DIGITAL AGRICULTURE COUNTRY STUDY ANNEX: MALAWI

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

2021/2022

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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 Malawi 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 Malawi 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 Malawi, 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 Malawi 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 Points in Malawi, Upile Faith Muhariwa, Department of Extension Services, and Hector Mulaidza, Department of Agricultural Research[i]. The study team also worked with a National Consultant in Malawi, Mr. Wongani Langa.

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 the 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

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[i] An interview was only conducted with one of the focal points.

Regulation; Digital Infrastructure; Digital Skills and Human Capacity; Digital Innovation and Entrepreneurship).

DIGITAL ECONOMY BLUEPRINT FOR AFRICA

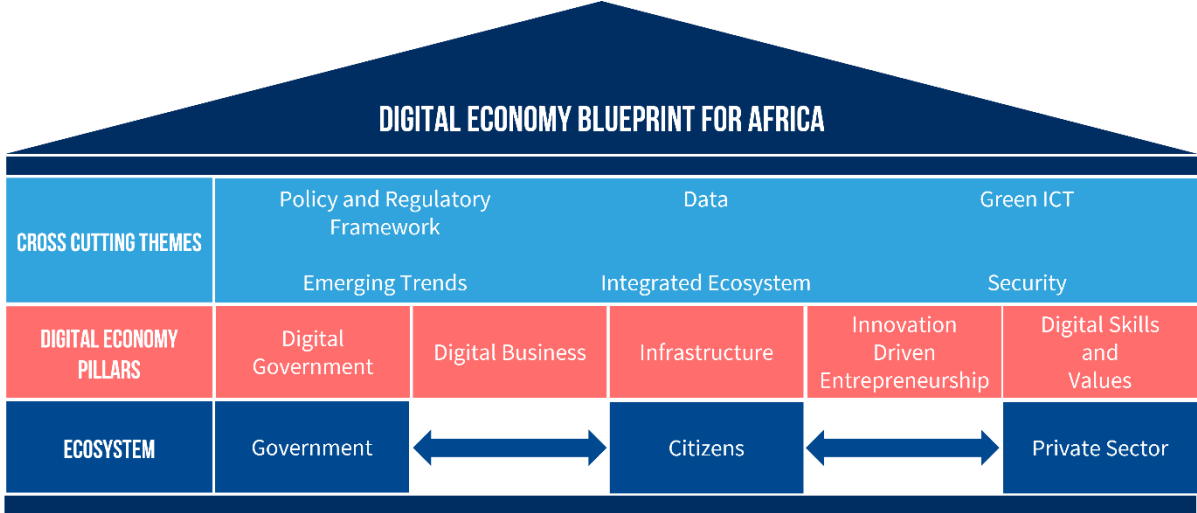| CROSS CUTTING THEMES	Policy and Regulatory Framework		Data		Green ICT
	Emerging Trends		Integrated Ecosystem		Security
DIGITAL ECONOMY PILLARS	Digital Government	Digital Business	Infrastructure	Innovation Driven Entrepreneurship	Digital Skills and Values
ECOSYSTEM	Government	←→	Citizens	←→	Private Sector

FIGURE 1 OVERVIEW OF THE 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 was 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, enforceable 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 Malawi 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 voluntarily 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.
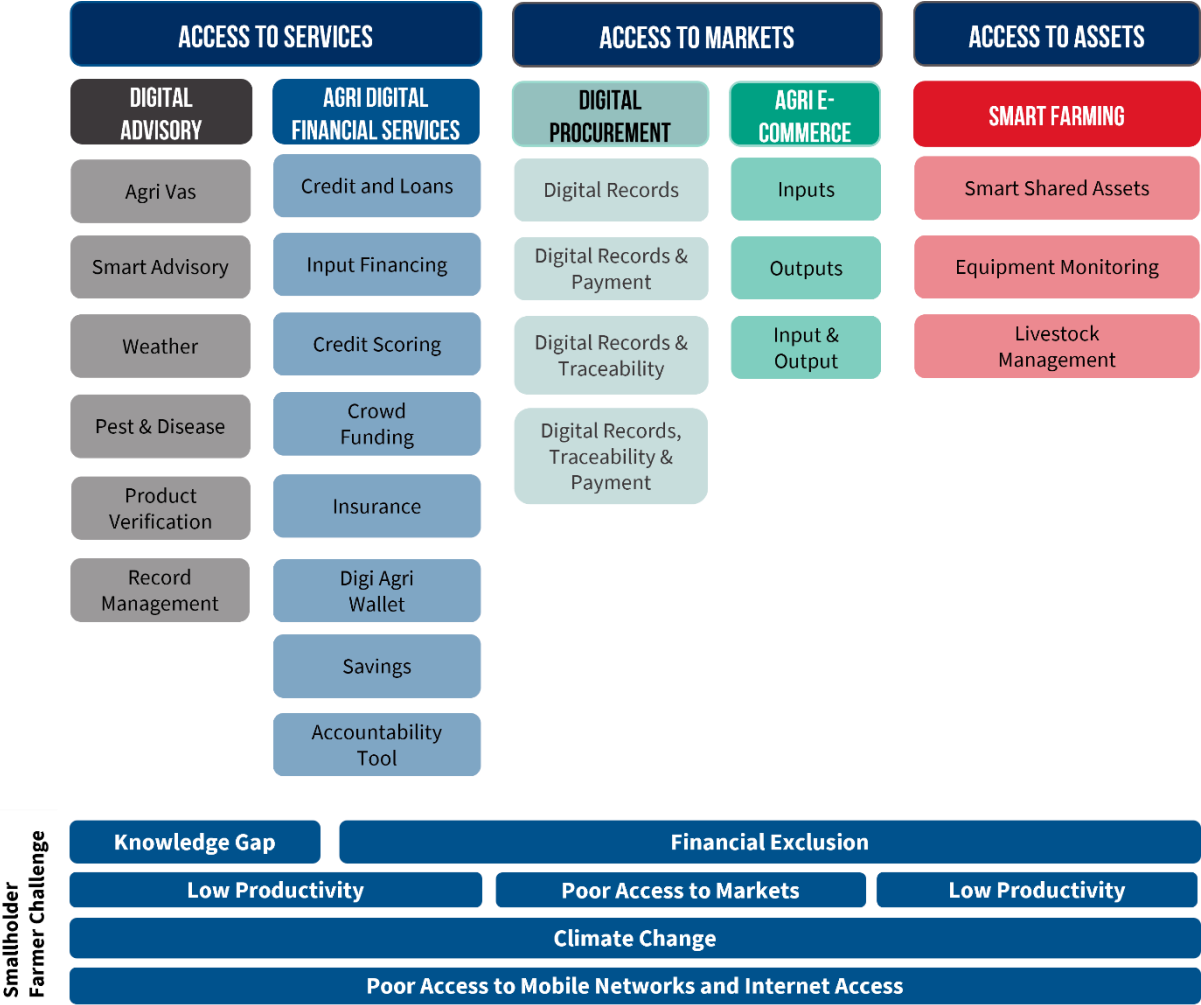

FIGURE 2 USE CASE MODEL BASED ON GSMA FRAMEWORK

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

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

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 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 Malawi and some may be declining because of the Covid-19 pandemic. Due to various Covid-19 restrictions, physical meetings could not always 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 their 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 mush 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
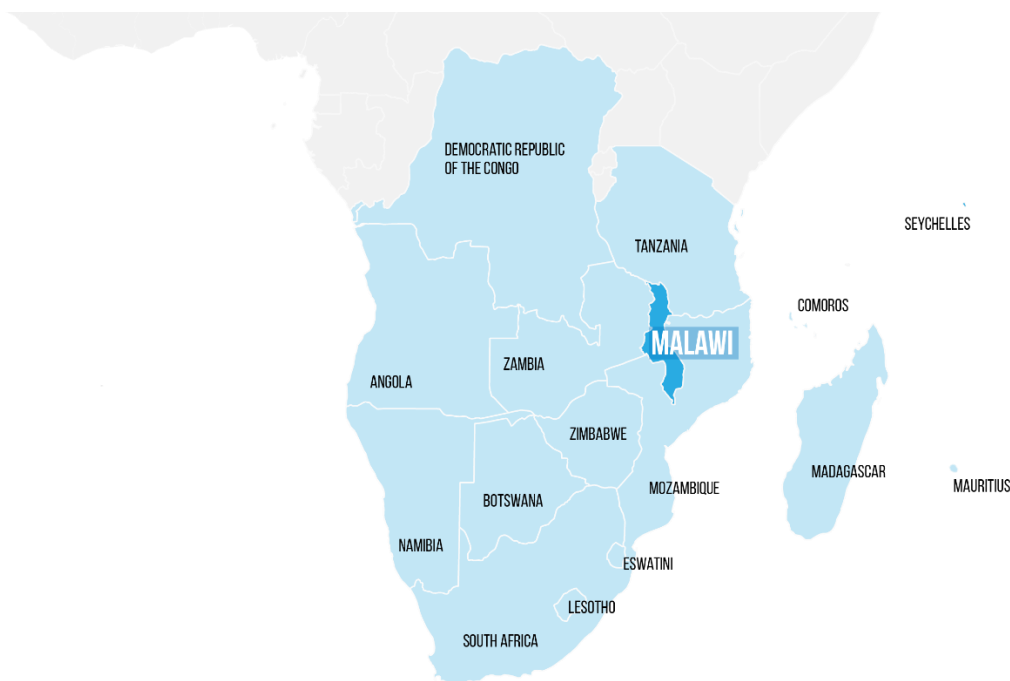
FIGURE 3 MAP OF MALAWI IN SADC

Malawi is a landlocked low-income country with a population of 19.1 million.[1] UNDP's Human Development Indicators[2] rank Malawi as 174th out of 190 countries and 14th out of the 16 SADC countries. Malawi scores on the higher scale in the region for gender equality with a Gender Development Index of 0.986.[ii] It is one of the poorest countries in the SADC region with a Gross National Income per capita of only $1,090 (compared to an average of $8,050 in the region).[3] Although 52.6% of the population falls under the UN Multidimensional Poverty Index,[4] 51.5% live below the poverty line according to the World Population Review.[5] This is above the average rate of the SADC region of 40.8%. The median age of Malawi's population is also younger than the average in SADC with 18.1 years (versus 22.1 years).

