DIGITAL AGRICULTURE COUNTRY STUDY ANNEX: TANZANIA

Supplement to the Situational Analysis Report | Assessment of Digitalization in the Agricultural Systems of the SADC Region

Centre for Coordination of Agricultural Research and Development for Southern Africa | World Bank Group

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CCARDESA
Centre for Coordination of Agricultural Research and Development for Southern Africa
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SUPPLEMENT TO THE ASSESSMENT OF DIGITALIZATION IN THE AGRICULTURAL SYSTEMS OF THE SADC REGION: SITUATIONAL ANALYSIS REPORT

Centre for Coordination of Agricultural Research and Development for Southern Africa | World Bank Group

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ACRONYMS AND ABBREVIATIONS

AI	Artificial Intelligence
AIDI	Africa Infrastructure Development Index
APPSA	Agricultural Productivity Program for Southern Africa
AR4D	Agricultural Research for Development
AU	African Union
B2B	Business-to-Business
B2C	Business-to-Consumer
CCARDESA	The Centre for Coordination of Agricultural Research and Development for Southern Africa
COVID-19	Coronavirus pandemic
DACS	Digital Agricultural Country Study
DE4A	Digital Economy for Africa Initiative
DIAL	Digital Impact Alliance
EGDI	E-Government Development Index
FANR	Food, Agriculture and Natural Resources Directorate
FAO	Food and Agriculture Organization of the United Nations
GCI	Global Competitiveness Index
GDP	Gross Domestic Product
GII	Global Innovation Index
GIS	Geographic Information System
GNI	Gross National Income
GPS	Global Positioning System
GSMA	Global System for Mobile Communications
HDI	Human Development Index
ICDL	International Computer Driving License
ICKM	Information, Communication and Knowledge Management
ICT	Information Communication Technology
ICT4AG	ICT for Agriculture
IDIA	International Development Innovation Alliance

IOT	Internet of Things
IS	Information Society
IT	Information Technology
ITU	International Telecommunications Unit
KII	Key Informant Interview
MSMES	Micro, Small and Medium Enterprises
NGO	Non-Governmental Organization
NREN	National Research and Education Networks
OECD	Organization for Economic Co-operation and Development
OSI	Online Service Index
R&D	Research and Development
RCOL	Regional Centers of Leadership
RUFORUM	Regional Universities Forum
SAAS	Software as a Service
SADC	Southern African Development Community
SME	Small and Medium Enterprise
SMS	Short Message Service
SSA	Sub Saharan Africa
TOR	Terms of Reference
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Program
USSD	Unstructured Supplementary Service Data

1 INTRODUCTION

1.1 INTRODUCTION TO THE STUDY AND THE STRUCTURE OF THE DACS

The Centre for Coordination of Agricultural Research and Development for Southern Africa (CCARDESA) is a sub-regional organization that was approved by the Council of Ministers of the Southern African Development Community (SADC) in 2010 and launched in 2011. CCARDESA promotes innovative research, technology generation and adoption of sustainable agricultural development through partnership and capacity development. CCARDESA also coordinates the Agricultural Productivity Program for Southern Africa (APPSA), a regional program supported by the World Bank to promote collaboration and to encourage technology generation and dissemination across national borders of participating countries of SADC. CCARDESA has appointed IMC Worldwide to carry out a situation analysis of the status of digitalization in the agricultural systems of SADC member states.

Aligned with the Terms of Reference, a separate report has been produced by the study team, the *Situational Analysis Report: Assessment of Digitalization in the SADC Region* which addresses the assignment objectives (Section 2.2 in the Situational Analysis Report).

This Digital Agricultural Country Study (DACS) for Tanzania is an annex to the *Situational Analysis Report* and provides a snapshot of the general digital ecosystem, the policy environment of digital and agricultural policies, relevant digital agricultural innovations, and an overview of digital agricultural skills and digital entrepreneurial skills development in universities, incubators, and accelerators within an ecosystem. This document is not intended to provide a full analysis of the ecosystem in this country but provides an early baseline in gathering data and information collected from voluntary respondents on these topics for possible further study.

The baseline data collected provides insights into the extent to which Tanzania has enabled and encouraged digital technology solutions, such as the use of digital data in agricultural research, education, extension, and market access. In specific terms and to the extent possible:

- The DACS identified available public national policies and legislation which provide a conducive environment for agricultural digital innovations to thrive. The study team also reviewed the context in which digitalization is linked to agriculture to enhance the agricultural innovation ecosystem.
- The DACS provides a catalogue of relevant agricultural digital innovations and where available, their availability, affordability, usability, and potential for scalability (adoption by smallholder farmers). These innovations were characterized in use cases according to a suitable framework and mapped to the roles they play in providing solutions within fragmented agriculture value chains.
- The DACS also maps syllabi at Agricultural Universities, Colleges, Incubators, and Accelerators which have embraced digital and entrepreneurial skills training to encourage and empower young people to become digital entrepreneurs in the future.

The study has assembled a wide array of evidence and research using qualitative and quantitative methods and approaches. Data collection on digital tools reflects the extent to which they have been embraced, but it

is important to note that this study is not exhaustive in identifying every digital tool available. The report has the following structure:

Chapter 1:	Introduction to Tanzania, including the general digital ecosystem, agriculture sector, digital infrastructure, and benchmark assessment results.
Chapter 2:	The Broader Policy Environment
Chapter 3:	Digital Agricultural Innovations
Chapter 4:	Digital Agricultural Skills and Entrepreneurship Training
Chapter 5:	Insights and Reflections

All the information compiled for Tanzania will be combined with data from the other 15 SADC member states and presented on a platform hosted by CCARDESA.

1.2 METHODOLOGY

IMC Worldwide, CCARDESA and the World Bank agreed to the framework, approach, and methodology for the assignment. CCARDESA facilitated the introduction to the Information, Communication and Knowledge Management (ICKM) Focal Point in Tanzania, Dr. Richard Kasuga, the Tanzania Agricultural Research Institute (TARI), and Vidah Mahava, the Ministry of Agriculture Food and Cooperatives. The study team remotely met with the focal points to discuss the current situation with regards to digital agricultural technologies in Tanzania. The study team also worked with a National Consultant in Tanzania, Prof. Honest Prosper Ngowi.

Further information on the methodology for this assignment is provided in the *Situational Analysis Report* (Section 3) along with the data collection tools used, including the key informant guides and surveys (Annex 6-13 in the *Situational Analysis Report*).

GENERAL ECOSYSTEM

The study team collected key digital ecosystem figures for each country through a desk review of country reports and industry websites (World Bank, ITU, GSMA, etc.). These figures are presented in section 1.3 and 1.4 below.

BENCHMARK ASSESSMENT

The team completed a benchmark assessment across the 16 SADC member states. The assessment sought to provide a context to the findings of this study, and not to determine each SADC country's development of a digital economy. The approach was adapted from Unlocking the Digital Economy in Africa: Benchmarking the Digital Transformation Journey by SMART Africa and the Digital Impact Alliance (DIAL). SMART Africa's mandate is to encourage Africa's transformation into a knowledge economy through the usage of ICTs, and therefore this assessment would be most compatible to the SADC member states. Other frameworks and toolkits were reviewed in preparation for the benchmark with more information in the *Situational Analysis Report.* The assessment areas in the SMART Africa/ DIAL report are based on the five foundational pillars of the Kenyan Digital Economy Blueprint, illustrated in figure 1, and are similar in nature to the African Union's Digital Transformation Strategy foundation pillars, illustrated in figure 5, (Enabling Environment; Policy and Regulation; Digital Infrastructure; Digital Skills and Human Capacity; Digital Innovation and Entrepreneurship).

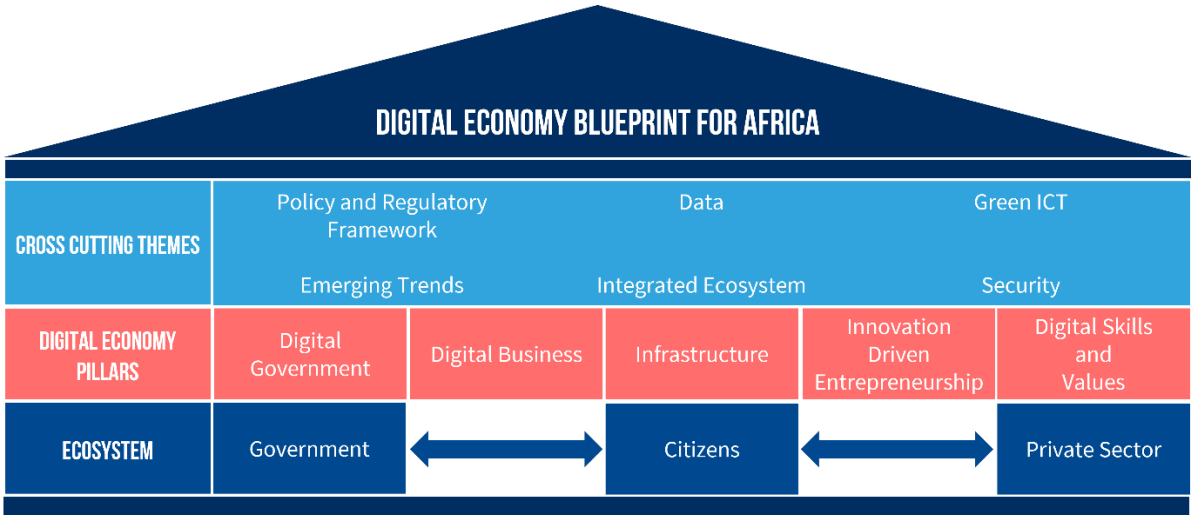

FIGURE 1 OVERVIEW OF KENYAN DIGITAL ECONOMY BLUEPRINT

A sixth pillar was added to the benchmark to include Policy and Regulatory Frameworks to align it with this study and as this was a regular cross-cutting area mentioned in other frameworks. These six pillars are presented in table 1.

TABLE 1 PILLARS FOR THE BENCHMARK ASSESSMENT

Digital Government	Digital Business	ICT Infrastructure	Innovation Driven Entrepreneurship	Digital Skills	Policy and Regulatory Frameworks
The presence and use of digital services and platforms to enable public service delivery.	The development of a robust marketplace for digital trade, digital financial services, and digital content.	The availability of affordable, accessible, resilient, and reliable infrastructure.	The presence of an ecosystem that supports homegrown firms to generate world-class products and services that help to widen and deepen digital economic transformation.	The development of a digitally skilled workforce that is grounded on sound ethical practices and socio-cultural values.	The presence of policies and regulations that are dynamic, flexible and promote the digital economy.

Assessing all pillars has provided a picture across all 16 countries and forms the basis of the specific indicators that were selected for the benchmark assessment. The indicators used were based on the SMART Africa/DIAL report. Changes were made to some of the indicators for this study to focus more specifically on the digital elements. For example, the ICT Infrastructure pillar uses the ICT Composite Index score, rather than the general Infrastructure indicator from the Africa Infrastructure Development Index (AIDI) that included elements such as roads. For the Digital Skills pillar, only the digital skills among active population score were used for this benchmark rather than the general score in the Global Competitiveness Index (GCI) which includes factors not related to digital. The indicators and data stream used and the maximum score available is illustrated in Table 2.

TABLE 2 INDICES AND DATA STREAM USED FOR THE BENCHMARK ASSESSMENT AND MAXIMUM SCORE AVAILABLE

Benchmark Pillar	Index	Data Stream	Maximum Score
Digital Government	E-Government Development Index (EGDI) 2020	Online Service Index (OSI)	1

Digital Business	GCI 2019	Business Dynamism Component	100
ICT Infrastructure	AIDI 2020	ICT Composite Index	100
Innovation Driven Entrepreneurship	Global Innovation Index (GII) 2021	N/A	100
Digital Skills	GCI 2019	Digital skills among active population	100
Policy and Regulatory Frameworks	ITU G5 Benchmark 2021	N/A	100

Each SADC country received a total score based on the specific scores of each pillar, outlined above. These figures were then compiled into an index (this was done by dividing the scores by the maximum possible score). The benchmark is based on a mix of indicators from 2019-2021, outlined in Table 2.

POLICIES

For the broader policy section, the study team identified available policies, strategies, and legislation around Information Communication Technologies (ICT), digitalization, data, cybersecurity and privacy, e-commerce and transactions and agricultural sector policies through desk-based research and discussions with in-country consultants. The team undertook key informant interviews (KIIs) with available CCARDESA ICKM focal points to identify additional policies, including draft versions that may be unavailable online and to understand practical challenges around the policy environment within ministries.

The team reviewed available public policies to understand their complexity, basic goals and strategies and the relationship with agriculture within the public sector. The team took stock of relevant digital laws, although the list included in this report is not exhaustive but focused on electronic transactions and electronic commerce, cyber security, data protection and open data. Findings from stakeholder interviews were then analyzed to provide a deeper understanding of the challenges faced within the public sector and to what extent digitalization is being prioritized by Government.

The approach sought to provide an audit of the policies in the public domain illustrating to what extent digitalization is embraced by government, and the relationship and implication for the agriculture sector. The report did not seek to analyze the content of policies or strategies or assess whether they are effective or have achieved their objectives.

INNOVATIONS

Digital agricultural innovations were identified through a desk review of international reports, internet searches, local networks supplied by the CCARDESA ICKM focal point in the country and the national consultants. In some countries innovations were identified that were also implemented in other countries (regional innovations), this is reflected in Chapter 3: Digital Agricultural Innovations. The national consultants validated all identified innovations available (national and regional innovations in that country) and identified contact information of the innovators which was then uploaded into a Google Form. Some regional innovations which claimed they were implemented in Tanzania could not be fully validated, but this was insufficient to suggest they did not exist and so are included in the lists.

Each identified innovator was sent a survey by email, requesting more detail on their innovations related to the maturity, numbers of users and scale as well as more detailed characterizations of their unique innovation. Survey participants provided the survey responses through Google Sheets which were converted into excel

files. All innovators were pursued rigorously for some weeks, by email and by phone, to encourage them to fill out the survey.

