzania and Ericsson Launch 5G and Enhance Existing Network](#)."

39 GSMA, [Mobile Connectivity Index](#).

**FIGURE 20: REGIONAL NETWORK COVERAGE**

	3G COVERAGE	4G COVERAGE
RWANDA	98%	99%
KENYA	97.9%	96.3%
UGANDA	90.5%	62%
TANZANIA	83%	55%

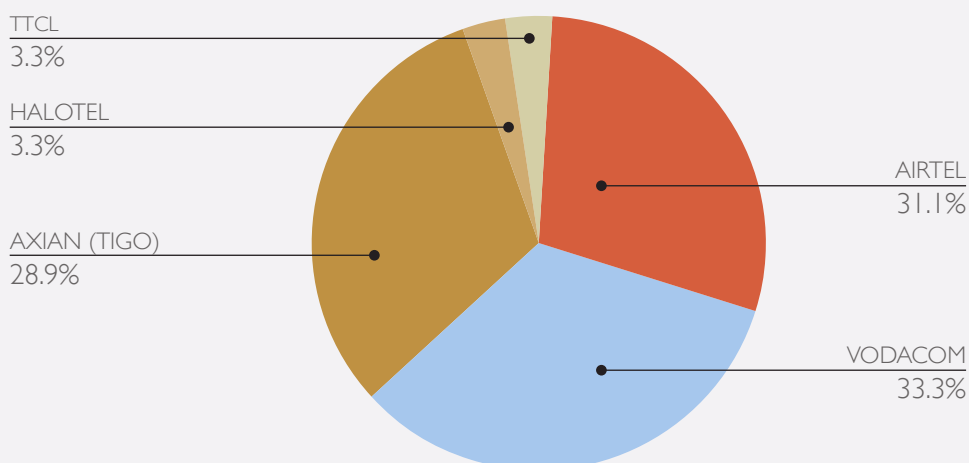
Relative to regional peers, Tanzania is noticeably trailing in 3G and 4G population coverage.

SOURCE: GSMA.⁴⁰

Last-mile connectivity, especially in rural areas where 65% of the population lives, remains constrained, as highlighted in interviews conducted with agtech entrepreneurs and innovation hubs. Limited or unreliable electricity supply is one of the primary challenges, making it difficult to establish and maintain the necessary infrastructure for digital connectivity. Additionally, the geographic terrain, with remote and dispersed settlements, poses difficulties in deploying and maintaining network infrastructure.⁴¹

Moreover, the economics of the business case behind mobile infrastructure are challenging, as the cost of network capital expenditure (CAPEX) and operational expenditure (OPEX) is 2–3 times higher in rural areas compared to urban areas, while revenues can be as much as 10 times lower due to the significantly smaller population covered by one base station.⁴² This makes it less economically viable for service providers to invest in the necessary rural infrastructure and hampers the expansion of digital infrastructure in remote areas. Established in 2006, the UCSAF (Universal Communication and Services Access Fund) aims to extend digital services to underserved areas where commercial firms face viability challenges. It collaborates with TCRA (Tanzania Communications Regulatory Authority), subsidizing mobile network operators to deploy last-mile connectivity infrastructure in harder-to-reach regions.

As a result, rural communities in Tanzania often face limited internet connectivity, slower network speeds, and inadequate access to digital technologies, which highlights the existence of a digital divide between urban and rural areas. While sufficient investments are required to expand rural infrastructure, the digital divide in rural areas is likely to remain a significant consideration for programs, services, and investments aiming to reach rural and farming communities.

FIGURE 21: MNO MARKET SHARE

Three major mobile network operators, namely Vodacom, Airtel, and Tigo, dominate the majority of the mobile connectivity market.

Note: Smile maintains less than 0 percent of market share.

SOURCE: TCRA.⁴³

40 GSMA, [Mobile Connectivity Index](#).

41 GSMA (2022), [Accelerating Rural Connectivity: Insights from the GSMA Innovation Fund for Rural Connectivity](#).

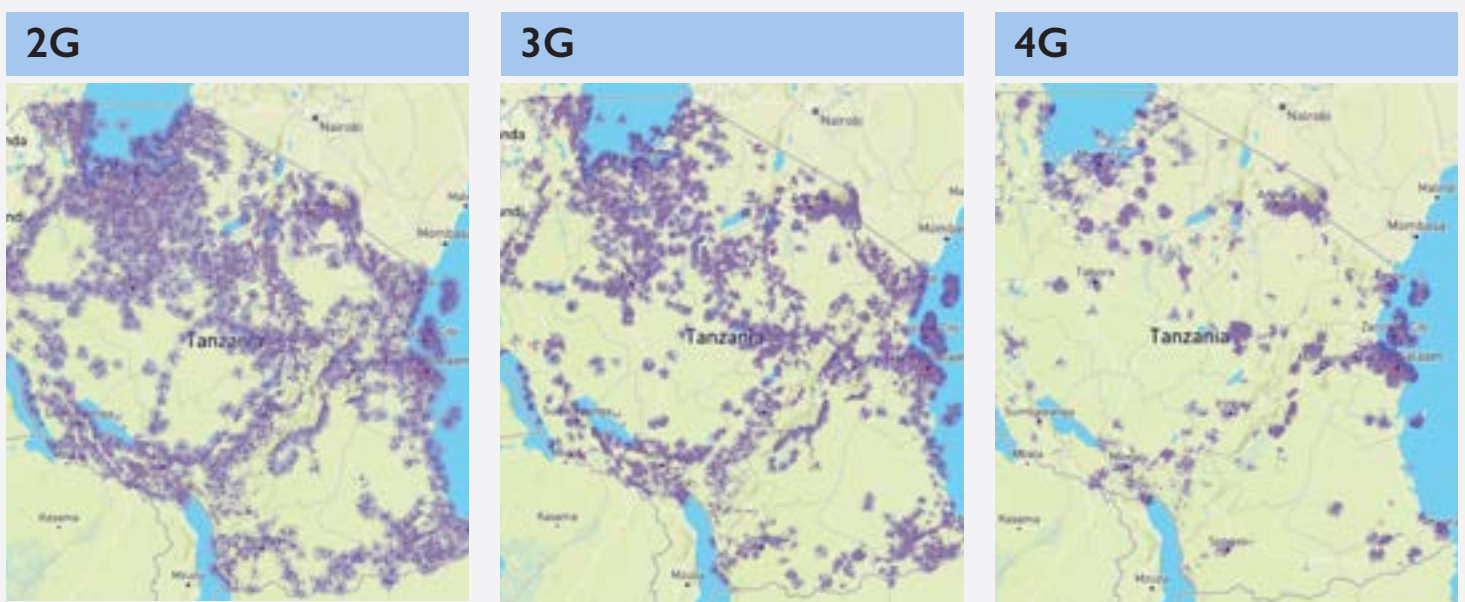
42 GSMA (2022), [Accelerating Rural Connectivity: Insights from the GSMA Innovation Fund for Rural Connectivity](#).

43 TCRA (2022), [Communication Statistics: A Report for a Quarter Ending September 2022](#).



Mobile broadband coverage maps (**Figure 22**) predominantly depict mobile broadband coverage in major and medium-sized cities. The lack of coverage increases from 2G to 3G and from 3G to 4G.

FIGURE 22: 2G, 3G, AND 4G NETWORK COVERAGE



SOURCE: [GSMA Mobile Coverage Maps](#).

3.1.1 DEMAND-SIDE BARRIERS TO DIGITAL INCLUSION

Digital inclusion is a multifaceted endeavor aimed at addressing the barriers that hinder equal access and participation in the digital world. While Tanzania has made strides in improving connectivity and availability of mobile services, challenges persist in terms of affordability and literacy—particularly in rural farming communities.

AFFORDABILITY: While the cost of mobile services has decreased over the years, ensuring further affordability remains essential to encourage adoption and usage among farmers. In Tanzania, the cost of 1 GB of data is estimated at 4.9% of gross national income (GNI), which is slightly more affordable than the African average of 5.1%.⁴⁴ However, the Alliance for Affordable Internet defines mobile broadband as “affordable” when 1 GB is priced at 2% or less of average monthly income or GNI. Even the price of basic 2G connectivity (voice, SMS, and USSD) ranges from US\$2.11 to 4.24 per month and is a significant household expense for the 39% of the smallholders in Tanzania who live below the national poverty line (US\$1.90/day).⁴⁵

The cost of smartphone devices, which are key tools for using the internet, is still seen as prohibitively high. As a result, while over 80% of the population is covered by 3G internet, less than 30% use 3G or 4G, and more than two-thirds of the population lack smartphones.⁴⁶ This usage gap hinders the full potential of digital infrastructure for smallholder farmers, especially those living below the national poverty line.

LITERACY: According to feedback received from interviews with agtech innovators, low digital literacy remains a significant barrier to widespread and meaningful use of digital technologies in Tanzania. Despite the ubiquity of digital tools, training on practical relevant ICT skills has not reached much of the population, especially in rural areas. The education system lacks effective integration of ICT skills, with a scarcity of practical, market-oriented training and professional courses. This gap in digital literacy poses challenges for smallholder farmers in fully harnessing the benefits of digital infrastructure.⁴⁷

44 Alliance for Affordable Internet (2021), “[Affordability of 1GB of Broadband Data](#).”

45 FAO (2018), [Smallholders Dataportrait](#).

46 GSMA (2022), [Tanzania’s Digitalisation Journey: Opportunities for Value Creation](#); GSMA, [Mobile Connectivity Index](#).

47 USAID (2023), [DECA: Tanzania](#).



USAID defines digital literacy as the ability to access, manage, understand, integrate, communicate, evaluate, and create information safely and appropriately through digital devices and networked technologies for participation in economic, social, and political life.⁴⁸

In 2007, the government of Tanzania introduced an ICT policy for basic education, aiming to integrate technology into preschools, primary schools, and secondary schools. Additionally, development partners have supported initiatives like the African Digital School Initiative (ADSI). Launched in 2017, ADSI aims to transform selected secondary schools into Digital Schools of Distinction, benefiting 1,200 teachers and 40,000 students over three years.⁴⁹ This research did not identify any parallel programs targeting rural populations or farmers.

FIGURE 23: GSMA MOBILE INTERNET SKILLS TRAINING TOOLKIT



The GSMA Mobile Internet Skills Training Toolkit (MISTT) (available in several languages, including Swahili as pictured) is a set of free resources to teach the basic skills needed to access and use mobile internet. It uses a “train the trainer” approach and consists of short lessons available in PDF and video format that can be easily adapted to local needs and languages.

3.1.2. THE GENDER GAP

According to the 2019 GSMA Mobile Gender Gap Report, there was a 11% gender gap in mobile phone ownership, with 86% of men owning mobile phones compared to 77% of women. The disparity becomes even more significant when considering mobile phone internet usage, with a staggering 52% gap between men and women.⁵⁰ This gender gap is influenced by various factors, including socioeconomic constraints that hinder women’s access, limited digital literacy and skills, and purchasing power, as well as traditional cultural norms that may discourage women from using mobile phones, as indicated during interviews with key stakeholders.⁵¹ Addressing these underlying issues is essential to bridge the gap and empower women with equal access to mobile technology in Tanzania.

3.2 DIGITAL SOCIETY, RIGHTS, AND GOVERNANCE

Digital society, rights, and governance examines the interplay of digital technology with government, civil society, and the media. In the context of digital agriculture, we examine personal data protection and digital ID as they pertain to farmer data and their use of digital agriculture services.

48 USAID (2023), [DECA: Tanzania](#).

49 USAID (2023), [DECA: Tanzania](#).

50 GSMA (2019), [The Mobile Gender Gap Report](#).

51 GSMA (2019), [The Mobile Gender Gap Report](#).



3.2.1 PERSONAL DATA PROTECTION AND FARMER-CENTRIC APPROACH TO DATA

Digital farmer registries can play a pivotal role in facilitating digital agriculture service providers' operations by providing valuable data and insights on farmers. However, one critical challenge that arises in this context is the lack of a robust personal data protection framework. This absence raises concerns about the potential risks to farmer rights and privacy within these registries. Acknowledging the significance of personal data protection, the current ruling party, Chama Cha Mapinduzi (CCM), included a commitment in their 2020–25 manifesto to enact a Personal Data Protection Act by 2025. This commitment is one step towards ensuring that farmers' personal data is safeguarded from misuse and unauthorized access.

Apart from implementing national personal data protection laws, it is essential to foster an environment that prioritizes farmer-centric approaches when utilizing farmer data. Placing farmers and their communities at the core of data-gathering initiatives, empowering them with greater control over their data, and encouraging their active participation in data-related activities can strengthen their collective influence. This approach enables a shift of data control to individuals and groups, while also establishing safeguards against privacy violations, data misuse, lack of transparency, and other potential harms.⁵² This concept of farmer-centric approaches to data are discussed in **Section 6.2.1**.

3.2.2. DIGITAL IDENTITY

The Tanzanian government has implemented a digital ID initiative aimed at streamlining citizen identification, which can play a crucial role in facilitating access to various agricultural services and benefits. The National Identification Authority (NIDA) issues a digital ID in the form of an 80Kb Near Field Communication (NFC) smart card, with potential future applications as a mobile wallet. Registered individuals receive a unique 20-digit identifier number linked to their biometric attributes stored in NIDA's databases. As of 2021, approximately 74% of the population had successfully registered for this digital ID.

However, an evaluation by Research ICT Africa raised concerns about the digital ID's compliance with international rights and data protection norms, as outlined in the African Union Commission's Draft AU Interoperability Framework for Digital ID.⁵³ The evaluation highlighted several areas of weakness, particularly the potential to exclude individuals from accessing civic services if they are not registered and the lack of an opt-out framework.

52 Development Gateway (2023), [Farmer-Centric Data Governance: Towards A New Paradigm](#).

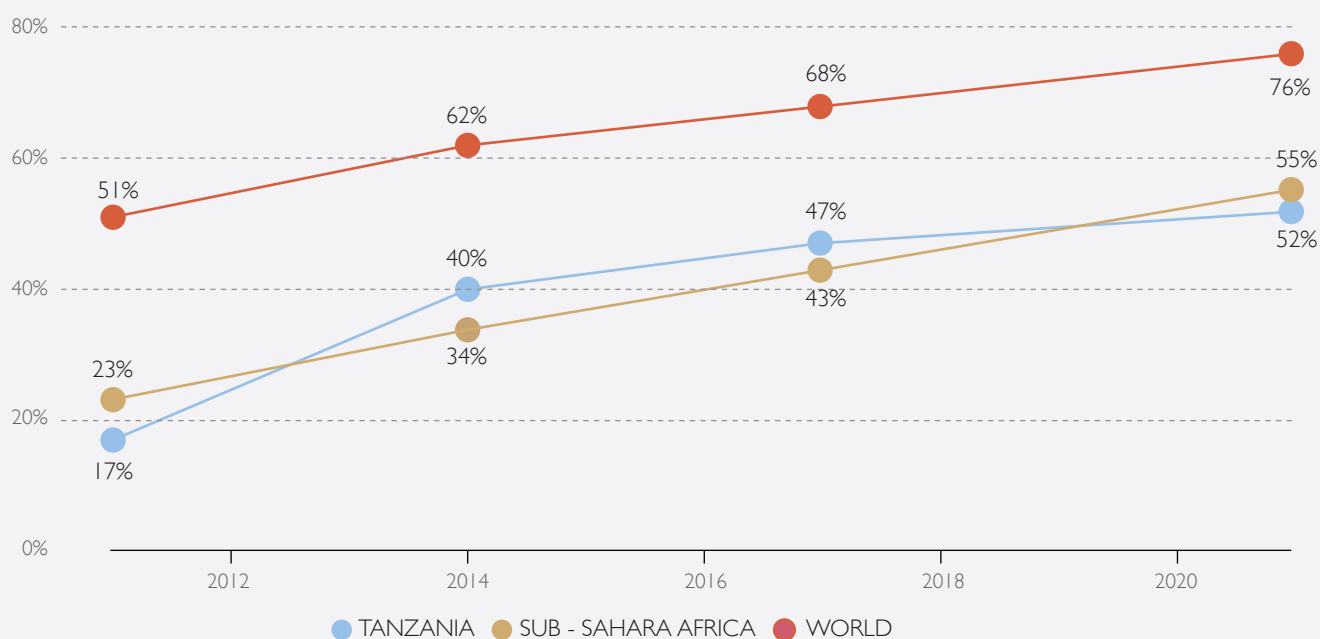
53 USAID (2023), [DECA: Tanzania](#).



