

DIGITAL AGRICULTURE COUNTRY STUDY ANNEX: SOUTH AFRICA

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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SYSTEMS OF THE SADC REGION: SITUATIONAL ANALYSIS REPORT**

Centre for Coordination of Agricultural Research and Development for
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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 South Africa is an annex to the *Situational Analysis Report* and provides a portrait 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 South Africa 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 South Africa, 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 South Africa 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. During this study, South Africa were in the process of appointing a new Information, Communication and Knowledge Management (ICKM) CCARDESA Focal Point but did facilitate an introduction to the predecessor. The study team also worked with a National Consultant in South Africa, Mr. Tawanda Kamutatari.

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

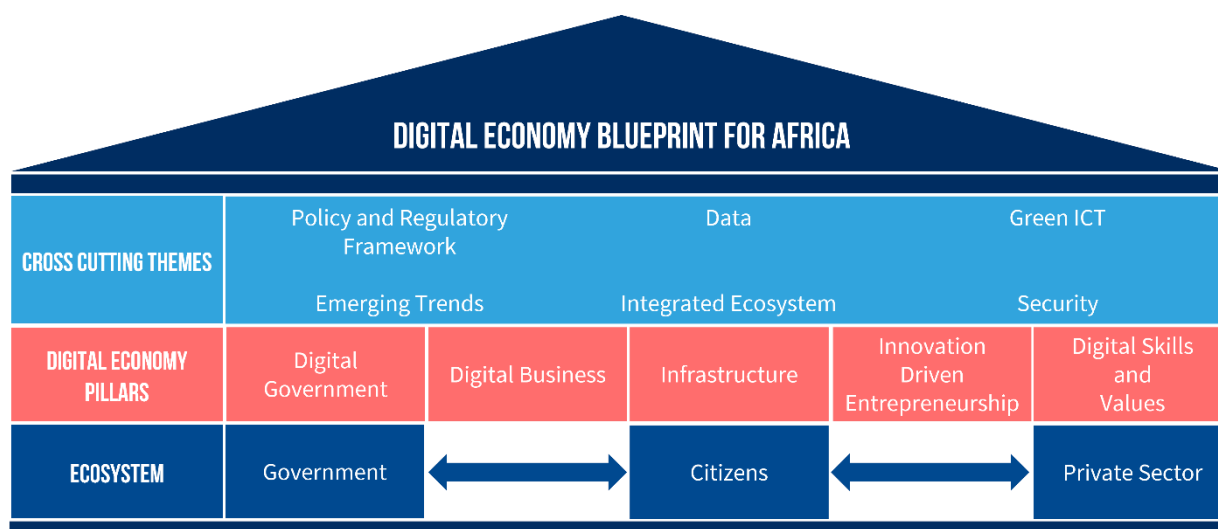


FIGURE 1 OVERVIEW OF THE KENYAN DIGITAL ECONOMY BLUEPRINT

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 South Africa 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.