AGRICULTURE ENVIRONMENT

In the case of urbanization, Malawi is significantly below average in the SADC region with only 17.2% living in urban areas. Although only 21.09% of the GDP is earned in agriculture, 76.36% of the population works in the agriculture sector (higher than the average of the SADC region of 43.37%). On the Global Food Security Index, Malawi ranks as the 110th country with an overall score of 36.7, making it the eighth in the SADC region.[6]
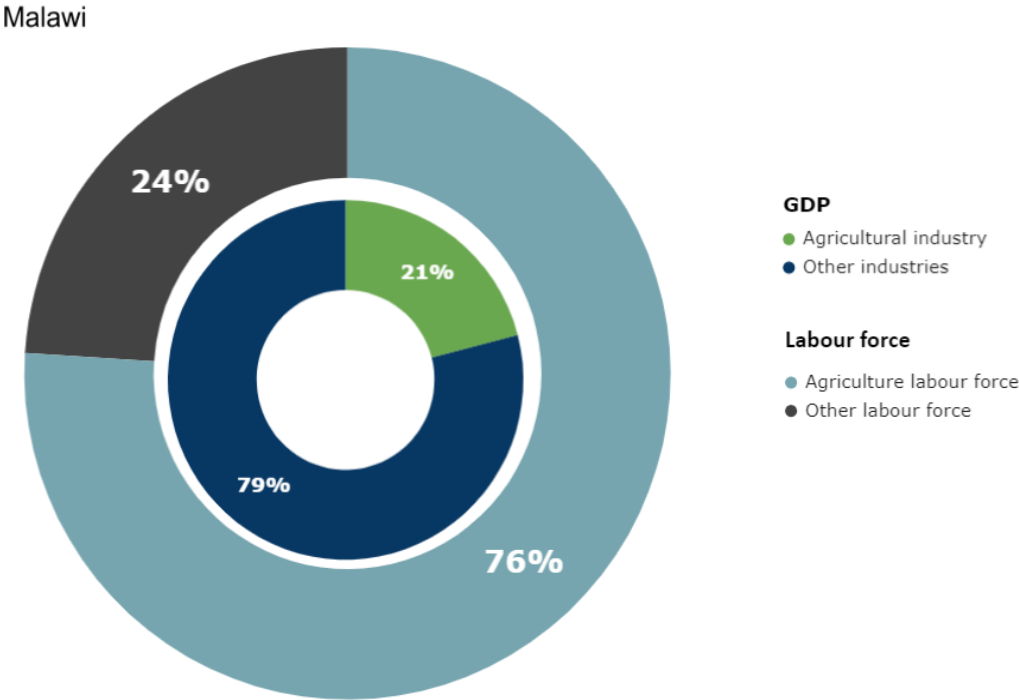
FIGURE 4 MALAWI'S AGRICULTURAL INDUSTRY SHARE OF GSP AND THE SHARE OF THE AGRICULTURAL LABOR FORCE

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

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

sustainable growth[7]. 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.

AFRICAN UNION DIGITAL TRANSFORMATION STRATEGY			
CROSS CUTTING THEMES	Digital Content and Applications Digital ID	Emerging Technologies Research and Development	Cyber Security, Privacy and Personal Data Protection
CRITICAL SECTORS TO DRIVE DIGITAL TRANSFORMATION	Digital Industry Digital Trade and Financial Services	Digital Governance Digital Education	Digital Health Digital Agriculture
FOUNDATION PILLARS	Enabling Environment/ Policy and Regulation	Digital Infrastructure	Digital Skills and Human Capacity / Digital Innovation and Entrepreneurship

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[8].

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 *Situational Analysis Report*.

The results for Malawi are illustrated in table 3.

TABLE 3 BENCHMARK PILLAR SCORES: MALAWI

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

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: MALAWI
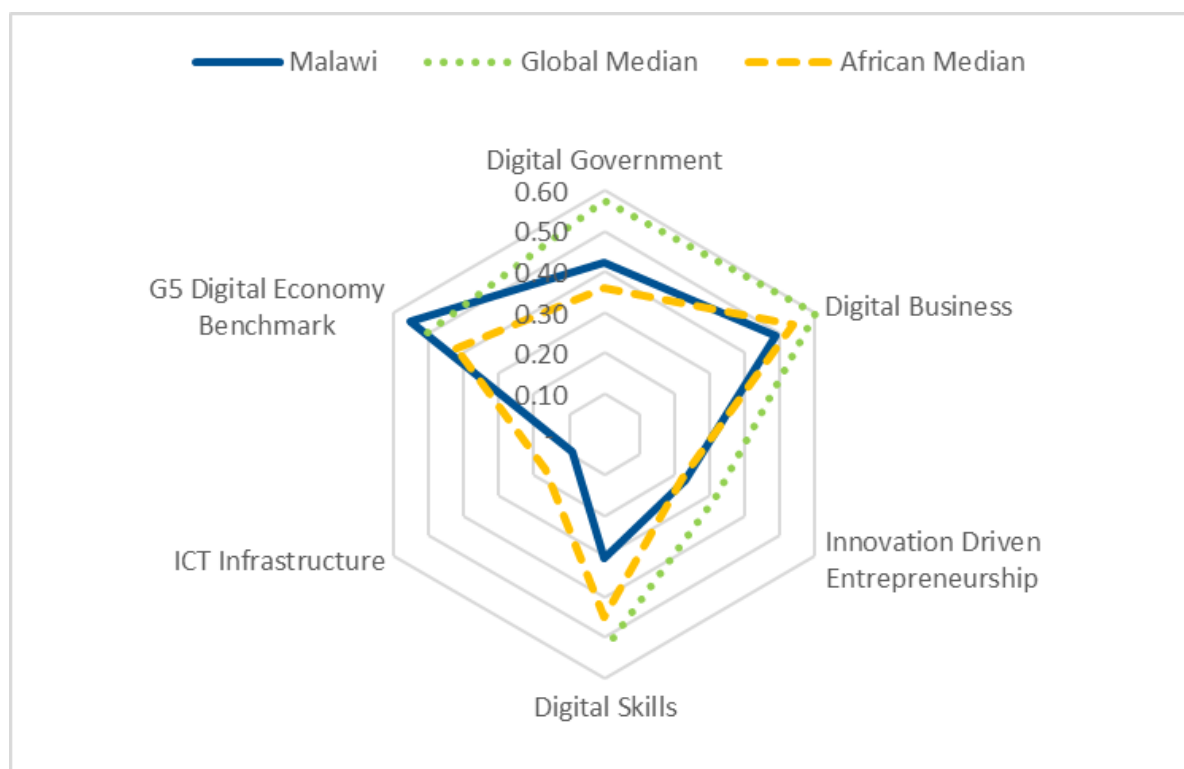
FIGURE 6 RESULTS FROM BENCHMARK ASSESSMENT FOR MALAWI

In the benchmark assessment Malawi ranked 11 out of the 16 SADC member states. Figure 6 below illustrates the results of the benchmark in comparison to the Global and African medians. Malawi presents mixed results

Digital Agriculture Country Study Annex | **Malawi**

in all assessment areas. It exceeds the global median on the G5 Digital Economy Benchmark and exceeds the African median in Digital Government. The benchmark suggests that Malawi is in transition and has a developing digital economy but may be lacking in some key foundational areas necessary.

Malawi scored highest in the innovation driven entrepreneurship pillar where it ranked sixth and the G5 benchmark where it ranked fourth. Despite these high scores, it ranked in the bottom half of the SADC member states in all other assessment pillars. Table 5 below illustrates the ranking for each individual pillar.

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 INFRASTRUCTURE

Malawi ranks 14 out of 16 SADC member states in ICT Infrastructure pillar above. This is reflected in the usage of the population using the internet, with only 13.8% according to the UN.[9] This percentage is much lower than the regional average of 29.94%. The GSMA Mobile Connectivity Index shows a 92% access to the 3G network,[10] while the HDI reports mobile cellular subscriptions at 39 per 100 people.[11] Malawi also ranks as 114th on the Inclusive Internet Index[12] which details the accessibility, affordability, and relevancy of internet in 120 countries. However, according to the Mobile Connectivity Index,[13] Malawi is ranked number 13 out of 16 in terms of overall mobile connectivity in the SADC countries with an overall index of 26.9—which disqualifies it as an emerging country (above 35). It scores above average for availability of infrastructure, but below average on affordability, consumer readiness, content, and services.[iii] In terms of ICT adoption, Malawi scores position 128 (out of 140). The Malawi government does not seem future orientated based on the position 107 (out of 140), but it scores slightly higher on the innovation capability index as number 112 out of 140.[14] Additionally, it scores 2.84 out of 7 points on the GCI 4.0 Digital Skills Among the Population Index,[15] which is significantly below the SADC average.

[iii] The enablers of mobile internet connectivity that inform the indicators: 1. Infrastructure, 2. Affordability, 3. Consumer readiness and 4. Content and Services.

2 THE BROADER POLICY ENVIRONMENT

In the benchmark assessment Malawi ranked 11 out of 16 in the region but had mixed results in the individual assessment areas. It excelled in business but scored poorly for infrastructure and skills. The low scores and ranking in the assessment pillars indicate that Malawi is lacking in some foundational requirements for a digital economy and that there is likely a poor enabling environment for digital transformation. In the *Situational Analysis Report* the clusters of SADC countries identified from the benchmark are discussed in more detail. Malawi forms part of Group 3 which is made up of countries that are in digital transition and could benefit from learning from its regional neighbors.

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[16]. 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[17]. 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[18].

2.1 GENERAL DIGITAL POLICIES

The benchmark assessment suggested that Malawi's digital economy is lacking in key areas, however from the stock take it is apparent that there is a certain level of prioritization for digital transformation. Malawi has several general policies and legislation relating to technology and digitalization that build a promising picture on the progress being made.

POLICIES, STRATEGIES AND PLANS

The **National ICT Policy 2013** set out a direction on how to mainstream ICTs in all sectors of the economy to drive implementation of the Malawi Growth and Development Strategy II. The policy provides a rudimentary level of detail. It covers several priority areas including increasing access and use of ICTs within government and society, integrating ICTs into educational and health systems, improving ICT skills among the population, increasing the utilization of ICTs for public service provision, establishing an enabling environment for private sector investment in ICT, improving ICT infrastructure, and dealing with the risks of ICTs including privacy, cybercrimes, and digital frauds. The **National ICT Master Plan 2014-2031** operationalized the ICT Policy and

split the objectives into four plans: Plan 1 (2014-16) which focuses predominantly on infrastructure investment to increase universal access and affordability, Plan 2 (2017-21) which focuses on intensification of innovation and human capital development in specific industries to enhance competitiveness, Plan 3 (2022-26) with a focus on ICT industry development and e-business, including working on creating an enabling environment for businesses, and Plan 4 (2027-31) which focuses on e-government and public platforms to increase engagement with citizens in policy formulation.

The production of both these plans suggests that there is an appetite and appreciation for the importance, and benefits, of digitalization and the need to incorporate them into national plans and strategies.

Malawi's Ministry of Information has produced more specific strategies and policies that address some of the key dimensions from the Master Plan (ICT Infrastructure Development, Innovation and Human Capital Development, ICT Industry Development and E-Business, and E-Government and Growth Sector Development). The **Malawi Digital Government Strategy 2018-2023** focuses on improving efficiencies and promoting greater collaboration within the various government Ministries, as well as increasing access to information for the citizens of Malawi. The **National Cyber Security Strategy 2018-2022** provides a national framework for ensuring a secure, safe, and resilient cyberspace to increase enforcement of laws and greater focus and trust on e-commerce and online transactions. The Cyber Security Strategy follows key legislation for the sector, enacted in 2016 (see **section 2.2**). A **National Broadband Strategy 2019-2023** released in 2019 focused on infrastructure, access, affordability, and availability of broadband and network coverage, particularly in rural areas.

The production of the National ICT Policy and the Master Plan, along with the more specific priority area plans suggests that there is an appetite and appreciation within government for the benefits of what digitalization can achieve.

2.2 LEGISLATION

Below are some key items of legislation relevant to this study:

- The **Communications Act 2016** provides regulation of the provision of services in the electronic communications sector and establishes MACRA as an authority to protect consumers, license providers of communications services, promote access to information, and promote research and development in communication services. More specifically it aims to remove unnecessary barriers to entry and therefore attract investment into the communications sector, encourage the adoption of new services and technologies, and to facilitate technology neutrality.