3.3 DIGITAL ECONOMY

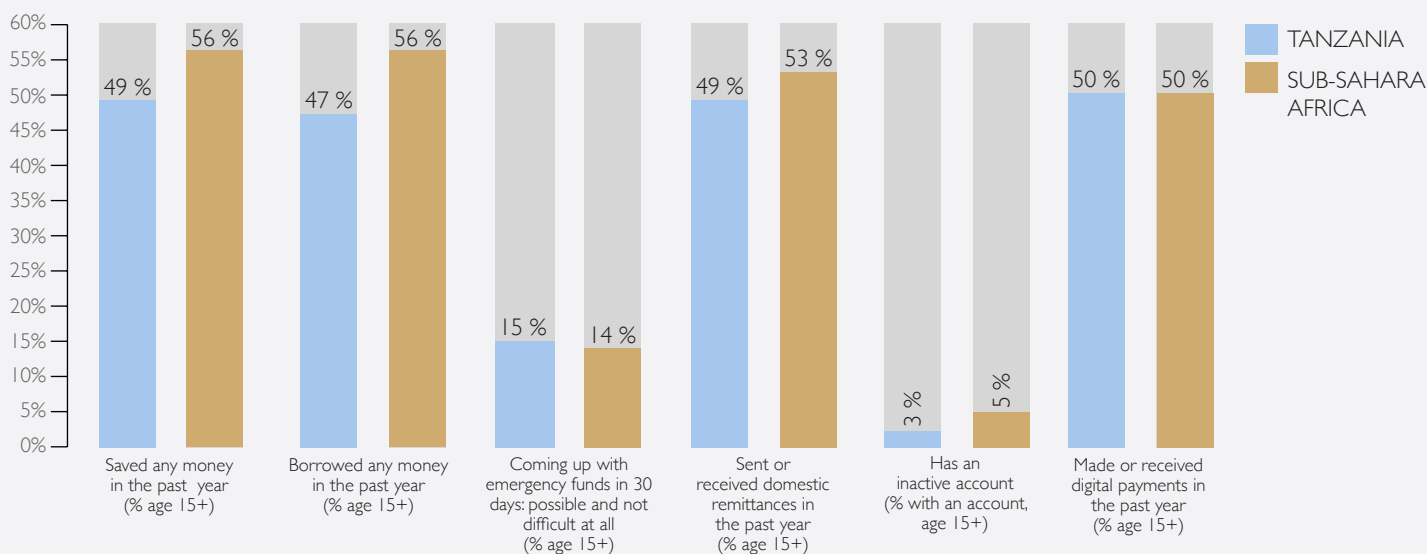
The final DECA pillar, digital economy, focuses on the impact of digital technology in enhancing economic opportunities, efficiency, trade, and global economic integration. In the context of digital agriculture, we focus on financial inclusion of smallholders by exploring the use of mobile money and digital financial services.

FIGURE 24: ACCOUNT OWNERSHIP: PERCENTAGE OF ADULTS AGE 15+ WITH AN ACCOUNT AT A FINANCIAL INSTITUTION OR THROUGH A MOBILE MONEY PROVIDER



SOURCE: [Findex](#)

FIGURE 25: USE OF FINANCIAL SERVICES OF ADULTS AGE 15+ (%)



SOURCE: [Findex](#)



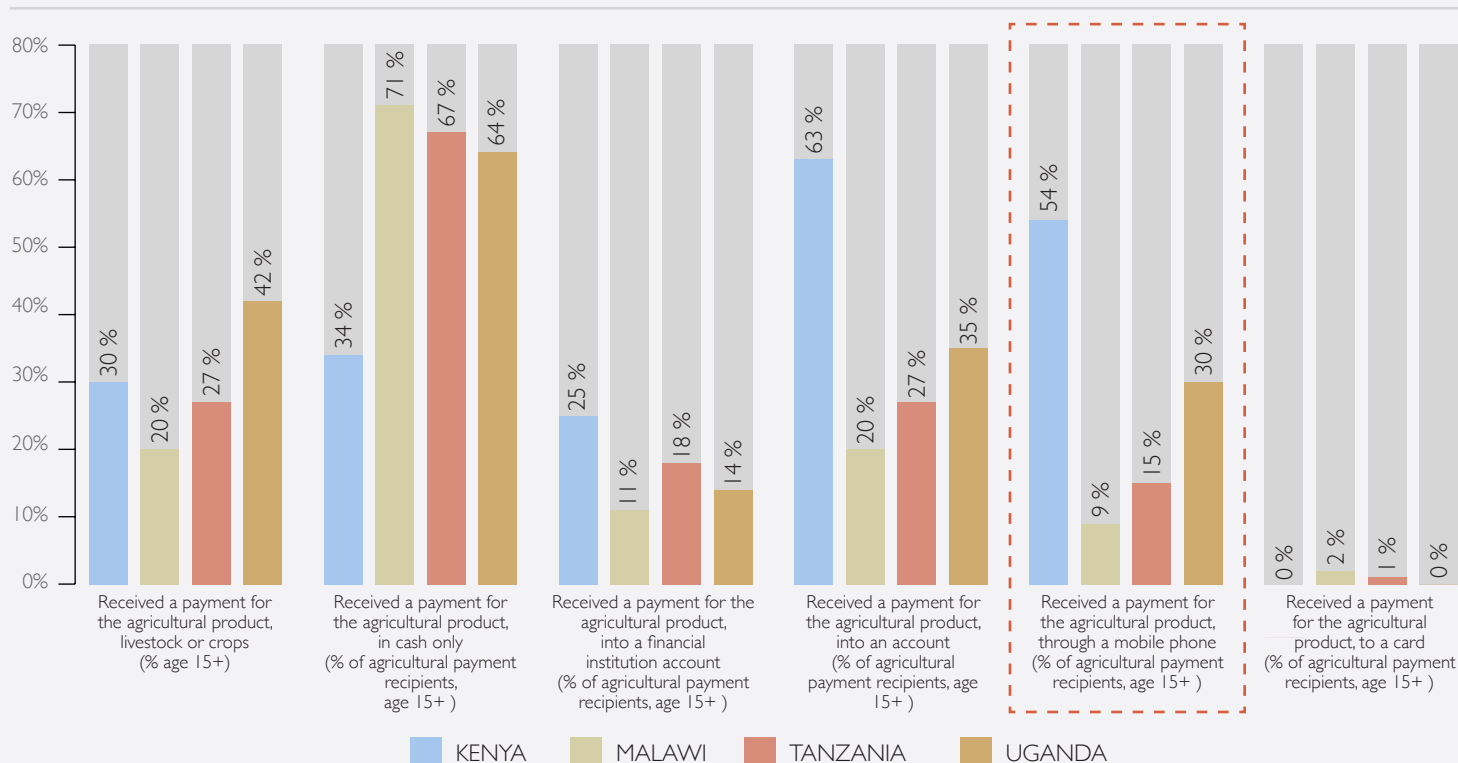
The current state of financial inclusion in Tanzania reflects a mix of recent progress and ongoing challenges, particularly for women and farmers, who still represent large proportions of the population excluded from formal financial services. Findex data shows 52% of adults have an account with either a financial institution or mobile money provider. While this is in line with the average for Sub-Saharan Africa (53%), it is well behind the world average of 76%.⁵⁴

Mobile money services have played a crucial role in increasing access to financial services, with ownership of mobile money accounts estimated at 45%, surpassing bank account ownership at 23%.⁵⁵ The rapid growth of mobile money can be attributed to factors such as instant payments through real-time settlement, enhanced security due to reduced cash handling, and scalability achievable via bulk transfers.

Despite these improvements, a significant financial inclusion gap persists, particularly among women and those in rural areas. Among those without access to a bank account or mobile money, approximately 55% are estimated to be women, and 47% are farmers.⁵⁶ Tanzanians in rural areas are also 27% less likely to have a mobile money account compared to their urban counterparts, and this disparity is further amplified for women in rural areas.⁵⁷ Challenges in the adoption of mobile money in rural areas stem from less developed mobile money agent networks, liquidity issues, and lower levels of digital literacy.

GSMA has estimated the annual direct revenue opportunity for mobile money operators to digitize agricultural value chain payments (from businesses and governments to farmers) to reach about US\$7.69 million by 2025.⁵⁸ Despite such potential, data reveals that so far only 15% of Tanzanian farmers who earn income from farming are paid via mobile money, whereas the figure is significantly higher in Uganda (30%) and Kenya (45%).⁵⁹ This gap highlights the potential opportunity for digital agriculture in Tanzania, which would contribute to farmers' financial inclusion and their eventual access to a full range of services, including savings, credit, and insurance, among others.

FIGURE 26: MEANS OF PAYMENT FOR THE SALE OF AGRICULTURAL PRODUCTS, LIVESTOCK, OR CROPS AND HOW FARMERS RECEIVE THEM



SOURCE: Findex

54 Findex.

55 Findex; The Global Economy.com (2021), "Tanzania: Percent People with Bank Accounts."

56 Financial Sector Deepening Trust (2017), *Finscope Tanzania*.

57 GSMA (2023), *Advancing Women's Financial Inclusion in Tanzania: The Role of Mobile Money*.

58 GSMA (2020), *Digitising Payments in Agricultural Value Chains: The Revenue Opportunity to 2025*.

59 Findex.



Increasing digital inclusion and financial literacy and expanding and strengthening the mobile money agents network are vital to enhancing financial inclusion for smallholder farmers. A robust agent network ensures that farmers have convenient access to cash-in and cash-out services, builds their trust in mobile money services, and enables them to convert digital funds into physical currency and vice versa. It is also a foundational use case on the journey to more sophisticated services like digital credit, lending, savings, and insurance. Expanding the agent network in rural areas and improving liquidity management can address last-mile challenges and enhance farmers' access to financial services.

Digital and financial literacy challenges persist in rural areas, leading to corresponding bottlenecks in relation to the adoption of digital agriculture services linked to mobile money. While providing training and educational programs on the benefits and usage of mobile money services, as well as promoting financial management skills, can empower farmers to make informed financial decisions, it is an expensive and time-consuming effort that ultimately benefits more than one commercial service provider due to the network effect that benefits everyone in the ecosystem. A collaborative approach among stakeholders to ecosystem development and farmer education could be beneficial in rural areas and promote efficient use of resources.

3.4. GENDER GAP

Along with the digital gender gap, outlined in **Section 3.1.2**, the financial gender gap in Tanzania remains a significant challenge, hindered by various barriers. Factors such as women's lower awareness of digital services, Know Your Customer (KYC) requirements, limited digital literacy, limited affordability, and social norms contribute to the persistence of this gap. This has knock-on implications on women who will face further obstacles in accessing climate-resilient technologies such as insurance and irrigation equipment.

In the 4-year period from 2017 to 2021, the gender gap in financial account ownership in Tanzania widened, increasing by 3% to 13%.⁶⁰ This data indicates that men's ownership of financial accounts continues to surpass that of women, emphasizing the disproportionate impact of the COVID-19 pandemic on women's financial inclusion.

In 2021, the gender gap in mobile money account ownership was 22%, a **3% increase from 2017**, and a change in trajectory from the previous 3 measurements. This gap also surpasses the gender gaps in neighboring countries such as Kenya (7%) and Uganda (4%).⁶¹

FIGURE 27: GENDER GAP IN MOBILE MONEY ACCOUNT OWNERSHIP

	FEMALE %	MALE %	GENDER GAP (MALE%-FEMALE%)/MALE %
World 2021	74%	78%	5.1%
Sub-Saharan Africa 2021	49%	61%	19.7%
Tanzania 2021	46%	59%	22.0%
Tanzania 2017	42%	52%	19.2%
Tanzania 2014	34%	45%	24.4%
Tanzania 2011	14%	21%	33.3%

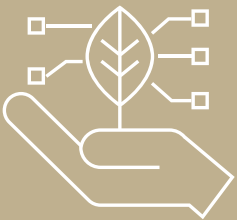
SOURCE: [Findex](#)

60 [Findex](#)

61 [Findex](#)

4.

**DIGITAL AGRICULTURE
CONTEXT: THE
ROLE OF DIFFERENT
STAKEHOLDERS**





4. DIGITAL AGRICULTURE CONTEXT: THE ROLE OF DIFFERENT STAKEHOLDERS

In this section, we take a look at the diverse roles of various stakeholders in supporting digital agriculture in Tanzania to realize its potential, including the government, donors and development agencies, investors, and innovation hubs.

4.1. KEY GOVERNMENT PROGRAMS TO DIGITIZE THE AGRICULTURAL SECTOR

The Tanzanian government has already implemented various initiatives to facilitate trade, enhance market access, and provide valuable information to farmers. These programs aim to promote efficient agricultural practices while contributing to the broader goals of enhancing country development, mitigating climate risks, and supporting rural communities. While these government activities demonstrate the important role of public sector interventions in fostering a digital ecosystem, they also reveal limitations which present opportunities for the development and private sector partners to step in.

ESTABLISHED GOVERNMENT DIGITAL AGRICULTURE PROGRAMS:

1. **TANZANIA MERCANTILE EXCHANGE (TMX):** TMX, developed with funding from Ireland and Norway through TradeMark Africa and the United Kingdom Agency for International Development (UKAID), is the country's first digital commodity exchange. It provides a platform for producers and buyers to trade agricultural commodities based on domestic and global market demand. Between 2019 and 2021, the trading platform facilitated the exchange of around 56,367.5 metric tons of commodities, valued at approximately US\$42.05 million. Data from this period indicates that farmers using the TMX system earned higher incomes, with prices for certain regulated crops doubling compared to selling through unregulated channels.⁶²
2. **AGRICULTURAL TRADE MANAGEMENT INFORMATION SYSTEMS (ATMIS):** ATMIS aims to digitize access to information and certifications for regulated crops. Traders can register on the web platform and make online applications for different certifications such as import permits, registration licenses, and phyto-sanitary certificates.
3. **M-KILIMO:** The government introduced M-Kilimo, a USSD-based mobile solution that provides farmers with access to agronomic information, market prices, and opportunities to sell their produce. M-Kilimo was funded from IFAD's US\$882,842 Rural Poor Stimulus Facility (RPSF) and registered 1,979,662 farmers and 6,840 extension officers within the first year of launch.⁶³

GOVERNMENT PROGRAMS UNDER DEVELOPMENT

1. **DIGITAL FARM MAPPING:** The Ministry of Agriculture is planning to develop digital maps of farms across the country. These maps will incorporate farmer and farm data, providing valuable insights for agricultural planning and resource allocation. Digital farm mapping enables the government to identify areas suitable for specific crops, monitor land use, and support targeted interventions to enhance agricultural productivity and sustainability.
2. **CENTRALIZED DIGITAL FARMER REGISTRY:** The Tanzanian government is currently conceptualizing a Centralized Digital Farmer Registry for all farmers in the country. This initiative aims to resolve and unify the conflicting farmer databases that have been developed both by the private and public sector with differing scales, types of data, and frequency of updates. To be managed by the Ministry of Agriculture, this Centralized Digital Farmer Registry is to serve as the backbone for different farmer-facing services, such as advisory and provision of inputs from the government.

62 TradeMark Africa (2022), "[Automation of Tanzania's Mercantile Exchange Trading System Eases Commodity Trading in Tanzania](#)."
63 IFAD (2021), "[Tanzania Small Scale Farmers Receive Support to Improve Food Security in the face of the Covid-19 Pandemic](#)";
Ministry of Agriculture (2021), "[Wakulima Million 2 Wasajiliwa Kwenye Mfumo wa M-Kilimo - Bashe](#)."



3. **FARMER CARDS FOR FERTILIZER SUBSIDY PROGRAM:** The Ministry of Agriculture is considering the development of farmer cards that can be loaded with funds for the fertilizer subsidy program. These cards would enable farmers to access subsidized fertilizers through a digital payment system, reducing reliance on cash transactions and enhancing transparency in the distribution of subsidies. By digitizing the subsidy program, the government aims to improve the efficiency of fertilizer distribution and ensure that subsidies reach the intended beneficiaries.
4. **COORDINATION OF DIGITAL AGRICULTURE PLATFORMS:** Efforts are underway to coordinate various digital agriculture platforms to ensure better harmonization and consolidation of services. By aligning these platforms, the government aims to streamline data sharing, avoid duplication of efforts, and provide a more unified experience for farmers and other stakeholders. Coordinated digital agriculture platforms would facilitate access to a wide range of services, including market and weather information, agronomic advisory, and financial services.

These government digital agriculture initiatives aim to provide data and digital infrastructure that could enable different use cases, notably advisory, and support innovators in accessing information that would allow them to tailor services and products to farmers' unique profile and location. Still, there is a notable lag between the needs of the innovators and the development of such digital assets, as well as gaps in terms of diversity and reach of the services in focus, with a wide range of financial services and solutions enhancing access to equipment, transport, infrastructure, and storage currently out of scope. While new digital infrastructure planned by the government could reduce operational cost for both public and private service providers, there remains a significant need for funding and technical support in digital innovations for the agricultural sector; especially those with focus on climate, financial services, and access to assets, while being user-centric and inclusive.