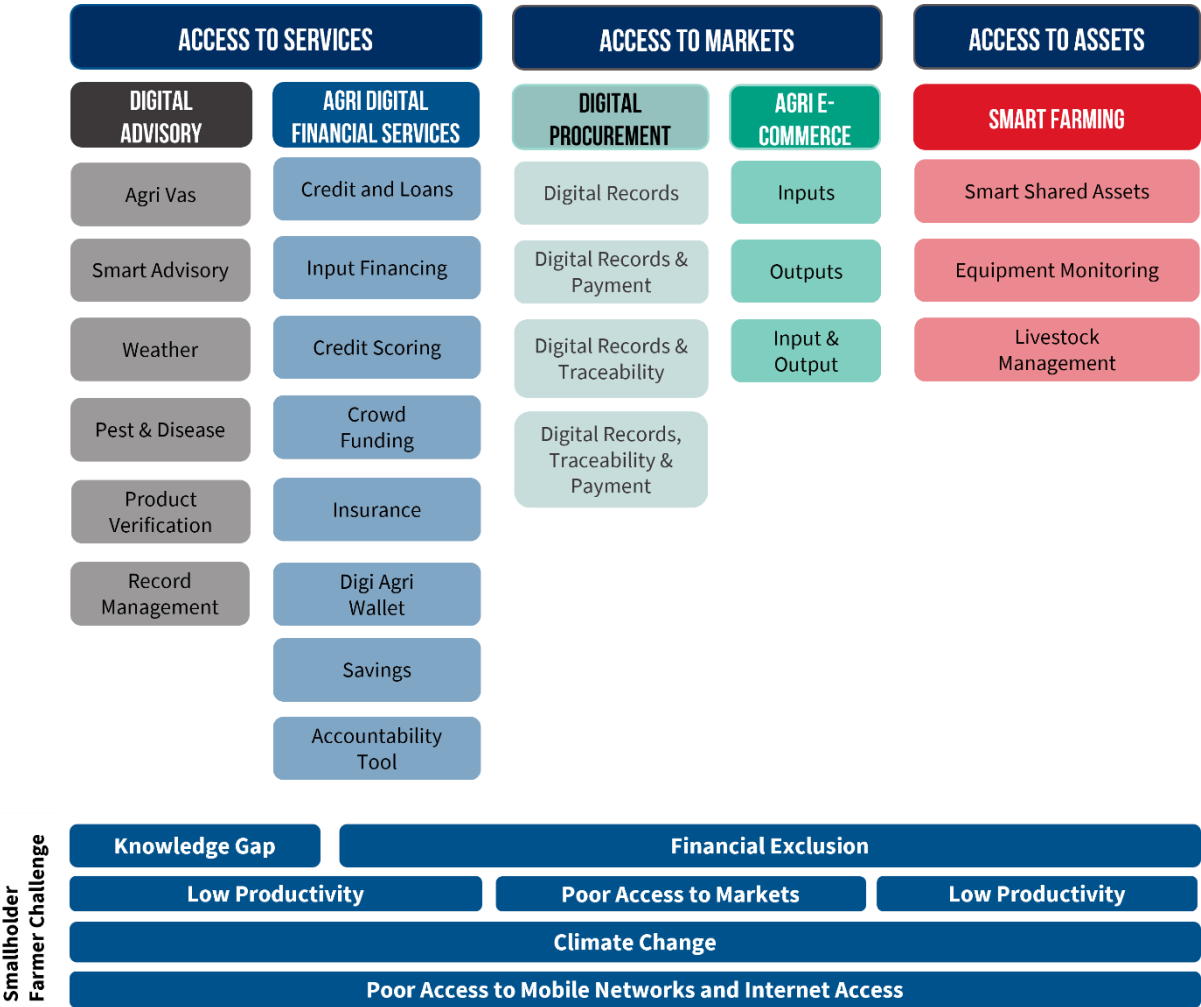


FIGURE 2 USE CASE MODEL BASED ON GSMA FRAMEWORK

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



DIGITAL SYLLABI

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

LIMITATIONS TO THE METHODOLOGY

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

As a result of the change in CCARDESA ICKM focal point, the study team experienced significant delays to being able to interrogate the policies and key digital innovations in the public sector through an appropriate focal point.

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 South Africa 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.

Furthermore, in relation to South Africa, the violent exchanges and political uncertainty, as well as the heavy toll of the Covid-19 pandemic was very clear to see, with a significant decrease in the willingness of people to participate in the study and the challenges they faced to dedicate their time to work that was not paid.

DIGITAL SYLLABI

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

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 SOUTH AFRICA IN SADC

South Africa is an upper-middle income country and the third most populous country in the SADC region with a population of 59.3 million.¹ The UNDP Human Development Indicators rank South Africa as 114th out of 190 countries and 4th out of the 16 SADC countries.² South Africa scores on the higher scale in the region for gender equality with a Gender Development Index of 0.986.¹ It is one of the richer countries in the SADC region with a Gross National Income per capita of \$11,870 (compared to an average of \$8,277 in the region).³ Although only 6.3% of the population falls under the UN Multidimensional Poverty Index,⁴ 55.5% 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 South Africa's population is also higher than the average in SADC with 27.6 years (versus 22.1 years).

AGRICULTURE ENVIRONMENT

In the case of urbanization, South Africa is above average in the SADC region with 66.9% living in urban areas. This is reflected in the low share of agriculture on GDP and the labor force, with only 2.4% of the GDP earned in agriculture and 5.28% of the population employed in the agriculture sector (significantly lower than the average of the SADC region of 43.37%). On the Global Food Security Index, South Africa ranks as the 69th country with an overall score of 57.8, making it the first in the SADC region.⁶