- The **Electronic Transactions and Cyber Security Act 2016** addresses cybercrime, data protection and privacy. It also provides various electronic transactions with protection of the law and makes provisions for criminalizing offences related to computer systems and ICTs.

- The **Payment Systems Act 2016** provides regulation, management, and supervision of payment systems and electronic money transfers in Malawi.

- **Data Protection Act** is still in draft form and not readily available online. This law was first mentioned in the ICT Master Plan in 2014 and was noted as awaiting review and cabinet approval, however in 2021 this has still not been enacted and ratified. The Data Protection Act has not been reviewed for this report.

2.3 DIGITALIZATION IN AGRICULTURE

DIGITAL IN AGRICULTURE POLICIES

While digital has been embraced within the general policies, plans and legislation of Malawi, one key finding was that Malawi does not have a singular policy on digitalization in agriculture. In the reviewed polices and plans within the agricultural sector, there is little to no mention of innovative digital technologies and solutions. Agriculture had appeared sporadically in the earlier strategies and plans of ICTs in Malawi. In the **National ICT Policy** and the **National ICT Master Plan** specific mention was made to encourage the utilization of ICTs in the priority growth sectors including agro-business industry, agricultural extension services, and research in agricultural production and processing. This highlights the importance that the agriculture sector has in Malawi, one of its key priority sectors and the largest contributor to ICTs.

The **Digital Economy Strategy 2021-2026** does have a specific focus on agriculture beyond increasing use or access to smallholder farmers and stakeholders and includes the use of innovative technologies such as the Internet of Things (IoT), smart farming, open data and makes specific references to online platforms. The key objectives for agriculture under the Malawian Digital Economy Strategy are listed in table 6.

TABLE 6 MALAWI'S 2026 DIGITAL ECONOMY OBJECTIVES FOR AGRICULTURE

2026 Objective	Actions required	Potential Financing Source	Responsible parties	Timelines
Farmers access high quality inputs and plug into a rich commercial market supported by a variety of platforms	Develop e-verification to ensure quality of inputs distributed through the Affordable Inputs Program (AIP)	MoAIWD; MAIIC	MoAIWD	3 years
	Digitize food safety certification processes to improve access to export markets	MoAIWD; MAIIC; PPPC	MoAIWD	3 years
	Pilot IoT-enabled storage monitoring of national storage facilities	MoAIWD; MAIIC; PPPC	MoAIWD	3 years
Digitally delivered services support modern farming practices to increase productivity	Provide government extension workers with tablets to use and promote adoption of digital support applications	MoAWID; Development partners	Department of Agricultural Extension Services	1 year
	Develop an open repository of common extension content and farmer feedback to support demand driven innovation	Government of Flanders	Department of Agricultural Extension Services; Farm Radio Trust; MoI	3 years
	Develop public sector delivered mobile applications for digital extension services that support USSD and voice functionality for increased update by farmers	MoAWID; PPPC; Agriculture Sector Wide Approach Support Project (Development partner trust fund management by World Bank)	Department of Agricultural Extension Services; Malawi Forum for Agricultural Advisory Services	1 year
	Subsidize the costs of asset sharing services when delivered to farming cooperatives and associations	MAIIC; Development Partners	MoAIWD; MAIIC; Famer co-operatives and associations	3 years
Rich and updated data provides the latest view on	Target additional funding to expedite the implementation of the National Agriculture Management Information	Agriculture Sector Wide Approach Support Project;	MoAIWD; Esoko	3 years

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| agricultural activity and supports innovation, monitoring, and investment | System (NAMIS) and prioritize integration with **Esoko** for pricing information | MoAIWD; Development partners | | |
| | Develop an open-GIS data repository under National Statistical Office (NSO) | NSO | NSO | 5 years |

What sets this strategy apart from the previous ICT and digital plans proposed is the approach to the economy as a whole, while recognizing key priority sectors to the Malawi economy. The agricultural objectives above look across the entire value chain and have a specific focus on improving the efficiency and productivity of smallholder farmers with clear solutions and technologies, rather than simply stating that greater access to ICTs and digital technologies will result in agricultural efficiencies.

The Digital Economy Strategy for Malawi addresses some key foundational concerns such as access, use and skills, but also extends the focus on digital to wider sectors and functionalities of the economy that have specific and knock-on effects for the agriculture sector. This strategy is the most digitally mature and ambitious plan that Malawi has put forward and provides a clear response and solution to unlocking the digital economy, and therefore the digital agriculture economy.

CHALLENGES

While the Digital Economy Strategy sounds promising for agriculture, greater efforts need to be made to spread knowledge of active policies and strategies.

Sourcing documents for Malawi has been a challenge as the majority of these are not available online through the Government portals. Common feedback when interviewing public sector stakeholders across the SADC region within Agricultural Ministries has been the lack of awareness and accessibility to understand what policies and strategies are currently in place and how they relate to the sector.

A stakeholder informed the team about the Digital Economy Strategy, but a final copy is not available on any of the Government portals. Reference is made to the strategy on the National Planning Commission website and that it is forthcoming, but no updates are provided for when this is likely to be rolled out. The same was found for the Data Protection Act which has been in development since 2014. The Digital Economy Strategy was obtained from a third-party website using an online search engine. Further, the public sector stakeholder was not able to comment on whether agriculture was included in the strategy, but rather that the strategy "aimed at boosting access to connectivity". The review of the Strategy in the section above identifies that there is a strong focus on agriculture and specific objectives suggested for the sector. This poor awareness of the strategy highlights how ministries operate in silos. This is also reflected in the sourcing of the policies, for which access is required to each Ministry website rather than available in a comprehensive repository of all policies and legislation. Not having a singular area where this information can be found clearly and easily creates an added time burden for time-poor public servants.

3 DIGITAL AGRICULTURAL INNOVATIONS

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

3.1 MAPPING DIGITAL AGRICULTURAL INNOVATIONS

This DACS of Malawi presents use cases based on a model and framework created by GSMA. These broadly fall into categories labelled access to services, access to markets, and access to assets.

From the analysis collected on the 25 innovations, the diagram below represents the type of use cases found in Malawi. From the identified innovations most (14) were identified as being developed for multiple use cases, and 11 were identified as being developed for a single use case. Figure 7 illustrates the type of GSMA use cases found in the identified innovations in Malawi.
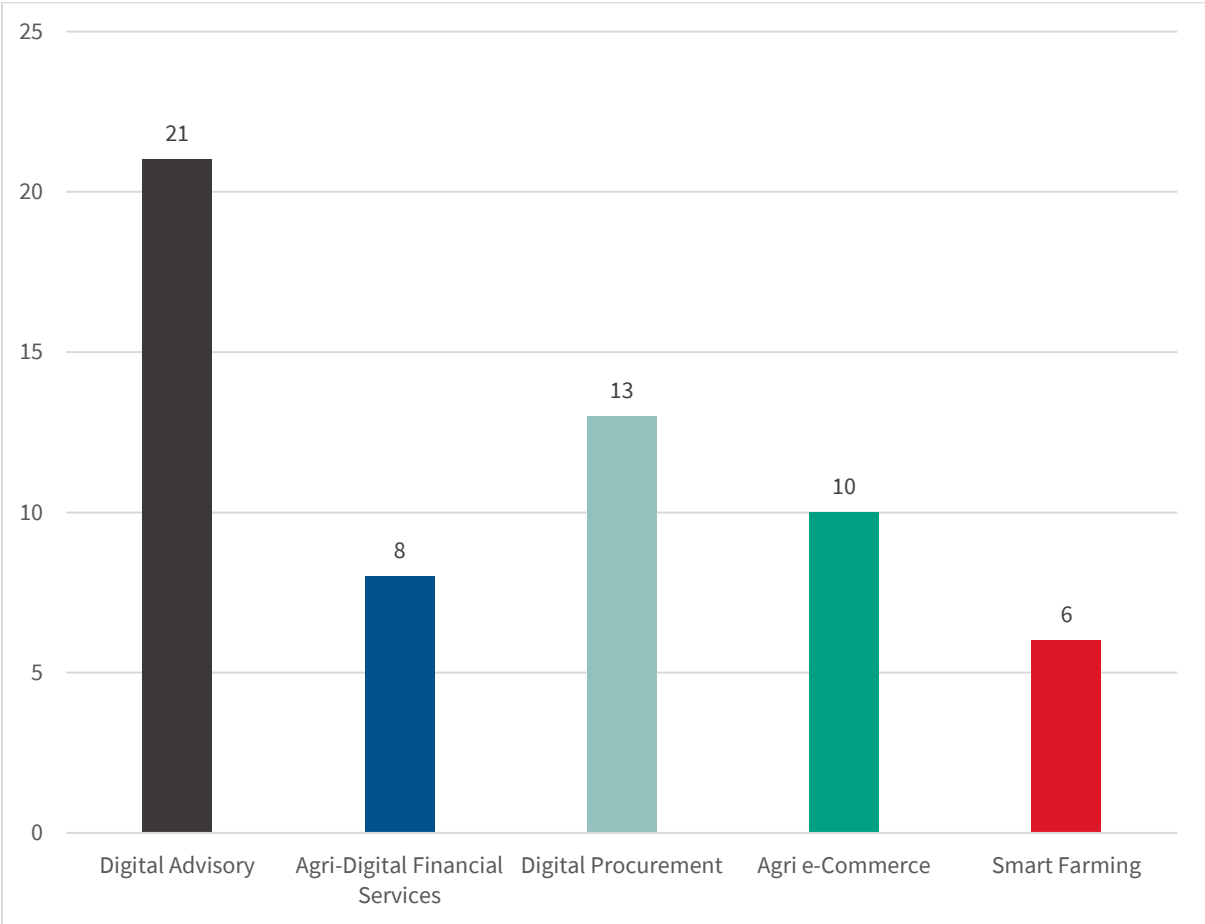

FIGURE 7 IDENTIFIED USE CASES FROM INNOVATIONS IN MALAWI

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 MALAWI

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 7 OVERVIEW OF IDENTIFIED AGRICULTURAL INNOVATIONS OPERATIONAL IN MALAWI