4.2. KEY DONOR AND DEVELOPMENT AGENCIES SUPPORTING DIGITAL AGRICULTURE

In addition to the government programs, several key donor programs have played a crucial role in advancing digitization in Tanzania's agricultural sector:

CASE STUDY: GIZ'S SUPPORT FOR AGTECH STARTUPS IN TANZANIA

PROJECT:	Scaling Digital Agriculture Innovations through Start-ups (SAIS)
COMMISSIONED BY:	German Federal Ministry for Economic Cooperation and Development (BMZ)
CO-FUNDED BY:	Bill & Melinda Gates Foundation
REGION:	Tanzania (part of a global project in Africa)
OVERALL TERM:	2019 to 2027

Objective: SAIS aims to scale digital agriculture innovations by supporting African tech startups in the agriculture, food, and livestock sectors to raise capital for growth. Through its Investment Readiness Programme (IRP), SAIS aims to catalyze the growth and impact of digital agriculture startups in Tanzania among other African markets, while driving economic development and creating opportunities for smallholder farmers and rural communities.



APPROACH:

- With a dedicated SAIS navigator, startups in the program design a development plan to implement for the duration of the IRP. They gain access to a network of experts, mentors, investors, and business partners who provide individual coaching sessions and industry insights.
- SAIS offers specialized services to address startups' specific needs, such as legal and marketing support, as well as technical assistance to strengthen their digital products and data analytics capabilities. By integrating startups into local hubs, SAIS fosters networking opportunities and collaborations with relevant stakeholders in the industry.
- Peer-to-peer learning is encouraged through the SAIS community, enabling founders to exchange knowledge and experiences with other entrepreneurs. SAIS also provides web-based training modules covering topics around startup management and growth.
- Startups access GIZ's network of partners and investors. Female founders and management staff have access to the Female Leader Circle, a platform with additional support and mentorship.

GIZ's SAIS project has invested in several digital agriculture startups in Tanzania, including:

- [BizyTech](#) (2023): A technology company providing innovative solutions for the agricultural sector.
- [Digital Mobile Africa](#) (2022): A digital platform offering mobile-based agricultural services and solutions.
- [Foodsasa](#) (2021): An online marketplace connecting farmers with buyers, facilitating efficient and transparent trade.
- [Mavuno Technologies](#) (2023): A technology company offering agricultural solutions for farmers, including access to markets and financial services.
- [PhemaAgri](#) (2021): A digital platform providing advisory services and information to farmers to enhance their productivity and profitability.

Overall results from across Africa:

- Over 60% of startups who completed the IRP have raised follow-on funding totalling over US\$32 million.
- Startups have increased their number of users by 500,000.
- Over 90% of startup participants are still active.

CASE STUDY: AGRA'S DIGITAL AGRICULTURE INITIATIVES IN TANZANIA

With funding from the likes of the Bill & Melinda Gates Foundation (BMGF), Rockefeller Foundation, UK Foreign, Commonwealth & Development Office (FCDO), BMZ Germany, and USAID, the Alliance for a Green Revolution (AGRA) has invested US\$28 million in Tanzania's agriculture sector with a target to empower 1.8 million farmers.⁶⁴ By leveraging partnerships, creating digital tools, and advocating for policy changes, AGRA aims to empower farmers, strengthen market systems, and enhance agricultural productivity.

AGRA implements several initiatives to support digital agriculture in Tanzania:

- Wakala Digital is a platform developed by AGRA to digitize the supply chain of agricultural inputs. The aim is to improve the distribution and availability of inputs between large urban agro-dealers and small agro-dealer shops in rural areas. Through Wakala Digital, agro-dealers can manage their inventory, track sales, and reorder stock. Wakala Digital enhances the affordability and accessibility of inputs for smallholder farmers.



- AGRA has developed a knowledge platform, the Spatiotemporal Agribusiness Framework (SAF) that leverages geo-agronomic data to provide actionable insights for the rice value chain. The platform collects and analyzes data related to soil quality, weather patterns, and crop performance. By profiling farmers and connecting them with agribusinesses, the platform enables informed decision-making at various stages of the rice value chain. Farmers can access customized recommendations for crop management, pest control, and market opportunities based on their specific location and conditions.
- AGRA's Village Based Advisors (VBAs) initiative involves training lead farmers to act as extension officers and deliver essential services to farmers in remote areas. AGRA partners with Cropin, a technology company, to digitize VBAs' operations. Through digital tools and mobile applications, VBAs can efficiently collect and manage data related to farmer profiles, crop performance, and market trends. This digitization enables timely and targeted delivery of extension services, inputs, and market information to farmers.
- In 2021, AGRA piloted T-HAKIKI, which was later adopted by the Tanzania Official Seed Certification Institute (TOSCI) and became E-HAKIKI. This initiative works to reduce the prevalence of counterfeit and adulterated agricultural inputs by creating awareness on how to identify genuine inputs (seed) using mobile phones.

These initiatives seek to contribute to enhancing the efficiency, knowledge access, and market opportunities for smallholder farmers in Tanzania.

CASE STUDY: YEESI LAB AT SOKOINE UNIVERSITY OF AGRICULTURE AND USAID BUILDING DOMESTIC CAPACITY FOR FRONTIER TECH IN DIGITAL AGRICULTURE

In the context of Tanzania's nascent digital agriculture ecosystem, building domestic capacity in frontier technologies is crucial to unlock the full transformative potential of digital agriculture. One notable initiative addressing this challenge is the Youth Empowerment through Establishment of Social Innovation (YEESI) Lab, part of the Electronics and Precision Agriculture (EPA) Lab at the Department of Agricultural Engineering, Sokoine University of Agriculture (SUA). YEESI focuses on developing solutions leveraging frontier technologies, particularly machine vision, to address agricultural challenges such as pest and disease management.

The YEESI Lab provides a dedicated space for students to meet, collaborate, and access tools necessary for developing innovative solutions. One of the key applications in development leverages machine vision for disease detection and classification, weed classification, crop seedlings stand count, and yield estimation. Another is a robotic sprayer for chemicals to reduce health risks and automate tasks that may be challenging for smallholder farmers. Other areas of research include the use of Large Language Models (LLMs) and Natural Language Processing (NLP) to enable generative AI advisories.

USAID plays a crucial role in supporting YEESI's efforts through funding of US\$157,000, provided through the Partnerships for Enhanced Engagement in Research (PEER) program. This funding has been used to support YEESI's operations, including stakeholder meetings, development of datasets, and running hackathons and workshops. Moreover, YEESI's success has attracted additional funding from organizations such as the Global Challenges Research Fund (GCRF), UK Research and Innovation (UKRI), the African Research Universities Alliance (ARUA), the German Federal Ministry of Education and Research (BMBF), and the United Nations Educational, Scientific and Cultural Organization (UNESCO).

The case of YEESI highlights the importance of funding and supporting research and development (R&D) labs dedicated to advancing frontier technologies in Tanzania. It also underscores the need for partnerships between academia, innovation hubs, and the private sector to commercialize ideas and bring them to market.



4.3. INVESTMENT ACTIVITY AND STARTUPS IN DIGITAL AGRICULTURE

The startup sector plays a unique and vital role in the digital agriculture ecosystem of African countries, including Tanzania. Successful agtech startups, like Twiga Foods in Kenya and DeHaat in India, bring agility, innovation, and a deep understanding of technology to address the specific needs of farmers and other agriculture stakeholders. Agtech startups are unique in their nimbleness and ability to quickly adapt to changing market dynamics and emerging challenges.

In Tanzania, the agtech startup sector is quite nascent. In particular, the investment landscape for agtechs lags considerably behind other African markets. Over the last six years, the cumulative publically reported amount invested in Tanzanian agtech startups is approximately US\$4 million. This falls drastically short compared to leading African markets. According to AgFunder, who has tracked 150 agtech investment deals for Africa in 2022, the average value of a single individual investment was US\$3.2 million.⁶⁵

FIGURE 28: INVESTMENT DEALS IN TANZANIAN AGTECHS (2017–2023)

ORGANIZATION	YEAR	VALUE (US\$)	INVESTOR(S)
East African Fruits	2020	3,100,000	Goodwell Investments, Finca Ventures, elea
YYTZ Agro-Processing	2017	500,000	Africa Enterprise Challenge Fund
Digital Mobile Africa	2020	200,000	Mastercard Foundation Fund for Rural Prosperity
Flamingo Foods	2023	110,000	develoPPP ventures (GIZ)
Phema Agri	2020	50,000	GoGettaz
Kilimo Fresh	2020	50,000	MEST Africa
Total value of investments		4,010,000	

SOURCE: [Crunchbase](#).

FIGURE 29: INVESTMENT DEALS IN AFRICAN AGTECHS

COUNTRY	VALUE (US\$)	DEALS	AVERAGE DEAL
Nigeria	147,800,000	38	3,889,474
Egypt	186,100,000	36	5,169,444
Kenya	88,500,000	32	2,765,625
South Africa	22,100,000	14	1,578,571
Morocco	15,400,000	7	2,200,000
Ghana	2,400,000	5	480,000
Rest	20,000,000	18	1,111,111
Totals	482,300,000	150	3,215,333

SOURCE: AgFunder.⁶⁶

⁶⁵ AgFunder (2022), [2022 Africa AgriFoodTech Investment Report](#).

⁶⁶ AgFunder (2022), [2022 Africa AgriFoodTech Investment Report](#).



The comparatively lower reported investment in Tanzanian agtech startups indicates that the sector is still in its early stages of growth. This was also reflected in interviews with several agtech startups, both in Tanzania and regional standouts who had experience in Tanzania. To fully realize the potential of agtech startups, it is crucial to attract more investment and create an enabling environment for them to flourish. Interviews highlighted efforts being made to create a more conducive business environment, notably through the preparation of the Tanzania Startup Act. The proposed legislation would address processes in startup registration, levies, and taxes and to advocate for tax exemption. A Baseline Comparative Study has been conducted to identify specific current policy challenges, which is informing the ongoing drafting of the Tanzania Startup Act.⁶⁷

Improving the business environment also involves providing support, platforms, and networks for startups to connect with investors and raise growth-stage funding. According to the interviews, the majority of funding to agtech startups in Tanzania is for the early stages of prototyping and piloting, often in the form of grants. This has led to many digital agriculture solutions that have been successfully piloted in Tanzania but do not have the capital to scale up. The WFP Innovation Accelerator also highlighted how there is often a mismatch between donor funding timelines and the reality of the agriculture sector. Donors tend to provide short-term funding, as they need to report program results relatively quickly, compared to the pace of growth of agtechs, which are dependent on agricultural cycles and the pace of business in rural areas.

4.4. DIGITAL HUBS SUPPORTING AGRICULTURAL INNOVATION

In Tanzania, the presence of incubators and accelerators supporting startups with mentorship, training, capacity building, and networks, is on the rise. There are more than 40 such startup hubs across the country, with the highest share in the leading commercial city of Dar es Salaam, followed by Arusha Mbeya.⁶⁸ These organizations tend to support entrepreneurs through specific programs, some which have specific themes, such as a sector, stage, or gender, while others are open to all types of entrepreneurs.

Agtech-specific startup programs have domain-specific knowledge and expertise that enable them to provide focused guidance to startups operating in the agricultural domain. This support can better help them address industry-specific hurdles, such as knowledge on the process to obtain food certifications, managing farmer-facing agent networks, and how to design digital solutions for smallholders with low digital literacy. These programs often have established networks of experts, funders, mentors, and industry players with extensive knowledge and experience in agriculture, such as facilitating connections for startups to farmer organizations like TAHA or the Ministry of Agriculture. This network can develop into an invaluable asset for startups as it grants access to relevant stakeholders, potential customers, and funders who possess a deep understanding of the specific requirements and potential impact of agtech solutions for the country.

Although domain-specific support is vital for agtech startups, and the agriculture sector is among the top three sectors supported by innovation hubs in Tanzania (based on the number of startups and funding raised), our research revealed that the majority of this support comes from sector-agnostic programs. This suggests that agtech startups in Tanzania may not be receiving the type of support they need to succeed.⁶⁹

The following are examples of agtech-specific programs from different hubs in Tanzania.

The **WFP Innovation Accelerator** was established with the aim of identifying and scaling innovative solutions to achieve Sustainable Development Goal (SDG) 2 (Zero Hunger). The WFP Innovation Accelerator provides capacity building through training, funding opportunities, and market linkages within the WFP network. For example, the WFP-X Moonshot Launchpad program supported nine startups addressing urban food security in 2021. An example of an agtech startup previously supported by WFP is NINAYO, an online platform connecting smallholder farmers to buyers and agro dealers leveraging WhatsApp groups and USSD codes.

67 USAID (2023), [DECA: Tanzania](#).

68 Human Development Innovation Fund (2020), [Catalyzing and Scaling Innovation in Tanzania](#); Tanzania Startup Association (2023), [Tanzania Startup Ecosystem Report 2022](#).

69 Tanzania Startup Association (2023), [Tanzania Startup Ecosystem Report 2022](#); GSMA (2023), [Tanzania's Digitalisation Journey: Opportunities for Value Creation](#).



Another prominent innovation hub in Tanzania is the **Westerwelle Startup Haus Arusha (WSHA)**, formerly Ubuntu Hub and currently part of the international Westerwelle Foundation network. Located in Arusha, WSHA offers coworking space, capacity-building programs, and a supportive community for entrepreneurs. In collaboration with Agriedo Hub and Smartcore Enterprise, WSHA implemented the DigiTrade Agribusiness program in 2020. This digital skills accelerator trained over 200 agripreneurs in Arusha and Iringa, providing them with the necessary tools to leverage digital technologies for business growth, including digital marketing and e-commerce.

Sahara Ventures is another notable consulting firm that designs and manages programs to promote innovation and entrepreneurship in Tanzania, with a specific focus on ICT. Sahara Ventures has run agtech-focused acceleration programs such as e-Kilimo and Lishe Accelerators, which support enterprises providing agriculture and nutrition solutions. The e-Kilimo program, funded by the Royal Dutch Embassy, aims to build the capacity of agtech startups using advanced technologies like drones and blockchain. It offers training and seed funding disbursement of US\$20,000 to selected startups.

These innovation hubs aim to nurture and grow agtech startups in Tanzania. However, further efforts and resources are needed to bridge the gap between agtech startups and investors, enabling greater access to growth-stage funding and fostering the sustainable development of the digital agriculture ecosystem in the country.





5.

**DRIVERS OF CHANGE AND
EVOLVING TRENDS IN THE
DIGITAL AGRICULTURE
ECOSYSTEM**





5. DRIVERS OF CHANGE AND EVOLVING TRENDS IN THE DIGITAL AGRICULTURE ECOSYSTEM

5.1. DIGITAL AGRICULTURE SERVICES USE-CASE FRAMEWORK

To develop a comprehensive understanding of Tanzania’s digital agriculture landscape, we turn to a global framework derived from extensive research and insights presented in the GSMA 2020 report Digital Agriculture Maps and CTA’s 2019 The Digitalisation of African Agriculture Report. By adopting this framework, we can analyze and assess the Tanzanian context within the broader global digital agriculture ecosystem.

FIGURE 30: DIGITAL AGRICULTURE SERVICES SEGMENTATION FRAMEWORK

USE CASE	DIGITAL ADVISORY	AGRI DFS	AGRI E-COMMERCE	DIGITAL PROCUREMENT	SMART FARMING
Key challenges addressed	Agriculture knowledge gap Climate change	Financial exclusion	Poor access to markets (inputs and harvest)	Poor access to markets (B2B harvest)	Climate change Financial exclusion
Value proposition	Access to information	Access to finances	Access to markets	Access to markets	Access to assets
Brief	Dissemination of agricultural information through USSD, SMS, etc., which is increasingly using data to provide more specific advice.	Provision of financial services through mobile phones including payment, savings, credit, and insurance.	Open selling of agriculture produce through 2-sided e-commerce platforms connecting consumers directly to farmers.	Purchasing of agriculture produce by agribusiness from farmers through digital platforms, facilitating digital recordkeeping and traceability.	Using digitally connected (IoT) equipment (e.g., sensors, tractors, drones, etc.), through digital platforms allowing sharing/ rental use.

SOURCE: GSMA, CTA.⁷⁰

Throughout our research we identify several key common barriers impeding the scale of digital agriculture services in Tanzania. These barriers have distinct impacts on each of the five use-case categories.