Survey answers were self-reported and where there were outlier responses, follow-ups were made to ensure conformity of information. The survey results were cleaned by combining duplicate answers (when submitted from more countries), clustered (in cases of open answers, for example with “other”) and names between identified and survey results were aligned. In some cases, the answers were coded for better analysis of the data. An analysis spreadsheet was developed to analyze the data in more depth and to create the graphs. All innovations received a unique number and were uploaded to the database. The database forms the basis for the interactive web portal of CCARDESA, further information on the portal can be found in the *Situational Analysis Report*. Alongside the survey, several KIIs with innovators took place both with regional innovations and with national innovations that have reached a certain level of scale.

This DACS has characterized use cases based on a model and framework created by GSMA based on different use cases and sub use cases and is represented below in figure 2. These broadly fall into access to services, access to markets and access to assets.

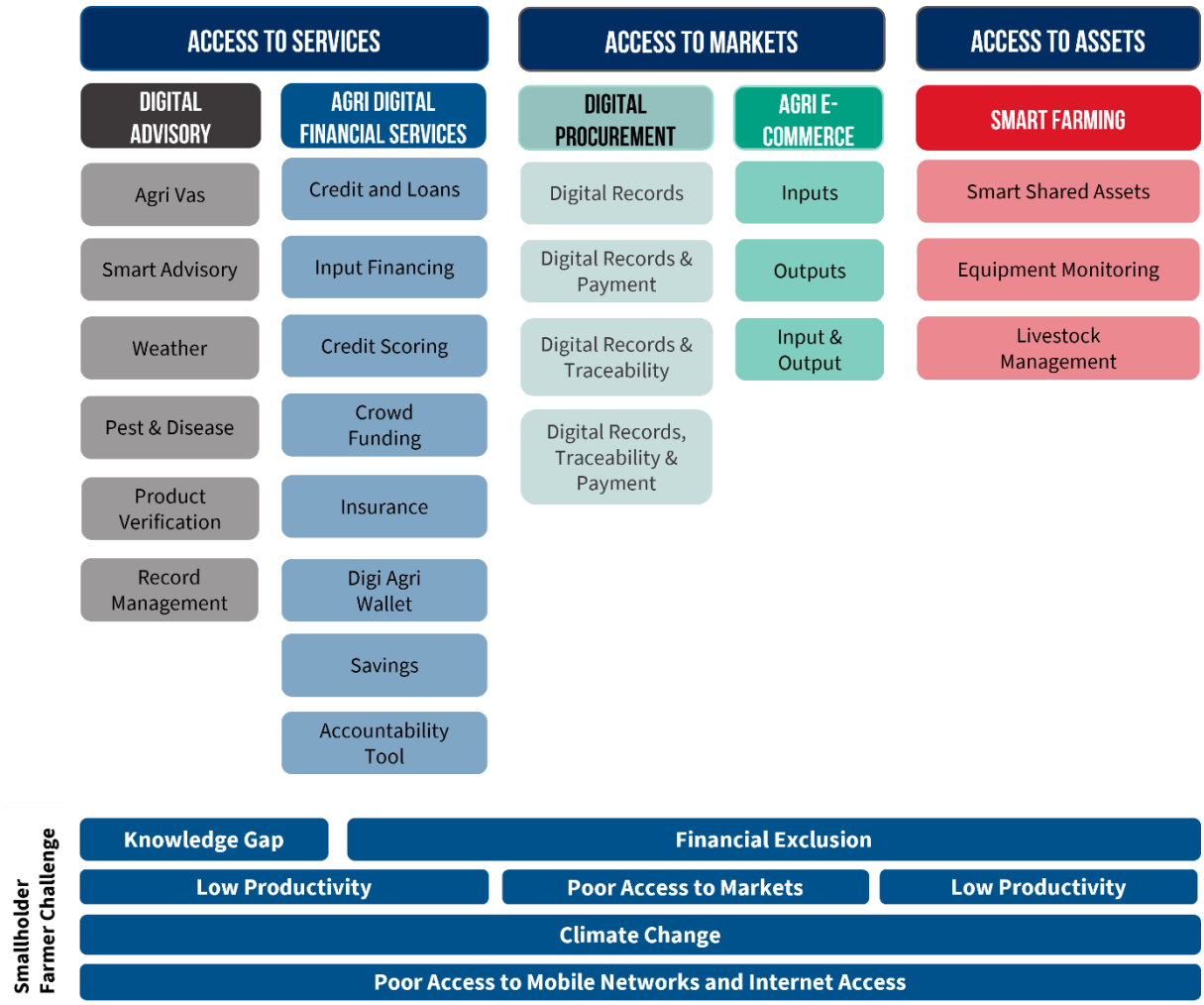

FIGURE 2 USE CASE MODEL BASED ON GSMA FRAMEWORK

In graphs and tables included in this DACS, the following color coding was used to illustrate the different use-cases:

DIGITAL SYLLABI

Digital and entrepreneurial skills training was assessed through a quantitative Survey Monkey tool sent to 54 Universities, the majority of these were Faculties of Agriculture that are part of the Regional Universities Forum (RUFORUM) network, but some institutions were contacted that were not strictly agricultural to try and provide a complete picture in the region (a total of 58 different faculties were contacted). The names and addresses of these University contact points was facilitated via collaboration with the RUFORUM University membership in the SADC member states. The study team also carried out KIIs with representatives of faculties of agriculture at selected Universities and Incubators. The full list of universities and incubators approached, tools used, and stakeholders interviewed can be found in annex 3-4 and 8-10 in the *Situational Analysis Report.*

LIMITATIONS TO THE METHODOLOGY

The planning, data collection, analysis and reporting of this study was completed between April to December 2021. Due to the Covid-19 pandemic much of the data collection and delivery of this assignment was completed remotely across the 16 SADC member states. The inability of some national consultants to conduct in-person meetings or interviews, and restrictions around national travel due to Covid-19 protocols limited the data collection and led to delays in some areas.

The data collection for this study was entirely voluntary and self-reported. Every effort was made by the study team to engage a representative sample of stakeholders under each theme and encourage completion of surveys and interviews, there are cases within some of the DACS where the data may be more limited than in others due to the maturity of the digital agricultural ecosystem. Therefore, while the data collected for each country provides a reasonable baseline of the current landscape, this overview is not exhaustive and must not be seen as such. The intention of the data collection was to address the assignment objectives which sought to understand regional trends, themes, and opportunities around digitalization in agricultural systems. The DACS are supplemental documents which present the country data collected, some of which was used in the *Situational Analysis Report*, but they should not be interpreted as providing a detailed analysis of the country ecosystem.

POLICIES

There were several challenges in obtaining policy documents and determining if they were accurate, final, or valid and implemented. The impact of the Covid-19 pandemic has affected the priorities of governments and implementation of their related policies. Furthermore, the pandemic has constrained open and full consultation of policies that have been drafted and may have delayed their finalization. Additionally, much of the documentation the team found is split between ministry websites and illustrates the siloed nature of policy formulation in this space. If documents were unavailable online then the ICKM focal points were asked for access where possible, national consultants also tried to source documents locally. Unverified versions of documents available online were also used for review.

INNOVATIONS

The current DACS is a snapshot in time as new digital innovations are in development in Tanzania and some may be declining because of the Covid-19 pandemic. Due to various Covid-19 restrictions, physical meetings could not take place. People had to work from home which significantly affected their ability and willingness to participate in online interviews and survey instruments. The efforts of the national consultants to convince innovators to participate in the survey required significant energy and effort and, in some cases, took longer than expected. Many innovators are very busy and mentioned that participating in another survey or interview did not equate to new opportunities for this innovation. There was also suspicion and caution by innovators and public sector stakeholders to engage with consultants and share proprietary data.

DIGITAL SYLLABI

Across the region, the response rate of universities to the survey tool and interviews was 47% which was a reasonable response rate. However, the response rate is variable between countries and the number of participating universities in some countries was much lower than expected given their diversity and maturity and contrasted highly with much smaller nations in the region. This is believed to be due to the enormous additional workload on staff at Universities as a direct result of the pandemic forcing many to move all activities online and the time and pressures this entailed. As a result, University staff struggled to find available time for the survey.

The level of digital skills represented in the study is believed to be much lower than the reality for the region. In part, this can also be explained by the intentional targeting of Agricultural Faculties and Universities in the region rather than conducting a wider survey across Universities and Colleges more widely. During the KIIs it was also established that some Universities and Faculties struggled to see their role as part of an ecosystem actor in providing for agricultural digital skills building specifically.

1.3 COUNTRY CONTEXT

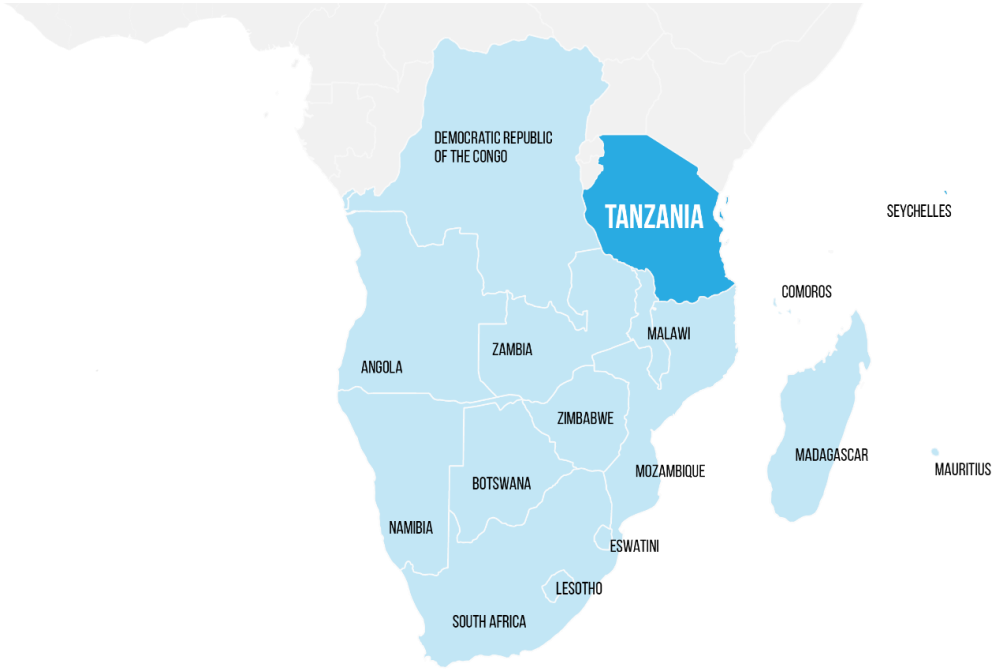

FIGURE 3 MAP OF TANZANIA IN SADC

Tanzania is a lower-middle income country with a population of 59.7 million, one of the largest in SADC[1]. The UNDP's Human Development Indicators rank Tanzania as 163rd out of 190 countries[2] and 11th out of the 16 SADC countries. For gender equality, Tanzania scores 0.948[1] on the Gender Development Index, which is slightly lower than the average of the region (0.954). It is one of the poorest countries in the SADC region with a Gross National Income per capita of only $2,760 (compared to an average of $8,277 in the region)[3]. Although 55.4% of the population falls under the UN Multidimensional Poverty Index, only 29.4% live below the poverty line according to the World Population Review[4]. This is below the average rate of the SADC region of 40.8%. The median age of Tanzania's population is also significantly younger than the average in SADC at 18 years (versus 22.1 years).

AGRICULTURE ENVIRONMENT

Tanzania is one of the least urbanized countries in the region with only 34.5% living in urban areas. Although only 26.74% of the GDP is earned in agriculture, 65.09% of the population works in the agriculture sector (much higher than the average of 43.47% in the SADC region). On the Global Food Security Index, Tanzania ranks as the 89th country of 113--making it the 3rd in the SADC region alone[5].

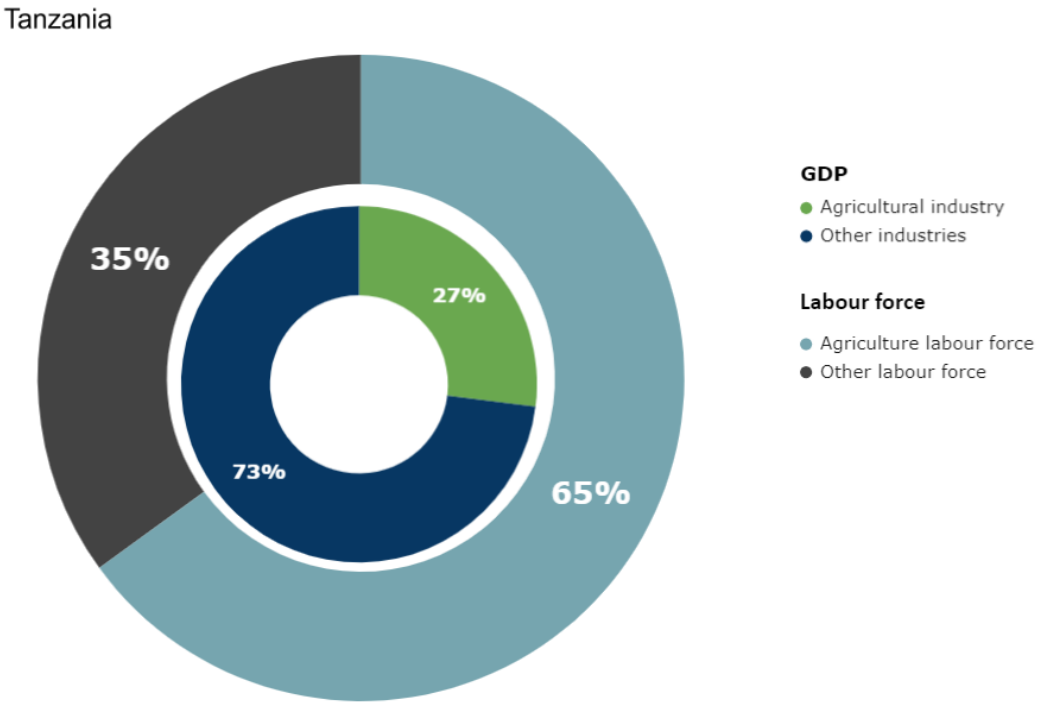

FIGURE 4 TANZANIA'S AGRICULTURAL INDUSTRY SHARE OF GDP AND THE SHARE OF THE AGRICULTURAL LABOR FORCE

1.4 THE GENERAL DIGITAL ECOSYSTEM

In 2020, the African Union (AU) adopted the Digital Transformation Strategy for Africa (2020-2030) which presents a vision of an integrated and inclusive digital society and economy in Africa. It recognizes the digital economy as a key factor in stimulating economic growth and jobs, reducing inequality, and promoting

[1] The Gender Development Index (GDI) measures gender inequalities in achievement in the three basic dimensions of human development.

sustainable growth[6]. The Strategy, illustrated in Figure 5, is based on foundational pillars, critical sectors to drive the digital transformation, and cross cutting themes to support the digital ecosystem.