				Name of innovation	Name of the company	Survey ✓/X	Description of innovation	Operational Countries in SADC
■	■	■	■	Chiweto Insurance	Enterprise Innovation Hub	✓	Chiweto Insurance from Chiweto for Malawi is in the development phase but intends to launch in 2022 to provide livestock insurance services (life and health insurance).	Malawi
■				Chiweto SMS platform	Enterprise Innovation Hub	✓	Chiweto SMS Platform from Chiweto for Malawi is an interactive digital service for sourcing and delivering information such as advisory and agricultural extension service in real time via SMS.	Malawi
■				Communication Platform	Farmers Union of Malawi	X	FUM Communication Platform by Farmers Union Malawi is an internet-based product that can send bulk short messages to farmers that have their mobile phone numbers uploaded into the system. FUM is managing the platform in partnership with Agriculture Commodity Exchange for Africa (ACE). Information ranges from crop production techniques such as plant spacing, fertilizer application, storage; market information related to input suppliers, prices of inputs. The platform bridges the information gap that has existed between farmers and other value chain actors like private companies and extension advisory service providers. The platform is cheap and easy to verify. The Platform has contacts of leaders of farmer organizations representing major commodities such as legumes, dairy,	Malawi

								cotton, coffee, tea, sugar, beef, and others and District Farmer Unions (DFU) leaders from all Extension Planning Areas (EPAs)in Malawi.	
■					DAES v1	Ministry of Agriculture	✓	DAES v1 is an Android App that is designed to target farmers, extensions workers and other government workers and stakeholders. The app provides: agricultural advisory services, extension worker contacts, marketing information and climate and weather forecasts. The app is fully funded by the Government of Malawi Ministry of Agriculture. It is a free service that is available to all, using a smartphone. The innovation has reached sustainable scale with most farmers and extension agents using it, but further scaling is necessary to increase the usage of the app across the whole country so that it can be used by every farmer and agriculture agent.	Malawi
		■			E-License application for Exporters of Agri-products and Agricultural ERP	Twenty Third Century System	✓	E-License application for Exporters of Agri-products and Agricultural ERP (2020) from Twenty Third Century System. Farmers apply for export licenses online using a clean and friendly user interface. Operational in Malawi, Mozambique, Namibia, Tanzania, Zambia, and Zimbabwe with 135 registered users.	Malawi, Mozambique, Namibia, Tanzania, Zambia, Zimbabwe
■					Esoko Platform	Esoko	✓	Esoko was established in Ghana. It is an agricultural profiling and messaging service that provides automatic and personalized price alerts, buy and sell offers, weather information, agricultural tips, and voice-based services. Its services have expanded to include data collection, biometric profiling, analytics, communication services, digital credit, insurance, and payment services. The aim of the innovation is to reduce the cost of communication and improve value chain management for stakeholders in the agricultural sector. Developed in Ghana the innovation is implemented in several African countries and is currently being used in Malawi by the Ministry of Agriculture.	Malawi

					Farmer Radio Programs	Farm Radio Trust	✓	Farm Radio Programs by Farm Radio Trust for Malawi is a radio program that educates, informs, and equip farmers with required knowledge about sustainable agricultural practices.	Malawi
■			■	■	Fruitlook	eLeaf BV	✓	FruitLook in South Africa is a web-based portal with near real-time data based on satellite and remote sensing data modelling for the Western Cape agricultural sector. The FruitLook portal delivers weekly remote sensing data year-round for subscribing farmers. FruitLook incorporates a suite of data products covering crop growth, evapotranspiration deficits, and crop nitrogen status provided on a near real-time basis updated weekly. These data products are relevant for orchards, vineyards, pastures, range lands and field crops. The quantitative and spatial information on water, vegetation, and climate is designed to enable farmers to better understand the effects of their water use and their farm management decisions. The FruitLook data and team inform farm operations on management decisions relating to irrigation scheduling and crop production. The service is free of charge and funded by the Western Cape Department of Agriculture and provides metrics such as biomass production, evo-transpiration, water use efficiency which are provided weekly for the largest part of the Western Cape throughout the year. They launched the FruitLook service in 2010 and have 500 active users and 2000 registered users and provide smart data driven advisory based on tailored, farm-level agro-climatic and crop specific information to support decision making, maximize productivity and reduce costs. Technologies such as sensors, satellites, and drones, as well as big data analytics and AI, underpin many of these services., Weather information: Specialist services that provide regional and localized weather forecasts. This sub-category may include weather-adaptive and climate-smart advice. They enable resource use optimization and asset management (e.g., irrigation equipment). They use computers, satellite information and earth observation and technologies such as sensors, satellites, and drones, as well as big data analytics and AI, to address a knowledge gap by farmers. Record keeping: Digital tools that enable farmers to keep	Malawi, South Africa, Zambia

							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., Information for farms to develop, manage, measure, and report a sustainability strategy for their business. The channels are principally computers, cloud-based databases, website, and dashboard. As a private company they have supported themselves, with support also from the Western Cape government. Their challenges include levels of digital literacy, farmer uptake and behavior change and address pain points around planning, inputs, and on-farm production. They are at the level of sustainable scale Implementing on over 300,000 Ha and resulting in water savings on farms and in catchments on average of 10% with as high as 30% in some cases. An integral part of the Western Cape Department of Agriculture's climate change response strategy. Their technology has been developed in conjunction with others and, has taken active approaches to ensure its inclusivity particularly for disadvantaged groups.	
■		■		■	GeoFarmer	GEOTERRAIMAGE (Pty) LTD	✓	GeoFarmer at GEOTERRAIMAGE Ltd is established in 2017 and has combined innovations in smart farming and digital advisory and e-commerce and are regional in their deployment across the entire SADC region. Whilst GeoTerraImage is a private sector company which provides actionable intelligence through monthly crop monitoring through 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. Through the use of computers, satellites and Earth Observation the innovative solution provides 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 have reached wide scale sustained adoption and operate in Angola, Botswana, Comoros, DRC, Eswatini, Lesotho, Madagascar, Malawi, Mauritius,	Angola, Botswana, Comoros, Democratic Republic of Congo, Eswatini, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa,

								Mozambique, Namibia, Seychelles, South Africa, Tanzania, Zambia, and Zimbabwe. Through specialized software, proprietary algorithms, and application GeoTerraImage use remote sensed data to create spatial information. They combine advanced information and reporting to enable analysis, quantification, and monitoring to support key decision making. They charge business subscription fees for their fully commercial product and believe their technology is inclusive of underrepresented groups.	Tanzania, Zambia, Zimbabwe
■					Intelligent Monitoring Systems-IMOSYS	IMOSYS	X	Intelligent Monitoring Systems by iMoSyS for Malawi. iMoSyS provides software, hardware, and engineering services to enable connectivity for remote monitoring of Industrial processes, infrastructure, health issues and environmental aspects. iMoSyS provides Farm Management Services and have deployed Smart Irrigation Systems that apply sensor technology and soil analytics.	Malawi
	■	■			Khusa (Village Savings App)	Angle Dimension	✓	Khusa (Village Savings App) by Angle Dimension for Malawi is an online platform that allows community savings groups to automate and connect to the formal financial sector. The platform aims to enhance trust and bridge the divide between rural groups with banks, mobile money, and Microfinance. Khusa provides real time information, calculates the portfolio, and enables payments. It enables groups to digitize their transactions and securely save money.	Malawi
■	■	■	■		Kurima Mari (LimaMali)	Welthungerhilfe	✓	Kurima Mari (LimaMali) (2016) app from Welthungerhilfe (WHH). Kurima Mari is an android application that is designed to enable smallholder farmers access extension advisory and market linkages using a smartphone. It enables the smallholder farmer not to overly depend on extension officers and not to be stranded when seeking markets. It enables smallholder farmers to access the relevant information pre-production such that they can make informed choices about participating in agriculture value chains. The app, which includes Kurima Mari - Beef and Kurima Mari - Poultry, also provides digital support tools such as	Malawi, Zimbabwe

					Name	Organization		Description	Country
								gross margin calculators and seasonal calendars that ensures farmers make the right choices about input investments and production practices. Operational in Malawi and Zimbabwe, with 84,719 registered users.	
■					M'chikumbe 212	Airtel Malawi	✓	M'chikumbe 212 by Airtel Malawi is a mobile agriculture service launched in 2016. Airtel Malawi with GSMA provides a platform where all agriculture related information can be accessed for free, with the aim to enhance the stretched agricultural extension network. M'chikumbe aims to transform farming using mobile technology and to increase Airtel's subscriber base, revenue, and brand loyalty in rural Malawi. M'chikumbe 212 is an interactive voice response (IVR) and short messaging services (SMS) content platform that does not require any internet connectivity to be accessed. Farmers, cooperatives, suppliers, trades, government staff and agencies and NGOs are all considered the target audience and users. Since its launch in 2016, the platform was registered over 700,000 users with a reach of about 70% of Malawian farmers. The platform connects buyers with producers, connect farmers, cooperatives and even programs.	Malawi
■					Mlimi Hotline (Farmer Call Centre)	Farm Radio Trust	✓	Mlimi Hotline (Farmer Call Centre) by Farm Radio Trust for Malawi is a direct response information service dedicated to help farmers with immediate support, by answering their questions, giving them advice and other information.	Malawi
■				🟥	Mlimi Manager	Agricentre	✓	Mlimi Manager by Agricentre is based on the Internet of Things (IoT) and Artificial Intelligence (AI). The innovation aims to collect different types of data on the field and save it in a central data warehouse. The data is on soil fertility, soil moisture and soil PH for farm management. The data housed in the central data warehouse will be used to train different AI models.	Malawi

| | | | | | 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, Social Media Platform, and (Fb, Twitter, WhatsApp, 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. 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 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | | | | | My Bank App | Sir Hackson Processors | ✓ | My Bank App by Sir Hackson Processors is an app in development that will enable farmers to transact their finances and access other financial services, as well as providing agricultural practices. Sir Hackson Processors currently provides information on agricultural products and vaccinations schedules through SMS. This has not yet launched | Malawi |

■	■			SHERPA	Blue North Sustainability	✓	SHERPA from Blue North Sustainability is a specialized consulting company supporting businesses in the agriculture and food sectors in proactive clarification, development, and implementation of sustainability strategies. SHERPA was launched in 2019 and expertly guides and supports businesses on the challenging & complex journey to achieve true and lasting resilience, viability & sustainability. It is operating in Malawi, South Africa, and Zambia. Developed by Blue North Sustainability, SHERPA is an integrated on-line management system specifically designed to support & empower business owners, managers, and management-teams within agricultural supply-chains, in the development and implementation of proactive, relevant, and impactful sustainability strategies for their businesses. It has 52 active users and 305 registered users providing them with Smart advisory: Data-driven advisory based on tailored, farm-level agro-climatic and crop-specific information to support decision making, maximize productivity and reduce costs. Technologies such as sensors, satellites, and drones, as well as big data analytics and AI, underpin many of these services., 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., Information for farms to develop, manage, measure, and report a sustainability strategy for their business. SHERPA is designed to enable farmers to take full ownership of the sustainability strategies for their farms, to be in a proactive position in relation to market access requirements and to be able to comprehensively report to their stakeholders. Sherpa is a bottom-up approach and an alternative to the prescriptive "top down" approaches most often used. It puts the control of the sustainability agenda in the hands of the farmer/business management. It covers all aspects of sustainability in a holistic and integrated way, allowing the business to "see", measure and improve the whole system towards greater resilience and viability. The innovation helps build greater resilience and viability and uses computers, landlines,	Malawi, South Africa, Zimbabwe

								a website, GeoData and cloud-based databases. The advisory addresses a knowledge gap and helping farmers through reporting on multiple prescriptive standards. They have been challenged by digital literacy limitations, access to device, data collection and farmer uptake and behavior change as well as lack of mobile coverage. They facilitate planning, on-farm production, post-harvest processing and access to markets. They are scaling towards replicating this in other countries, have funded themselves using their own resources and charge individual subscription fees, business subscription fees and an aggregated reporting service vis MS PowerBi over and above SHERPA licenses. They have not taken specific actions for inclusivity. They have worked with Hydrologic based in the Netherlands that also uses ICT solutions to ensure water systems are more weather resistant and climate adaptive. They have also worked with Pixofarm that have developed an App based system to monitor accurate yields on farms. They use noise resistant image processing, machine learning for forecasting and AI for enabling accurate fruit analysis.	
■						Skudu Exact	Skudu.co.za	✓	This is an innovation implemented in Malawi, Mozambique, Namibia, South Africa, and Zimbabwe. Skudu Exact launched in 2019 provides smart advisory: Data-driven advisory based on tailored, farm-level agro-climatic and crop specific information to support decision making, maximize productivity and reduce costs. It addresses planning, inputs, and on-farm production. Technologies such as sensors, satellites, and drones, as well as big data analytics and AI, underpin many of these services. It enables farmers and agronomists to effortlessly automate and expedite plant nutrition guidelines for multiple blocks and fields and product guidelines are issued specific to crop growth state and ordering and application for soil correction. Skudu's algorithm generates the requirement for lime, gypsum, fertilizer, and foliar feed specific to the crop, growth stage and region based on provided soil and leaf sample analyses. They have 400 registered users and 50 active users. Their challenges include bridging time and technical capacity to generate plant	Malawi, Mozambique, Namibia, South Africa, Zimbabwe