South Africa

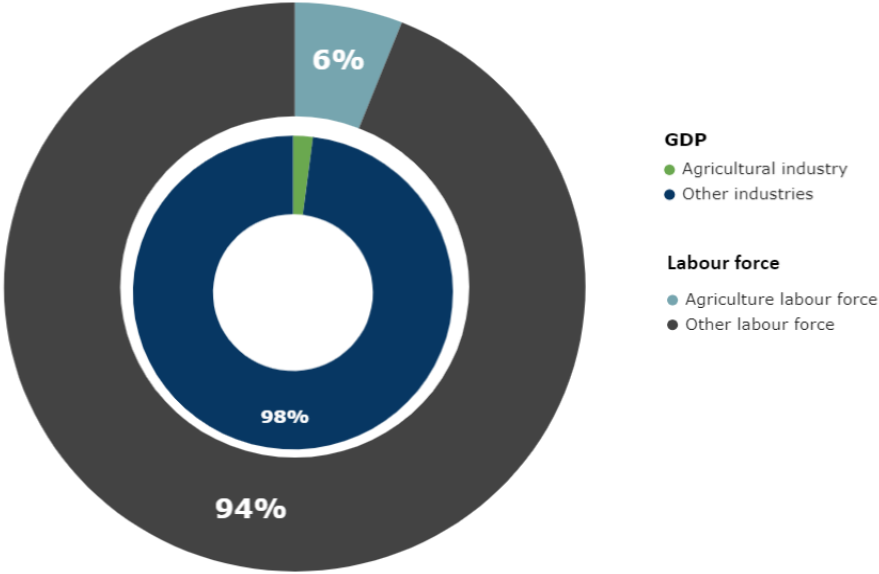


FIGURE 4 SOUTH AFRICA'S AGRICULTURAL INDUSTRY SHARE OF GDP AND THE SHARE OF THE AGRICULTURAL LABOR FORCE

1.4 THE GENERAL DIGITAL ECOSYSTEM

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

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

sustainable growth⁷. The Strategy, illustrated in figure 5, is based on foundational pillars, critical sectors to drive the digital transformation, and cross cutting themes to support the digital ecosystem.

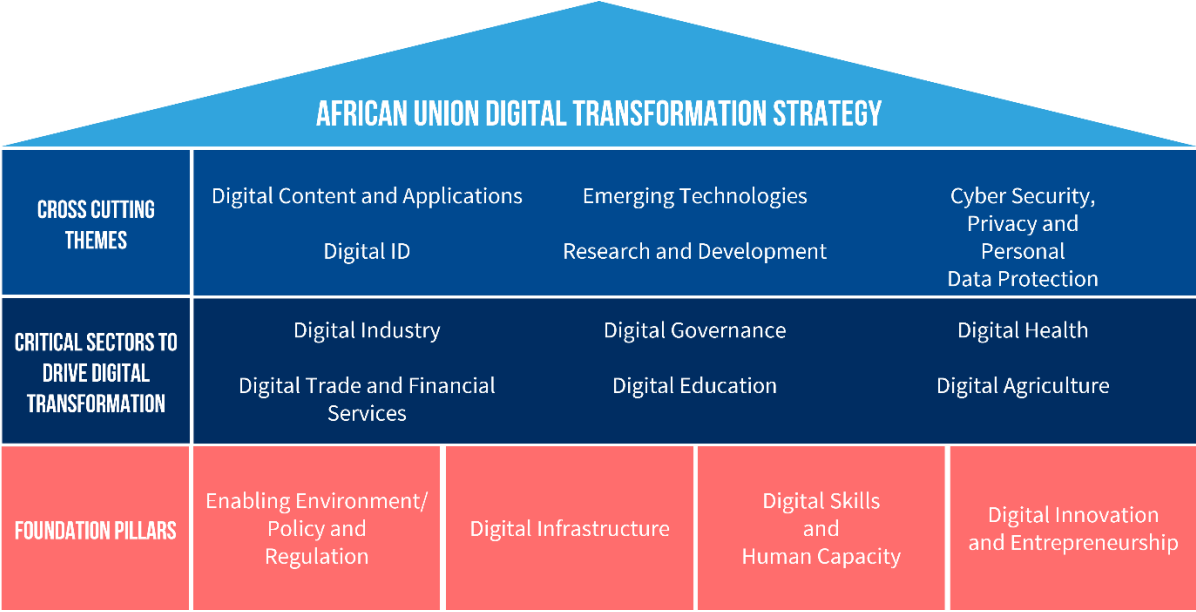


FIGURE 5 OVERVIEW OF THE AFRICAN UNION DIGITAL TRANSFORMATION STRATEGY

The transition to, and importance of a digital economy is illustrated in the prevalence of this agenda within regional institutions, donors, and multilateral organizations. Where agendas previously focused on ICTs, providing hardware and universal access, the focus is now on enabling a digital economy with a more holistic view of digital and ICTs. The digital economy considers sectors beyond the ICT industry and encourages a whole-of-government approach to have more emphasis on the overall ecosystem and economy⁸.

BENCHMARK ASSESSMENT FINDINGS

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

The results for South Africa are illustrated in table 3.