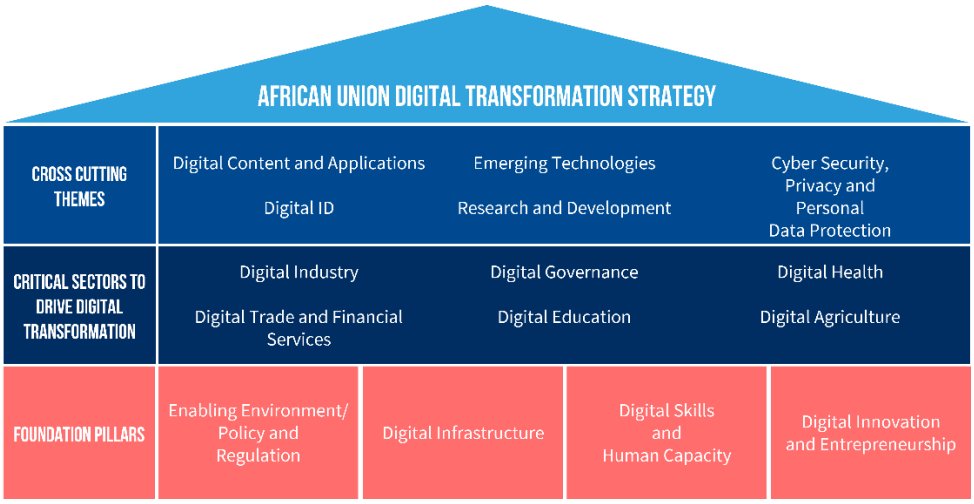

FIGURE 5 OVERVIEW OF THE AFRICAN UNION DIGITAL TRANSFORMATION STRATEGY

The transition to, and importance of, a digital economy is illustrated in the prevalence of this agenda within regional institutions, donors, and multilateral organizations. Where agendas previously focused on ICTs, providing hardware and universal access, the focus is now on enabling a digital economy with a more holistic view of digital and ICTs. The digital economy considers sectors beyond the ICT industry and encourages a whole-of-government approach to have more emphasis on the overall ecosystem and economy[7].

BENCHMARK ASSESSMENT FINDINGS

The purpose of the benchmark is to provide a context to the findings and identify where SADC countries are progressing, or where they may be behind or not developing in terms of a digital ecosystem. The benchmark assessment and the overall rankings illustrate some key front-runners in the region that are perceived to have better foundational pillars required for a digital economy. Most of these front-runners are less dependent on agriculture for economic growth, and to some extent employment. Further information on these groupings, the assessment results and regional trends can be found in the main report *Situational Analysis Report*.

The results for Tanzania are illustrated in Table 3.

TABLE 3 BENCHMARK PILLAR SCORES: TANZANIA

Tanzania	Score	Maximum Score
Digital Government (OSI, 2020)	0.488	1
Digital Business (GCI, 2019)	36.720	100
ICT Infrastructure (AIDI, 2020)	9.934	100
Innovation Driven Entrepreneurship (GII, 2021)	15.000	100
Digital Skills (GCI, 2019)	24.094	100
Policy and Regulatory Frameworks (ITU, 2021)	44.500	100

The benchmark assessment identified four clusters of countries:

Group 1: South Africa, Mauritius, Seychelles.
Group 2: Eswatini, Tanzania and Botswana.
Group 3: Zimbabwe, Namibia, Lesotho, Zambia, Malawi, and Madagascar.

Group 4: Angola, Mozambique, the Democratic Republic of Congo (DR Congo), and Comoros.

TABLE 4 OVERALL BENCHMARK ASSESSMENT RESULTS AND RANK FOR ALL SADC MEMBER STATES

Country	Benchmark Index Score (Adjusted)	Overall Benchmark Ranking
South Africa	0.5891	1
Mauritius	0.5839	2
Seychelles	0.5155	3
Global Median	0.5064	
Eswatini	0.4222	4
Tanzania	0.4138	5
Botswana	0.4114	6
Zimbabwe	0.3895	7
Namibia	0.3809	8
Lesotho	0.3802	9
African Median	0.3595	
Zambia	0.3506	10
Malawi	0.3483	11
Madagascar	0.3005	12
Angola	0.2985	13
Mozambique	0.2919	14
DR Congo	0.2782	15
Comoros	0.2497	16

BENCHMARK ASSESSMENT: TANZANIA

In the benchmark assessment Tanzania ranked fifth out of the 16 SADC member states. Figure 6 below, illustrates the results of the benchmark in comparison to the global and African medians. Tanzania scores well in all areas in comparison to most SADC member states. The benchmark suggests that Tanzania has some key foundational elements necessary for a robust digital economy.

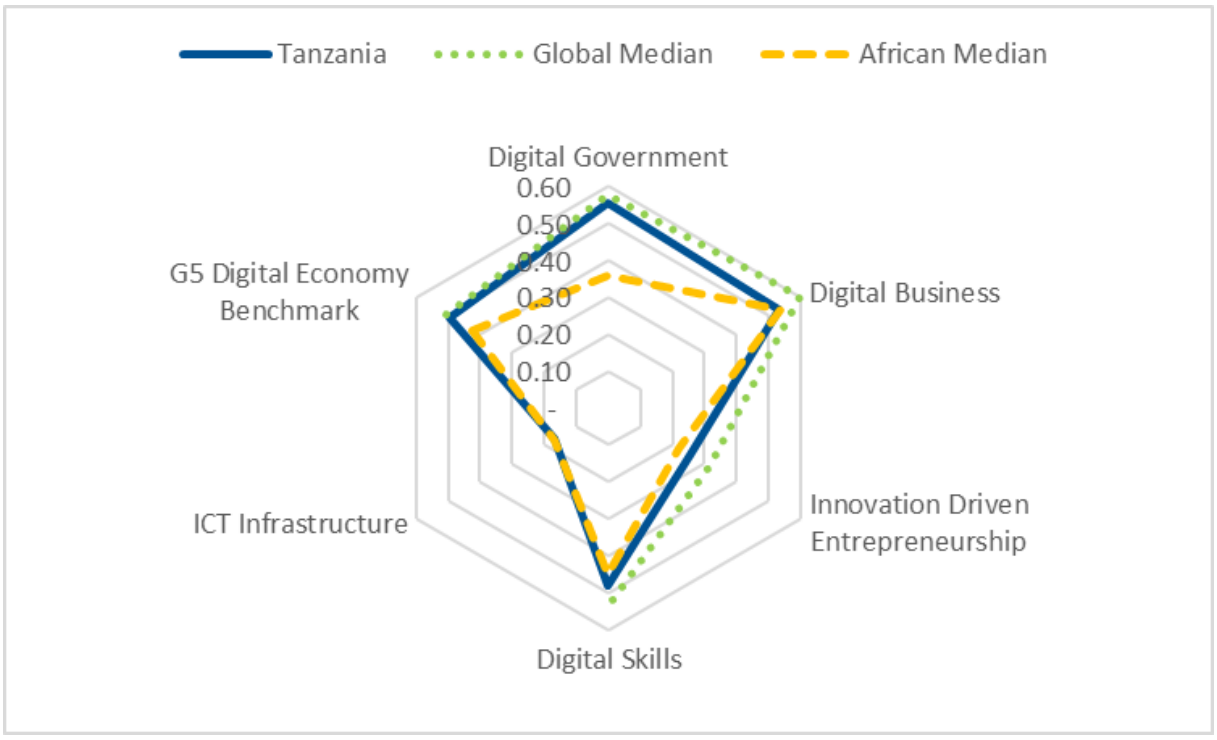

FIGURE 6 RESULTS FROM BENCHMARK ASSESSMENT FOR TANZANIA

Tanzania scored well in all but the infrastructure and G5 benchmark pillar, where it ranked tenth and seventh, respectively. Table 5 below, illustrates the ranking for each individual pillar where it predominantly ranked in the top six of countries in most pillars.

TABLE 5 RANKING OF ALL SADC MEMBER STATES PER BENCHMARK ASSESSMENT PILLAR

Rank	Digital Government	Digital Business	Innovation Driven Entrepreneurship	Digital Skills	ICT Infrastructure	G5 Digital Economy Benchmark
1	South Africa	Mauritius	Mauritius	Seychelles	South Africa	South Africa
2	Mauritius	South Africa	South Africa	Mauritius	Mauritius	Mauritius
3	Seychelles	Seychelles	Tanzania	Zimbabwe	Seychelles	Botswana
4	Tanzania	Zambia	Namibia	Tanzania	Botswana	Malawi
5	Namibia	Botswana	Botswana	Botswana	Namibia	Eswatini
6	Zimbabwe	Tanzania	Malawi	Namibia	Zimbabwe	DRC
7	Mozambique	Madagascar	Madagascar	Zambia	Eswatini	Tanzania
8	Angola	Namibia	Zimbabwe	Lesotho	Zambia	Zambia
9	Eswatini	Eswatini	Zambia	Eswatini	Lesotho	Lesotho
10	Malawi	Lesotho	Mozambique	South Africa	Tanzania	Zimbabwe
11	Botswana	Malawi	Angola	Madagascar	Mozambique	Angola
12	Lesotho	Mozambique		Malawi	Angola	Madagascar
13	Madagascar	Zimbabwe		Mozambique	Comoros	Namibia
14	Zambia	DRC		Angola	Malawi	Comoros
15	DRC	Angola			DRC	Mozambique
16	Comoros				Madagascar	Seychelles

DIGITAL INFRASTUCTURE

Tanzania scored lowest in the ICT Infrastructure pillar, ranking tenth out of 16 SADC member states. This is reflected in the figures for internet usage by the UN where 25% of the total population uses the internet in Tanzania[8]. This is slightly below the regional average. The GSMA Mobile Connectivity Index[9] shows a 66% access to the 3G network, which complements the HDI report of mobile cellular subscriptions at 77.2 per 100 people. Tanzania also ranks as 98th on the Inclusive Internet Index, which details the accessibility, affordability, and relevancy of internet in 120 countries. However, according to the Mobile Connectivity Index, Tanzania is ranked number 7 in terms of overall mobile connectivity in the SADC countries with an overall index of 40.1—which qualifies it as an emerging country (above 35). It scores above average for affordability and for content and services, but below average on consumer readiness and availability of infrastructure. In terms of ICT adoption, Tanzania scores position 135 (out of 140). The Tanzanian government is on the higher scale of being future oriented, based on the position 45 (out of 140), but it scores lower on the innovation capability index as number 119 out of 140[10]. However, it does score high on the GCI 4.0 Digital Skills Among the Population Index with 3.87 out of 7 points, which surpasses the SADC average of 3.5.

2 THE BROADER POLICY ENVIRONMENT

In the benchmark assessment Tanzania ranked fifth out of 16 in the region, scoring well in all indicators except infrastructure and the G5 benchmark. The high scores and ranking in the assessment pillars indicate that Tanzania is unlocking the digital economy to an extent, but it is unclear from these results whether there is a robust enabling environment. In the *Situational Analysis Report* the clusters of SADC countries identified from the benchmark are discussed in more detail but Tanzania forms part of Group 2 which is made up of countries that scored well in the benchmark but are lacking in some foundational areas.

The purpose of this section is as follows:

- Take stock of available public policies, strategies, and legislation to understand their scale and scope, and assess whether digitalization has been generally embraced by Governments.
- Understand the degree to which these policies provide an enabling environment for a digital economy that includes the agriculture sector.

It is important to recognize that the presence of policy, regulatory or legal frameworks may not always translate into awareness, effectiveness, or enforcement of these frameworks. Policies provide one part of the wider ecosystem needed for enabling innovations. The ability of an innovation to demonstrate value and a viable business model underpinning their innovation, progress towards investment readiness, sustainability and the level of scale that is achievable is likely to play a more important role in enabling innovations rather than policy frameworks[11]. Concurrently, a lack of policies or legislation does not inhibit the creation of digital innovations and technologies. The OECD highlights the common pacing problem, whereby digital technologies and innovations are advancing much faster than regulations and policies[12]. The inherent risks of rushing policies and regulations into effect must be weighed up against the benefits, as getting the pacing wrong could ultimately lead to greater barriers to innovation and risks creating regulations that could be outdated[13].

2.1 GENERAL DIGITAL POLICIES

The benchmark assessment suggested that Tanzania's digital economy is fairly developed within the region, and this prioritization of digital transformation is clearly apparent when doing a stock take of available policies, strategies, and legislation.

POLICIES, STRATEGIES AND PLANS

The **National ICT Policy 2003** was the first policy to prioritize the importance of ICT and ICT enabled development for Tanzania. A lack of an overall policy and poor harmonization of initiatives have led to the random adoption of different systems and standards, duplication of effort and waste of resources. The Policy attempts to harmonize the aims of Vision 2025 and focuses on ten elements of a multi-dimensional space with cross-cutting themes. These include:

- Strategic ICT Leadership
- ICT Infrastructure
- ICT Industry
- Human Capital
- Legal and Regulatory Framework
- Productive Sectors
- Services Sectors
- Public Service

- Local Content
- Universal Access

This inaugural ICT Policy set out a vision for Tanzania to become a hub of ICT infrastructure and solutions which was heavily dependent on the foundational element of improving infrastructure and achieving universal access. The other key element of the Policy was to establish an enabling legal framework for the promotion of ICTs in the country, including cyber security. Its successor, the **National ICT Policy 2016**, attempts to update the Policy so that it addresses new challenges such as data access and privacy, as well as new technologies. The 2016 Policy prioritizes measures and mechanisms to accelerate broadband penetration and access, strengthen ICT security and standardization, enhance management and efficient utilization of spectrum and other scarce ICT resources, promote a business process outsourcing industry, enhance innovation in e-services and promote local content development and hosting, strengthen national capacity in protection of cyberspace users, and increased integration of ICTs in the productive sectors (agriculture, tourism, natural resources, manufacturing and financial services).