**KEY BARRIERS:**

1. **LACK OF CENTRALIZED FARMER REGISTRIES.** The absence of comprehensive farm and farmer databases results in fragmented and underutilized data, hindering effective agricultural planning, targeted support, and service harmonization.
2. **LOW MOBILE AND INTERNET SERVICE ADOPTION.** Limited usage of mobile phones and internet services within the farming community impedes smallholder farmers' access to valuable digital agricultural services and further isolates marginalized farmers.
3. **UNCLEAR PROCESS FOR GOVERNMENTAL CONTENT APPROVAL.** Ambiguity surrounding the procedures for obtaining government approval for agricultural content creates obstacles in disseminating relevant information and resources to farmers.
4. **LOW DOMESTIC PRODUCTION CAPABILITIES FOR SMART FARMING ASSETS.** Inadequate capacity to manufacture smart farming tools and equipment locally leads to reliance on imports, and higher costs and fewer choices for farmers.
5. **LOW FARMER ABILITY TO PAY.** Limited financial capacity among farmers to afford modern agricultural technologies or inputs restricts their access to essential resources for improving productivity and efficiency.
6. **LACK OF GUARANTEE FUNDS FOR AGRI DFS.** The absence of blended financing or first loss guarantee mechanisms to back agricultural DFS discourages conventional lenders to enter the space.

These common barriers are further examined in **Section 6.2**, while the rest of this section examines their applicability to each of the five use cases. Where relevant, this section also explores specific barriers unique to the use-case category.





5.2. TRENDS AND INSIGHTS IN PRIVATE SECTOR INNOVATION IN DIGITAL AGRICULTURE

Analyzing the impact of key barriers to each of the five use-case categories helps to reveal key insights that inform the report's recommendations in **Section 7**.



DIGITAL ADVISORY

Digital advisory encompasses a range of content-centric services accessible to farmers via 2G (SMS, IVR, OBD, USSD, call center) and 3G (apps and multimedia) channels. These services equip smallholder farmers with vital information, ranging from agronomic and livestock advice and best practices to information on market prices, weather, and climate.

FIGURE 31: DIGITAL ADVISORY

BARRIERS	IMPACT	EXAMPLE SERVICE PROVIDERS IN TANZANIA
1. Lack of centralized farmer registries	High	
2. Low mobile and internet service adoption	High	
3. Unclear process for content approval from government	High	
4. Low domestic production capabilities for smart farming assets	N/A	
5. Low farmer ability to pay	Medium	
6. Lack of guarantee funds for agri DFS	N/A	

Consistent with regional trends, most providers of digital agriculture advisory services we spoke with in Tanzania integrate their advisory service with other digital agriculture offerings. For instance, Acre Africa incorporates digital advisories into their core service—digital agriculture insurance—to mitigate risks for farmers who hold insurance policies. Vodacom combines their digital procurement service with digital advisories, collaborating with agribusinesses interested in promoting good agricultural practices among their supplier farmers. On the other hand, eHakiki and TAHA stand out as organizations that focus on providing standalone digital advisories. eHakiki specializes in digital product verification, while TAHA operates a WhatsApp chatbot for farmers (see **Section 7.2**).

The majority of digital advisory services in Tanzania are delivered via SMS or USSD in order to reach the many smallholder farmers with basic feature phones. This is the approach taken by the government's digital advisory service, M-Kilimo, and even in the private sector with services such as M-Kulima (Vodacom), Agrinfo, and Maza Hub. Internet-based digital advisory is being used by TAHA through WhatsApp and by Justdiggit through a mobile application which allows for more content, such as images.



As reported by interview respondents, key barriers impeding the scale of digital advisory services in Tanzania include the lack of centralized farmer registries, low mobile service adoption, and unclear content approval process.

Interviews with digital advisory service providers emphasized that the absence of centralized farmer registries makes it difficult for them to identify potential users and customized advisories for them. Without access to this data, providers are required to invest significant time and resources in collecting individual farmer data and maintaining their own farmer profiles. However, some agtech companies, like Agrinfo, have addressed this challenge by using drones to gather real-time farm-level data. This enables them to deliver tailored advisory messages based on specific conditions such as soil health, plant growth, pests and diseases, and weather conditions. By utilizing such data-driven approaches, service providers can deliver more accurate and context-specific guidance to farmers.

The limited adoption of basic mobile services, particularly among marginalized smallholder farmers such as women and youth, restricts the accessibility and reach of digital advisory services. This constraint was echoed by the majority of digital advisory service providers we spoke with, including platforms like Tigo Kilimo, the government's M-Kulima, and Vodacom's M-Kilimo. However, some organizations interviewed, such as One Acre Fund and MyAgro, reported incorporating in-person training to facilitate more interactive and personalized advisory support.

Finally, the lack of a clear and streamlined process for approval of advisory content (whether government provided or independently generated) from the government poses another challenge for digital advisory services. Digital advisory service providers repeatedly shared the lack of clarity on the requirements to obtain approvals from government bodies, including some local governments, Ministry of Agriculture, Tanzania Meteorological Authority, and the National Bureau of Statistics (NBS). This complex approval process can be time-consuming and costly for service providers, resulting in delays in disseminating accurate and timely advisory information to farmers. Simplifying and streamlining the content approval process could significantly enhance the efficiency and effectiveness of digital advisory services by enabling timely access to relevant information.



AGRI DIGITAL FINANCIAL SERVICES

Agri digital financial services (agri DFS) provide tailored digital financial solutions for smallholder farmers, including short-term credit, longer-term asset financing, savings products, and crop and livestock insurance.

FIGURE 32: AGRI DIGITAL FINANCIAL SERVICES

BARRIERS	IMPACT	EXAMPLE SERVICE PROVIDERS IN TANZANIA
1. Lack of centralized farmer registries	High	
2. Low mobile and internet service adoption	Medium	
3. Unclear process for content approval from government	Low	
4. Low domestic production capabilities for smart farming assets	Medium	
5. Low farmer ability to pay	Low	
6. Lack of underwriting partners for agri DFS	High	



The landscape of agricultural digital financial services in Tanzania encompasses various service types and value chains. Non-bank providers like Mavuno Tech and Digital Mobile Africa primarily focus on financing inputs, while conventional banks such as CRDB Bank and Equity Bank tend to offer cash loans. One Acre Fund stands out by providing input loans to organized farmer groups, which has shown higher repayment rates. Pula and Acre Africa specialize in offering agricultural insurance services. Notably, MyAgro is a major player in digital savings for smallholders, utilizing mobile money for savings deposits. Digital Mobile Africa also works on digitizing traditional savings groups, providing valuable individual and aggregated data for input demand. However, no providers of long-term asset financing for agricultural assets, such as tractors, irrigation equipment, or livestock, were identified in this research.

Agri DFS in Tanzania face several barriers that hinder their widespread adoption and impact. Most innovators we spoke with felt that the lack of up-to-date and accurate farmer data is one of the most significant challenges. Access to reliable profile data on farmers and their farming activities is crucial for assessing creditworthiness and designing tailored financial solutions.

To address this data challenge, innovative approaches are being employed. Companies like Mavuno Technologies and One Acre Fund are leveraging advanced technologies such as satellite imagery and machine learning algorithms to map farms, identify individual farmers, and gather essential data points. This data-driven approach enables these providers to make more informed credit decisions, extend financing to farmers based on their actual needs and capabilities, and reduce some risks.

Another critical barrier reported by agri DFS providers we interviewed in Tanzania is the lack of guarantee funds for lending. Many traditional financial institutions and underwriters perceive smallholder farmers as high-risk borrowers, which limits their willingness to invest. However, some well-established banks are finding ways to overcome this challenge. CRDB Bank, for example, has formed guarantee partnerships with institutions like the Tanzania Agriculture Development Bank (TADB) and the Agriculture Africa Guarantee Fund (AAGF). These partnerships provide a level of assurance and risk mitigation, encouraging underwriters to extend credit to smallholders.

CRDB Bank has taken additional steps to de-risk smallholders by increasing their access to markets. Leveraging their client relationships with large agribusiness clients, CRDB Bank matches these buyers of crops with networks of smallholder producers. Through procurement agreements, smallholders are provided with a more reliable market for their harvest, reducing the risk of not being able to sell their produce and enhancing their creditworthiness.

While these examples demonstrate successful efforts in overcoming the lack of farmer data and underwriting partnerships, there is still a need for further action to bring down these barriers on a larger scale. It requires collaborative efforts from agri DFS providers, financial institutions, government agencies, and development partners to create an enabling ecosystem that supports data collection, promotes risk-sharing mechanisms, and encourages the participation of a wider range of digital service providers in offering agri DFS.



CASE STUDY: MAVUNO TECHNOLOGIES: AGRICULTURAL DFS FOR TANZANIAN CASHEW FARMERS

In Tanzania, a leading producer of cashew nuts in the region, farmers often lack access to affordable pesticides and fertilizers to manage problematic diseases such as anthracnose, foliar blight, fruit rot, and gummosis. To address this issue, Mavuno Technologies leverages satellite imagery and machine learning to calculate the amount of sulfur each farmer needs for optimum growth, generates credit scores, and enables access to necessary pesticides on credit. Farmers access the service via USSD and pay affordable monthly installments deducted from their increased earnings.

Cashew farmers earn, on average, US\$500 per year without the assistance of Mavuno's services. However, farmers utilizing the Mavuno service, which costs about US\$250, have reported their yields and income doubling. In this case, farmers' earnings increase to US\$1,000 after using Mavuno's services. Accounting for the service cost, they still experience a significant 50% rise in their income.

To date, more than 9,000 cashew farmers have registered on the Mavuno Technologies platform, and they have supplied 600 tons of sulfur powder.

Currently, Mavuno Technologies carries the financial risk on their own balance sheet and are actively seeking underwriting partners, both commercial and development organizations, to support them to scale their offering. They are also exploring partnerships with banks and peer-to-peer lending platforms. The company aims to incorporate additional data sources, such as census data and weather data, to enhance their machine learning models' accuracy.

CASE STUDY: CRDB BANK: DRIVING CLIMATE-SMART AGRICULTURE FINANCING

CRDB Bank, in collaboration with the Green Climate Fund (GCF), has established a new partnership focused on climate financing for smallholders. GCF is providing US\$100 million, which CRDB Bank is matching with an additional US\$100 million. This joint fund aims to support farmers practicing climate-smart agriculture, with 70% allocated for lending and 30% for a credit guarantee facility and insurance. The fund will also help unlock other credit facilities through additional guarantee facilities.

As part of this initiative, CRDB Bank has launched the Tanzania Agriculture Climate Adaptation Technology Deployment Programme (TACATDP), a US\$200 million program co-financed with GCF. TACATDP provides a lending and de-risking facility to facilitate access to climate adaptation technologies for farmers and agribusinesses, targeting 6.1 million beneficiaries.

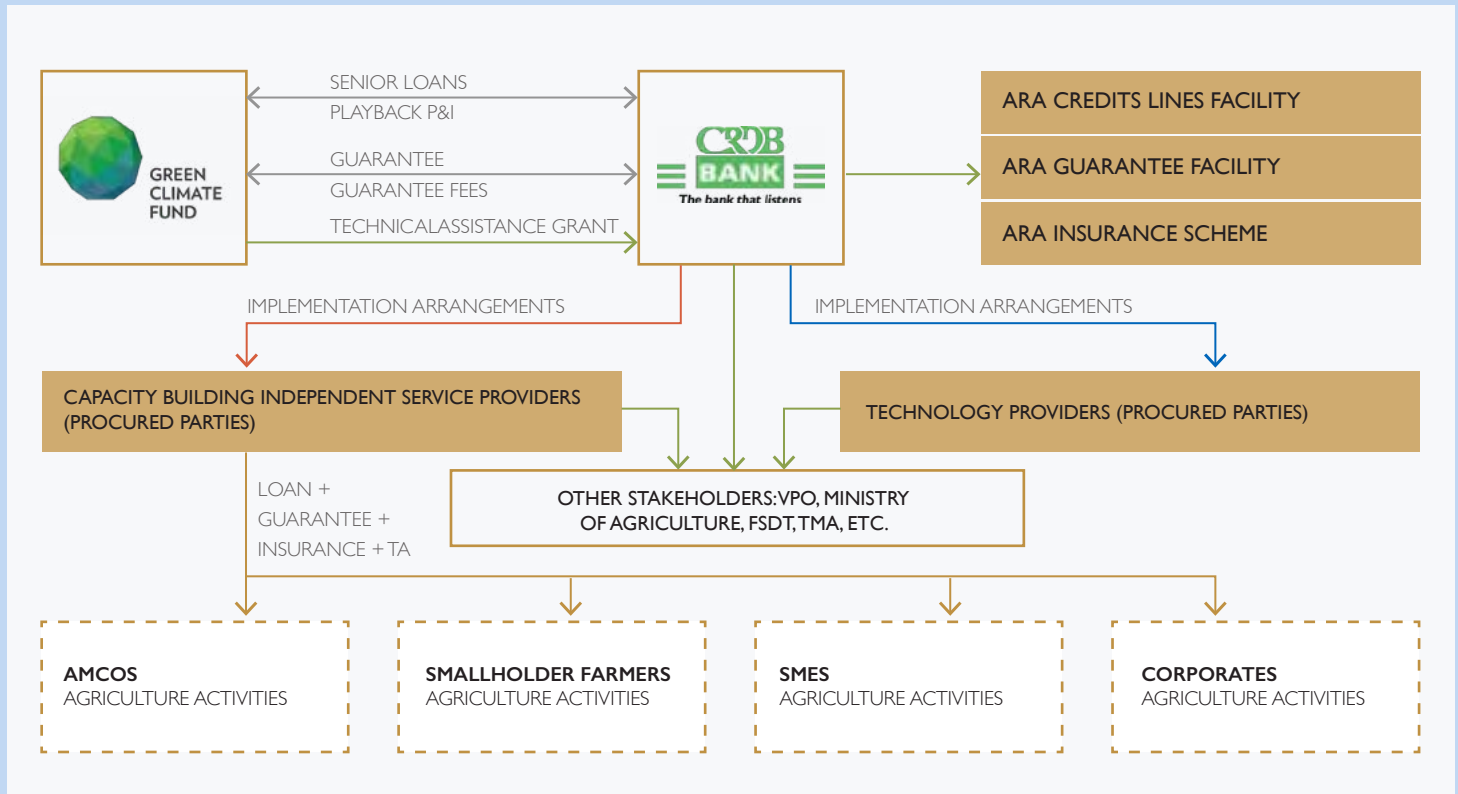
Leveraging concessional resources from GCF, CRDB Bank will introduce three new financial products to support local agribusinesses:

1. **A DEDICATED CREDIT LINE** specifically designed to finance climate adaptation technologies and practices.
2. **A CREDIT GUARANTEE FACILITY** that aims to expand access to financing for new borrowers.
3. **A WEATHER-INDEXED INSURANCE** product that offers protection against losses caused by climate-related events.

By offering these financial products, CRDB Bank aims to de-risk financing for smallholder farmers and promote climate-smart agriculture. They have also formed partnerships with organizations like Private Agriculture Sector Support (PASS), TADB, and AAGF to further enhance de-risking efforts. Additionally, CRDB Bank facilitates market linkages between smallholder producers and large agribusiness buyers to reduce the risk of limited offtake market opportunities.



FIGURE 33: TACATDP FUND FLOW STRUCTURE



Source: Green Climate Fund, 2021, Tanzania Agriculture Climate Adaptation Technology Deployment Programme (TACATDP)





AGRI E-COMMERCE

Agri e-commerce services refer to digital platforms that facilitate the buying and selling of agricultural outputs (agriculture commodities) and inputs (seeds, fertilizers, pesticides/herbicides).

These platforms provide farmers with:

- Expanded market access, allowing them to reach a wide range of customers, including end consumers and businesses.
- Convenient sourcing of essential agricultural inputs from suppliers, enhancing efficiency and profitability in the agricultural value chain.

FIGURE 34: AGRI E-COMMERCE

BARRIERS	IMPACT		EXAMPLE SERVICE PROVIDERS IN TANZANIA
1. Lack of centralized farmer registries	Low		
2. Low internet coverage and basic mobile service adoption	High		
3. Unclear process for content approval from government	Low		
4. Low domestic production capabilities for smart farming assets	N/A		
	AGRI E-COMMERCE OUTPUTS	AGRI E-COMMERCE INPUTS	
5. Low farmer ability to pay	Medium	High	
6. Lack of guarantee funds for agri DFS	Medium	High	

Agricultural e-commerce in Tanzania is still in its early stages, with a limited number of platforms operating in the country. The most popular e-commerce model facilitates the sale of agricultural produce from farmers to consumers and businesses, as well as the sale of agricultural inputs to farmers from input suppliers. Some examples of this model come from Digital Mobile Africa, Ubia Soko, and mFarming.