TABLE 3 BENCHMARK PILLAR SCORES: SOUTH AFRICA

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

The benchmark assessment identified four clusters of countries:

Group 1: South Africa, Mauritius, and the 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: SOUTH AFRICA

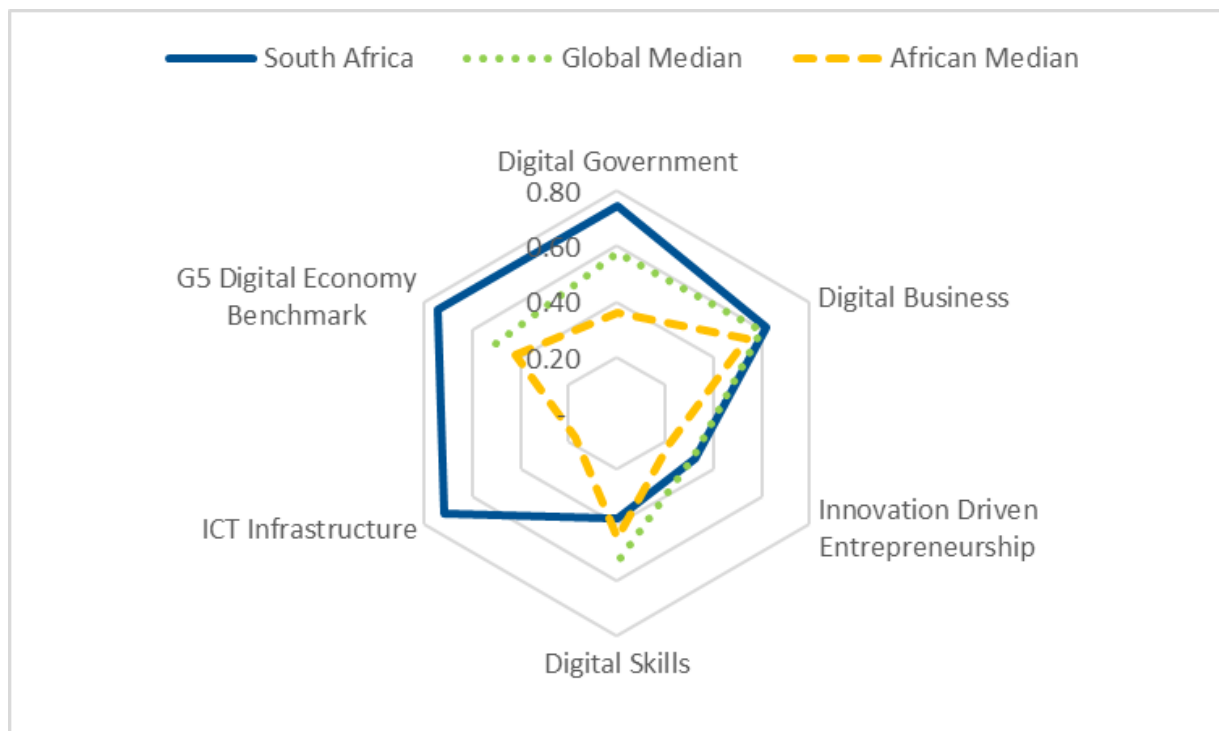


FIGURE 6 RESULTS FROM BENCHMARK ASSESSMENT FOR SOUTH AFRICA

In the benchmark assessment South Africa ranked first out of the 16 SADC member states. Figure 6 below illustrates the results of the benchmark in comparison to the Global and African medians. South Africa exceeds in most assessment areas, but scores lowest in digital skills. The benchmark suggests that South Africa is a front-runner in the region and has some key foundational areas necessary for a robust digital economy.

South Africa scored in the top two in all assessment areas except digital skills, where it ranked tenth. Table 5 below, illustrates the ranking for each individual pillar in comparison to the other SADC member states.

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	DR Congo
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	DR Congo		Angola	Malawi	Comoros
15	DR Congo	Angola			DR Congo	Mozambique
16	Comoros				Madagascar	Seychelles

DIGITAL INFRASTRUCTURE

In South Africa, 66.9% of the total population uses the internet.⁹ This is much higher than the regional average of 29.94%. The GSMA Mobile Connectivity Index shows a 100% access to the 3G network,¹⁰ which complements the HDI report of 153.3 mobile cellular subscriptions per 100 people.¹¹ South Africa also ranks as 47th on the Inclusive Internet Index,¹² which details the accessibility, affordability, and relevancy of internet in 120 countries. Moreover, according to the Mobile Connectivity Index, South Africa is ranked 2nd in terms of overall mobile connectivity in the SADC countries with an overall index of 60.1, which clearly qualifies it as an emerging country (above 35)¹³. It scores above average for each category of consumer readiness, affordability, availability of infrastructure, and content and services.ⁱⁱ In terms of ICT adoption, South Africa ranks 102 (out of 140). The South African government ranks lower on the scale when considering its future orientation based on the position 102 (out of 140), while it ranks higher on the innovation capability index 46 out of 140.¹⁴ However, it scores 3.27 out of 7 points on the GCI 4.0 Digital Skills Among the Population Index,¹⁵ which is slightly lower than the SADC average.