Apart from these two ICT policies, there is little else in terms of specific digital strategies, plans or policies[2]. There is an **e-Government Strategy** that has been periodically updated, most recently 2016-2021, but beyond that there are no specific sector strategies or thematic strategies or policies on issues such as open data or cybercrime. The **Tanzania Development Vision 2025** explicitly states that the ICT sector should be utilized in all sectors of the economy, and in the **National Five-Year Development Plan (2021-2026)** the use of ICTs, investment in ICT infrastructure, and the development of ICT services are mentioned throughout and in all sectors. There is also the **Strategic Plan for the Ministry of Information, Communication, and Information Technology 2021/22-2025/26** that is meant to provide a roadmap of objectives and targets over a 5-year period to achieve various strategies and plans. In the 2021-2025 Strategy the following key objectives and targets are presented:

- Digital Empowerment Enhanced:
    - Enhance human capital
    - Promote research and innovation
    - Strengthen cyber security
    - Framework for digital skills development prepared and operationalized by June 2025
    - National ICT research agenda developed by June 2022
    - Framework for digital innovation coordination established by June 2022
    - National cyber security strategy operationalized by June 2025
- Institutional Management of IT, Telecommunications and Postal Services Improved:
    - National ICT Act established by June 2022
    - Personal Data Protection Act established by June 2022
    - National Digital Strategy developed and operationalized by June 2025

Vision 2025 is frequently cited as a guiding framework to achieve a strong and competitive economy, and it is encouraging to see that several strategies and laws are in the pipeline. A National Digital Strategy will aid in providing a clear and updated vision that can incorporate elements that are missing from existing policies such as emerging technologies. The focus on cybersecurity and data protection is also encouraging and if enacted will be beneficial in encouraging more trust for citizens and businesses in new technologies and digital solutions. The development of a national digital economy blueprint has been mentioned by the

[2] On the Ministry of Health website there is a link for a Digital Health Strategy, but a copy was unavailable.

Ministry for Communications and Information Technology, but there is no information available on what it would include or on a timeframe[14].

Tanzania scored well on the benchmark assessment in section 1.4, and while there are some guiding strategies, it is surprising that there are not already specific strategies operationalized on issues around cyber security and privacy.

2.2 LEGISLATION

There are a few pieces of legislation relating to the sector, but the following three are of most relevance to the study within Tanzania:

- The **Electronic and Postal Communication Act 2010** is the principal legislation governing electronic, telecom, and postal communications and is enforced by the Tanzania Communications and Regulatory Authority (TCRA). It replaces the Tanzania Broadcasting Services Act, and the Tanzania Communications Regulatory Authority Act. The Act has several clauses that cover things such as sharing network resources and infrastructure but has also made registering Sim-cards mandatory.
- The **Cybercrimes Act 2015** makes provisions for criminalizing offences related to computer systems and ICTs.
- The **Electronic Transactions Act 2015** provides regulation on electronic records, signatures, and contracts, as well as the recognition of e-Government services.

The strategies, policies and legislation listed above provide an insight into how Tanzania is managing the digital transition. There are some significant gaps mentioned above that also relate to the legislation. Currently there are limited digitally relevant laws that relate to data protection and consumer protection. Without these protections it is unlikely that there will be sufficient trust and investment within the sector which will likely have knock on effects for the application of digitalization in the agricultural system.

2.3 DIGITALIZATION IN AGRICULTURE

DIGITAL IN AGRICULTURE POLICIES

Several agriculture sector documents and strategies sporadically mention ICTs. The **National Strategy for Growth and Reduction of Poverty II (NSGRP II)**, which is not an agriculture specific document but features a whole section on agriculture as a priority sector, recognizes the importance and benefit of integrating ICTs within the entire value chain. Specifically, it mentions the benefit of ICTs to provide information on prices, markets and advisory services and climate-smart solutions. The **Agricultural Sector Development Program (ASDP)** which predates the NSGRP II includes a section on information and communication and states that a "critical component in the provision of improved agricultural services involves the integration of [ICTs]". The focus within the ASDP features heavily in improving extension services and the management of information systems. There is little mention of the potential for using emerging technologies within the agricultural system. However, the **Cooperative Reform and Modernization Program** does suggest initiatives for leveraging data that is collected from Cooperatives to build a database and a website for greater information dissemination.

The **Agricultural Sector Development Program Phase II (ASDP II)** is the most comprehensive document reviewed that refers to ICTs and modern technologies. Many of the practical mentions of modern ICTs are to facilitate greater dissemination of information on agricultural practices and livestock information. Like ASDP, there is a focus on e-extension services, but this is expanded to e-learning, market information, and developing innovative ICT-based approaches to financial advisory services. There is a much more holistic approach to "leveraging ICT tools and methodologies" in ASDP II. It will support the development and implementation of the ICT system and its backbone architecture (comprehensive agricultural data, network services and integrated and optimized solutions). This backbone will include:

- Consolidation of the government's current agricultural data centers into one state-of-the-art facility
- Provision of the improved ICT infrastructure and standardized security services to external suppliers (i.e., firms) of e-services such as e-voucher and e-wallet
- Intercommunication between integrated solutions
- Data collection, processing, and cataloguing.
- The equipping of agricultural advisors/extension agents in selected areas with ICT tools (low-cost tablets for advisors, smartphones for lead farmers) and methodologies to enable enhanced access to technical and economic information and relevant information sharing networks.

The ministry has also designed an ICT Policy and Master Plan for the crops subsector, but the ASDP II mentions that it needs to be updated to include other subsectors, and marketing inputs from the Ministry of Industry Trade and Investment, for a sector wide approach. This is most encouraging and highlights a prioritization of integrating ICTs effectively in agricultural systems beyond just greater information systems and encouraging greater uptake by farmers but also focusing on two-way communication flows and looking into solutions.

CHALLENGES

The benchmark assessment seems to show that Tanzania has a developed digital economy. However, following the stock take of available strategies, policies, and legislation there are some notable gaps that could be problematic. Digitalization has been embraced in Tanzania through multiple national strategies, and even in the Agricultural Development Plan with a planned sector specific ICT Policy and Master Plan. If successful, the initiatives mentioned in the ASDP II could improve efficiencies, productivity, and profit for farmers. However, with greater digitalization more focus should be placed on ensuring trust, privacy, protection of consumers and for businesses. Innovative digital technologies, and even modern technologies like smartphones, rely heavily on the collection, dissemination, and analysis of data. If the aim is to better integrate ICTs into agricultural value chains, then regulations and frameworks need to be developed or updated that address these digital issues directly.

Some other challenges related to digitalization include the application of digitalization within the government itself and budgetary constraints.

3 DIGITAL AGRICULTURAL INNOVATIONS

This chapter provides a stocktaking analysis to assess the numbers, scope, trends, and characteristics of digital agricultural innovations in Tanzania.

3.1 MAPPING DIGITAL AGRICULTURAL INNOVATIONS

The DACS for Tanzania presents use cases according to a typology and framework developed by GSMA (see Figure 2). The broad areas include access to services, access to markets and access to asset classes.

A total of 27 innovations were identified in Tanzania that had a mix of use cases as illustrated in Figure 7 below. Of the innovations identified, 10 were innovations operational in Tanzania only and 17 were operational in multiple countries within the SADC region. Most innovations were developed with only one single use case (14) and 13 were developed with multiple use cases. Three innovations had five use cases, four had three use cases and six had two use cases.

The identified innovations in Tanzania mainly came from private sector companies (20) and NGOs (6).

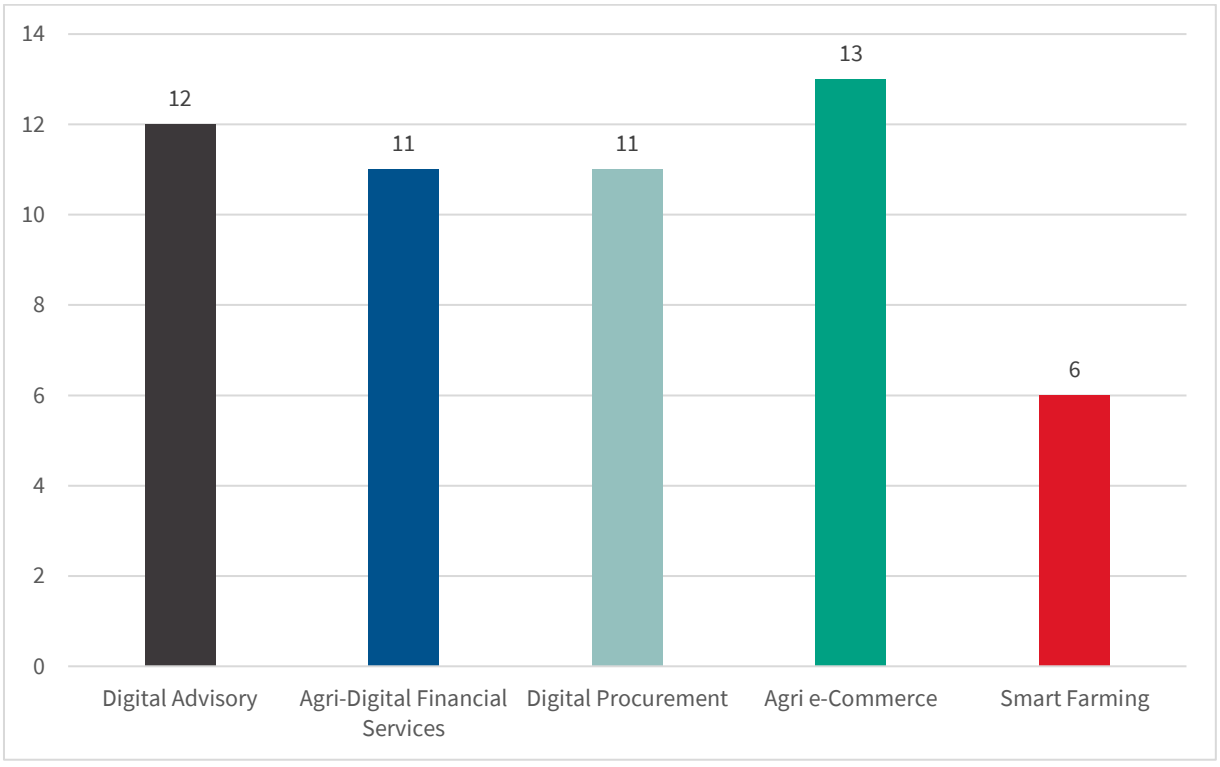

FIGURE 7 IDENTIFIED USE CASES FROM INNOVATIONS IN TANZANIA

The table below presents an overview of all identified innovations with their use cases, if they filled in the survey or not, a brief description of the innovation and company, and where the innovation is operational in the SADC member states.

3.2 IDENTIFIED AGRICULTURAL INNOVATIONS OPERATIONAL IN TANZANIA

In the first four columns the following color coding is used for the different use-cases:

DIGITAL ADVISORY | AGRI-DIGITAL FINANCIAL SERVICES | DIGITAL PROCUREMENT | AGRI E-COMMERCE | SMART FARMING

TABLE 6 OVERVIEW OF IDENTIFIED AGRICULTURAL INNOVATIONS OPERATIONAL IN TANZANIA

					Name of innovation	Name of the company	Survey ✓/X	Description of innovation	Operational Countries in SADC
■	■	■	■	■	Agricultural Innovation Pilot Project	Anglican Church Diocese of Morogoro	✓	Agricultural Innovation Pilot Project (including Jambo Maisha referred to separately below) from the Anglican Church Diocese of Morogoro (ACDM). The church runs agriculture training and capacity building projects that include Digital Solutions, Drone for Crops Management and Drip irrigation.	Tanzania
			■		Alternative Exchange (trading platform) in Eastern and Southern Africa	Escrow Group	X	Alternative Exchange (trading platform) in Eastern and Southern Africa from the Escrow Group is a registered alternative exchange (trading platform) in eastern and southern Africa. The platform enables members of the public to access financial markets using mobile phones / USSD platforms and apps to shop and choose what they want to invest in, including mobile retail bonds (Government and Corporate), securities, and commodities (piloting).	Tanzania, Zambia, Zimbabwe
		■			E- License application for Exporters of Agri-products and Agricultural ERP	Twenty Third Century System	✓	This is a private sector company operating in Malawi, Mozambique, Namibia, Tanzania, Zambia, and Zimbabwe. They are a software solutions company providing services to businesses including agribusinesses and farmers for digital certificates. Their innovation is an e-License application for Exporters of Agri-products and Agricultural ERP where farmers apply for export licenses online using a clean and friendly user interface that was launched in 2020. They have 135 active users of which 85 are registered. These licenses enable access to export markets. They use smartphones and computers and have a website and use spreadsheets and cloud-based software. They	Malawi, Mozambique, Namibia, Tanzania, Zambia, Zimbabwe

								address a knowledge gap and face challenges around understanding the market, user needs and accessibility by users, language and literacy levels, digital literacy, data collection and the inclusive nature of their application. They are in a scaling stage of their innovation and have used impact investors to develop the innovation but currently rely on donor subsidies and will continue to do so.	
	■		■		eKilimo	Master Card	X	eKilimo from Mastercard. A mobile solution developed by the Mastercard Lab for Financial Inclusion. eKilimo is a digital platform accessed via a smartphone that will help introduce efficiency, security, and transparency in the agriculture supply chain. eKilimo will help to make transacting faster, safer, and easier for all stakeholders including the farmer, buyer, and agent. Using a digital platform developed by the Mastercard Lab, eKilimo helps by providing price transparency and more direct access to buyers.	Tanzania
		■			Food Processing Software	Matrix Software	✓	Matrix Software is a meat and food matrix software solution for stock control, yield management, traceability, productivity, and cost margin management. Matrix Software is a service-led private company that provides software services predominantly to the livestock and meat industry and established in 2019. These are digital, mobile, and tablet-based systems for yield and stock control and statistics leading to costings and profitability. Matrix software utilizes android mobile scanners and their associated applications, RFID integrated solutions, automated weighers, and third-party integration. This reduces the initial capital outlays and good implementation support for feedlots, abattoirs, deboning plants, and meat processing plants including others such as fish, poultry, butcheries, and retail outlets. Matrix Software has been located/incubated in the AgVentures Hub in South Africa. This regional solution is deployed in 10 SADC countries (Botswana, Eswatini, Lesotho, Mauritius, Namibia, Seychelles, South Africa, Tanzania, Zambia, and Zimbabwe), but also in counties such as Australia and New Zealand. Matrix Software solutions has reached a stage of replication and adaptation in other geographies and is in the Scaling stage of development.	Botswana, Eswatini, Lesotho, Mauritius, Namibia, Seychelles, South Africa, Tanzania, Zambia, Zimbabwe