							nutrition guidance (content). They have also had constraints on farmer uptake and technical usability of the platform. They are transitioning to scale, have been funded by technology investors and charge business subscription and transaction fees.	
■	■	■			Small-Scale farmer seed production	Good Nature Agro	✓	Small-Scale farmer seed production from Good Nature Agro (2014). This is an integrated agriculture digital tool that can monitor production, logistics and supply of the legume value chain products and services. It has 15,000 users in Zambia and Malawi.	Malawi, Zambia
	■	■	■		Smart Identity e-KYC	Angle Dimension	✓	Smart Identity e-KYC by Angle Dimension for Malawi aims to address know-your-customer (KYC) issues that are prevalent in the financial sector. The innovation is aimed at industries such as banks, telcos, government agencies, insurance companies and NGOs. The Smart Identity solution helps businesses simplify the onboarding of customers and enables the use of a digital ID through facial recognition, fingerprint reader, and QR code scanning.	Malawi
■	■	■	■	■	SmartFarmer	Riskflow DBS	✓	Smart Farmer of Riskflow DBS, a private sector company, 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	Botswana, Lesotho, Malawi, Mozambique, South Africa, Tanzania, Zambia, Zimbabwe

| | | | | | | | | providers, Production information systems e.g., best practices, planning, e-Extension services. The Agri-VAS service assist 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, helplines), text channels (SMS and USSD) and via apps., Smart advisory: 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 farmer to upload a picture of the infected plant for diagnosis. Some services are also accessible via USSD. Also includes national and regional-level pest and disease early warning systems., 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 open integrated and adaptive web based platform with details of dealers, counterparties, making use of Intelligent Financial Performance Monitoring components.

a) 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.

b) Improved Yields through use of 3rd Party software that we have partnered with on our Platform such as Skudu to provide fertilizer and Insuring Yields through an Area Yield Index based Insurance model from PULA, our 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.	
■					Viamo platform	Viamo	✓	Viamo 321 Platform from Viamo. The Viamo platform is implemented in Democratic Republic of Congo, Madagascar, Malawi, Mozambique, Tanzania, 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, 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, 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
■		■	■	■	Virtual ranching farming program	VIRTUAL FARMING PTY LTD	✓	VRFP app of Virtual Ranging Ltd. Virtual Ranching Farming program (VRFP)mainly is an app-based e-commerce platform where Individuals get in farming via mobile phone application and get to own and trade Livestock and Farm produce – Horticulture products. Through Agribusiness Insurance in reputable Insurance companies these farm products will be insured to avoid any loses and cover all risk through this	Botswana, Malawi, South Africa

							program. This app manages Farmers produce' sellers and buyers' demand for livestock and Horticulture farm produce. Quality cows and farm produce will see Botswana becoming self-reliant on the national food security and international markets.	
■		▨	■		Zaulimi	ACE	✓	Zaulimi by the Agricultural Commodity Exchange for Africa (ACE) is an inclusive mobile application which assists farmers and extension officers with essential production and marketing information for selected crops, livestock, and baobab. Farmers are presented with detailed crop information on climate and soil requirements, planting, manure and fertilizer application, weeding, pest, and diseases control as well as harvesting and storage. The crops featured currently include groundnuts, maize, and soya. The content can be accessed offline. Market price information for major crops that are traded through ACE are also featured in the app. The app also contains contact details of ACE field officers, government extension officers and public service providers.	Malawi

3.3 RESULTS FROM INNOVATION SURVEY RESPONDENTS

All identified innovators received a survey and 23 innovations implemented in Malawi responded. Of those that responded, 14 were Malawi-only innovations, and 11 were operational in multiple countries (as reported by the innovations themselves). The answers in the survey are self-reported. All innovators were reminded several times by email and by phone to complete the survey. The response rate of the survey for Malawi was 92% (23 out of 25 identified innovations responded).

USE CASES AND SUB USE CASES

The division of GSMA use cases shows that in Malawi multiple use cases are most common. 15 of the 25 respondents provided multiple answers and eight provided a single use case.

Figure 8 below presents the division of use cases. Digital Advisory was the most common use case cited by 19 survey respondents. Digital Procurement (13) and Agri E-Commerce (10) were the next most common in Malawi. Smart Farming was the least common and was only provided by six respondents, two of which operate only in Malawi (Mlimi Manager and the Bank App by Sir Hackson Processors, however both are still in the development phase).
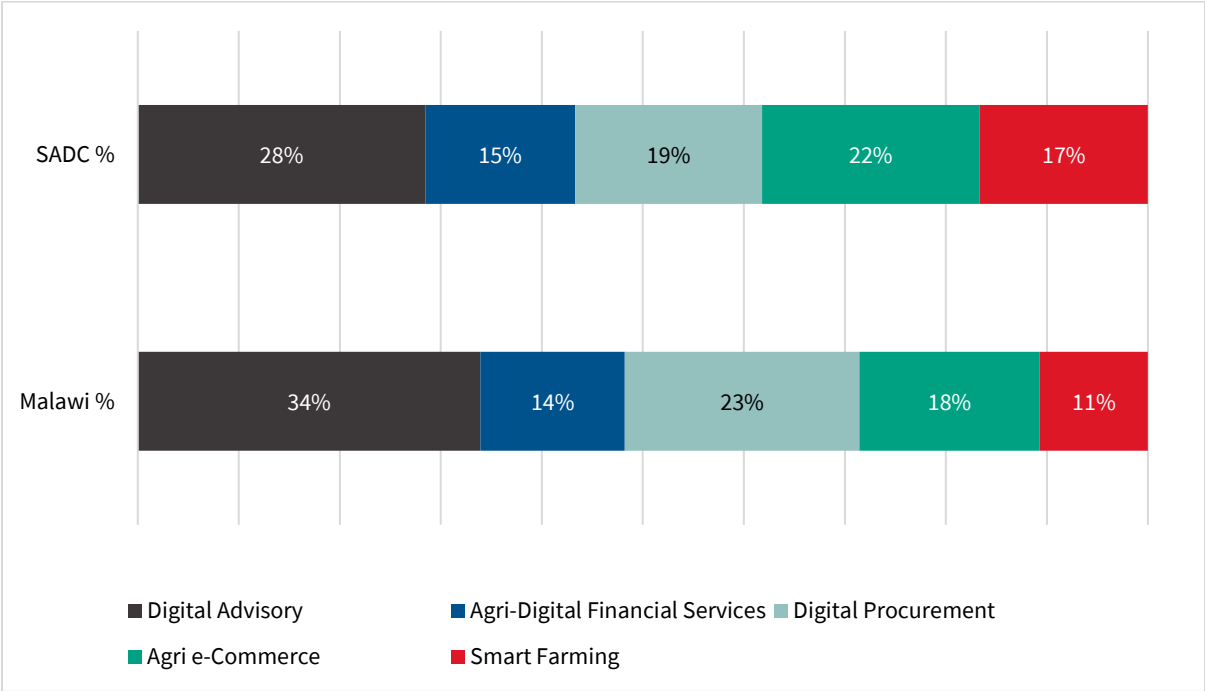

FIGURE 8 DIVISION OF USE CASES FOR SURVEY RESPONDENTS IN MALAWI VS. IDENTIFIED INNOVATIONS IN SADC

The innovations present in Malawi provide a large variety of sub use cases as presented in figure 9. For Digital Advisory, agricultural value-added services and smart advisory were the most common. In terms of e-commerce there is a marginal preference in the number of innovations that focus on outputs[iv]. Almost all the survey respondents under digital procurement also selected digital records as the sub use case which deals with replacing paper-based systems and digitizing transactions between farmers and agribusinesses.

[iv] Platforms that enable farmers to sell to consumers (B2C model) and to enterprise customers (B2B model) such as companies in the catering industry (e.g., hotels, restaurants) and market retailers, or a hybrid of the two.
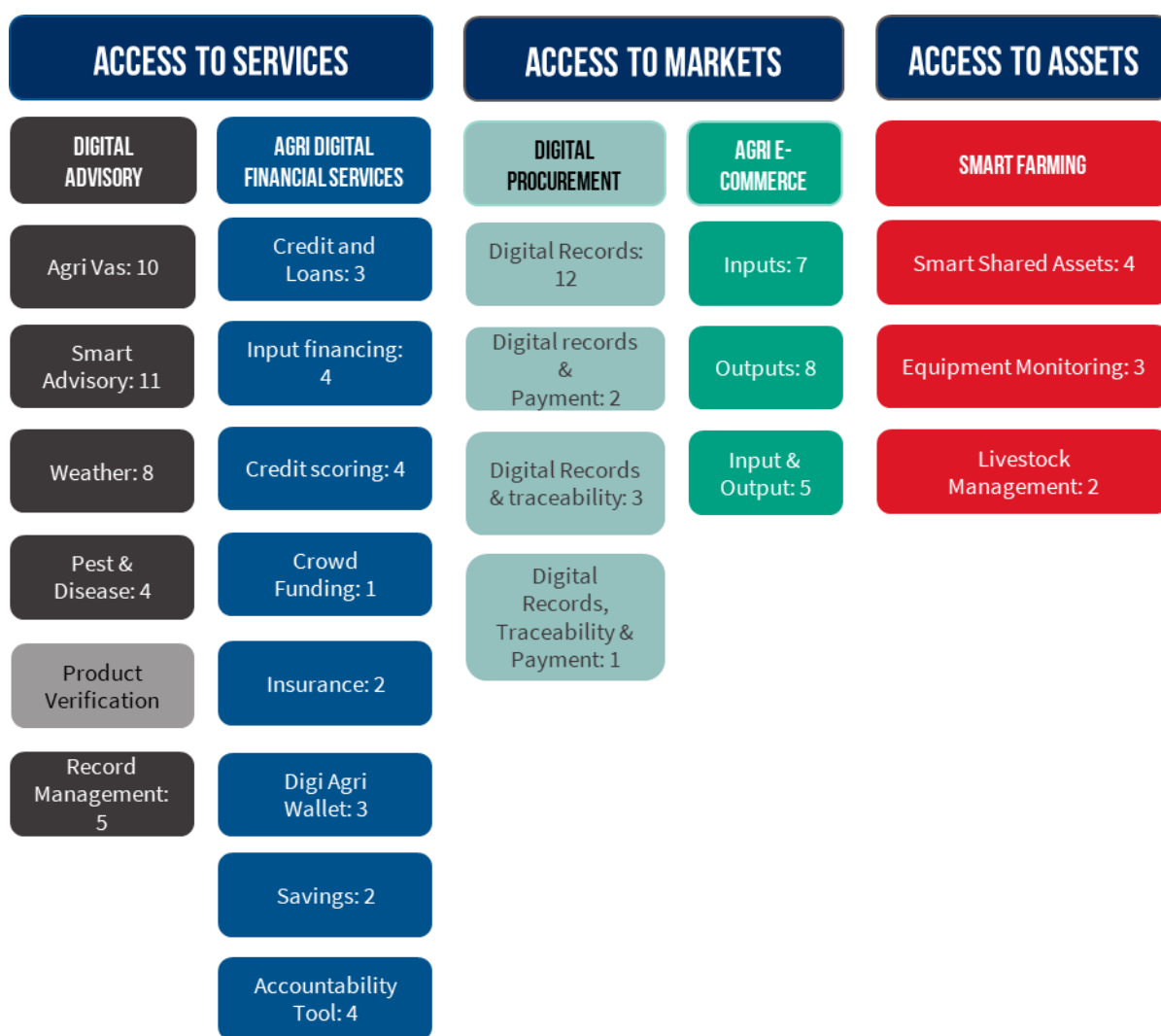
ACCESS TO SERVICES