ⁱⁱ 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 South Africa ranked first out of 16 in the region, scoring highly in all indicators except digital skills. The high scores and ranking in the assessment pillars indicate that South Africa has some foundational requirements for a digital economy and that there is likely a strong enabling environment in place for a digital economy. In the *Situational Analysis Report* the clusters of SADC countries identified from the benchmark are discussed in more detail but South Africa, as a front-runner, forms part of Group 1 which is made up of countries that scored highly in the benchmark, are generally less reliant on agriculture for GDP growth and are the richest of the SADC member states.

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 frameworks¹⁶. 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 policies¹⁷. 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 outdated¹⁸.

2.1 GENERAL DIGITAL POLICIES

The benchmark assessment suggested that South Africa's digital economy is one of the most mature in the region, and this prioritization of digital transformation is clearly apparent when doing a stock take of available policies, strategies, and legislation. South Africa has several general policies and legislation relating to technology and digitalization that contribute to the suggestion of a robust digital economy.

POLICIES, STRATEGIES AND PLANS

Most of the ICT-related Policy documents are available from the website of the Department of Telecommunications and Postal Services, and the Department of Communications and Digital Technologies. The **National Information Society and Development Plan 2007 (ISAD)** is a lengthy and overarching framework and roadmap intended to shift South Africa from an industrial society to an information society. The overall objective of the plan is to broaden participation and increase the competitiveness of the economy, whilst promoting social inclusion and equality. The plan is split into 10 key pillars which includes, policy and regulatory environment, digital inclusion and e-awareness, human capital, local content, and ICT capacity

development. While lengthy, this national plan sets up a broad vision for South Africa and references several foundational elements required for a transition to a digital economy, such as the policy and regulatory environment, infrastructure and access, and skills. The addition of local content, digital inclusion and e-Awareness is a novel idea that, while mentioned in other country strategies in passing, has not been as central to a strategy or plan.

“South Africa Connect” Broadband Policy 2013 outlines a series of steps needed to create a “dynamic and connected vibrant information society and a knowledge economy that is more inclusive, equitable and prosperous” and sets out four policy interventions:

1. **Digital Readiness** addresses institutional administrative impediments (i.e., policy, legal and regulatory frameworks).
2. **Digital Development** aims to digitally enable government through key activities.
3. **Digital Future** creates conditions for infrastructure and services that are future proof.
4. **Digital Opportunity** stimulates demand through general awareness and formal skills.

This policy serves as a framework and addresses the need for a broadband council, modifications to how the regulator (ICASA) functions, an open access wholesale network, and policies that enable a competitive broadband market. This is all underpinned by the need for both public and private sector involvement and funding to achieve the roll out of the necessary infrastructure including spectrum. South Africa Connect sets out some ambitious targets with a strong focus on the relationship with the private sector in achieving goals. In [The State of Broadband Report 2014](#), the World Bank lauded South Africa Connect citing it as “providing an excellent example of a policy which focuses on both supply-side and demand-side considerations”.

ISAD and South Africa Connect both provide a detailed vision for the implementation of ICTs and digital transformation within the wider economy, however information on data, security and privacy has limited mention in both these early documents. In 2015, South Africa’s State Security Agency produced a **National Cybersecurity Policy Framework 2015** (and a subsequent **Cybersecurity Policy 2009** which is believed to be in draft version but has not been verified) which aims to address national security in cyberspace, review existing laws and policy guidelines related to cybersecurity, and the establishment of a Cybersecurity Hub and the Computer Security Incident Response Team (CSIRT) with a mandate to identify and counter cybersecurity threats, and create and increase public awareness around threats and education.

The **ICT Research, Development, and Innovation (RDI) Roadmap** from the Department of Science and Technology and Council for Scientific and Industrial Research (CSIR) is a ten- year implementation plan to help South Africa achieve digital advantage, and coordinate and manage South Africa’s investment across research, technology development and innovation activity. Opportunities are presented where the application of ICTs can respond to needs at the individual, societal, and wider economy level to identify focus areas and the market opportunities that exist to increase investment, both public and private, and digital prosperity.

The **National Integrated ICT Policy White Paper 2016** is a framework for the transformation of South Africa into an inclusive and innovative digital and knowledge society with the core philosophy of “facilitating ‘openness’ – open access, open Internet, and open Government.” The comprehensive document attempts to cover all sectors and trends relevant to ICTs and digital transformation, with a deliberate focus on extending access and digital inclusion. The Policy addresses issues such as establishing cross-government leadership in ICT, promoting innovation and competition, strengthening regulation, privacy and security, emerging innovations, addressing the digital divide, and ensuring affordable access. In comparison to the RDI Roadmap

which provides a strong vision and clear plan, the ICT Policy shares a strong emphasis on shaking up regulation and legislationⁱⁱⁱ.