Despite these initiatives, agri e-commerce (for both inputs and outputs) faces several common barriers to scaling, including weak logistics infrastructure (e.g., roads, transport, and storage facilities) and low mobile and internet service adoption, as explored during interviews with FAO and AGRA.

Agri e-commerce relies heavily on logistics infrastructure (transport and storage) for the efficient fulfillment of orders from online transactions. The World Bank's Logistics Performance Index highlights this weakness with Sub-Saharan Africa, including countries like Tanzania, Uganda, and Kenya, scoring relatively low. This lack of logistics infrastructure, especially in rural areas, increases the risk of post-harvest wastage. Agri e-commerce providers we spoke to explained how investing in geographically disbursed logistics infrastructure is capital intensive and significantly impacts their business model.

Limited access to mobile and internet services among smallholder farmers restricts their ability to fully utilize agri e-commerce platforms. Digital literacy skills are essential for updating product information, engaging with potential customers or suppliers, and managing transactions effectively. To bridge this gap, agtech companies are deploying a network of digitally literate agents who assist farmers in using the platforms. For instance, Digital Mobile Africa's "Village Digital Agents (VIDA)" model employs individuals with digital expertise, such as agronomist graduates or agro dealers, to enable agri e-commerce by aggregating farmer demand for inputs and connecting them with suppliers.



Barriers specific to agri e-commerce for inputs include low farmer ability to pay and lack of guarantee funds for agri DFS.

Affordability becomes a significant barrier for farmers seeking to engage in agri e-commerce for inputs. If farmers lack the financial means to purchase essential inputs, such as seeds and fertilizers, their participation in the digital marketplace is impeded.

Agri DFS play a crucial role in providing credit to farmers for purchasing inputs on credit through agri ecommerce platforms. However, the availability of guarantee funds for agri DFS is essential, which was the consensus among interviews conducted with traditional and digital financial service providers. Without sufficient funds, agri DFS providers may face challenges in extending credit to farmers, hindering their ability to participate in agri e-commerce for inputs.

CASE STUDY: DIGITAL MOBILE AFRICA: PROVIDING FARMERS WITH A BUNDLE OF SERVICES TO SUCCESSFULLY PARTICIPATE IN MARKETS

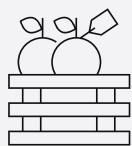
Digital Mobile Africa (DMA) aims to be the “digital operating system” for agriculture and has developed a digital platform, complemented by an agent network, for smallholders. Consistent with global trends, DMA offers a bundle of services for farmers to sell their products, buy necessary inputs, and access credit. This approach of bundling complimentary services and utilizing agent networks is especially valuable for agricultural e-commerce in African markets. It addresses crucial challenges faced by farmers in participating in e-commerce, such as limited access to information, inputs, credit, logistics, and more.

Key to driving adoption among farmers is a network of trained agents who act as the link between smallholder farmers and the digital ecosystem. These agents, predominantly youth, are selected based on their passion for agriculture and their aptitude for technology. Equipped with Android devices, they serve as DMA's extension service officers, bringing essential inputs, knowledge, markets, and finance directly to the farmers.

HOW THE PLATFORM WORKS:

1. **INPUT SUPPLY:** Farmers place orders with agents who aggregate orders and post them on the platform enabling input suppliers to fulfill them efficiently.
2. **ADVISORY SERVICES:** Agents equipped with smartphones leverage real-time data to provide farmers with crucial information, such as weather updates, recommendations on suitable seeds, and optimal planting practices.
3. **ACCESS TO MARKETS:** Agents help farmers post their agricultural commodities on the platform and sell their produce to hotels, restaurants, and grocers, eliminating the need for intermediaries. DMA facilitates secure transactions by integrating a mobile wallet linked to the platform, ensuring farmers receive prompt and fair payment for their products.
4. **FINANCIAL SOLUTIONS:** DMA collaborates with partner banks like Equity Bank to provide smallholder farmers with access to credit. By sharing relevant data, such as farmers' planting history, farm size, and sales records, DMA helps banks assess the creditworthiness of farmers.

DMA's network of VIDA and bundled approach seek to support farmers with access to markets, knowledge, and financial services, and also act as an enabler for agriculture ecommerce and for other services providers to extend their reach to smallholders.



DIGITAL PROCUREMENT

Digital procurement solutions aim to enhance transparency, efficiency, and profitability in agricultural value chain transactions by transitioning from paper to digital records and integrating secure and convenient digital payments, streamlining the procurement process. Traceable digital records enable end-to-end tracking of produce, ensuring transparency from farm to consumer.

FIGURE 35: DIGITAL PROCUREMENT

BARRIERS	IMPACT	EXAMPLE SERVICE PROVIDERS IN TANZANIA
1. Lack of centralized farmer registries	Medium	
2. Low mobile and internet service adoption	Medium	
3. Unclear process for content approval from government	Low	
4. Low domestic production capabilities for smart farming assets	N/A	
5. Low farmer ability to pay	Low	
6. Lack of guarantee funds for agri DFS	Low	

Digital procurement in Tanzania has shown great progress in overcoming barriers and scaling, making it one of the most successful use case categories in the digital agriculture landscape, as noted during the GSMA interview. This is due, in large part, to the business-to-business nature, which sets it apart from other use cases predominantly focused on business-to-consumer/farmer interactions. One of the key drivers of this use case are the progressive agribusinesses and cooperatives that have already organized a large number of farmers into groups and maintain established relationships with them. Leveraging these existing structures, digital agriculture service providers find compelling opportunities to digitize the pre-existing activities, such as procurement and payment. This approach proves to be cost-effective and efficient, eliminating the need for individually identifying farmers, establishing new relationships, and registering them, thereby streamlining the digitization process.

Noteworthy examples of digital procurement and payment initiatives include Vodacom and Alliance Ginneries, which have digitized cotton transactions and Tigo, in partnership with both Kikamagu Coffee union (in Kagera Region) and Masasi-Mtwara Co-operative Union, in digitizing coffee and cashew-nuts payments, respectively. This use case has also been applied to high-value export crops like vanilla, where SourceTrace and Natural Extracts Industries (NEI) have worked to bring transparency and traceability to the vanilla value chain, ensuring better compliance with stringent production standards. Nonetheless, our interviews revealed challenges to widespread adoption of digital procurement solutions remain, such as the lack of farmer data and low mobile service adoption, which still need to be addressed.

One of the key challenges is the absence of accurate and up-to-date farmer data, which poses difficulties in reaching and effectively engaging with farmers. Having profile data on farmers is crucial for payments, transparency, and traceability in digital procurement. M-Kulima, developed by Vodacom, initially faced low uptake because agribusinesses did not have access to digitized farmer data. They took on the time-consuming and capital-intensive



process of profiling each farmer. However, alternative strategies have emerged to mitigate this challenge. Vodacom later implemented self-registration of farmers through USSD, allowing farmers to enter their own data using their feature phones. Additionally, some digital procurement services leverage existing records from farmer cooperatives or crop boards, particularly for regulated crops such as cotton, cashew nuts, and coffee, where farmers sell through these entities that may have non-digitized procurement data.

Limited connectivity and low adoption of basic services among the rural population in Tanzania also hinder the accessibility of digital platforms for farmers. This barrier prevents the seamless integration of digital payment systems, communication channels, and procurement platforms. M-Kulima, for example, encountered connectivity challenges and had to develop offline functionality as an alternative in areas without network coverage. To overcome this challenge and fully unlock the potential of digital procurement, it is crucial to enhance internet coverage, access to devices and promote digital literacy among rural communities.

CASE STUDY: DIGITIZING PROCUREMENT: CASH CROPS VS HIGH VALUE CROPS

In the context of digital procurement in Tanzania's agriculture sector, two examples highlight the distinct needs of different value chains.

Alliance Gineries, a leading cotton processing company operating in the Lake Zone of Tanzania working with up to 50,000 farmers, collaborated with Vodacom on digitizing cotton, an export-oriented cash crop. The partnership tackles issues such as cash-handling risks, limited visibility in cotton aggregation, and the absence of a digitized farmer database. Through the M-Kulima solution, accessible via USSD, digital procurement transactions and payments are facilitated using M-Pesa. The benefits of this collaboration include reduced cash-handling risks, improved logistics planning (cotton collection), and enhanced financial inclusion for smallholder cotton farmers.

NEI is an exporter of ethically sourced and sustainably grown vanilla who has partnered with SourceTrace to digitize the vanilla value chain. This collaboration concentrates on enhancing farm management, production tracking, and product traceability for vanilla to meet sustainability requirements. The solution includes farmer registration, tracking distribution of vines, farmer training management, and crop procurement based on grades. By catering to the needs of agribusiness procurement officers and field agents, this partnership has improved transparency and supports the use of sustainable growing practices by their farmers producers.




This comparison demonstrates how the relevancy of digital solutions is met when adapted to meet the specific requirements of different value chains.



SMART FARMING

SMART FARMING involves using sensors, drones, satellites, and other farm assets to gather and transmit real-time data about environmental conditions, crops, animals, and farming practices. By optimizing production processes, minimizing costs, and conserving resources through data-driven solutions, farmers can achieve increased efficiency and productivity.

FIGURE 36: SMART FARMING

BARRIERS	IMPACT	EXAMPLE SERVICE PROVIDERS INTANZANIA
1. Lack of centralized farmer registries	Low	
2. Low internet coverage and basic service adoption	Medium	
3. Unclear process for content approval from government	N/A	
4. Low domestic production capabilities for smart farming assets	High	
5. Low farmer ability to pay	High	
6. Lack of guarantee funds for agri DFS	High	

Relative to the other use-case categories, the smart farming sector in Tanzania is least developed and is still in its early stages, as indicated by the limited number of providers identified in this research. Among them, AgriTechs stands out as one of the few domestic players, specializing in smart greenhouse and hydroponic equipment. However, their services have found a market with commercial farmers rather than smallholders due to affordability, as expressed during the interview with AgriTechs. ImaraTech, which also manufactures agricultural equipment for smallholder farmers in Tanzania, does not incorporate digital technologies to optimize its use beyond social media for marketing. SunCulture, on the other hand, offers solar-powered irrigation products in Tanzania through a distribution pilot with Simusolar. Hello Tractor, a tractor-sharing platform based in Nigeria, also operates in Tanzania for regular operations. These findings highlight the emerging nature of the smart farming sector and the need for further development and adoption of digital technologies for smallholder farmers.

The smart farming equipment providers we spoke with shared how low production capacity (e.g., manufacturing and assembly) in Tanzania poses a challenge for the sector as it increases costs and prevents the realization of economies of scale. Consequently, the high upfront costs associated with smart assets make them unaffordable for many farmers, especially smallholders who typically have limited cash reserves for investments. This affordability issue is what drove AgriTechs to focus primarily on larger farmers who have greater financial capacity.

In other markets, the challenge of low farmer ability to pay has been addressed by implementing pay-as-you-go asset financing models. However, in Tanzania, the lack of available capital for extending long-term asset financing options hinders the widespread adoption of such models as mentioned during the interview with ImaraTech. Without the existence of guarantee funds for agri DFS, startups like ImaraTech face significant risk in leasing out their machines to farmers, as they would bear the loss in the event of default.

To overcome these challenges and promote the adoption of smart farming technologies in Tanzania, there is a need for innovative financing mechanisms that cater to the financial limitations of smallholder farmers. The establishment



of guarantee funds or risk-sharing mechanisms could incentivize agtech startups to provide pay-as-you-go financing options, making smart assets more accessible to a broader range of farmers. Additionally, efforts to enhance domestic production capacity of smart farming technologies would contribute to their availability and affordability, ultimately driving widespread adoption.

CASE STUDY: SUNCULTURE

SunCulture offers solar-powered irrigation systems for smallholder farmers through affordable means via a Pay-As-You-Grow model. The devices are priced between US\$450 and US\$1000 and can be paid through mobile money micro-installments. This financing model enables smallholders to access and afford the smart farming devices, promoting their adoption and enhancing productivity.

SunCulture employs credit scoring to assess applicants' eligibility for its solar irrigation products. Usage data from the devices is also analyzed for donor reporting and to proactively identify potential default risks. To de-risk farmers, SunCulture's Pay-As-You-Grow team includes agronomists who provide agricultural support, and they are piloting technical assistance programs such as soil testing.

SunCulture recently initiated a pilot project in Tanzania through its solar distribution partnership with Simusolar. Although initially cautious about the business environment in Tanzania, SunCulture recognized the country's favorable factors such as a large agriculture sector, potential yield and purchasing power (e.g., ability to make installment payments over time) of smallholders, groundwater availability, and mobile money penetration.

CHALLENGES AND LESSONS LEARNED:

1. **AFFORDABILITY:** Despite SunCulture's efforts to make its products affordable, upfront costs remain a significant barrier for many smallholder farmers. The company recognized the importance of developing innovative financing models to ensure greater accessibility to their solar-powered irrigation systems.
2. **AWARENESS:** Though knowledge of solar irrigation products is growing, it's very low in many regions. Low trust in efficient irrigation methods like sprinklers and drip irrigation is also a big challenge.
3. **TECHNICAL SUPPORT AND MAINTENANCE:** Providing reliable technical support and maintenance services in remote rural areas posed logistical challenges. SunCulture learned the importance of building strong local partnerships to deliver effective after-sales services and timely assistance to farmers.
4. **CULTURAL ADAPTATION:** Adapting SunCulture's products to suit the specific needs and practices of different farming communities required deep understanding and localization. SunCulture emphasized the importance of cultural adaptation and tailored communication strategies to effectively engage with farmers and promote adoption.

5.3. DIGITALLY ENABLED SOLUTIONS ADDRESSING CLIMATE CHANGE

Climate change poses significant challenges to agriculture, impacting farmers worldwide, and is an even greater threat to already vulnerable smallholders across Africa and in Tanzania, as explored in **Section 3.4**. In response to these challenges, there are a range of digitally enabled solutions enabling smallholders to respond, recover, adapt to, and mitigate the impacts of climate change.

Digitally enabled solutions in Tanzania can play a crucial role in enabling both climate mitigation and climate adaptation. They empower farmers to adapt their farming practices, minimize and transfer risks, and better prepare for the changes in weather patterns. These solutions address climate change challenges across different dimensions, ranging from financial services to information services (see **Figure 37**).



FIGURE 37:
DIGITAL SOLUTIONS ENABLING KEY CLIMATE MITIGATION AND ADAPTATION MEASURES

KEY MEASURES	ADAPTATION	MITIGATION	ENABLING DIGITAL FINANCIAL SERVICE FOR THE END USER	SUPPORTING DIGITAL SERVICES FOR THE END USERS
Solar irrigation	✓	✓	PAYGO/ lease/ credit	Precision advisory
Transition to drought resistant crops and varieties	✓		Input financing & savings	Advisory, including seasonal agro-climatic advice
Insurance against extreme weather	✓		Micro-insurance	Financial literacy, weather forecast
Agro-forestry and improving tree cover	✓	✓	Input financing, long-term finance, payments for carbon capture	Agronomy advisory services
Improved seasonal and short-term planning	✓	✓	Input financing	Weather forecast, seasonal agro-climatic advice
Improved on-farm practices	✓	✓	Input financing & savings	Agronomy advisory services
Storage & transport solutions	✓	✓	PAYGO/ lease/ credit	Market information, e-commerce
Other renewably powered productive assets, including mechanisation	✓	✓	PAYGO/ lease/ credit	Agronomy advisory services

✓ Direct link

✓ Possible contribution depending on the context

Digital financial services, including innovative pay-as-you-go models, are essential to allow smallholders' access to assets, including productive energy assets like solar-powered irrigation, controlled environments for crop production (e.g., greenhouses, hydroponic systems), and shared assets (e.g., transport, storage, tractors). When such equipment is powered by renewable energy, there is a direct link to climate mitigation activities. However, in most cases the farm assets enable more efficient use of resources, including water and fertilizer, avoiding crop spoilage and waste; hence, they directly contribute to farmers' ability to adapt to changing climate conditions. Short-term financing and savings also play a critical role in climate adaptation, enabling transition to better inputs, diversification of crops on the farm plot, and transition to agroforestry (when provided in tandem with other necessary support). For example, in Tanzania farmers can obtain loans for drought-resistant seeds through services offered by One Acre Fund.

Another example of a digitally enabled solution for climate adaptation is the utilization of digital channels to provide crop and livestock insurance. By reducing the costs of onboarding customers and expediting payouts, digital platforms enhance smallholders' ability to cope with climate-related shocks like droughts, pests, and floods. For instance, in Tanzania, providers ACRE Africa and Pula offer innovative micro-insurance solutions that provide a safety net for farmers in the face of adverse weather events that result in crop failure.