■		■		■	GeoFarmer	GeoTerraImage (Pty) Ltd	✓	GeoFarmer at GeoTerraImage Ltd was established in 2017 and has combined innovations in smart farming and digital advisory and e-commerce and is regional in its deployment across the entire SADC region. GeoTerraImage is a private sector company which provides actionable intelligence through monthly crop monitoring through the GeoFarmer-©-Crop monitoring platform to support precision farming and accurate information to map crop trends and statistics by using a dashboard in a cloud-based environment. The innovative solution provides - through the use of computers, satellites and Earth Observation - visual maps and illustrations, statistics and trends for each field or farm being analyzed (crop type, crop growth stages, land suitability, crop irrigation) and guiding decision making around farm management and practices for more efficient and sustainable production. GeoTerraImage has reached wide scale sustained adoption and operates in Angola, Botswana, Comoros, DRC, Eswatini, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Tanzania, Zambia, and Zimbabwe. Through specialized software, proprietary algorithms and application, GeoTerraImage uses remote sensed data to create spatial information. It combines advanced information and reporting to enable analysis, quantification, and monitoring to support key decision making. It charges business subscription fees for its fully commercial product and believe its technology is inclusive of underrepresented groups.	Angola, Botswana, Comoros, Democratic Republic of Congo, Eswatini, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Tanzania, Zambia, Zimbabwe
■	■			■	GreenFingers Mobile	GreenFingers Mobile	X	GreenFingers Mobile from GreenFingers Mobile in Tanzania, South Africa, Zambia, and Zimbabwe. GreenFingers Mobile is a mobile-first Software-as-a-Service (SaaS) technology platform, to manage and finance large groups of smallholder farmers. Developed by a team of agricultural value chain experts, the platform easily adapts to different crop types and use cases.	South Africa, Zambia, Zimbabwe, Tanzania
■					Iringa – Mitigation, Adaptation, Productivity for Climate Smart	Kilimo Trust	X	Iringa – Mitigation, Adaptation, Productivity for Climate Smart Agriculture (IMAP4CSA) from the Kilimo Trust. Part of the Enable's Digital for Development (D4D) program called Wehubit on scaling up digital solutions in the Iringa region, it aims to benefit 12,000 smallholder paddy farmers by mapping in the Iringa region. IMAP4CSA is a 2-year project (2019 – 2021) that aims to mitigate and adapt to climate change and increase rice productivity by providing farmers with actionable information services based on digital data systems, supporting them in better decision-making in risk	Tanzania

					Agriculture (IMAP4CSA)			management. It is funded by the Belgian governmental cooperation through their development agency Enabel and implemented by the Kilimo Trust and Rikolto. The project's aims are: · to strengthen farmers' rice-related climate change mitigation practices · to support farmers in their adaptation to climate change, and · to sustainably increase smallholder rice farmers' agricultural productivity and income by scaling-up digital knowledge and information services in combination with the Sustainable Rice Platform standard to smallholder farmers in the Iringa region.	
■			■		Jambo Maisha	Anglican Church Diocese of Morogoro (ACDM)	X	Provision of agricultural extension to smallholder farmers. The innovation makes use of drones for crops management. It is funded by the Norwegian Church Aid (NCA).	Tanzania
■					Jembe	Agrinfo	X	Jembe from Afrinfo is a precision ag-tech platform that offers a full-stack solution for high precision aerial surveillance imagery to pre-emptively avert crop yield loss due to insects, crop disease, weeds, and nutrient deficiencies.	Tanzania
	■	■			Jumo	JUMO	X	Jumo is a market leading banking as a service platform, launched in 2015, which enables real-time access to funds at the lowest possible operating costs. They offer high quality providers of financial services products to connect entrepreneurs to the world's growing markets. They also offer loans, savings, and a range of financial choices. They have a core next-to-end generation banking infrastructure. And unify which is a machine learning capability to analyze the data to reduce the cost and risk of lending by building accurate credit scores and target people who do not have a formal financial identity, collateral, or credit record. They also use automated algorithms to ensure they do not overextend themselves and have built protective safeguards into the heart of their technology. They have served 18M+ individuals and small businesses, with 120M loans and $3.5b+ dollars disbursed. They are active in Ghana, Tanzania, Kenya, Uganda, Zambia, Cote d'Ivoire, and Pakistan with an operational tech hub in Cape Town, Nairobi, Porto, and London.	South Africa, Tanzania, Zambia

■					Keep an eye on Poultry Business	Agrinfo	X	Lay-Insight, Broiler-Insight, Turkey-Insight and Duck-Insight are innovative management tools for the poultry industry, based on scientific self-learning algorithms, using users' enterprise data to further improve and optimize their production and business process. They are designed to support managers in taking proper decisions concerning their daily business, as well as the strategic decisions they are facing.	Tanzania
	■		■		Kilimo Klub	Vodacom	X	Kilimo Klub from Vodacom It is about funding smallholder farmers through mobile phone money transfers. A mobile innovative solution that sees smallholder farmers receiving support to improve their lives through Information and Communication Technology (ICT) on their phones. The initiative dubbed Kilimo Klub is an exclusive service targeting smallholder farmers and enables farmers to access M-Pesa and get empowered financially using M-Pawa, which provides access to the safest and most convenient banking services giving them access to savings and loans facilities.	Tanzania
■					Macho Sauti	SWISSAID Tanzania	X	Macho Sauti from SWISSAID Tanzania is an e-extension in which smallholder farmers use smart phones with the app to collect information mainly through photos of their troubled crops and send them to extension officers/experts for solutions via an internet platform. An online translator translates the comment from Swahili into English and vice versa. Experts in Tanzania or Switzerland can thus quickly provide personally tailored answers to the most pressing questions. Using GPS, the location of the affected field can be determined precisely so that a disease could, for example, be prevented from spreading to neighboring countries.	Tanzania
		■			Metajua	Metajua	X	Metajua of Metajua. This innovation provides a modular solution with the aim of covering all data flow needs for organizations buying agriculture products from and interacting with smallholder farmers.	Democratic Republic of Congo, Madagascar, Tanzania
	■				Mobis	Agrinfo	X	Mobis from Agrinfo. A cloud-based microfinance management platform designed uniquely to help savings and loans cooperatives go paperless and become more efficient by digitizing how they manage customer data and transactions.	Tanzania

								Agrinfo works in partnership with farmers associations, financial institutions and input and output suppliers.	
					More Than Cashews	YYTZ Agro-Processing	X	More Than Cashews from YYTZ Agro-Processing. Use of blockchain technology in cashew nuts farming for traceability. They developed a blockchain technology with a startup in the Netherlands where each pack of roasted cashews has a QR code that you can scan and see exactly which farmer it came from.	Tanzania
					Mukuru App	Mukuru Africa	✓	Mukuru Money Transfer Limited is a private sector company operating regionally (Botswana, DRC, Eswatini, Lesotho, Malawi, Mauritius, Mozambique, South Africa, Tanzania, and Zimbabwe). The application addresses a knowledge and access gap and provides access to markets and financial services. The Mukuru App was launched in 2019 and allows customers to create orders for remittances individually and initiate a payment for the transfer to happen. The app can also be used to self-register a customer on the platform and verification takes 24 hours. This enables efficient access to financial services through smartphones. The innovation uses SMS, USSD, a Smartphone App, Website, Dashboard and Social Media Platforms (Facebook, Twitter, WhatsApp, and Messenger). The platform uses local and cloud-based databases (Excel, MS Access, SQL) and AI platforms (IBM Watson) for Machine learning. Regionally it has 500,000 users and 1M registered users. It also enables farmers to sell to consumers (B2C) and to enterprise customers (B2B) such as hotels, restaurants, and market retailers. Challenges include digital literacy, device sharing, lack of mobile coverage, and financial sustainability of the business model in different locations. The application has reached sustainable scale and is focused on individual users. The business was supported by friends and family and development support and training grants. The revenue model is based on transaction fees and the in-house development of the App and platform which is believed to be inclusive of disadvantaged groups.	Botswana, Democratic Republic of Congo, Eswatini, Lesotho, Malawi, Mauritius, Mozambique, South Africa, Tanzania, Zimbabwe

			■		NAAT APP (Netherlands Alumni Association of Tanzania App)	NAAT	X	NAAT App from the Netherlands Alumni Association of Tanzania. It is an application that seeks to link farmers and livestock keepers with the market. It is being supported by the Netherlands embassy in Tanzania.	Tanzania
			■		Obus	Obus Digital company Limited	✓	An app where buyers can order rice (Grade I) from the nearest shop registered in the app selling grade I rice (delivery not exceeding 0.5USD fare by motorcycle). The delivery is by a motorcyclist registered on the app.	Tanzania
				■	Robotech Lab	Robotech Lab	X	Robotech Lab of Robotech Lab. A robotics lab in Tanzania that focuses on training and education and research and development of various sectors including Farming and Agriculture. It uses technologies such as censors to solve smallholder farmers' challenges.	Tanzania
■					SAGCOT Integrated Knowledge and Information for Agriculture (SIKIA)	Kilimo Trust	X	SAGCOT Integrated Knowledge and Information for Agriculture (SIKIA) from the Kilimo Trust. SAGCOT was a 3-year project (2014-2016) that employed the latest technology to provide reliable information on Weather forecasts, Agribusiness support, Plot specific crop advice and a SAGCOT database to increase production and productivity of 125,000 rice farmers and 400 other VC actors in the Southern Agricultural Growth Corridor of Tanzania. The project was implemented in partnership with TechForce Innovations B.V, Netherlands, Milan Innovincy B.V., Netherlands, Kadaster International, Netherlands and Alliance for a Green Revolution in Africa (AGRA), Kenya. The achieved project goals included the delivery of actionable information services, acquired from satellite geodata (e.g., environmental, crop status via Synthetic Aperture Radar (SAR) and plot boundaries information), augmented by more detailed data acquisition under the clouds (multispectral agronomic information) and web-based information.	Tanzania
■	■	■	■	■	Smart Village Agri hubs	UjuziNet Edtech Limited	✓	Smart Village Agri hubs from UjuziNet Edtech Limited. It partners with entrepreneurs, agronomists, and innovators to convert local agro inputs' shops into Smart Village AgriHubs that function as Agricultural Support Centers with all farmers' support tools	Tanzania

								under-one-roof by using their farm management software integrated to all Village Agri Hubs. With this partnership, they join hands together to incubate small scale and emerging farmers into fully- fledged, future-fit, sustainable enterprises attaining higher improved quality yields, participating in commercial supply chains, and enabling multinationals in the food and beverage sector to source a reliable supply of high-quality raw materials from their network of small-scale farmers registered in their Smart Village AgriHubs (Kliniki za Kilimo). They provide value through integrated agronomic support services that combine technology and latest research developments to ensure current farming demands are met with knowledge and confidence.	
■	■	■	■	■	SmartFarmer	Riskflow DBS	✓	Smart Farmer of Riskflow DBS. Riskflow DBS is a private sector company, and this innovation was launched in 2019. Smart Farmer is an agriculture value chain connector, linking agricultural communities to value adding services through networks with markets, suppliers, service providers, other farmers, and relevant government departments. It achieves this through the provision of user friendly, efficient, and flexible ICT-based services which cut across many functions and access channels. The value of Smart Farmer is in assisting farming communities and other stakeholders in doing things smarter, with transparency, accountability, and efficiency, while driving profitability. As a response to the problems faced by agricultural communities, Smart Farmer provides the following services: Peer-to-Peer communication for Farmer-to-Farmer Interaction, Funder-to-Farmer Communication, Government-to-Farmer Communication, Price tracking and reporting, Agricultural alert systems (sending and receiving), Commodities offer and bid facilitation, Location services for service providers, Production information systems e.g., best practices, planning and e-Extension services. The Agri-VAS service assists farmers throughout the production cycle and livestock information and market prices – from planning to sale stages, whether locally, regionally or globally. Smart Farmer offers a new way through which information systems in agriculture are vastly improved. Agri VAS are delivered via voice channels (IVR and helplines), text channels (SMS and USSD) and via apps, Smart advisory: enabled data-driven advisory based on tailored, farm-level agro-climatic and crop specific information to support decision making, maximize productivity and reduce costs. Most of the services are accessible via mobile applications and require a	Botswana, Lesotho, Malawi, Mozambique, South Africa, Tanzania, Zambia, Zimbabwe

								farmer to upload a picture of the infected plant for diagnosis. Some services are also accessible via USSD. It also includes national and regional-level pest and disease early warning systems, and record keeping, digital tools that enable farmers to keep detailed records of livestock, including health and feeding data, to help mitigate diseases and avoid missed conceptions. Record keeping tools are also used to keep details of input usage, procurement, cost and revenue and sales records. The other product is the CashFlow Optimizer to deal with an open integrated and adaptive web based platform with details of dealers and counterparties, making use of Intelligent Financial Performance Monitoring components. The Primary Outcome of this innovation is improved access to Finance through providing each farmer an Income statement balance sheet and cashflow, to assist them in accessing loans as well as keeping their Bio Data digitally and open for appraisal to Financial Institutions. Improved Yields through use of 3rd Party software that it has partnered with on their Platform such as Skudu to provide fertilizer and Insuring Yields through an Area Yield Index based Insurance model from PULA; their insurance partner. The regional initiative is active in Botswana, Lesotho, Malawi, Mozambique, South Africa, Tanzania, Zambia, Zimbabwe with 15,000 active users and 300,000 registered users and is in the transition to scale stage.	
	■		■		Tigo Kilimo	Tigo (Mobile phone operator - Telco)	X	Tigo Kilimo from Tigo. Tigo Kilimo is an agricultural value-added service (Agri VAS), operated by the mobile network operator Tigo. The service offers farmers relevant, timely and actionable information via mobile phones across three domains: agronomic practices on major crops, market price information, and weather forecasts. Content can be accessed via three mobile channels: Supplementary Service Data (USSD), Interactive Voice Response (IVR) and a helpline.	Tanzania
	■	■	■		Ubia Soko	AGRI Insight/Twigalpha	✓	Ubia Soko from AGRIInsight/Twigalpha. Ubia Soko is a unique multi-service platform developed by AGRIinsight Ltd where existing and new technologies/algorithms are	Tanzania

								combined in an innovative way to build a comprehensive business-support solution for farmers' families and servicing businesses.	
■					Viamo platform	Viamo	✓	Viamo 321 Platform from Viamo. The Viamo platform is implemented in the Democratic Republic of Congo, Madagascar, Malawi, Mozambique, Tanzania, and Zambia. Viamo is a global Mobile for Development (M4D) organization that aims to improve lives via the power of mobile technology. With a presence in more than 20 major markets in Africa and Asia, Viamo is a global social enterprise that specializes in mobile engagement and Information and Communication Technology for Development. Viamo works in partnership with organizations to connect them and individuals through digital technology, for everyone to make better decisions. Viamo uses IVR technology for Agri-VAS for information dissemination and data collection. It also helps provide market linkages between farmers and consumers. It assists farmers with climate smart information hosted on a hotline that farmers can access on-demand and provides market price information. Agri VAS are delivered via voice channels (IVR and helplines), text channels (SMS and USSD) and via apps. Launched in 2017, it has 300,000 smartphone users and 8.5M registered users in the SADC region. The challenges they face relate to understanding the market and user needs, device sharing, uptake by farmers especially women and girls, lack of mobile coverage and electricity. They have reached sustainable scale and charge commercial rates as a social enterprise. Development partners can use the platform for a fee to develop content and disseminate this to the subscribers of the platform.	Democratic Republic of Congo, Madagascar, Malawi, Mozambique, Tanzania, Zambia

3.3 RESULTS FROM INNOVATION SURVEY RESPONDENTS

All identified innovators received a survey and 10 innovations implemented in Tanzania responded. The answers on the survey are self-reported. Of the innovations that responded, four were operational in Tanzania only and the remaining six operated in several countries. All identified innovators were reminded several times by email and by phone to complete the survey. The response rate of the survey for Tanzania was 37% (10 out 27 identified innovations responded).