In addition to the overarching policies, strategies, and plans that have been released through a mix of the Department for Telecommunications and Postal Services, the Department for Science and Technology, the Department for Communications and Digital Technologies, and the CSIR, South Africa has also released some specific strategies including the **ICT Small Medium and Micro Enterprises (SMME) Development Strategy 2017**, the **National e-Strategy 2017-2030**, and the **National e-Government Strategy and Roadmap**. These strategies include specific actions and policy suggestions to stimulate and increase ICTs and digital capacity in the key foundational pillars of the *Kenyan Digital Economy Blueprint*: digital business and digital government.

The topic of data has become increasingly prevalent in the strategies and plans for South Africa, with an acknowledgement of a data-driven economy in the ICT RDI Roadmap and the ICT Policy White Paper. Data will become more important as emerging technologies become more prevalent within South Africa to achieve the Fourth Industrial Revolution. In fact, the creation of a Centre for the Fourth Industrial Revolution under CSIR is mentioned in the **National e-Strategy**. In 2021 a **Draft National Data and Cloud Policy** was published for public comment by the Minister of Communications and Digital Technologies. This draft policy aims to stimulate government action on data and cloud computing to achieve economic growth and seeks the alignment of existing policies, legislation, and regulations to create a conducive and enabling environment for data. Cybersecurity, data protection, open data, localization, cross-border data transfers, competition, research, digital infrastructure and access to data and cloud services are also addressed within the draft policy.

2.2 LEGISLATION

There are countless pieces of legislation within this sector for South Africa but below are outlined the most relevant and frequently referenced:

- **Protection of Personal Information Act, 2013 (POPIA)** provides protection of personal information against unauthorized access and use and is in line with international standards. It only recently came into effect (2021) and establishes an Information Regulator that regulates the flow of personal information within South Africa and access to information.
- **Electronic Communications Act 2005 (EC Act)** which promotes the convergence of the broadcasting and telecommunication sector and provides a legal framework for these sectors; makes a new provision for the regulation of electronic communication services and electronic communication networks, provides the granting of new licenses and has control of radio frequency spectrum.
- **Electronic Communications and Transactions Act, 2002 (ECTA)** provides regulation of electronic communications and transactions, provides the development of a national e-Strategy, promotes universal access to electronic communications and transactions including by SMMEs, prevents abuse of information, provides identification, protection and management of critical data and databases, provides certain provisions to protect users' online experiences, and encourages the use of e-government services.

ⁱⁱⁱ The objectives of the plan are ambitious and well-intentioned but have been controversial and criticised by number of stakeholders: Research ICT Africa.net - [The State of ICT in South Africa](#) (2017).

- **Cybercrimes Act 2020** which was signed into law in 2021, but not yet enacted, attempts to create offenses that relate to cybercrime, criminalize the dissemination of harmful data and interference of data, and further regulate law enforcement jurisdiction over cybercrimes. It closely interacts with aspects of POPIA.

The strategies, policies, and legislation listed above provide a useful insight into how South Africa has frequently updated its strategy to keep pace with regulatory frameworks globally, whilst following a social digital inclusion mandate. The policy frameworks in place are good and there is a clear drive to push the digitalization agenda, however there is also the impression that the system is highly regulated, and policies are frequently developed perhaps hampering implementation, something this report cannot comment on but was referenced in the Information Society and Development Plan. There has been a concerted effort to transition South Africa from an industrial society to an ICT society, and now more of a focus on the digital economy or the Fourth Industrial Revolution and a strong commitment to digitalization will lend itself to prioritization in the agricultural system.

2.3 DIGITALIZATION IN AGRICULTURE

DIGITAL IN AGRICULTURE POLICIES

There are several public sector organizations that are engaged in digital agriculture of some form in South Africa, but there is no clear overarching digital agriculture strategy available. Instead, the study team identified references in the general strategies and plans above and in specific policies or plans to better incorporate ICTs or digital innovations.

National Policy on Comprehensive Producer Development Support 2018 [DRAFT]^{iv} is intended to “*regulate and guide the provision of support measures to the various categories of producers, thereby contributing to a sustainable and competitive.... sector*”. With regards to ICTs or digitalization, there is an objective to establish a Comprehensive Electronic Producer Register that would serve as a prerequisite for accessing support from Government. The database would also provide a means to disseminate appropriate and cost-effective agricultural technologies (ICTs) by extension and advisory services, a way to establish an e-voucher system to provide quality and affordable production inputs and sharing mechanization services with all registered users. Although the policy does not provide detailed information on the type of technologies or solutions intended there is an acknowledgment to utilize ICTs in the sector as “essential tools to provide digital assets (access, information, knowledge, data, communication resources, ways of participation, etc.), foster capacity development and facilitate the exchange of experiences”. As with the general digital policies above, there is a mention of pushing for greater Research and Development (R&D) in innovation technologies especially ones that are pro-small producer and gender sensitive, and a strong focus on Public-Private-Partnerships (PPP) where the public sector provides services and support, and the private sector provides investment.