DIGITAL ADVISORY	AGRI DIGITAL FINANCIAL SERVICES
Agri Vas: 10	Credit and Loans: 3
Smart Advisory: 11	Input financing: 4
Weather: 8	Credit scoring: 4
Pest & Disease: 4	Crowd Funding: 1
Product Verification	Insurance: 2
Record Management: 5	Digi Agri Wallet: 3
	Savings: 2
	Accountability Tool: 4

ACCESS TO MARKETS

DIGITAL PROCUREMENT	AGRI E-COMMERCE
Digital Records: 12	Inputs: 7
Digital records & Payment: 2	Outputs: 8
Digital Records & traceability: 3	Input & Output: 5
Digital Records, Traceability & Payment: 1	

ACCESS TO ASSETS

SMART FARMING
Smart Shared Assets: 4
Equipment Monitoring: 3
Livestock Management: 2

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

CHALLENGES

Innovations that operate within Malawi are looking to address all the key challenges and pain points listed in the survey. The most common pain points addressed are the knowledge gap (16), low productivity (15), poor access to markets (13), and climate change (11). More specifically the innovations seek to address low productivity by improving access to information, increased profits for farmers, access to export markets, improved access to agricultural extension and increased access to financial transactions.

Low digital literacy is overwhelmingly the key challenge that innovators face when implementing technologies with 17 innovations noting it as a barrier. Farmer uptake and access to devices are the next most common challenge. Lack of mobile network coverage, understanding the market and user needs, uptake by women and girls, user affordability, lack of electricity, financial sustainability of business models, and language levels were also cited as challenges. More specifically, the Malawi-only innovations also cited the following challenges encountered: lack of donor or angel investment make it difficult for start-ups to innovate and sustain the innovations, low funding to cover farmers, poor engagement with farmers during Covid-19, and sustainability issues to maintain the innovations.

TECHNOLOGY USE AND CHANNELS

The innovations relied on varied digital devices and implementation channels. The most common devices required were computers and smartphones (11, respectively), and basic feature phones (10). The most common channels utilized in Malawi were websites (13), smartphone apps (10) and SMS (10). Some advanced technologies are also utilized in the Malawi-only innovations such as drones (2), sensors and GPS (1, respectively). However, the most common channel for Malawi-only innovations was SMS, which seven out of twelve innovations cited. Other channels used in the Malawi-only innovations include messaging platforms such as WhatsApp (3), social media platforms (2), USSD (2), and radio (1).

For analysis of the data and information, most of the innovations used spreadsheets (13), followed by cloud-based databases (11). All the tools for analysis, including the more advanced tool, Artificial Intelligence and Machine Learning, were also used by Malawi-only innovations.

Most of the technology and channels required for the innovations in Malawi rely on more modern technology rather than the advanced emerging technology available which should make it more accessible. It is not expected that all farmers have personal computers or smartphones but by using internet centers and cafes these are more accessible than technology such as drones or sensors.

VALUE CHAIN PHASES COVERED

Surveyed innovations in Malawi addressed all stages of the value chain. On-farm production was the most common (18) followed by the planning stage, access to markets, and post-harvest. Storage and transport had the least innovations which is common across the SADC responses.
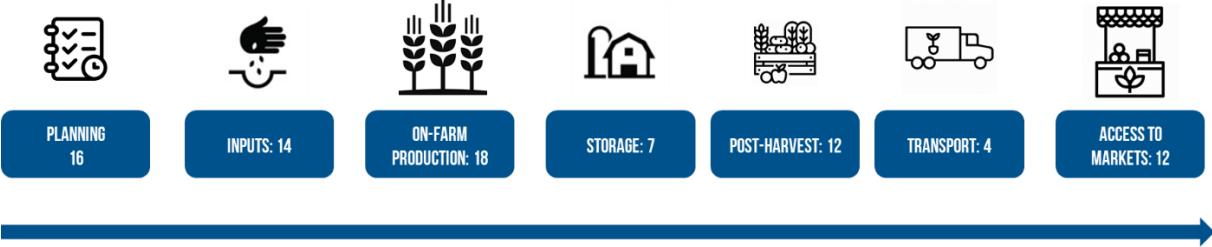

| PLANNING 16 | INPUTS: 14 | ON-FARM PRODUCTION: 18 | STORAGE: 7 | POST-HARVEST: 12 | TRANSPORT: 4 | ACCESS TO MARKETS: 12 |

FIGURE 10: SURVEYED INNOVATIONS PRESENCE IN THE VALUE CHAIN IN MALAWI

SCALING

Most digital innovations in Malawi are in the late scaling stage based on the Insights on Scaling Innovation report, which is accessible _here_[19]. Figure 11 illustrates the spread across the innovations surveyed.

Seven innovations had reached wide scale adoption (Esoko, FruitLook, GeoFarmer, M'chikumbe 212, Mukuru Money, DAES v1 Phone App, and Viamo Platform), five innovations had reached scaling stage with replication or adaptation in other geographical areas (VRFP App, Khusa (Village Savings App), SHERPA, Kurima Mari, Mlimi Hotline (Farmer Call Centre)), four had reached demonstrated small-scale success, three were in the proof of concept phase, and one innovation was in the concept development phase (Small Scale Farmer Seed Production by Good Nature Agro).
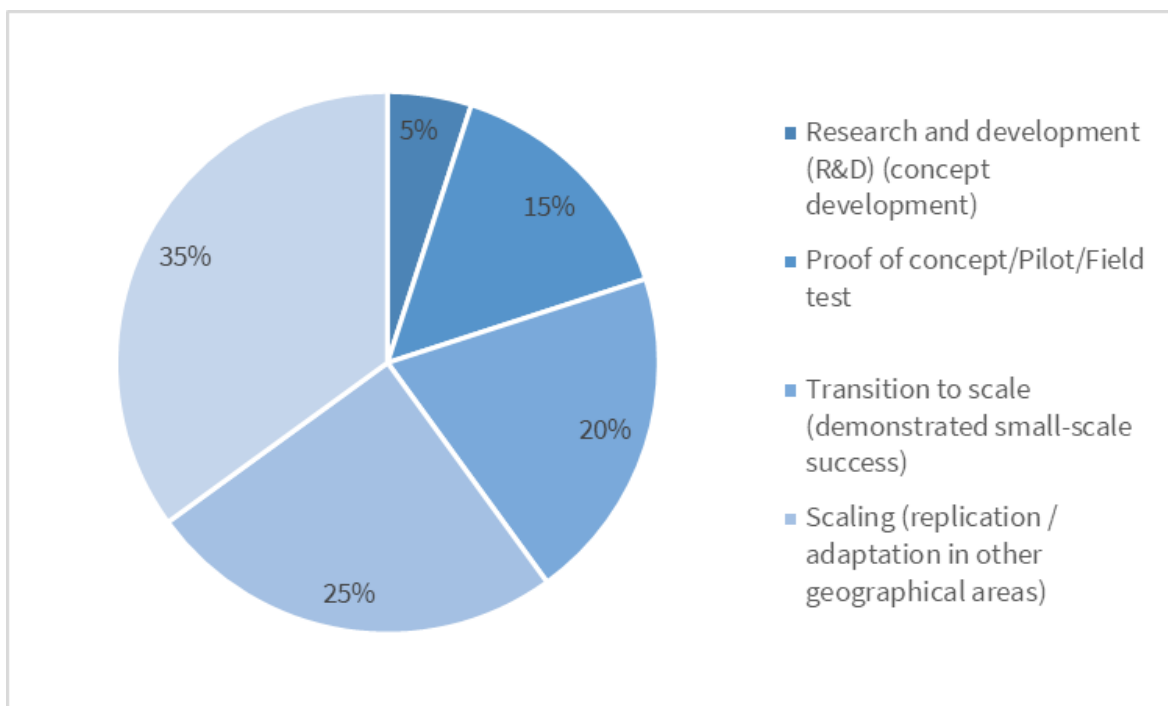
FIGURE 11 SCALING STAGES FROM SURVEYED INNOVATIONS IN MALAWI

Survey respondents self-reported and determined scale. Mukuru Money which has reached sustainable scale and operates regionally reported 1,000,000 registered users; Esoko, also a regional innovation, which has reached sustainable scale reported 50,000 users. M'chikumbe 212, a Malawi-only innovation at sustainable scale, reported 780,000 users. Khusa, a Malawi-only innovation, which is at the scaling stage reported 5,000 users. Skudu Exact, a regional innovation that is transitioning to scale reported 400 users, whereas Zaulimi a Malawi-only innovation which is at the same scaling stage reported 23,700 users. It is unclear if these figures consider businesses and individuals separately

DEVELOPMENT, FUNDING AND REVENUE SCHEMES

Six innovations in Malawi were developed in 2019, four were developed in 2020, four in 2016, two in 2017, and the rest were developed between 2009-2019. Two innovations were launched in 2021. The oldest innovation is the Farmer Radio Program by Farm Radio Trust.

In both the development and implementation of innovations, national government bodies and agencies, and commercial agriculture companies were the most common actors involved. For Malawi-only innovations, such as Khusa (Village Savings App) and Zaulimi, community organizations, such as local CSOs, donor programs or entrepreneurs were noted as supporting the development of the innovation.

Funding of the innovations was provided by donor grants in 10 innovations, but a variety of actors were selected as providing funding support. Only two regional innovations were self-funded FruitLook and SHERPA. For Malawi-only innovations the overview is much less diverse with donor grants, friends and family, business development and network opportunities cited.

In terms of revenue schemes, the most common funding comes from business subscription fees (8), followed by individual subscription fees and donor subsidies (5, respectively). When asked if additional subsidies or donor support would be required, four responded that it was not necessary, five were unsure but the majority

(11) responded that it would be required to sustain the innovation. For the Malawi-only innovations all but one innovation (the Government led DAES v1 extension app) would require additional funding for support.

INCLUSIVITY AND TARGET AUDIENCES

Innovators in Malawi target their innovations at communities (16) and individuals (16) the most, followed by businesses (13) and households (13), and then government (12). Farmers were the largest number of primary users for 17 innovations. Cooperatives (11) and extensions workers (11) were the next most common. NGO staff were the least common users (6).