USE CASES AND SUB USE CASES

The division of GSMA use cases shows that in Tanzania multiple use cases are most common. Six out of 10 respondents provided multiple services and four respondents provided a single use case. Three respondents provide all five use cases in their innovation, and three provide three use cases.

Figure 8 below provides the division of use cases provided. Digital procurement was the most common use case cited by nine survey respondents. This is unusual as in other SADC countries it has tended to be digital advisory that is the largest use case. Figure 8 also illustrates a comparison of use cases to the rest of the identified innovations in the SADC region.

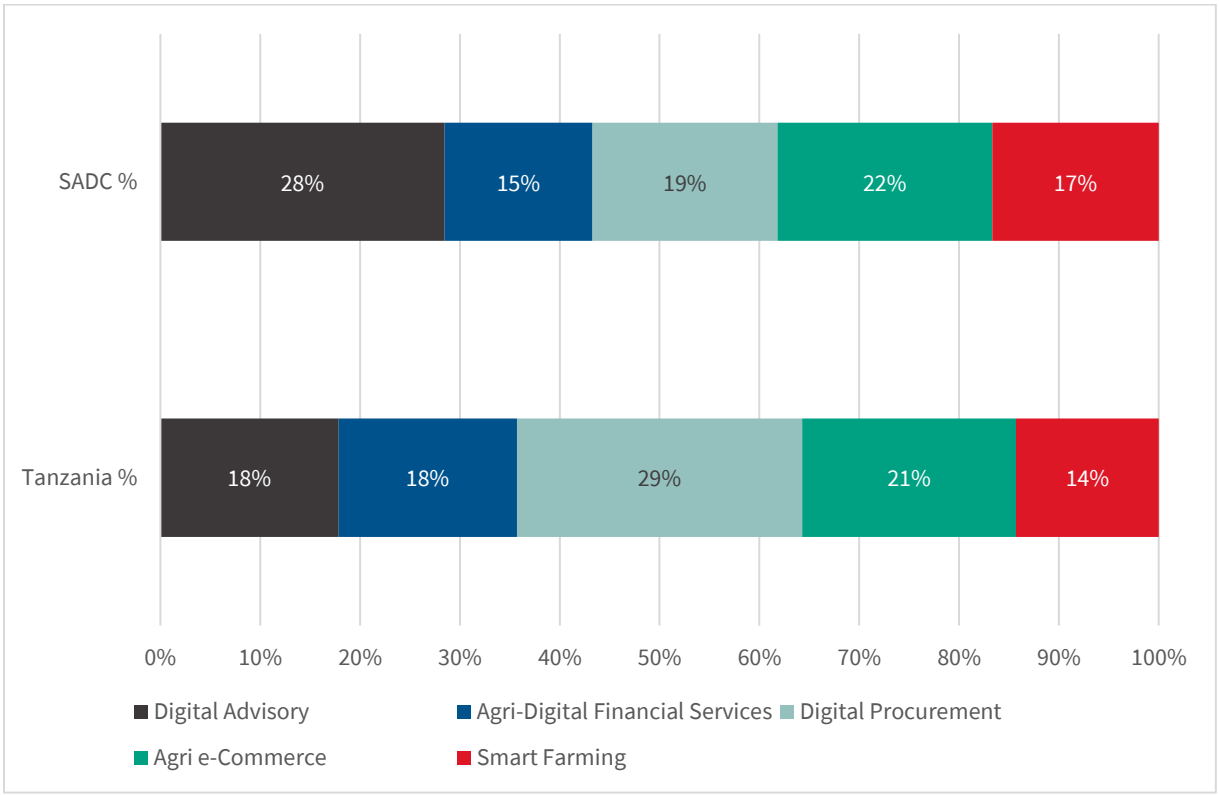

FIGURE 8 DIVISION OF USE CASES FOR SURVEY RESPONDENTS IN TANZANIA VS. IDENTIFIED INNOVATIONS IN SADC

Most innovations were launched in 2019 (4), with one in 2020 and one in 2021 (Smart Village Agri hubs by UjuziNet Edtech Limited who already have 1,860 registered users (1,123 active) despite being in operation for under 1 year). The oldest innovation is a food processing application from Matrix Software that launched in 2002.

The innovations present in Tanzania provide a large variety of sub use cases as presented in figure 9 below.

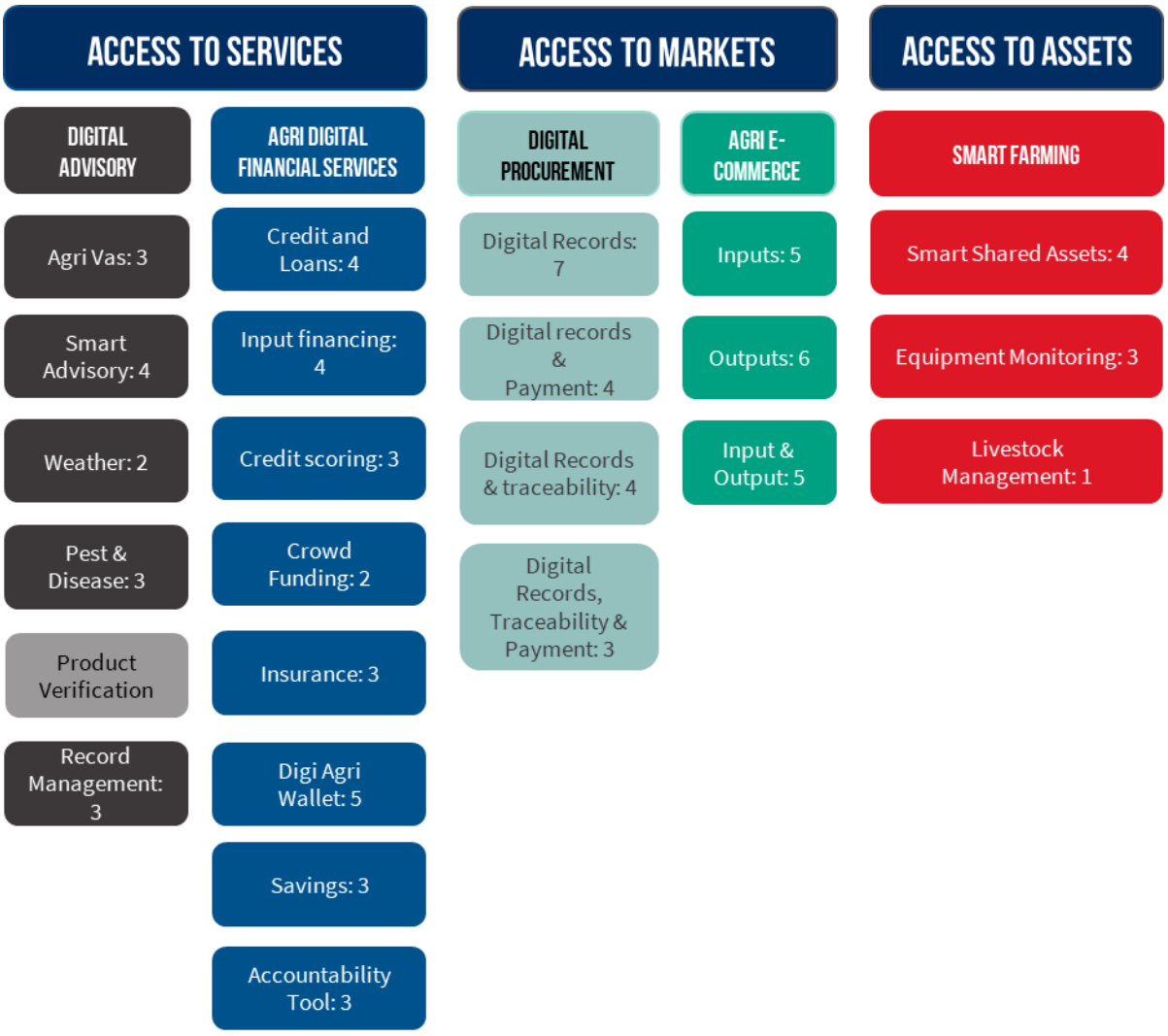

FIGURE 9 OVERVIEW OF SUB USE CASES PRESENT IN SURVEYED INNOVATIONS IN TANZANIA

CHALLENGES

The innovations targeted a wide range of anticipated outcomes. Poor access to markets was the biggest challenge targeted (9), followed by the knowledge gap (7), low productivity (7) and financial exclusion (6). In looking at the biggest challenges in the application of technology, an even spread over all the options given was found. Digital literacy was the most frequent (7), followed by farmer uptake/use/behavior change (5), access to a device (sharing with family and others) (5), and a lack of mobile network coverage (4).

TECHNOLOGY AND CHANNELS

A Website / Dashboard / Portal is the most common channel (8) followed by Smartphone apps (7), SMS (5) and Mobile voice / IVR / call centers (3). Cloud-based software (8) and Cloud-based databases (7) were the most popular tools for analysis. In looking at the Tanzania-only innovations, all of them noted the use of Cloud-

based databases/software, highlighting the high level of cloud-based software within Tanzania and knowledge in using it.

VALUE CHAIN PHASES COVERED

Innovations in Tanzania are generally quite spread throughout the value chain as can be seen in figure 10.

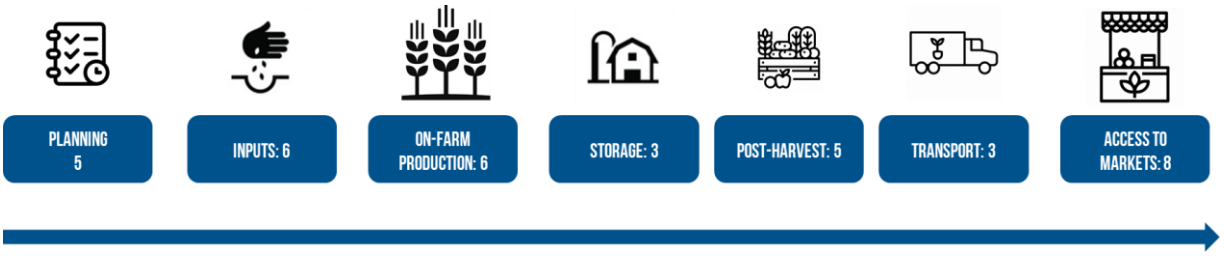

FIGURE 10 SURVEYED INNOVATIONS PRESENCE IN THE VALUE CHAIN IN TANZANIA

SCALING, DEVELOPMENT AND FINANCE

Most digital innovations in Tanzania are in the mid to later stages based on the Insights on Scaling Innovation report, which is accessible here[15]. Half of the innovations have reached a form of scale. Of the Tanzania-only respondents, only one had reached the scaling stage, two were in transition to scale and one was in the proof-of-concept phase.