The Department for Agriculture, Forestry and Fisheries (DAFF) produced a **2015/16-2019/20 Strategy** which does not include much information on ICTs, innovation, digitalization or their application in the agricultural system but there is mention of “fragmented ICT systems/antiquated knowledge and information management systems”. There is also a proposal for an ICT Plan which focuses largely on improvement of hardware and software. This suggests a lack of capacity in digitalization infrastructure and skills within the department. It is

^{iv} The policy document used for review was found online from a search engine and was titled as a [draft copy](#).

also likely that the DAFF sees IT as a service to the internal units of departments and therefore has a more supportive role, rather than a creative one for solutions^v.

The **National Extension and Advisory Services Policy** sets to provide a regulatory framework to guide the sector in the provision of extension and advisory services. Similar to the Producer Development Support Policy, there is not much detail on technologies or innovations but there is a focus on digitalizing information and strengthening ICT based extension services. In particular, the policy seeks to design a user-friendly ICT knowledge sharing platform, such as a social network, to encourage mass communication amongst actors and ensure that it is multi-lingual so that it is accessible to all sectors across the value chain.

An upcoming **Agriculture and Agro-Processing Master Plan** is due to be released and will include a focus on “enhancing competitiveness and entrepreneurial opportunities through technological innovations, infrastructure development and digitalization”¹⁹. However, further detail is unavailable as there were no draft versions of the plan available at the time of research.

CHALLENGES

There is a clear difference between the available documentation for general digital policies and those that are related to agriculture. While there are several strategies and plans in place that articulate the national vision for the rollout and encouragement of a digital economy, the same cannot be said for the agriculture documents. Agriculture is referenced and included in the **National Development Plan 2030** and the **ICT RDI Roadmap** but is only mentioned in passing and with little detail in the overarching policies for the agriculture sector. There does not seem to be much collaboration between the Department of Communication and the Department of Agriculture. One public sector stakeholder mentioned that departments are at risk of working in silos and even within the same department there can be duplication of the same policy working under a different directorate which then leads to contradictory policies.

Other challenges cited by a stakeholder are more infrastructure and cost based. The ARC provides digital extension and includes the use of a “digital pen”, which records GPS coordinates and provides other real-time information²⁰. However, the pen requires a linked device, network data, and a stable network connection to work. If these basic requirements of accessibility and affordability are not met, there can be challenges in implementing rural digital solutions, particularly those that use Emerging Technologies and are more data and network intensive.

^v KII with public sector stakeholder.

3 DIGITAL AGRICULTURAL INNOVATIONS

This chapter provides a stocktaking analysis to assess the numbers, scope, trends, and characteristics of digital agricultural innovations identified in South Africa during the study.

3.1 MAPPING DIGITAL AGRICULTURE INNOVATIONS

The research into the South African ecosystem revealed a total of 57 identified innovations that were either digital agricultural innovations or digital innovations relevant to agriculture sector stakeholders. Of these identified innovations, 20 were identified with a regional operating pattern that either had operating or registered activities in South Africa. Of these regional innovations, one was regionally introduced in all 16 countries (GeoFarmer), one in 8 countries (Smart Farmer), one in 6 countries, two in 5 countries, one in 4 countries, eight in 3 countries, and four in 2 countries.

The South African DACS presents use cases based on a model and framework created by GSMA. These broadly fall into access to services, access to markets and access to assets. From the analysis collected on the innovations, the diagram below represents the types of use cases found in South Africa.