Almost all climate mitigation and adaptation activities at the smallholder level could benefit from training and extension services, raising awareness and understanding about climate-smart farming practices, improving financial literacy, and providing critical climate information. Through digital platforms, farmers gain access to information on minimum tillage, crop rotation, intercropping, and water management techniques that promote soil health and improve moisture retention. Digital advisory services, such as those provided in Tanzania by Agrinfo, can empower farmers to make informed decisions and adopt sustainable agricultural practices.



CASE STUDY: THE TANZANIA METEOROLOGICAL AUTHORITY

The Tanzania Meteorological Authority (TMA) provides agrometeorological services to support farmers and other users in Tanzania. These services offer information and advisories that assist in planning activities, irrigation scheduling, pest control, fertilizer application, animal husbandry, and fishery management. TMA regularly issues agrometeorological bulletins, published in English and the local language, Swahili, to enhance accessibility.

The bulletins contain details about historical and anticipated weather conditions, along with specific advice for farmers regarding agricultural operations based on these conditions. By receiving timely and accurate information, farmers can make informed decisions to improve their agricultural practices and enhance productivity.

TMA collaborates with the Tanzania Agriculture Research Institutes (TARI) to gather data for agricultural research purposes. This data collection takes place through designated agrometeorological stations across Tanzania, including Hombolo, Tumbi, Ilonga, Kibaha, Naliendele, Mlingano, Lyamungu, Uyole, Mbimba, Kizimbani, Matangatuani, Igeri, and Ukiriguru. These efforts contribute to ongoing research aimed at advancing agricultural practices in the country.

Acknowledging the significance of marine weather forecasts for fishermen and small-craft operators, TMA extends its services to Lake Victoria through the High Impact Weather Lake System (HIGHWAY) project. This initiative involves collaboration with the Uganda National Meteorological Authority (UNMA) and the Kenya Meteorological Department (KMD) to develop an integrated early warning system for the region. The standardized forecasts, including format, content, weather icons, and warning colors, are shared through various channels, including a WhatsApp group involving forecasting offices from UNMA and KMD.

To ensure wide dissemination, TMA employs various channels to share agrometeorological bulletins. Alongside conventional media outlets such as print, television, and radio, TMA utilizes mobile technology to distribute bulletins through FarmSMS, a mobile phone-based service. This approach facilitates convenient access to important agrometeorological information for farmers across Tanzania.

A relatively new and innovative way to apply digital technologies in the context of climate mitigation and adaptation is through connecting farmers practicing agroforestry with voluntary carbon markets, while rewarding them for the transition to climate-smart agriculture. This approach is particularly relevant to Tanzania's commitment to restore 5.2 million hectares of forest cover by 2030.⁷¹

Traditionally since the establishment of voluntary carbon markets, available climate finance did not trickle down to smallholders for a number of reasons explored during interviews with Rabobank and One Acre Fund. One of the main pathways to a certified carbon credit is via on-the-ground verification of biomass and carbon capture. Extremely high transaction costs associated with on-the-ground verification do not work in favor of small farms, hence such projects require significant aggregation, which is viable for larger-scale farms in Europe or the US. In addition, the costs for a project to get the most common certification (e.g., Golden Standard or Verra) are prohibitive for MSMEs, not to mention micro-entrepreneurs (i.e., smallholders). However, recent use of remote sensing in combination with randomized samples of farms for ground-truthing (similar to modern micro-insurance systems using a combination of indices with big data and ground-truthing to determine if the event has happened) reduces the cost per farmer associated with linking them to the carbon markets (see **Rabobank ACORN Case Study**).

71 Arf100, "Tanzania."



CASE STUDY: RABOBANK'S ACORN PROJECT IN TANZANIA: CONNECTING SMALLHOLDERS TO INTERNATIONAL CARBON MARKETS

Rabobank's ACORN project is a standout solution when it comes to connecting farmers to voluntary carbon markets, due to its level of transparency, focus on the farmer, inclusivity, and scale. The methodology used for carbon credit verification and the data on number of participating farmers and carbon credits sold, as well as information on the buyer are all publicly available online in real time. ACORN's platform connects farmers to voluntary carbon markets, aligning with Rabobank's mission to support smallholder farmers and combat climate change. ACORN focuses on transitioning smallholder farmers to agroforestry practices, such as planting fruit trees, to enhance farmer resilience and provide income diversification opportunities. By utilizing GPS coordinates, farmer data, and remote-sensing techniques, ACORN measures the growth of biomass and generates Carbon Removal Units to sell on the market.

Technology plays a vital role in supporting the ACORN project in two main ways. ACORN is currently developing a data collection tool that enables local partners to gather farmer data on the ground in a streamlined way. Remote-sensing data from European satellites is used to monitor changes in vegetation throughout the year. Machine learning models are trained using both remote-sensing data and randomized ground-truthing to analyze and quantify carbon stored in the biomass.

FIGURE 38: KEY METRICS FROM RABOBANK'S ACORN PROJECT IN TANZANIA

PARTICIPATING FARMERS	CO2 CAPTURED	LAND AREA COVERED	CRUS ISSUED
261,106	38,195 t	28,366 ha	38,195

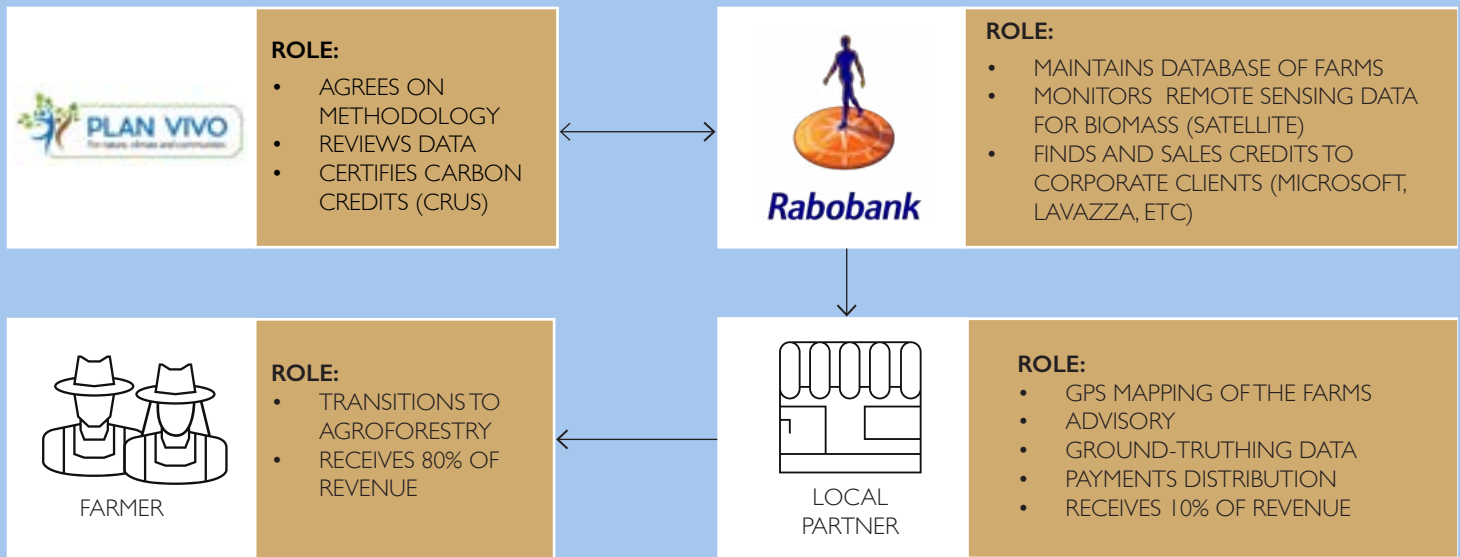
SOURCE: ACORN.⁷²

ACORN follows a unique revenue-sharing model that is centered on the farmer. They allocate 80% of the carbon credit revenue to the farmers, 10% to the local organization to reimburse their effort to collect data and support the farmer in transition to agroforestry through technical assistance, and the remaining 10% for administrative purposes to cover the cost of ACORN's operations. This approach ensures that a significant portion of revenue directly benefits the farmers, promoting income diversification and enhancing their livelihoods.

72 ACORN (2022), "[Kaderes Peasants Development Plc Tanzania Project Data](#)."



FIGURE 39: RABOBANK'S ACORN INITIATIVE:
DIGITAL INNOVATION SUPPORT LINKING FARMERS TO CARBON MARKET



5.4. LESSONS FROM OTHER EAST AFRICAN GOVERNMENTS' WORK IN DIGITAL AGRICULTURE

The Tanzanian government can also learn from the experiences of neighboring governments in promoting digital agriculture.

The Kenyan government in particular has demonstrated a strong commitment to transforming the agricultural sector through its investment and strategic initiatives. In 2019, the Ministry of Agriculture, Livestock, Fisheries, and Irrigation (MoALF&I) launched the ten-year "Agricultural Sector Transformation and Growth Strategy" (ASTGS) to drive transformation in the sector. It focuses on three key anchors to drive transformation.

- **ANCHOR 1:** Increase small-scale farmer, pastoralist, and fisherfolk incomes.
- **ANCHOR 2:** Increase agricultural output and value addition.
- **ANCHOR 3:** Increase household food resilience with a focus on digitization.

Under these anchors, the government has emphasized the use of e-vouchers with digital service delivery for the nationwide subsidy program. This approach streamlines the distribution of agricultural inputs and services to farmers, ensuring efficient and transparent delivery. Additionally, the government has invested in digitally enabled government extension agents, empowering them with digital tools to enhance their reach and effectiveness in providing advisory services to farmers.

Strengthening research and innovation to launch priority digital and data use cases has been another key focus of the government's strategy. By leveraging data-driven insights, decision-making processes and performance management in the agricultural sector can be greatly improved. The establishment of the Agriculture Transformation Office (ATO) demonstrates the government's commitment to coordinating the implementation of the ASTGS effectively.

Supported by considerable investment from the World Bank, the Kenyan government has made significant efforts to digitize key agricultural institutions, such as the Kenya Agricultural Livestock Research Organization (KALRO). KALRO is now seen as a valued partner in the Kenyan agriculture ecosystem due to its quasi-governmental status,



as well as because it hosts much of the research and scientific data on Kenya's agriculture sector. A significant effort has been made to digitize KALRO's data, from reports to research to training and extension materials.

KALRO has around 50 apps⁷³ available to users. The World Bank has invested hundreds of millions of dollars in projects with KALRO, such as the National Agricultural and Rural Inclusive Growth Project⁷⁴ and the Kenya Climate Smart Agriculture Project.⁷⁵ As part of this investment, KALRO has been able to build a database with between 700,000 and 1 million smallholder farmer records, including value chain and geolocation data. Additionally, KALRO has created the Big Data Platform and Kenya Agricultural Observatory Platform (KAOP). KAOP enables users to access weather information via a website or SMS. KALRO has also digitized 650 climate smart agriculture practices across 19 value chains which are available to farmers via an app, IVR, or through a website.

FIGURE 40: THE KENYA AGRICULTURAL OBSERVATORY PLATFORM



By combining and continuously updating data sources, KALRO can provide farmers with more personalized and location-based digital services. These services include access to localized weather information, crop suitability advice, and yield forecasting, enabling farmers to make informed decisions and improve their productivity. Continuous data updating ensures that farmer records are kept current, contributing to high-quality data collection and analysis.

Most recently, the government's efforts to establish the Kenya Integrated Agriculture Management Information System (KIAMIS) received a major boost after it received a grant of US\$5.2 million from the Swedish government.⁷⁶

The Kenyan government's success in the agricultural sector is also attributed to its efforts in building partnerships with the private and public sectors. KALRO has effectively collaborated with several CGIAR centers, leveraging their expertise and resources. Through programs like the Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA) initiative and the One Million Farmer Program supported by the World Bank, KALRO has facilitated partnerships with county governments and private sector agtechs and fintechs. This collaboration creates a trusted environment for sharing farmer data in a central database, eliminating duplication of efforts and resources. KALRO's partnership with Digital Green's FarmStack supports data sharing between parties, further enhancing the data ecosystem in Kenya.

73 KALRO, "Mobile Applications."

74 World Bank, [National Agricultural and Rural Inclusive Growth Project](#).

75 World Bank, [The Kenya Climate Smart Agriculture Project](#).

76 Capital FM (2023), "[Kenya Receives 5.2M USD Grant from Sweden to Aid Agriculture Management Information System.](#)"



6.



KEY FINDINGS



6. KEY FINDINGS

6.1. KEY ENABLERS, DRIVERS, AND SUCCESS FACTORS

The advancement of digital agriculture services in Tanzania is being driven by a number of key enablers, drivers, and success factors that contribute to the scalability and adoption of innovative solutions in the agricultural sector. These include rural agent networks, wide opportunities for collaboration with large-scale farmer groups, existing technology platforms, domestic R&D capacity in frontier technologies, and the emergence of revenue models for carbon capture. These factors collectively contribute to an enabling environment, reduced costs of operation, and opportunities for scale for digital agriculture innovation in Tanzania.

6.1.1 RURAL AGENT NETWORKS

Multiple service providers in the country are building or leveraging agent networks to provide hands-on support for onboarding to their digital agriculture services

One such network is operated by Digital Mobile Africa (DMA) through their Village Digital Agents (VIDA) model, which involves recruiting, training, and equipping rural freelancers with a device and digital app. These agents engage directly with farmers, aggregating demand for inputs or facilitating bulk harvest selling. DMA's strategy includes offering their rural agent network as a service to other providers, further expanding the reach and impact of digital agriculture services overall. DMA's network includes approximately 500 agents.

MyAgro utilizes a proprietary network of Village Entrepreneurs who onboard farmers to their digital savings platform. These rural agents also assist smallholder farmers in using digital tools such as mobile money for making layaway payments for input purchases and receiving SMS-based advice. The digitization of these processes helps reduce ongoing operational costs compared to MyAgro operations in West Africa, where in-person agents are used to collect micro-payments and manage cash.

According to feedback from digital agriculture innovators during our consultations, access to such rural agent networks can facilitate cost-efficient growth for local and international agtechs. For example, iProcure, a Kenya-based digital agricultural input platform, is expanding into Tanzania in 2023 in partnership with the Farm to Market Alliance (FtMA).⁷⁷ iProcure can leverage FtMA's 295 Farmer Service Centres in rural areas across Tanzania for last-mile service delivery.

It's important to note that the availability of rural mobile money agents is an essential enabler for digital payments, credit, and insurance adoption among the farming population, and multiple service providers already benefit from it. There is further potential for MNOs to leverage their existing agent networks and distribution capacity to support the scaling of digital agriculture services. Similar to DMA's VIDA model, offering access to a rural agent network to other digital agriculture service providers can greatly benefit the entire ecosystem.

Opening agent networks to other service providers hasn't been always considered as a business opportunity in the agriculture, financial inclusion, or health space, but rather as a cannibalization threat, as agents get limited time with a customer and conflicting KPIs. Service providers that have dedicated representatives engaging on the ground with farmers tend to observe higher usage of their services. For instance, having exclusive field agents to train agribusinesses or farmer cooperatives on digital procurement leads to increased adoption and engagement. Still, there is hope that there could be a mutually beneficial model in sharing field agents, and if the DMA model of "agents as a service" is successful, there could be more similar service providers entering the market, which would greatly benefit digital agriculture service providers as well as individual farmers.

77 Farm to Market Alliance (2023), "[iProcure Expands to Tanzania, Partners with Farm to Market Alliance to Reach 125K+ Farmers.](#)"



6.1.2. FARMER GROUPS

Another significant driver of scale of digital agriculture services is the opportunity for collaboration with large established farmer groups in Tanzania, particularly Agriculture Marketing Cooperative Societies (AMCOS). These farmer groups offer digital agriculture service providers efficient access to large organized networks of farmers, enabling them to quickly reach a wider user base.

For example, MyAgro shared how they decided to prioritize the Tanzanian market for the deployment of their digital savings solution due to a strategic partnership with the Aga Khan Development Network. This network already had a substantial presence of farmers organized in saving groups. Leveraging this existing customer base allowed MyAgro to onboard a significant number of farmers to their digital savings solution in a cost-efficient manner. The prior established trust and relationships within these farmer groups had a positive effect on both the adoption and usage of MyAgro's digital savings solution.

Agromovil also capitalized on the existence of organized farmer groups in Tanzania by partnering with TAHA and its network of approximately 40,000 farmers. The established trust and credibility of TAHA among farmers played a crucial role in driving the quick adoption of Agromovil's digital solution.

Several innovators we spoke with shared how partnerships with farmer groups not only reduce onboarding costs for digital agriculture service providers but also contribute to maintaining relationships and fostering repeat usage. By working with farmers in groups, providers can also offer services such as input loans by leveraging group liability. One Acre Fund has taken this approach, which has shown improved repayment rates and financial sustainability.