Inclusivity of women was a priority for at least six innovations in Malawi that had taken explicit action to be more inclusive. Smallholder farmers and adults with low or no literacy levels were also prioritized explicitly by five innovations. This trend is similar when extrapolated for Malawi-only innovations. These are self-reported results and so the validity of these statements cannot be confirmed.

4 DIGITAL AGRICULTURAL SYLLABI AND ENTREPRENEURSHIP TRAINING

In February 2021, the Government of Malawi deployed a five-year digital economy strategy that lays a solid foundation for different aspects of the digital economy. The strategy's target for skills and education is raising the pass rate of secondary school examinations from 50% to 80% and increasing the availability of digitally relevant skills. To achieve this by 2026, the government is expected to provide open access to digital content and support for teachers and students in all Malawi's schools. Other identified priorities are solar power, offline Wi-Fi, revised teacher training curriculum to include blended learning, device usage for education, Learning Management Systems, a community digital champion program to deepen digital literacy and skills across Malawi, introduction of mandatory project-based testing in technical curricula in secondary schools and further education, open online distance learning (ODL) certificates in areas of scarce technical skills and piloted community computer labs that support ODL to university graduates. The importance of building strong communications infrastructure for higher education and research institutions in Malawi cannot be over-emphasized. Such infrastructure is needed to support advanced services delivered through high-speed telecommunications networks. The Malawi Research and Education Network (MAREN) is a key institution that provides internet bandwidth services, cloud services and other value-added services to research and education institutions at reduced costs.

4.1 AGRICULTURAL SYLLABI UNIVERSITIES

A total of six Universities and institutions were approached to take part in the survey:

- Directorate of Science, Technology, and Innovation - Ministry of Education
- Lilongwe University of Agriculture and Natural Resources (LUANAR)
- Malawi University of Science and Technology
- Mzuzu University
- Nkhoma University
- University of Malawi

The Directorate of Science, Technology and Innovation - Ministry of Education, LUANAR, Nkhoma University and University of Malawi were the only respondents to our survey. LUANAR also participated in a KII.

Nkhoma University (Faculty of Education) responded to requests to complete the survey. Nkhoma provides digital skills training but not in agriculture, nor do they provide digital entrepreneurship training. Therefore, the results of this survey will not be mentioned in this chapter.

DIRECTORATE OF SCIENCE, TECHNOLOGY, AND INNOVATION

The Ministry of Education through the Directorate of Science, Technology, and Innovation (DSTI) offers various onsite and online digital training courses since 2002. Regarding the levels of these digital trainings and their implementation, twelve of them are delivered at certificate level, thirteen at B.Sc., nine at M.Sc., seven at Ph.D., ten at college incubators and ten at university incubator level. As for digital agriculture, four courses are delivered at B.Sc. level and three at M.Sc. level. All the courses are aligned with the Malawi Vision 2063.

The DSTI is also providing new skills in machine learning, drones, and robotics for agriculture. The digital entrepreneurship training courses focus on digital procurement, e-Extension, smart farming, and ICT-enabled advisory services. Students are equipped to start new businesses, work for the public sector or in advanced research.

For the Directorate, equipping young people in data collection, digital advisory, agri digital financial services, digital procurement, agri-e-commerce, e-Extension, and smart farming will facilitate their absorption into Malawi's agricultural labor market sector. University or college incubator and innovation spaces, experimental farms, research laboratories, student associations followed by ICT laboratories are considered to be important facilities by DSTI for digital training.

LILONGWE UNIVERSITY OF AGRICULTURE AND NATURAL RESOURCES (LUANAR)

The Faculty of Natural Resources of LUANAR offers various onsite and online digital training courses since 2009. Regarding the levels of these digital trainings and their implementation, ten of them are delivered at B.Sc. level, one at M.Sc. and one at Ph.D. In the area of digital agriculture, two courses are delivered at M.Sc. level and include big data for analytics in agriculture and digital entrepreneurship in agriculture. The digital entrepreneurship training courses focus on Agri digital financial services, Agri-e-commerce, E-extension, ICT-enabled advisory services, agriculture innovation, agribusiness and agricultural extension. Students are equipped to launch enterprises, work in advancing research (PhD, research institutions, others, etc.), or e-commerce skills. For LUANAR, equipping young people in data collection, agri-e-commerce and e-Extension will facilitate their absorption into Malawi's current agriculture sector labor market. Experimental farms are considered to be the most important facility by the Faculty of Natural Resources of LUANAR for digital training.

COMPLEMENTARY INFORMATION FROM THE KII

The Covid-19 pandemic has accelerated the use of digital technologies at Lilongwe University of Agriculture and Natural Resources (LUANAR) for teaching and research purposes. LUNAR has good digital infrastructure but there is a need to boost the Wi-Fi connection, build the capacities of faculty members in digitization, and equip faculties with the necessary tools to support teaching and learning. The University teaches students general IT and digital agriculture skills such as e-commerce, data collection and analysis tools (e.g., GIS tools). LUANAR's Agricultural Education and Development Communication Department houses a unique B.Sc. in agricultural innovations. The program is aimed at building the multi-layered innovative capabilities of the students in the field of agriculture. Students are taught in ICT in agricultural innovations, climate smart agricultural innovations and diffusion and adoption of agricultural innovations, among others.

Entrepreneurship skills are developed through various courses in addition to the innovation hub (AgriBiz) where students are mentored and taught how to successfully run a business. AgriBiz started last year with the support of the African Development Bank through the Job for Youth initiative in Malawi. Currently, the Government of Malawi is providing financial support to qualified students of the AgriBiz program.

In terms of national and regional collaboration, LUNAR collaborates with investors, industries, the government of Malawi as well as universities in SADC member states including University of Pretoria, University of Namibia, University of Dar es Salam and the University of Mauritius. The University is constantly working to secure funds from donors to ensure the sustainability of the hub.

UNIVERSITY OF MALAWI (FACULTY OF SCIENCE)

The University of Malawi, Faculty of Science, responded to the request to complete the survey however it is unclear from the responses if digital *agriculture* skills training if provided.

The Faculty of Science has offered various onsite and online digital training courses since 2017. Regarding the levels of these digital trainings and their implementation, nine of them are delivered at certificate level, ten at B.Sc., nine at M.Sc., and seven at Ph.D. level.

There is some contradiction in the survey responses as the Faculty responded negatively when asked if any of the digital agriculture skills were taught at the University. In the follow-up question on the level of training, Big Data for Analytics in agriculture, Internet of Things for agriculture, and cyber security in the agricultural context were all noted to be taught at B.Sc. level. Artificial Intelligence for agriculture and Programming/ Coding for agricultural systems are taught at M.Sc. level. Under "other" it was noted that general programming, Internet of Things, and Big Data analytics training is provided at both B.Sc. and M.Sc. level. All of these trainings are provided on site only.

The Faculty of Science confirmed in their responses that digital entrepreneurship training was provided at postgraduate and M.Sc. level. Students are taught how to launch an enterprise, find a job, work for the public sector or in advanced research. Equipping young people in data collection, digital advisory, agri digital financial services, digital procurement, agri-e-commerce, e-Extension, and smart farming are all considered important skills to facilitate their absorption into Malawi's agricultural labor market sector. University or college incubator and innovation spaces, experimental farms, research laboratories, student associations and ICT laboratories are considered to be somewhat important facilities by for digital training (these were all given a score of 3 in the survey with 1 indicating least important and 5 indicating extremely important).

TABLE 8 OVERVIEW OF RESPONSES FROM SURVEYED UNIVERSITIES IN MALAWI

MALAWI UNIVERSITIES	
The Directorate of Science, Technology and Innovation	
Digital Agri Skills	Artificial Intelligence for agriculture Internet of Things for Agriculture Digital entrepreneurship in agriculture Machine Learning, drones and robotics for agriculture
Digital training courses updated	Yes
Digital entrepreneurship trainings	Digital procurement E-extension Smart farming ICT-enabled advisory services
Type of Skills building	Launching an enterprise Working for the public sector Working in advancing research (PhD, research institutions, etc.)
Most important digital Agri skills	Data collection Digital Advisory Agri digital financial services Digital procurement Smart Farming
Most important facility for digital trainings	University or College Incubator/innovation space Experimental farms Research laboratories Students' associations space and clubs

Aligned with institutional strategy	Yes (Malawi Vision 2063)
Lilongwe University of Agriculture and Natural Resources (LUANAR)	
Digital Agri Skills	Big data for analytics in agriculture Digital entrepreneurship in agriculture
Digital training courses updated	Yes
Digital entrepreneurship trainings	Agri digital financial services E-commerce E-extension Digital advisory Agriculture innovation Agri business Agricultural extension
Type of Skills building	Launching an enterprise Working in advancing research E-commerce skills
Most important digital Agri skills	Data collection Agri e-commerce E-extension
Most important facility for digital trainings	Experimental farms
Aligned with institutional strategy	Unsure
University of Malawi (Faulty of Science)	
Digital Agri Skills	N/A
Digital training courses updated	No
Digital entrepreneurship trainings	Agri digital financial services E-commerce E-extension Digital advisory Agriculture innovation Agri business Agricultural extension
Type of Skills building	Launching an enterprise Finding a job as an employee Working for the public sector Working in advancing research
Most important digital Agri skills	Data collection Digital Advisory Agri Digital Financial services Digital Procurement Agri e-commerce E-extension Smart Farming
Most important facility for digital trainings	N/A
Aligned with institutional strategy	Unsure

4.2 INCUBATORS AND INNOVATION HUBS

In general, the incubator and innovation hub sector in Malawi is driven by the private sector. Access to the SME support programs remains a major issue despite the existence of various support programs provided by private and public actors[20].

A total of 12 business support organizations have been mapped in the country, of which six are operating in the agricultural sector. The general business support organizations with focus or activities in the agricultural sector that have been identified are Stimulus Africa, Grow Malawi, InCUBE8 Malawi, Innovation Hub Malawi,

[Dzuka Africa StartUp Hub](#) and [BeeBiz](#). For these organization there was no evidence of trainings and incubation activities dedicated to agricultural entrepreneurs and therefore they were not targeted for the KIIs.

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

- [mHub Malawi](#)
- [Polytechnic Design Studio](#)
- [Green Innovation Centers for the Agriculture and Food Sector (GIC)](#)
- [LUANAR Innovation and Incubation Centre](#)
- [The Centre for Agricultural Transformation](#)
- [Mzuzu Entrepreneur Hub](#)

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

GREEN INNOVATION CENTER FOR AGRICULTURE AND FOOD (GIC)

Established in 2018, GIC is a four-year project (or "a tool to train other entrepreneurs" as defined by themselves) commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ) and operated by GIZ.

GIC provides trainings and coaching sessions for existing entrepreneurs (MSMEs) with a 6–9-month training and coaching program aimed at strengthening their business plans and entrepreneurial or digital skills.

To date, they have supported 685 entrepreneurs in the country with coaching and training sessions in the agricultural sector and they have 279 entrepreneurs in their current portfolio.

Despite the important number of agriculture and agribusiness SMEs, they do not run digital agricultural trainings and the only digital training they provide is one module on digital marketing and some coaching for entrepreneurs if they lack some IT skills. The main target of these trainings are students, graduates and young entrepreneurs involved in different stages of the agribusiness value chain.