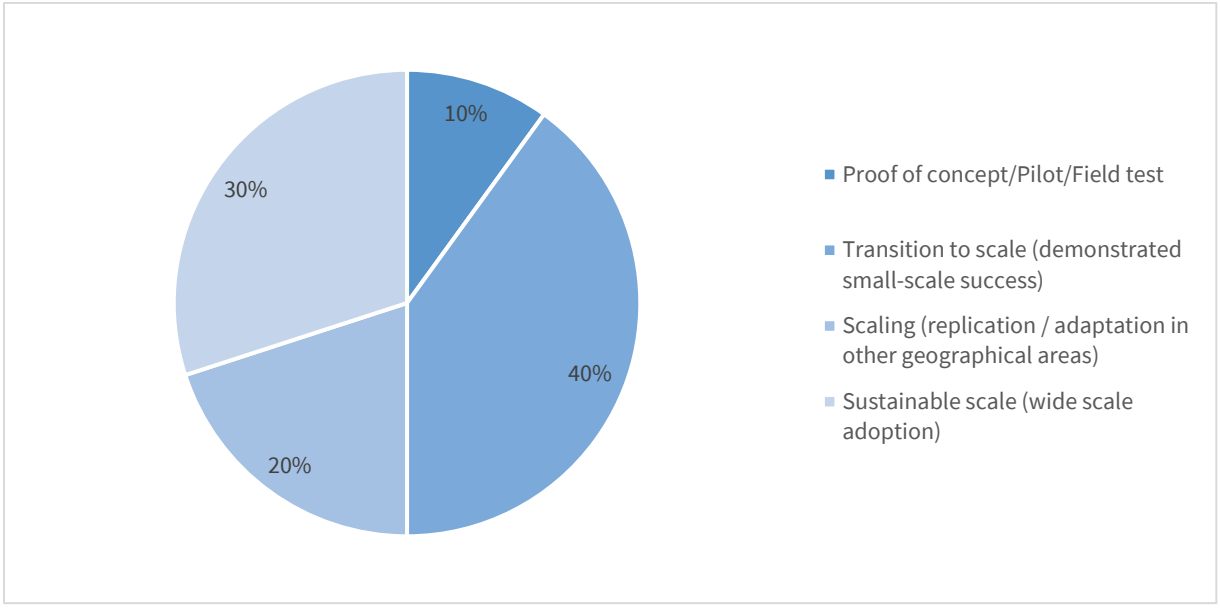

FIGURE 11 SCALING STAGES FROM SURVEYED INNOVATIONS IN TANZANIA

Innovators have different definitions of what it means to have achieved sustainable scale. Three innovations saw themselves at sustainable scale and five at transitional. Of note are the organizations that defined themselves at a transitional scale. The International Development Innovation Alliance (IDIA) defines “at transition to scale level” as having “the wide-scale adoption or operation of an innovation at the desired level of scale / exponential growth, sustained by an ecosystem of actors”. The self-declared innovations who are transitioning to scale have a vast range of users, years of operation and needs for future subsidies of donor

support to remain sustainable. It shows that there is no standard definition of when an innovation gets to a certain level of scale, but that it is very much a self-judgment:

- SmartFarmer launched in 2019, has 11,000 active users, 351,000 registered users and will require support to remain sustainable.
- E-License application for Exporters of Agri-products and Agricultural ERP was launched in 2020, has 135 active users, 83 registered users and is unsure if they require additional support to remain sustainable.
- Smart Village Agri hubs, launched in 2021, has 1,123 active users, 1,860 registered users and will require further support to remain sustainable.
- Ubia Soko, launched in 2019, with 11,000 active users, 11,000 registered users and unsure if they require additional support to remain active.

The Mukuru App (launched in 2019) is reported to be at a sustainable scale, with 1,000,000 registered users, half of which are active. They do not require any subsidies or donor support to sustain the innovation as funding is achieved through transaction fees. Viamo, with 8.5 million registered users in multiple SADC countries (300,000 active users) is still dependent on donor grants due to their model that relies on premium services of development partners such as content creation and dissemination of this information to subscribers.

The Food Processing Software by Matrix Software; the oldest innovation noted (launched in 2002), sees itself as scaling (replication / adaptation in other geographical areas), albeit with no need for subsidies or donor funding to be sustainable (150 registered and active users).

The innovations within Tanzania rely heavily on transaction fees (4) and business subscription fees (3). Whereas most countries in the SADC region reported farmers to be the main primary-end user of their technologies, in Tanzania it was found that both farmers and 'other value chain actors' (e.g., input suppliers, buyers, mills, etc.) were in joint-first position (6 each), which confirms the high reliance on business subscription fees.

There was a spread in methods of financial support, with the most common being incubator/accelerators (4), friends and family (4), network opportunities (4), business development support (3) and training opportunities (3). Donor grants (governments/foundations) and impact investors appeared twice each. Looking at the need for any subsidies or donor support to continue to sustain the innovation, three innovations did not need any subsidy / grant anymore, while two others were unsure about it. Five still require additional funding.

INCLUSIVITY

Not all innovations focused on inclusiveness. A few innovations took explicit action to reach persons with limited literacy levels (4), women (4), and the elderly (3). Some innovations mentioned that their technology is already inclusive of women (4) and the elderly (4).

4 DIGITAL AGRICULTURAL SYLLABI AND ENTREPRENEURSHIP TRAINING

The Tanzanian 2016 National ICT Policy articulates the potential of ICTs in the delivery of formal and informal education. It also states that access to ICTs is only available in very few schools and learning institutions in urban areas, most of which are private institutions. ICT facilities and sufficient bandwidth are not available in most universities and higher learning institutions. Furthermore, teachers lack digital training to utilize ICTs in their teaching. To overcome these challenges, the 2016 National ICT Policy recommends several strategies: *Creating ICT professional recognition and developing frameworks for promoting a human resource base that is ethical and capable of championing ICT initiatives towards the creation of knowledge society*; *Strengthening collaboration with the private sector in development of a critical mass of ICT skills and expertise while encouraging lifelong learning through the use of ICT; Ensuring effective use of ICT in teaching and learning throughout the formal and informal education system.* Education and research institutions are therefore responsible for the development of ICT curricula to train students in digital skills.

In addition, the Tanzania Development Vision 2025 highlights the importance of ICTs for the country's social and economic transformation. The vision states that ICTs should be applied in all sectors of the economy to fulfil people's basic needs, increase productivity, and promote competitiveness. To profit from the new opportunities facilitated by ICTs, appropriate skills and capabilities are needed. To achieve this, investments should be made to improve the quality of science-based education to stimulate the knowledge society.

In 2019 the ITU World Telecommunication/ICT Indicators Database reported that only 20% of the Tanzanian population was using the internet. In 2020, the Network Readiness Index rated Tanzania 117 out of 134 countries in the technology pillar. The technology pillar considers a country's access to technological infrastructure, content, usage and the vision for future technologies. These ratings provide an indication that Tanzania requires immense support to prepare for a digital agricultural future.

TERNET is the research and education network of Tanzania and was established in 2008 to provide network infrastructure and associated services for enabling sharing of education and research resources inside and outside the country. TERNET provides affordable bandwidth to all its members and other value-added services. TERNET is strategically positioned to create an enabling environment for a digital agricultural economy and needs continued support from the government to build last mile solutions and improve connectivity to remote regions in Tanzania.

4.1 AGRICULTURAL SYLLABI UNIVERSITIES

The study team asked two Agricultural Universities to complete the survey or participate in key informant interviews (KII):

- The Nelson Mandela Africa Institute of Science and Technology
- The Sokoine University of Agriculture and Technology

Both universities did not respond to our survey and did not participate in KIIs.

4.2 INCUBATORS AND INNOVATION HUBS

The study team mapped seventeen business support organizations, out of which seven are operating in the agricultural sector.

The general business support organizations without focus or activity in the agricultural sector that were identified are SHE Codes for Change, Seedspace Dar es Salaam, NLab Innovation Academy, Kiota Hub, Robotech Labs, Twende Social Innovation Center, Tanzania Data Lab, Apps And Girls, Bongo Tech & Research Labs (BT&R Labs) and AMCET Hub. For these organizations we did not find evidence of trainings and incubation activities dedicated to agriculture entrepreneurs and therefore they were not targeted for the KIIs.

The agriculture-related business support organizations that were identified and contacted are:

- Ndoto Hub
- Anza
- Startup Grind
- The Agricultural Business Innovation Center (AIC)
- Buni Hub
- Cube Zanzibar Center for Entrepreneurs and Innovators
- Sokoine University Graduate Entrepreneurs Cooperative (SUGECO)

These organizations support entrepreneurs and youth in Tanzania to build their digital and entrepreneurial capacities and skills in the agricultural sector. A total of **four** business support organizations responded to our request and took part in KIIs:

ANZA

Established in 2015, Anza is a private entrepreneur support organization (i.e., hub, accelerator and impact fund). It provides capacity building, market linkages and capital by targeting enterprises in six sectors (for growth and scale stage): agriculture, healthcare, education, water hygiene and sanitation, clean energy, and financial inclusion. It also provides capital investments through its own fund, the Anza Growth fund. It does not employ agricultural experts.

They have supported 1,900 agricultural startups to date. All startups that pass through the program receive lifetime support. Currently, they have 20 startups in their active program such as Swahili Honey (honey production, processing and distribution), Tanzania Tea collection (production and distribution of tea), Imara technology (provision of AgriTech solutions to smallholders farmers), Circlex Systems (provision of solar-based irrigation solutions to farmers), Green power group (processing of agricultural waste into clean energy) and Temnar Ltd (collection, processing and distribution of edible oil: sunflower, coconut, ground nuts).

Anza provides digital agriculture trainings in the areas of financial records, impact tracking, market access (e-commerce, linkages among the value chain producers, link to suppliers) and agri technical mentorship (through a platform and WhatsApp, entrepreneurs can be supported at distance with advice from extension officers, e.g., access to weather information and access to other agri-mentors). It covers the following concepts and tools in its digital agriculture trainings: digital advisory, agri digital financial services, digital procurement, agri e-commerce and smart farming if it refers to the business model of the startup incubated. Through these trainings, it targets young entrepreneurs and young agricultural entrepreneurs.

It collaborates with external organizations from the public and the private sector and with the following universities and institutions: Nelson Mandela University, St. Augustine Agriculture University and the Commission for Science and Technology.

The organization receives government support, and the innovators receive grants through the National Fund for advancement of science and technology. Furthermore, Anza receives funds from international philanthropic organizations and the private sector. It also sells services and programs to organizations. In addition, it provides loans to the businesses and earns money from that as well as through their fund. They have already invested two million Dollars in startups.

BUNI HUB

Established in 2013, Buni Hub is a mother hub with pre-incubation services and hosted by the Tanzania Commission for Science and Technology. It supports new and existing Hubs with capacity building and linkages with the government since they work closely with them. It targets technological ideas, but it also supports grassroots solutions. It does not employ experts in digital agriculture, but it employs general ICT experts.

The Buni Hub has supported 20 agricultural startups to date. It currently supports five agricultural startups including AgriTech (aquaponics), Hakiki (they help farmers to access the fertilizers through the authentication of the seeds through a mobile App) and Kilimo guide (a platform to get investment guidance/return based on agriculture activity/livestock).

Buni Hub's information technology and ICT engineers deliver digital skills trainings in:

- Designing prototypes
- Digital marketing
- Designing of brands/content creation
- Internet of Things
- Programming
- Data Science / Artificial Intelligence
- Mobile and website development

It does not generally offer specific trainings on AgriTech but if a startup in AgriTech needs training they support them. They include agri digital financial services, digital procurement and agri e-commerce tools in their trainings and target students, aspiring agricultural entrepreneurs and aspiring and early-stage entrepreneurs.

Buni Hub collaborates with the following universities: Dar es Salaam Institute of Technology, Tumaini University, University of Dodoma, Mbeya University of Science and Technology, St. Joseph College of Engineering and Technology, The Nelson Mandela Institute of Science and Technology, Sokoine University of Agriculture, The Open University of Tanzania and The Arusha Institute of Accountancy. The organization receives government and donor funding.

CUBE ZANZIBAR CENTER FOR ENTREPRENEURS AND INNOVATORS

Established in 2018, Cube Zanzibar Center for Entrepreneurs and Innovators is an NGO that works in the sectors of agribusiness, health, tourism, and education. It has an innovation space where it organizes events,

provides microfinance for seed capital, and connects startups with financial institutions. Furthermore, the organization offers acceleration/incubation, managerial support, physical spaces, entrepreneurial and managerial training, ICTs and digital agricultural training, administrative and legal services (with an external partner for the legal part), support in the development of networking relationships, support for technology scouting and development, support in fundraising and investment readiness, seed capital, internship opportunities, match makers meetings, innovation weeks like hackathons, pitching and other innovation events and the display of new technologies.

Cube Zanzibar has supported six agricultural startups from ideation to the product on the market and in between 50 and 60 with trainings. Currently it has sixteen agricultural startups in different stages of development. It supports four startups in prototyping by university students who are accompanied in their innovation by the incubator. Other examples of current agriculture startups are: Mecci Foundation (building machineries and tools in agriculture; connecting youth innovation from universities and supporting their implementation), Rashid aquaponic company (digital solution), Kiembesamki School (automatic irrigation – temperature testers, soil testing), Zanzibar Authentic (dry fruits processing facility), Soldier Fly (alternative food for poultry, has also a digital component) and Bio stimulator (alternative fertilizer from Seaweed; has also a digital component).

Cube Zanzibar offers general digital skills in the following sectors:

- How to use Search Engine Optimization
- How to use social media for marketing and branding identity
- TAHA: how to join the web platform www.taha.or.tz where they can join different services to market and sell the products.

It does not provide any specific training in digital agriculture, but it uses the tools of digital financial services and e-commerce for its general trainings.

For digital agriculture and ICTs/digitalization trainings, it targets mostly students, graduates, young agricultural entrepreneurs, aspiring agricultural entrepreneurs, seaweed farmers and women. Cube Zanzibar states that the youth do not like agriculture (farming) but are more interested in agribusiness (processing, furniture, transportation, and innovation). The target for its agriculture trainings are mostly women. For its entrepreneurship trainings/incubation it targets final year students or early-stage entrepreneurs, youth, and women. It selects about 50 youths and provides them with general trainings (three-day trainings in general entrepreneurship skills). Afterwards, the youth can choose in either entrepreneurship incubation or employment. If they choose employment, they are provided with soft skills and digital skills trainings. For those who chose entrepreneurship they are taken through a business canvas to clarify their ideas, have basic digital skills to go to the second stage of acceleration with advanced digital trainings like website management and marketing.

It collaborates with external organizations such as the NGO Digital opportunity trust Tanzania for digital trainings, the NGO MWAMBAO MCCS for credit and loan training, SUZA University ZANZIBAR for financial literacy, digital marketing, and business plan preparation. In addition, it collaborates with the following universities: State University of Zanzibar, SUZA University ZANZIBAR, University of Dar Es Salaam, Karume Institute of Science and Technology, and the University of Waterloo in Canada (the management science department).

Cube Zanzibar does not receive government funds. It is funded by Donors (UK Aid – HIDF project) and the Milele Zanzibar Foundation. Currently, it is renting space from the USAID Feed the Future project for its trainings and collaborating with other projects but does not receive any funds.

SOKOINE UNIVERSITY GRADUATE ENTREPRENEURS' COOPERATIVE (SUGECO)

Established in 2011, the Sokoine University Graduate Entrepreneurs Cooperative (SUGECO) is an incubator, training center, and innovation hub. SUGECO is a member-based organization to support youth in agribusiness. It is operating using business modules divided in five steps: 1) mindset transformation 2) training on entrepreneurship and finance literacy and innovation space 3) internship program locally and internationally (US and Israel) 4) Incubation 5) Mentorship and Coaching. In addition, it uses advocacy and policy to create an enabling environment to do business smoothly. SUGECO's space is hosted by the university but the organization is an independent entity.