Collaboration with farmer groups, such as AMCOS, presents a valuable opportunity for digital agriculture service providers to tap into established networks, leverage existing trust, and create sustainable relationships with farmers, ultimately driving the adoption and scale of digital agriculture solutions in Tanzania.

“I don't think you can scale a digital agriculture solution in Tanzania without going through cooperatives.”

- GSMA

CASE STUDY: VODACOM M-KULIMA

Vodacom successfully achieved scale by leveraging a range of partnerships, including a government-led fertilizer subsidy program that mandated biometric registration for farmers. By October 2022, Vodacom profiled 625,000 farmers onto their M-Kulima service. However, despite the significant numbers of total users, usage data reveals critical insights into the adoption of the service. Of 625,000 farmers profiled, around 173,000 farmers used the digital advisory service, while approximately 10,000 used digital procurement and payment solutions and 290 accessed insurance services. This leaves a majority of the profiled farmers, nearly 450,000, who did not go beyond basic profiling and have not utilized any additional services.⁷⁸

This disparity highlights the need to address the quality aspect of scaling via partnerships, ensuring that a greater proportion of farmers receive hands-on support and demonstrations to actively benefit from the full range of available digital services.

6.1.3. EXISTING TECHNOLOGY PLATFORMS

The availability and widespread usage of various digital platforms (e.g., mobile networks, messaging apps) among smallholder farmers in Tanzania are supporting the service delivery and rapid scale of digital agricultural services. Service providers are leveraging the familiarity and trust associated with these platforms to efficiently build and maintain a large user base, facilitating the adoption of their digital agriculture solutions.

In Tanzania, several digital service providers, such as TAHA (advisory services) and AFRICOM (machine leasing), have recognized the potential of partnering with MNOs. For example, Tigo has collaborated with these service providers to list their services on the Tigo Pesa USSD menu. This integration takes advantage of the fact that many farmers are already familiar with and actively use the Tigo Pesa mobile money platform, significantly reducing the acquisition and training costs for the service providers. By leveraging the existing infrastructure and user base of Tigo Pesa service, service providers can rapidly reach a wide audience and deliver their services more efficiently.



Furthermore, service providers have also reported an increase in the adoption of their advisory service by integrating with WhatsApp. By utilizing a messaging platform many farmers are already familiar with, they eliminate the need for extensive onboarding and training on how to use the service. This integration not only streamlines the onboarding process but also enhances the overall user experience, allowing farmers to engage with the digital solution via a user-friendly interface.

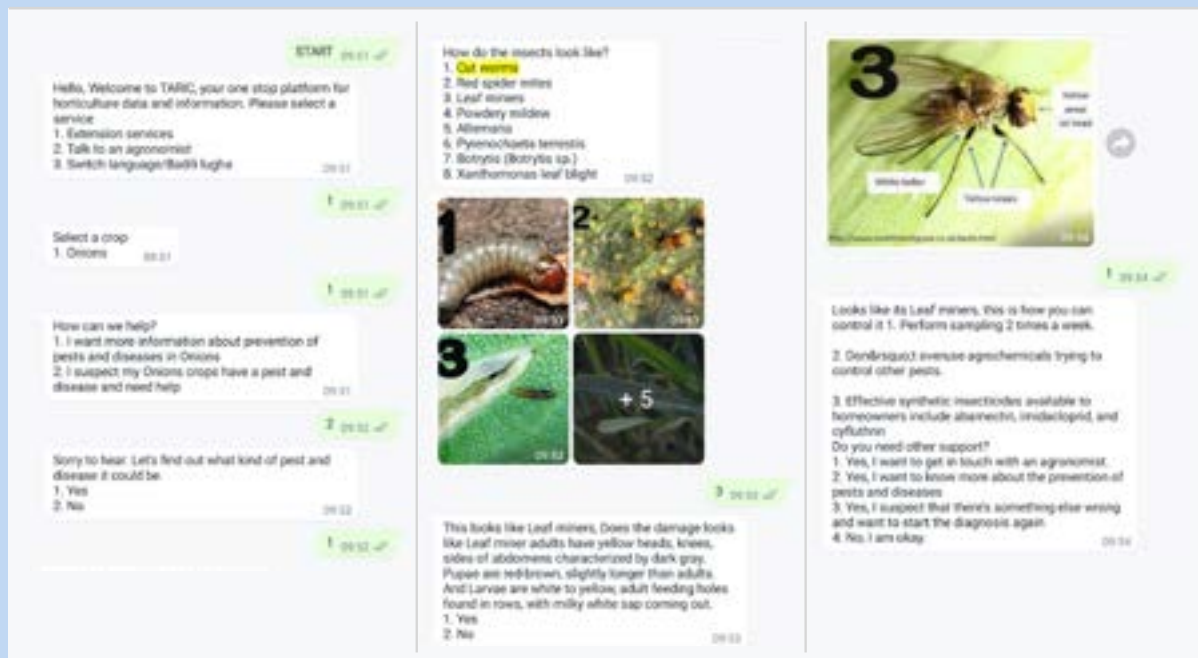
CASE STUDY: TAHA'S WHATAPP CHATBOT

The Tanzania Horticultural Association (TAHA) has developed TARIC Bibi Shamba, a WhatsApp chatbot, to reach a wider range of farmers. This interactive and automated messaging system complements its Android app and YouTube channel and serves as another communication bridge between TAHA and farmers.

The chatbot provides personalized responses and delivers relevant information on a range of topics, including weather updates, pest and disease management advice, market prices, crop-specific recommendations, and agricultural best practices. Some of the key benefits reported by TAHA include:

- Farmers' increased access to customized information for decision-making.
- Reduced costs and resources allocated to organizing physical training sessions and workshops.
- Increased data to generate insights into the needs and trends of farmers, facilitating evidence-based decision-making, targeted interventions, and tailored support.

FIGURE 41: TAHA'S TARIC ADVISORY CHATBOT



It should be noted that the accessibility of these services is closely tied to the limitations of the platforms through which they are offered. For instance, marginalized farmers who lack access to smartphones or are digitally illiterate and cannot use WhatsApp may face limitations in utilizing and benefiting from services like TAHA's WhatsApp-integrated platform. Therefore, it is important to consider alternative service delivery channels that are accessible to marginalized users, such as voice channels, to ensure inclusivity and equitable access to critical services and information.



6.1.4. DOMESTIC RESEARCH AND DEVELOPMENT CAPACITY

Domestic R&D capacity in frontier technologies is key to homegrown innovation and advanced applications relevant to the Tanzanian context.

One such notable local initiative is the Youth Empowerment through Establishment of Social Innovation (YEESI) Lab, located at Sokoine University of Agriculture in Morogoro. YEESI serves as a social impact lab focused on engaging youth in the development of solutions leveraging machine vision, specifically targeting the agriculture sector. The lab has received funding of US\$157,000 through the PEER program from the National Academy of Science, supported by USAID. YEESI also explores other homegrown innovations that address the specific challenges and requirements of the Tanzanian agricultural landscape, such as robotic spraying, the development of an open-source database for disease detection, yield prediction models, an application called Mwangilia that utilizes satellite information to guide daily irrigation decisions, and an NLP (Natural Language Processing)-enabled generative AI chatbot for agriculture. These initiatives aim to leverage cutting-edge technologies to improve productivity, efficiency, and decision-making within the agriculture sector.

Domestic R&D capacity, particularly driven by initiatives like YEESI, empowers Tanzanian youth to develop innovative solutions tailored to the local context. By nurturing homegrown talent and leveraging frontier technologies, Tanzania is fostering a culture of innovation and driving the development of digital agriculture applications that directly address the unique challenges faced by the agricultural sector.

6.1.5 INNOVATIVE APPROACHES TO CARBON CAPTURE REVENUE

The increasing demand and prices for carbon credits in the voluntary carbon market and the proliferation of carbon neutral commitments for 2030 intensify the demand for reliable and verifiable carbon credits. This increasing demand for carbon sequestration projects globally, coupled with availability of remote-sensing technologies (e.g., satellite imagery) and the genuine need to both mitigate climate change and adapt to its impacts, presents a significant opportunity to support smallholder farmers in transitioning to agroforestry practices and climate-smart agriculture.

Agroforestry, which involves integrating trees into agricultural landscapes, provides multiple benefits, including carbon sequestration. By incorporating trees on their farms, smallholders can capture and store carbon dioxide from the atmosphere, contributing to efforts to reduce greenhouse gases. When measured and verified by satellite imagery, in combination with randomized ground-truthing, these carbon sequestration activities can generate carbon credits that can be sold in the voluntary carbon market, or even directly to corporate buyers, while generating a new source of income for smallholders. This approach is exemplified in Tanzania by Rabobank's ACORN project, where smallholder farmers can receive compensation for planting trees (see Rabobank ACORN Case Study).

The innovative nexus of carbon capture revenue, agroforestry practices, and digital agriculture solutions holds great potential for driving sustainable agricultural practices, fostering climate resilience, and supporting the economic well-being of smallholder farmers in Tanzania.



6.2. KEY BARRIERS TO FURTHER SCALE AND ADOPTION OF DIGITAL AGRICULTURE SOLUTIONS

Several key barriers have been observed throughout the research that have been cited as posing challenges to the scale and widespread adoption of digital agriculture solutions in Tanzania. Overcoming these barriers is crucial for advancing and prospering the digital agriculture ecosystem in the country. The barriers discussed here, including the lack of centralized farmer registries, low mobile and internet service adoption, unclear process for content approval from government authorities, low domestic R&D capacity, low farmer ability to pay, and lack of guaranteed funds for agricultural DFS, have been identified through desk research and interviews with key in-country stakeholders.

6.2.1. LACK OF CENTRALIZED FARMER REGISTRIES

One key barrier to the further scale and adoption of digital agriculture solutions in Tanzania is the absence of centralized farmer registries, a concern raised by stakeholders during interviews with the Ministry of Agriculture, Sera Bora, FAO, and AGRA. Farmer registries can serve as a foundation for targeted interventions and customized solutions based on individual farmer context. When such registries incorporate farmer-centric data approaches, as outlined in the report [Farmer-Centric Data Governance: Towards A New Paradigm](#), they can lead to greater data sharing opportunities, prevent fragmentation, improve data quality, and open avenues for innovation.⁷⁹

A farmer-centric approach to developing farmer registries can also provide farmers with greater control over their data, fostering meaningful participation in data activities (e.g., data collection and consent), and strengthen their collective power while ensuring safeguards against privacy invasion, data misuse, and other potential harms.⁸⁰

In the current scenario, each digital agriculture service provider operates its own proprietary databases of farmer data, leading to inconsistencies in data quality. Such fragmented data collection and management prove inefficient and present challenges for all stakeholders involved. In contrast, a farmer-centric approach emphasizes streamlining data collection efforts and eliminating duplication. The government's fertilizer subsidy program in 2022, for instance, necessitated the re-registration of farmers despite existing databases. A centralized and standardized farmer registry system would overcome this issue and enhance data accuracy.

“At the moment each innovator has to come with the muscles to collect, analyze, and store the data. With more integration, different actors could divide the work along the value chain.”

- Agrinfo

“We are all talking about climate change but we don't have clear data about the climate-affected areas in Tanzania, especially for rural areas.”

- MAZAOHUB

Moreover, a significant amount of data is still preserved in paper form within various cooperatives, hindering effective access and utilization. To overcome this limitation, ecosystem stakeholders interviewed advocate for a comprehensive program to digitize farmer cooperatives. This program would prioritize digitizing farmer profiles and procurement data, introducing efficiency and streamlined processes.

⁷⁹ Development Gateway (2023), [Farmer-Centric Data Governance: Towards A New Paradigm](#).

⁸⁰ Development Gateway (2023), [Farmer-Centric Data Governance: Towards A New Paradigm](#).



6.2.2. LOW MOBILE AND INTERNET SERVICE ADOPTION

Another significant barrier to the further scale and adoption of digital agriculture solutions in Tanzania is the limited 3G coverage and adoption of basic mobile services among smallholders. This lack of service adoption and connectivity poses challenges for the effective use of digital agriculture solutions that heavily rely on access to mobile networks.

The high cost of devices and subscription packages is perceived as a significant barrier, preventing the adoption of basic digital services, including those related to agriculture. This affordability barrier is more acute for women and youth. For example, TRIAS, which supports the digitization of farmers' associations in both Tanzania and Uganda, has observed how cheaper costs of mobile devices in Uganda led to higher mobile phone usage rates compared to Tanzania.

Measures should be taken to address the affordability of mobile phones and smartphones, particularly for rural populations. This may involve exploring subsidy programs, reduced taxation on imports, partnerships with device manufacturers, or innovative financing models that make smartphones more accessible and affordable for farmers.

It is also essential to focus efforts to expand internet coverage in rural areas, ensuring that farmers have reliable access to 3G connectivity. This can be achieved through infrastructure development initiatives and collaborations between telecommunications companies, government entities, and other stakeholders. By improving internet accessibility, digital agriculture solutions can reach a broader user base and empower farmers with valuable tools and information.

“The challenge we have is getting phones in the hands of farmers.”

- Agromovil

6.2.3 UNCLEAR PROCESS FOR CONTENT APPROVAL FROM GOVERNMENT AUTHORITIES

Providers of content services often require approval from various government actors to distribute essential content, such as weather updates and agricultural advisories. The unclear process for receiving such approval from Tanzanian government authorities poses a significant barrier to digital advisory services.

During interviews, service providers reported that they are responsible for seeking individual approval from different government institutions, leading to a lack of clear requirements or standardized steps to follow. This fragmented approach to content approval creates uncertainty and delays in the dissemination of vital information to farmers.

In particular, digital agriculture service providers have encountered challenges with unclear and lengthy approval processes from entities such as the Tanzania Meteorological Authority, National Bureau of Statistics, and the Ministry of Agriculture. The lack of streamlined procedures and guidelines hampers the timely delivery of accurate and relevant information to farmers, limiting the effectiveness of digital agriculture solutions.

To overcome this barrier, there is a need for clear and transparent processes to gain approval for agriculture advisories and weather forecasts. Collaboration and coordination between digital agriculture service providers and relevant government authorities are crucial for establishing streamlined approval procedures. This would involve defining specific requirements, steps, and timelines for content approval, ensuring efficient and timely dissemination of information.



6.2.4. LOW DOMESTIC PRODUCTION CAPABILITIES FOR SMART FARMING ASSETS

One of the fundamental barriers to the adoption of smart farming assets (e.g., solar powered irrigation, green house technology, smart threshers and processors, etc.) in Tanzania is the lack of domestic production capacity, as revealed in our analysis of expert interviews. As a result, Tanzania heavily relies on imports, which incurs additional sourcing costs such as shipping and import tariffs, ultimately leading to higher costs for smart farming equipment.

For instance, the importation of water-soluble fertilizers, a key input for greenhouse technology and smart hydroponic systems, is associated with higher costs due to import duties. These increased costs reduce affordability and hinder the widespread adoption of these technologies in Tanzania. For example, AgriTechs, a provider of smart hydroponics equipment, has decided to exclusively target larger farmers who have greater financial capacity for the requisite expensive inputs.

Limited manufacturing capabilities also prevent the realization of economies of scale, which can be achieved through bulk purchases of raw materials and higher utilization rates of fixed assets. This results in higher production costs for locally manufactured equipment, such as maize threshers developed by ImaraTech or robotic sprayers developed by the EPA Lab at SUA.

To address this barrier, there is a need to develop and strengthen domestic production capabilities for smart farming assets in Tanzania. This could involve promoting local manufacturing initiatives, fostering partnerships between technology providers and local manufacturers, and exploring opportunities for technology transfer and knowledge exchange. Where building domestic capacity may not be viable (e.g., specialty or rare components or materials), dramatic reduction in import tariffs should be considered.

6.2.5. LOW FARMER ABILITY TO PAY

A significant barrier to the further scale and adoption of digital agriculture solutions in Tanzania is the low ability of farmers to pay for these technologies (e.g., smartphones and airtime). The smallholder affordability gap widens even further when it comes to acquiring farming assets, which are much more expensive than digital devices and airtime. Pay-as-you-go financing models have the potential to overcome the financial constraints faced by farmers, particularly those with limited upfront capital. By spreading the cost of assets over time, farmers can access and benefit from digital agriculture solutions without facing overwhelming financial burdens.

In many other East African markets, smart farming assets, such as solar irrigation systems, threshers, tractors, and other equipment, come with embedded remote locking technology that enables pay-as-you-go financing models. These models align the farmer's financial obligations with their income-generating activities and provide a mechanism for farmers to access and afford otherwise unaffordable assets.