The implementation of the coaching and training sessions is done by local private and public consultants such as training centers and private organizations. They also started a collaboration with the LUANAR Innovation and Incubation Centre. However, they do not have experience with them so far. The project does not receive support from the government, but the entrepreneurs receive grants from a public program.

POLYTECHNIC DESIGN STUDIO

The Polytechnic Design Studio has been in existence since 2015 and is a partnership initiative between the Polytechnic, the Rice 360 Institute for Global Health Technologies, NEST360 & the Lemelson Foundation (all US-based organizations except the Polytechnic).

The Design Studio is a FabLab and a prototyping space where students come to develop their project ideas through prototyping services such as electrical components, 3D printing, FabLabs services and others. To date they have supported four project ideas in the agricultural sector, ranging from building a drone to delivering pesticides and fertilizers, implementing sensors for irrigation systems of greenhouses, and using artificial intelligence to monitor plant diseases.

The general digital modules they cover are software languages (machine learning, python, etc.), hardware engineering, and 3D/2D Design. They also cover digital agriculture training in Digital Advisory, Agri Digital Financial services, Digital Procurement, Agri-e-commerce and Smart Farming. Since they are embedded in the Polytechnic, the main target of these trainings are students and graduates. However, their trainings are also open to external people. Even if the trainings are delivered by the internal staff, some of their modules are sometimes hosted by other organizations and incubators such as mHub, RICE 360, NEST360, the Malawi University of Science and Technology, and the African Drone and Data Academy of Malawi. Regarding the collaboration with the University sphere, they work with Rice University (USA), the Malawi University of Science and Technology, and Duke University (USA).

MZUZU ENTREPRENEUR HUB

Mzuzu Entrepreneur Hub has been operating since January 2018 and is a private incubator and innovation hub supporting startups and emerging enterprises in multiple sectors of agriculture, health, education, renewable energies, ICT, and media.

To date they have supported 24 startups in agribusiness - from the idea stage to early stage such as Mzuzu Dairy (dairy production company), Agri Center (an agri-extension service that provides information regarding the access to markets through an App and trainings on tomato processing) and Sir Hackson Processors (an agro-processing company developing cassava in flour also used in infant porridge and a digital app to help farmers access loans and manage their savings and accountability). The general digital trainings offered include digital marketing, market research online, and climate change adaptation through ICTs. Their modules are integrated with information sessions run by experts on digital agricultural concepts such as the use of drones, e-commerce, data management (record keeping, climate change adaptation aspects, weather information), e-wallet, digital financial records, and mobile money. The main target of these trainings and information sessions are graduates, young agriculture entrepreneurs and aspiring agriculture entrepreneurs. However, they also support skills development and entrepreneurship capacity building for smallholder farmers through the collaboration with ACADES Malawi, a network of 3,000 farmers across the country.

Regarding the collaboration with the University sphere, they work with Mzuzu University (Northern Region of Malawi), TEVETA (the local authority that manages the technical and vocational training and that runs colleges in Malawi) and community colleges across Malawi.

TABLE 9 OVERVIEW OF RESPONSES FROM INTERVIEWED INCUBATORS IN MALAWI

MALAWI INCUBATORS	
Mzuzu e-Hub	
Year of Establishment	2017
Agri start-ups incubated	24
Target of Digital Agri trainings	Graduate Young agriculture entrepreneurs Aspiring agriculture entrepreneurs
Digital Skills trainings	Climate change adaption enterprises through ICTs Digital marketing Product development for prototype development
Digital Agri Tools taught	Digital advisory Agri digital financial services Digital procurement Agri e-commerce Smart farming

Collaboration with Universities and Colleges	Mzuzu University (Northern Region of Malawi) TEVETA (Authority that manages the technical and vocational trainings, they run colleges in Malawi)
Supported by the Government?	Yes (as part of a project financed by the World Bank)
Green Innovations Center for Agriculture and Food	
Year of Establishment	2018
Agri start-ups incubated	685 MSMEs
Target of Digital Agri trainings	Students/Pupil Graduates Young agriculture entrepreneurs
Digital Skills trainings	Digital marketing
Digital Agri Tools taught	None
Collaboration with Universities and Colleges	Lilongwe University of Agriculture and Natural Resources (LUANAR)
Supported by the Government?	No
Malawi Polytechnic Design Studio	
Year of Establishment	2015
Agri start-ups incubated	2-4
Target of Digital Agri trainings	Students Graduates
Digital Skills trainings	3D/2D Design Software languages (machine leaning, python, etc.) Hardware engineering ICT for biomedical
Digital Agri Tools taught	Digital Advisory Agri digital financial services Digital procurement Agri e-commerce Smart farming
Collaboration with Universities and Colleges	Rice University Malawi University of Science and Technology Duke University
Supported by the Government?	Yes

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

Malawi ranked 11 out of 16 in the benchmark assessment which suggests that Malawi is in transition and has some elements for a digital economy. The benchmark assessment enabled the identification of countries within SADC that are unlocking positive pathways towards a digital economy and a vibrant ecosystem of different actors. Malawi scored in the bottom half of the SADC member states in four of the six digital economy pillars. It ranked highest (fourth) in the G5 digital economy benchmark, which identifies the presence of policies and regulations that are dynamic and flexible and promote the digital economy. It also scored well in the innovation driven entrepreneurship pillar, ranking sixth, which identifies 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. Malawi ranked lowest and behind the African median, in ICT infrastructure (which identifies the availability of affordable, accessible, resilient, and reliable infrastructure) and digital skills (which identifies the development of a digitally skilled workforce that is grounded on sound ethical practices and socio-cultural values).

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. Malawi makes up part of Group 3, these countries ranked in the middle of the benchmark and tend to be more reliant on agriculture for employment and economic growth.

POLICY ENVIRONMENT

The stock take of national policies, strategies and legislation identified that digitalization is being prioritized and that Malawi is in transition. Five key documents were available for review that focused on a general approach to integrating ICTs or transforming into a digital economy. Malawi was one of only a few SADC member states that had a Digital Economy Strategy in place. The national Digital Economy Strategy embodies the whole-of-government approach prioritized by the OECD Going Digital Toolkit. The Strategy also takes a forward thinking approach in addressing some challenges to enable a digital economy, such as the development of a data protection act to help with the development of e-commerce but also to ensure trust with the inevitable increase of data usage within digital technologies; expedite the deployment of the Electronic Single Window that will improve trade efficiency and reduce costs for the processing and facilitation

of e-payments; a change in the taxation of ICT service providers and network operators; and providing data vouchers to stimulate demand for broadband and network usage, as well as engaging citizens in the digital economy to understand the added value that connectivity and digitalization can provide.

No specific sectoral strategy or policy on digitalization within agriculture was identified. The Digital Economy Strategy highlighted the importance of agriculture and refers to existing initiatives and innovations (Esoko and the Department of Agricultural Extension Services app, DAES v1) included in our survey responses in section 3. These partnerships with the private sector are encouraging and exemplify the awareness of the wider digital economy operating within Malawi. While the strategy addresses some key challenges for agriculture specifically, such as attempting to reduce post-harvest losses, improving access to agriculture extension services, and increasing access to export markets locally and internationally, it needs to have greater emphasis on ensuring buy-in from smallholder farmers, increasing digital literacy skills for agriculture stakeholders specifically, and risk mitigation for digital transformation. Developing and publishing a clear digital transformation strategy specifically for the agriculture sector which includes clear priorities and objectives, and addresses specific challenges faced by smallholder farmers, innovators and the private sector could be used as an advocacy tool to push for greater funding and prioritization. The key challenges identified from the research, stock take review and key informant interviews is the lack of a guiding policy or strategy specific to agriculture, the level of digital literacy among farmers and the current ICT infrastructure in place. Many of these challenges require greater stakeholder collaboration including the private sector and civil society as they fall outside the remit of the Ministry of Agriculture.

DIGITAL AGRICULTURE INNOVATIONS

A total of 25 innovations were identified in Malawi and 23 responded to the survey. All use cases were present in Malawi but there was a clear gap around agri-digital financial services and smart farming. The agricultural objectives of the Digital Economy Strategy support the findings from the innovator survey responses in section 3, above. The top three common challenges that the survey respondents are attempting to address with their innovations are the knowledge gap, low productivity, and poor access to markets. The top three challenges faced when applying their innovations were digital literacy, access to devices, and farmer uptake and behavior change. Most of the technology and channels required for the innovations in Malawi rely on more modern technology (smartphones) rather than advanced emerging technology (drones etc.) which should make it more accessible.

The results from Malawi suggest there is a clear challenge for innovations to reach financial sustainability. Many survey respondents noted that they would require subsidies or donor grants to continue. This is also reflective of the start-up funding and revenue models used which relied heavily on donor grants, and friends or family. The Malawi-only innovations also noted that there was a lack of donor or angel investment making it harder for start-ups to innovate, low funding to cover farmers, and financial sustainability issues to maintain the innovations.

DIGITAL AGRICULTURAL SYLLABI AND ENTREPRENEURSHIP TRAINING

Digital skills education is included as a key priority in the Digital Economy Strategy, and an area that Malawi was significantly lagging in the benchmark. Low digital literacy was also the biggest challenge cited by innovators when implementing their solutions with just under half of innovations struggling with this issue. Currently, digital agricultural courses do not seem to be well integrated into the curriculum of agricultural higher education in Malawi. The entrepreneurship and innovation ecosystem are primarily driven by the

private sector which is dependent on donor funding to operate. However, they are well prepared to provide the technical and digital trainings required in the agri-related sector to the youth. An exchange of knowledge and capacity building for universities between the academic sector and the business support organizations is suggested to empower the higher education institutions in preparing youth for the labor market and to improve the development of digital agricultural curricula. The development of strong campus networks and the strengthening of National Research & Education Networks are key so that Malawi higher education institutions and innovation hubs can effectively provide all types of digital services for teaching, digital agricultural training, digital agricultural entrepreneurship, and advanced research activities.

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

- Improving digital infrastructure in rural areas where most young people live.
- Establishing a regional and national collaboration framework that promotes interactions between companies, start-ups, universities, public and financial authorities in each country and between member states.
- Digital agriculture courses should equip students with the necessary skills to leverage digital technologies to solve recurring problems in agriculture linked to production, post-harvest management, market access, finance, and supply chain management.
- The government must get involved to put in place support mechanisms for entrepreneurship and innovation hubs across Malawi.

Digitalization within agricultural policies and plans may not be fully integrated yet and Universities may not be providing adequate training for the agriculture entrepreneurs, but it has not inhibited agricultural innovations operating and establishing in Malawi. From the 24 survey respondents, 12 were Malawi-only innovations and one was a regional innovation that originated in Malawi (Mukuru Money App) suggesting that an ecosystem supportive of innovations does exist within Malawi.

5.2 REFLECTIONS FROM THE SITUATIONAL ANALYSIS REPORT

This document has presented the available data collected for Malawi 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 Malawi include:

- **Low digital literacy hinders the adoption new technologies especially in an aging rural population.** The most common challenge that survey respondents encountered was digital illiteracy 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. 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.

- **Appropriate training programs that take into consideration the local languages and the local contexts will be a priority particularly for agriculture which demands relevant and local content.** If farmers are to be trained how to use their mobile devices appropriately, the training content must be in the local languages, more easily understandable by farmers and using imagery to guide action.

- **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 will also promote a greater "entrepreneurship culture" within Universities**.**

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