It provides support in: acceleration/incubation, managerial support, physical spaces (both for incubation and for people to test their production on 20 hectares of land and 1000 in total outside the university and in a processing hub), entrepreneurial and managerial training, ICTs and digital agriculture training, some intellectual property, support in the development of networking relationships, support for technology scouting and development, support in fundraising/investment readiness and connecting students to agribusinesses. It does not provide administrative and legal services support but can refer people to the right organizations.

To date, it has supported 120 agricultural startups and supports 2000 students every year. Currently, it has around 20 agricultural startups in its portfolio, e.g. Get Aroma Spices Company Limited (spices production and digital ways to sell the product and communicate with the clients), SANAVITA Company Limited (processing of nutritious food products), Rat Farming business for lab specimen (provide rats to students for laboratories), VERO Juice (adding value to making juices), Solar Drying Technology business (expansion of use of solar dryers, especially in fisheries - sardines) and OFSP (Orange Fleshed Sweet Potato) Seed Production (and selling to farmers through digital technologies and digital extension services).

For agriculture entrepreneurs, it provides trainings in:

- Use of IT Applications to support agriculture development
- Designing of different solutions, especially for the use of farmers
- Networking with developers and the right institution
- Digital literacy (how to use the phone to use business, communicate with others, and showcase their products)
- Marketing intelligence

Its trainings include the digital agriculture concepts of digital advisory, agri digital financial services, digital procurement, agri-e-commerce and smart farming (except robotics, blockchain, and satellite imagery). Through the trainings, it targets students, graduates, young agricultural entrepreneurs, aspiring entrepreneurs and young/early-stage entrepreneurs.

SUGECO collaborates with FAO Tanzania, UNDP, Care International and the following universities: Sokoine University of Agriculture and fourteen Agricultural Related Diploma Colleges under the Ministry of Agriculture, e.g., Ilonga Agricultural Institute, Uyole Agricultural Institute and Ukiriguru Agricultural Institutes.

SUGECO does not receive government funds but gets access to government properties such as physical spaces and land. It is trying to become a private-oriented organization. It received funds through the provision of services to the government or international organizations like FAO.

TABLE 7 OVERVIEW OF RESPONSES FROM INTERVIEWED INCUBATORS IN TANZANIA

TANZANIAN INCUBATORS	
Anza	
Year of Establishment	2015
Agri startups incubated	1,900
Target of Digital Agri trainings	Young agricultural entrepreneurs
Digital Skills trainings	ICT for Financial records, impact tracking and access to market Agri technical mentorship
Digital Agri Tools taught	Digital Advisory Agri Digital Financial services Digital Procurement Agri-e-commerce Smart Farming
Collaboration with Universities and Colleges	Nelson Mandela University St. Augustine Agriculture University Commission for Science and Technology
Supported by the Government?	Yes
Buni Hub	
Year of Establishment	2013
Agri startups incubated	20
Target of Digital Agri trainings	Student/ Pupils Aspiring agricultural entrepreneurs
Digital Skills trainings	Prototypes Design Digital marketing IoT Programming Data Science/AI Mobile and web development
Digital Agri Tools taught	Agri Digital Financial services Digital Procurement Agri-e-commerce
Collaboration with Universities and Colleges	Dar es salaam Institute of Technology, Tumaini University, University of Dodoma, Mbeya University of Science and Technology, St. Joseph College of Engineering and Technology, The Nelson Mandela Institute of Science and Technology, Sokoine University of Agriculture, The Open University of Tanzania, The Arusha Institute of Accountancy
Supported by the Government?	Yes
Sokoine University Graduate Entrepreneurs Cooperative (SUGECO)	
Year of Establishment	2011
Agri startups incubated	120
Target of Digital Agri trainings	Graduates Young agricultural entrepreneur
Digital Skills trainings	Use of Apps for agriculture Design of solutions for farmers Digital Literacy Marketing Intelligence

Digital Agri Tools taught	Digital Advisory Agri Digital Financial services Digital Procurement Agri-e-commerce Smart Farming
Collaboration with Universities and Colleges	Sokoine University of Agriculture, 14 Agricultural Related Diploma Colleges (Ilonga Agricultural Institute, Uyole Agricultural Institute, Ukiriguru Agricultural Institutes etc.)
Supported by the Government?	Unsure
Cube Zanzibar Center for Entrepreneurs and Innovators	
Year of Establishment	2018
Agri startups incubated	6
Target of Digital Agri trainings	Student/Pupil Graduate Young agricultural entrepreneur
Digital Skills trainings	SEO / web marketing / social media TAHA: how to join this web platform (www.taha.or.tz)
Digital Agri Tools taught	Agri Digital Financial services Agri-e-commerce
Collaboration with Universities and Colleges	Zanzibar, SUZA University ZANZIBAR, University of Dar Es Salaam, Karume Institute of Science and Technology, University of Waterloo in Canada (management science department)
Supported by the Government?	No

5 INSIGHTS AND REFLECTIONS

The following section outlines the key insights from the data collection of the DACS and towards the end of the report signposts some broader reflections relevant to this country from the *Situational Analysis Report*.

It is important to note that digitalization is a gradual process, which requires a broad and well understood internal rationale, adjustment of organizational culture and adequate investments over time and of resources to align actors, processes, and capacity. This section acknowledges that the data collected is not exhaustive but has enabled some insights and reflections to be shared that are more country specific. To capitalize on these results, multi-stakeholder processes to define clear approaches based on agreed priorities will be necessary.

5.1 INSIGHTS

BENCHMARK RESULTS

Tanzania ranked fifth out of 16 in the benchmark assessment which suggests that it has some key foundational elements necessary for a robust digital economy. The benchmark assessment enabled the identification of countries within the SADC region that are unlocking positive pathways towards a digital economy and a vibrant ecosystem of different actors. Tanzania ranked in the top half of the SADC member states for all pillars except ICT infrastructure (which identifies the availability of affordable, accessible, resilient, and reliable infrastructure).

Four clusters of countries at different points in their progress were identified in applying the benchmark. The clusters formed through the benchmark help to identify the progress countries have made and where greater efforts may need to be directed. Tanzania makes up part of Group 2, these countries ranked in the top half of the benchmark but are not the front-runners in the region, based on the data collected.

POLICY ENVIRONMENT

The benchmark assessment suggested that Tanzania is unlocking the digital economy and that there is likely a supportive enabling environment. The stock take of national policies, strategies and legislation identified that digitalization is being prioritized but more needs to be done to incorporate emerging technologies. There are some notable gaps that could be problematic, the government needs to ensure a clear focus on ensuring trust, privacy, protection of consumers and for businesses. Regulations and frameworks will be required to better integrate ICTs into agricultural value chains to ensure related digital issues are addressed.

No specific sectoral strategy or policy on digitalization within agriculture was identified. It seems that digitalization within the agriculture sector in still at an early stage. Agriculture has been integrated into key national plans as a priority. The Agricultural Sector Development Program Phase II is encouraging with its inclusion of greater ICT focus but with greater digitalization more focus will need to be around ensuring privacy and trust. This came out as a key concern in the stakeholder interviews.

DIGITAL AGRICULTURE INNOVATIONS

A total of 27 innovations were identified in Tanzania and 10 responded to the survey. All use cases were present in Tanzania: digital advisory, agri-digital financial services, digital procurement, agri e-commerce and smart farming. Digital procurement and agri e-commerce were the most common use cases from survey respondents.

Innovations targeted a wide range of outcomes predominantly addressing poor access to markets, knowledge gaps, financial exclusion, and low productivity. Major challenges experienced in the application of technology were mentioned that included a lack of digital literacy in their target customers, access to a device, farmer uptake and behavior change and a lack of mobile network coverage. A lack of digital literacy is a common theme across the SADC region and highlights the strong need to focus on this going forward.

Tanzania's moderately developed digital economy is evident from a high number of innovations saying they use websites / dashboards / portals to transmit or store data and information. Followed by Smartphone apps (and SMS). These findings show the importance in continuing to improve internet access across the country, accessibility to devices and digital literacy to enable farmers to really benefit from the existing and future digital innovations in this sector.

Most innovations in Tanzania used financial assistance from incubators and accelerators, friends and family, business development support and training opportunities to support the innovation. The presence of support from incubators and accelerators shows the success of these programs within Tanzania, something that not all countries within the SADC region are benefitting from. However, most respondents require further subsidies or donor support to continue to sustain their innovations suggesting that there is a funding gap in maintaining viability.

DIGITAL AGRICULTURAL SYLLABI AND ENTREPRENEURSHIP TRAINING

In Tanzania, digital skills in agriculture have a great potential to stimulate economic growth and improve the livelihoods of many households. In the National ICT Policy 2016, the Tanzanian government recognizes the importance of ICT education in the country. The lack of sufficient infrastructure, especially in rural areas, is a challenge in the implementation of digital education in schools and learning institutes. The business support organizations in the agricultural sector seem to efficiently collaborate with the universities and their curricula are quite developed and focused on digital agricultural skills. It is recommended to continue and enhance these collaborations since they can be an important driver for innovation and entrepreneurship, as well as an example for the neighboring countries.

For the incubators interviewed, CCARDESA and other international partners could better support the development of digital skills for agricultural youth entrepreneurship in the SADC region in the following ways:

- Prioritize the strengthening of national research and education networks in the SADC region so that they can effectively play their role of providing affordable internet connectivity infrastructure and value-added services for successful digital agricultural economies
- Increase practical digital skills trainings by supporting trainings on the whole chain of agriculture for concrete results
- Certify the curricula of Hubs and Incubators and revisit and update the curricula and include existing solutions from past programs or develop new solutions.

- Strengthen collaboration with the African Regional Intellectual Property Organization to establish protection through patents registration to protect the youth's innovations.
- Provide the agri-research findings in a language that is widely used by the population (such as. Kiswahili).
- Establish pilot projects for people to learn and scale up to other areas.
- Improve the information sharing on how youth and farmers can benefit from digital agriculture.
- Strengthen business support organizations in building capacities as service providers.
- Support youth financially.
- Make documentation like case studies available for learning and training.
- Facilitate the creation of a network of hubs in the SADC region to build and share knowledge.
- Encourage governments to support more innovation Hubs but also community hubs like resource centers.

5.2 REFLECTIONS FROM THE SITUATIONAL ANALYSIS REPORT

This document has presented the available data collected for Tanzania and provides detailed insights on the three main elements: policies, innovations, and digital skills. The country data collected is intended to be useful for a local context, however the *Situational Analysis Report* presents a much broader perspective which examines regional trends, provides analysis on the regional findings, and highlights potential areas for shared learnings across the SADC region.

This section briefly presents key regional reflections that are relevant for this country that are derived from the *Situational Analysis Report.* The intention is to direct the reader to the report where these points have been elaborated on and presented alongside other countries in the region to learn from.

The key reflections from the Situational Analysis Report relevant to Tanzania include:

- **An agriculture sector specific digital strategy and roadmap is necessary with clear objectives, milestones, timelines, and funding requirements to tie in the sector performance with a digital economy advancement.** A key barrier to embracing digitalization in agricultural systems is a lack of a guiding policy framework and regulatory support that integrates the use of technologies and services. A clear agriculture sector specific strategy or roadmap can address some of the key challenges raised by stakeholders consulted during this study.
- **Greater efforts are necessary to understand whether the legal and regulatory standards in place for digital commerce, privacy and data fulfil their objectives for all stakeholders.** With greater digitalization more focus should be placed on ensuring trust, privacy and protection of consumers and businesses. Digital technologies, especially more advanced ones, rely heavily on the collection, dissemination, and analysis of data.
- **Innovators should be encouraged to take deliberate actions to ensure innovations are inclusive of those with lower digital literacy and lower literacy levels to enable both a raised awareness of the benefits of digital agricultural innovations but also to enable their use.** The most common challenge that survey respondents encountered was low digital literacy levels of their users. If farmers have limited access to digital solutions or are unable to use them, because they lack digital skills, further uptake is likely to be significantly impeded.

- **To use digital agriculture innovations, digital skills are critical.** Countries whose first language is not English are likely to be at a real disadvantage in terms of content generation and/ or adaptation. Digital Content should be hyper-localized, relevant to local constraints and deployed through channels that facilitate and enable action by farmers.
- **The development of strong campus networks and the strengthening of National Research and Education Networks are key to fostering higher education institutions and innovation hubs to effectively provide all types of digital services for teaching, digital agricultural training, digital agricultural entrepreneurship, and advanced research activities.** In the field of digital agriculture, mutual learning will be significantly enhanced by providing complementary expertise where it is lacking and sharing IoT/precision agriculture equipment for students and entrepreneurs.
- **It is important to boost the digital agriculture entrepreneurship sector through the acquisition of advanced skills in the space and an alternative model of sustainability for the incubators (especially those who are not supported by the government).** Involving the private sector through regional or local agriculture/digital agriculture companies might offer internships for students and helping aspiring entrepreneurs to acquire new skills. Collaborations with private sector entities may also facilitate new forms of fundraising/investments such as open innovation experiences and the funding of specific trainings/incubations programs for youth.

REFERENCES

[1] World Bank (2020) Population, total | Data
[2] UNDP (2020)Human Development Indicators | Tanzania
[3] World Bank (2020) GNI per capita, PPP (current international $) | Data
[4] World Population Review (2021) Poverty Rate by Country
[5] Global Food Security Index (2020) Rankings and trends
[6] African Union (2020) Digital Transformation Strategy for Africa
[7] OECD (2019) Going Digital: Shaping Policies, Improving Lives
[8] UNDP (2020) Human Development Indicators | Tanzania
[9] GSMA (2019) Mobile Connectivity Index | Tanzania
[10] World Economic Forum (2019) GCI Profile | Tanzania
[11] ReSAKSS Annual Trends and Outlook Report (2020) The Enabling Environments for the Digitalisation of African Agriculture
[12] OECD (2019) Regulatory effectiveness in the era of digitalization
[13] Forbes (2018) Law is Lagging Digital Transformation – Why It Matters
[14] All Africa (2021)Tanzania: Digital Economy Blueprint Coming
[15] International Development Innovation Alliance (2017) Insights of Scaling

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