To facilitate the adoption of pay-as-you-go financing models in smart farming assets, partnerships and collaborations between providers of smart farming assets, mobile money providers, financial institutions, and off-takers are essential. These collaborations can support the development of innovative financing mechanisms and payback schedules compatible with agricultural cycles.

6.2.6. LACK OF GUARANTEE FUNDS FOR AGRIFINANCING

One of the key barriers to scaling agrifinancing is the lack of guarantee funds, which was echoed across interviews with traditional and digital financial service providers, like CRDB Bank and DMA. Financial service providers often perceive lending to the agriculture sector, particularly to smallholder farmers, as risky. This perception hampers their willingness to extend credit to farmers, limiting farmers' access to crucial investment in inputs and smart farming assets, leading to an estimated US\$74.5 billion agriculture financing gap.

In other East African countries, innovative guarantee funds and blended finance schemes have proven effective in reducing risk and encouraging financial service providers to invest in the agriculture sector as well as to offer



financial services to farmers directly. These guarantee funds act as a safety net, providing assurance to financial institutions that, in the event of default, they can recover their funds.

However, in Tanzania, the number of guarantee funds specifically tailored for agri DFS is limited. The existing guarantee funds identified in this research primarily cater to established banks (i.e., Equity Bank) rather than innovative providers of agri DFS. Moreover, these funds are often in the pilot phase and have relatively small values, hindering their ability to address the substantial financing needs of the agriculture sector.

To overcome this barrier, it is crucial to establish and expand guarantee funds that are specifically designed to support agri DFS providers and smallholder farmers in Tanzania. These funds can play a vital role in de-risking agricultural lending and encouraging financial institutions to invest in digital agriculture solutions. Additionally, exploring blended finance schemes and innovative financing models can further unlock the potential for increased investment in the agriculture sector.

6.3. BUSINESS SUSTAINABILITY: OPPORTUNITY AND LIMITATIONS

Based on insights gathered from analyzing in-depth interviews with different stakeholders, digital agriculture service providers in Tanzania face challenges in finding sustainable business models that effectively monetize their offerings across different use cases. Many providers initially focused on digital advisory services, but soon encountered difficulties in generating revenue from these services alone. Farmers often require financial resources to implement the recommended practices, such as investing in inputs, which they may not possess. The limited value perceived by farmers in standalone advisory services, coupled with the lack of financial support to act on the advice provided, hampers the monetization of digital advisory services.

Adding to the challenge, the government currently provides both in-person and digital advisory services (via M-Kilimo) at no cost to farmers, further reducing the perceived value and potential to monetize standalone digital advisory services. While charging farmers for advisory services has potential, it typically requires either a massive scale of smallholder users to generate meaningful revenue on slim profit margins or cross-subsidisation from other types of users, such as agribusinesses or processors.

The testing of different service bundles and business models is resource and capital intensive, making it difficult for most digital agriculture service providers to explore and iterate on new approaches. Currently, this capacity is primarily found within large, well-resourced organizations like major telecommunications companies.

For instance, Vodacom's M-Kulima offers multiple services, including farmer profiling, procurement, payments, advisory, and mobile overdraft. They generate revenue through transaction fees from payments to farmers, airtime costs for bulk SMS communication, and commission fees for facilitating third-party services like loans. Similarly, Tigo Pesa's Tigo Kilimo started with an AgriVAS information service and expanded to a platform that provides payment, savings for inputs, and advisory services. They also now offer the Tigo Pesa Menu as a platform for external partners to list and offer their digital agriculture services.

Given the limited purchasing power of smallholder farmers, who are often the main beneficiaries of digital agriculture tools, solution providers have developed business models where the paying customer is another actor along the value chain, such as agribusinesses or agro dealers. This approach aims to incentivize other actors to pay for the services, leading to the popularity of digital procurement services that provide more immediate benefits to agribusinesses than to smallholders.

Business sustainability for most digital agriculture service providers relies heavily on patient donor funding. Most solution providers identified in this research have primarily relied on funding from international organizations such as USAID, UNCDF, WFP, GSMA, TRIAS, and UNDP. Donor funding serves as vital risk capital for innovation, supporting not only the early stages of prototyping and piloting, but also the scaling and growth phases once a viable business model is established. More patient capital is needed to account for long agricultural seasons and time for digital agriculture solutions to scale.



6.4. LESSONS ON GENDER AND INCLUSIVITY

Despite efforts to improve gender and youth inclusion in digital agriculture, innovators interviewed report that challenges to inclusion persist, mainly due to gendered crop dynamics and limited device accessibility.

Certain crops, particularly cash crops like coffee and cashew, are traditionally managed by older male farmers. This bias results in a higher representation of older male farmers in the user base of digital agriculture solutions targeting such value chains. Cash crops require more land and investment, making it more challenging for youth and women to access these opportunities, as explained during interviews with telecommunication companies like Tigo and farmer networks like MVIWAARUSHA. Some digital agriculture solutions catering to cash crops report that over 60% of their user base consists of older male farmers.

During our interview with TAHA, it was emphasized that limited access to mobile devices remains a major hindrance to the inclusion of women farmers. Due to a higher proportion of male farmers owning phones and, in certain instances, controlling the usage of their wife's phone, digital agriculture solutions in the country tend to attract a larger number of male users. According to TAHA, this results in a significant difference, ranging from 15% to 40% more male users for a given service.

In terms of wider inclusivity in digital agriculture services for farmers in Tanzania, there is a concern that livestock farmers may face a higher risk of exclusion from digital agriculture services compared to crop farmers. A farmer organization interviewed highlighted that most digital solutions have been developed primarily for crop farming, leaving fewer options available for livestock farming. This observation is further corroborated by our own research on digital agriculture services, which revealed a scarcity of services tailored specifically for livestock farmers. One reason for this, reported by the farmer association, could be the lack of source material. For instance, while there is ample content available for crop farming (e.g., growing practices, diseases management, etc.) for digital advisory applications, equivalent content is lacking for livestock farming. This discrepancy is also evident in the fact that the majority of digital agriculture solutions currently active in the country are focused on crop-related activities, neglecting the needs of livestock farmers.

However, there are opportunities to increase the participation of and benefits for women farmers, livestock farmers, and youth in digital agriculture.



1. PRIORITIZE LOW-RESOURCE-INTENSIVE VALUE CHAINS, LIVESTOCK FARMING, AND NON-FARMING ACTIVITIES.

Focusing on value chains that require lower resources and have shorter harvest cycles can attract more women and youth. For example, horticulture crops like fruits, vegetables, and spices are examples of value chains that provide opportunities for increased participation of women and youth. Targeted support for digital services for livestock farmers, such as the provision of livestock content (e.g., livestock health, animal husbandry, disease identification and treatment) for digital advisories, can also help fill the void in relevant digital service for them.

Youth involvement in non-farming activities, such as trading and processing, also increases their participation across the agriculture production value chain. Digital agriculture solutions catering to these activities tend to attract more young participants.

“Youth want quick returns, you will find them in crops with short harvests like horticulture crops.”

- Sera Bora

2. INVOLVE MORE WOMEN AND YOUTH IN SERVICE DEVELOPMENT AND DELIVERY.

There are some success stories in Tanzania to learn from when designing for more inclusive digital agriculture services and programs. For example, increasing the number of female agriculture extension officers can enhance the participation of women in agronomy training. One Acre Fund has observed that over 60% of participants in their training are female farmers.

Engaging women farmers as “Lead Farmers” can mobilize other women farmers through trust and close proximity for demonstration purposes. Agromovil’s Champions Program trains women farmers who then serve as trainers for other farmers, leveraging trust and achieving good success in Tanzania.

Engaging youth in disruptive frontier technologies presents an opportunity to lay the foundation for inclusion. Young Tanzanians, for example, are developing solutions based on machine-vision technology at the YEESI Lab. Digital Green envisions youth as key moderators for farming groups, facilitating engagement with generative AI advisory chatbots.

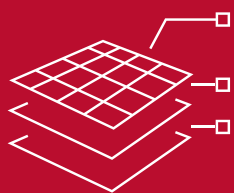
While challenges persist in achieving gender and youth inclusion in digital agriculture, there are opportunities to address these issues. Prioritizing value chains with lower upfront resource requirements, involving women and youth in service development and delivery, and leveraging disruptive technologies can contribute to increased participation and benefits for women farmers and youth.





7.

**RECOMMENDATIONS FOR
ENHANCING DIGITAL AGRICULTURE
ECOSYSTEM IN TANZANIA FOR KEY
STAKEHOLDERS**





7. RECOMMENDATIONS FOR ENHANCING DIGITAL AGRICULTURE ECOSYSTEM IN TANZANIA FOR KEY STAKEHOLDERS

To harness the full potential of digital agriculture in Tanzania, overcome the existing barriers, and make the most of the enablers, this section presents a comprehensive set of recommendations for ecosystem stakeholders. These recommendations are designed to foster an enabling environment, promote inclusivity, and drive the sustainable growth of the sector. By addressing key areas such as data management, financial services, partnerships, skills training, innovation support, gender and youth inclusion, digital infrastructure, and climate-smart practices, these recommendations aim to unlock the transformative power of digital agriculture in Tanzania.

RECOMMENDATION	STAKEHOLDER RELEVANCE
<p>1. Develop a centralized and open farmer database/registries with verified information under a government institution that could be used by service providers, along with guidelines to standardize the collection and management of data. This initiative could provide a reliable and accessible source of farmer data for value chain stakeholders, including agtechs, agribusinesses, and financial service providers. By involving key stakeholders in the consultation process, the data can be effectively utilized by different actors. Additionally, promoting clear standards for data collection will ensure harmonization and interoperability, enabling seamless integration and sharing of data among various digital agriculture solutions as well as financial service providers.</p>	Funders Government NGOs
<p>2. Support digital financial services for smallholder farmers, including credit and leasing, by making finance available to agri DFS providers through guarantees and blended finance mechanisms. This recommendation is rooted in the importance of access to finance for smallholder farmers to be able to invest in inputs, technologies, and other agricultural resources. By providing guarantees and leveraging blended finance approaches, agri DFS providers can mitigate the perceived risks associated with lending to the agriculture sector. This support will empower smallholder farmers to enhance their productivity and adopt digital agriculture solutions effectively.</p>	Funders



<p>3. Improve business sustainability of digital agriculture services by supporting networking, knowledge sharing, and partnerships between Tanzanian agtechs and other stakeholders, such as banks, agribusinesses, farmer associations, and investors. This effort aims to foster collaboration, service harmonization, scale, and business sustainability within the digital agriculture ecosystem. Facilitating connections between agtechs and farmer associations can enable the rollout of services to their members, ensuring effective reach and adoption. Networks between innovators and investors can help ensure agtech startups have access to appropriate types of capital and improve overall chances for digital agriculture services to achieve business sustainability. By creating an enabling environment for collaboration and partnerships, the sector can leverage collective expertise and resources to drive innovation and growth.</p>	<p>Funders Innovation Hubs</p>
<p>4. Support the startup ecosystem in the digital agriculture vertical by building technical capacity in collaboration with innovation hubs, accelerators, and other funders. Investing in research and development labs, such as YEESI, will enhance the exploration of AI for agriculture and facilitate in-country testing of frontier technologies. Supporting the ongoing efforts to establish the Tanzania Startup Act (legislative instruments aimed at accelerating the formation and growth of startups by providing strategic incentives and interventions) in Tanzania can incentivize local entrepreneurial innovation, creating a supportive environment for digital agriculture startups to thrive and contribute to the sector's growth and transformation (e.g., Tunisia's 2018 Startup Act).⁸¹</p>	<p>Donors Investors Accelerators Government</p>
<p>5. Facilitate essential skills training, including digital literacy and financial literacy. Recognizing the importance of digital skills and financial literacy for effective adoption and use of digital agriculture solutions, it is essential to provide training to rural communities. Agribusinesses, MNOs, farmer groups, NGOs, and agtech companies should allocate resources to train users on basic digital skills and financial literacy. Investments and development programs in agriculture should allocate ring-fenced budgets for essential training of rural customers in order to achieve quality targets on usage. By equipping rural communities with the necessary skills, the barriers to adoption can be reduced, enabling the market to embrace digital agriculture solutions more readily.</p>	<p>Government NGOs Banks and Financial Service Providers Donors</p>
<p>6. Support innovation by making catalytic and growth-stage finance available to scale agtech startups. Collaboration with other funders and investors is crucial to ensure the catalytic nature of development funding in the digital agriculture sector. It is important to develop clear roadmaps for progression of innovators from one stage of funding to the next, enabling startups and entrepreneurs to secure the necessary support at different stages of their development. By facilitating access to finance at both the early and growth stages, innovative digital agriculture solutions can be nurtured and scaled effectively.</p>	<p>Donors Investors</p>
<p>7. Continue to include gender and youth targets in interventions. Inclusion of women and youth in digital agriculture initiatives should remain a priority in the short term to avoid leaving these groups behind. Identifying and implementing best practices for the inclusion of women and youth, such as trainings led by women or young people, is essential. Partnerships with organizations that have a successful track record in working with women farmers and young people should be sought, and programming should consider including women-led cooperatives to ensure the participation and empowerment of these groups.</p>	<p>Funders</p>

81 GIZ (2021), *Strengthening Entrepreneurial Ecosystems*; INSME, "The Tunisian Startup Act."



<p>8. Support the development of digital rural infrastructure and inclusion through advocacy and targeted investments. Ensuring the affordability of mobile money services, smartphones, and airtime and expanding rural network coverage is crucial. By advocating for policies and investments that promote digital rural infrastructure and inclusion, barriers to access and adoption of digital agriculture solutions can be reduced. Improving affordability and connectivity will enable smallholder farmers in remote areas to benefit from digital tools and services, contributing to their overall productivity and well-being.</p>	<p>Government Fundors</p>
<p>9. Include digital elements (where relevant) to support the transition to climate-smart agriculture. Assessing opportunities for digitally enabled solutions for climate change within all agricultural development programs and cascading down KPIs for digitally enabled solutions to support climate resilience and adaptation across investments and programs is recommended. Collaboration with key players in the space, such as the ACORN initiative by Rabobank, ARAF by Acumen, the Catalyst Fund, and others, can help streamline best practices and metrics.</p>	<p>All</p>
<p>10. Accelerate smallholders along their pathway to increased financial inclusion starting by investing in the digitisation of agriculture value chain payments. This investment should be made in collaboration with mobile money providers to prepare their agent networks for ensuring liquidity. In later stages, engage government and financial sector stakeholders on the development (and associated regulation) of more advanced agri DFS use cases (credit, savings, and insurance).</p>	<p>Agribusinesses Mobile money providers Banks and financial service providers Governments. NGOs</p>

These recommendations, when implemented collectively by key ecosystem players in the country, have the potential to drive the growth, inclusivity, and sustainability of the digital agriculture sector in Tanzania.



APPENDIX: LIST OF ORGANIZATIONS AND STAKEHOLDERS INTERVIEWED

We would also like to acknowledge the following individuals for their time, insights, and support during the elaboration of this analysis.

AKYOO LETUNGAA - MVIWAARUSHA

ALEX VAN PRAAG - TECHFORCE NL

ALFRED CHENGULA - IMARATECH

ANDREW HICKS AND ARCHANA KARANAM -
DIGITAL GREEN

ANDREW MACK AND SARAH SMITH - AGROMOVIL

EDGAR MBOKI - VODACOM TZ

EMILY GAMBLE - GSMA

EWAN WHEELER - ACRE AFRICA

FRANCIS MURO - EQUITY BANK

GEOPHREY TENGANAMBA - MAZAO HUB

HACK STIERNBLAD - SUNCULTURE

JOHANNES RÖHRENBACH - MAVUNO TECHNOLOGIES

JOHN MUNDY - ONE ACRE FUND

DR. KADEGHE FUE - SOKOINE UNIVERSITY
OF AGRICULTURE - YEESI LAB

KERVIN BWEMELO - MYAGRO

MARGARETH PAUL - TIGO

**MAUD SLIPPENS, SEBASTIAN PAOLINI
AND MARTIN LAI**, RABOBANK - ACORN

MICHAEL PALLANORE - TRIAS

MPONDA MALOZO - FAO

NDEOYA MUNGURE - TAHA

NIXON GECHEO - AGRA

OBADIAH NYAGIRO - TANZANIA MINISTRY
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PRAYGOD JAPHET - AGRITECHS

PROFESSOR DAVID NYANGE - SERA BORA

ROB MADZIVA - DIGITAL MOBILE AFRICA

ROGERS MSELLE - CRDB BANK

ROSE FUNJA - AGRINFO

ROSE GOSLINGA, SUKIRTI VINAYAK - PULA

SHABANI MBWANA - TANGA DAIRIES

STEFANO CARCOFORO - IPROCURE

TAYAMIKA MATTAO - UN WFP

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