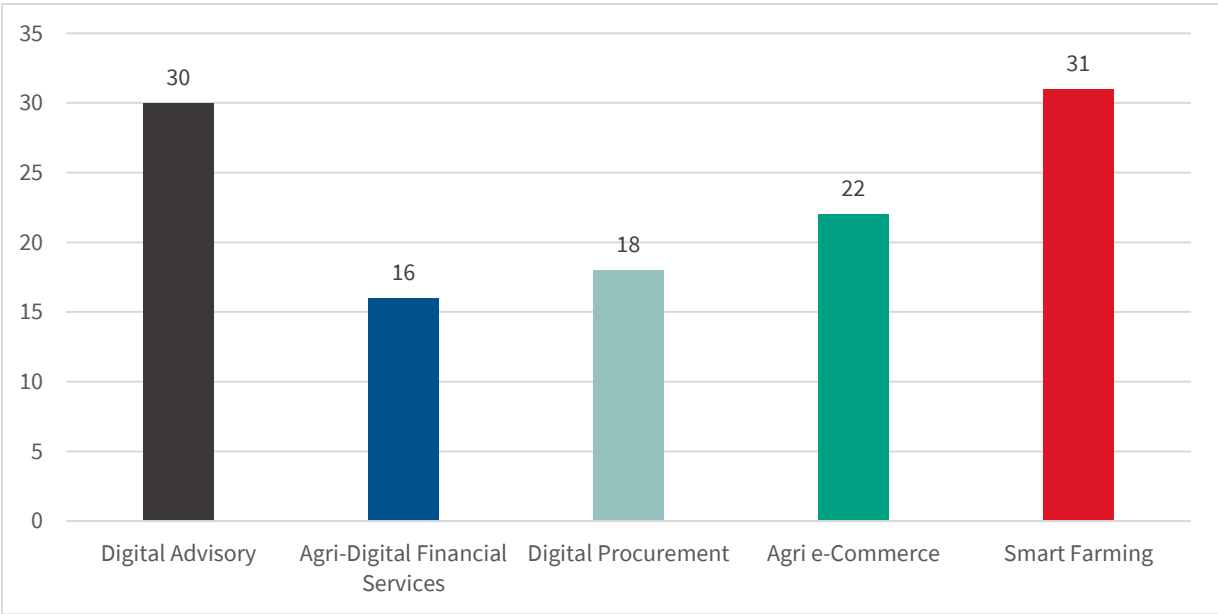


FIGURE 7 IDENTIFIED USE CASES FROM INNOVATIONS IN SOUTH AFRICA

From all the identified innovations there was a higher predominance of smart farming applications, followed by digital advisory, and agri e-commerce. There was also a significant number of digital financial services (not specifically agricultural but used by farmers) and digital procurement or digital records interventions.

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 SOUTH AFRICA

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



TABLE 6 OVERVIEW OF IDENTIFIED AGRICULTURAL INNOVATIONS OPERATIONAL IN SOUTH AFRICA

					Name of innovation	Name of the company	Survey ✓/X	Description of innovation	Operational Countries in SADC
					Adagin Technologies	Adagin Technologies	X	In 2017, Adagin Technologies was launched combining precision technologies and making them accessible for the agriculture industry. Their solutions combine farming, engineering, and software development to create some of the latest and progressive Agricultural Technologies in the industry. The focus is on aligning solutions to customers' core needs, thereby allowing customers to drive informed decisions and stay competitive in the new Industrial Revolution. Adagin provides precision harvesting and packing technologies from the field at source and understanding each yield and productive performance to increase efficiency and profits. Their smart weigh scales also enable precision traceability and packing from the farm to the fork, and through the value chain to the consumer. Their digital time and attendance solution enables accurate job costing information using smart phone technologies thereby enabling real time insight to labor costs, harvesting agriculture solutions.	South Africa
					Adumo	Adumo Pty Ltd	X	Adumo is South Africa's largest independent payments processor trusted by retailers across Africa. Used by large multi-nationals, independent retailers, entrepreneurs, and informal traders. A payment solution that provides expertise to make smart payment acceptance decisions. their package offers working capital requirements, consumer engagement platforms, business support solutions, an in-store consumer credit platform, retail point of sales software and hardware, customer analytics,	South Africa

							electronic voucher distribution and private label card issuing, all from a single provider. Located in 13 countries across Africa, with more than 30,000 active clients		
■				■	Aerobotics	Aerobotics	X	Aerobotics was founded by James Paterson and Benji Meltze in 2014, together with a team of agronomists, engineers, product developers, creatives, and customer service experts. Their mission is to provide their customers with intelligent tools throughout every season, so that they can feed the world. The full team compliment comprises of over 80 employees has operating across the globe with head offices in California and in South Africa. The operation has spread over 18 countries with over 100 drone pilots capturing aerial imagery for farmers. They have processed over 100 million aerial images of citrus trees.	South Africa
	■				AfriMoola	BoxFusion and Nedbank Uhkeshe Enterprise	X	BoxFusion and Nedbank Uhkeshe Enterprise have now partnered to create Afrimoola, a digital mobile money wallet to assist farmers with payment and e-wallet/ Voucher solutions. Afrimoola is a Fintech under the Nedbank Ukheshe Enterprise program. It is a dynamic Fintech and digital ecosystem built on the ethos of financial inclusion. Afrimoola technology is managed by digital transformation technology company, Boxfusion that provides cutting edge software solutions, providing solutions to may South African government departments, companies, and enterprise clients. Boxfusion has a 12-year track record and are 100% public sector focused and are a gold partner of Microsoft. Afrimoola platform offers omnichannel solutions, wallets, eCommerce, digital money movement across networks, banks and borders, savings and stokvel solutions at the touch of a button for merchants and customers.	Namibia, South Africa, Zimbabwe
			■		AGBIZ	AGBIZ	X	The agricultural business chamber, an NGO operating in Southern Africa. Agbiz is an association of agribusinesses operating in South and Southern Africa and enable their members to play a constructive role in the agriculture sector of the country, economic growth, development, and transformation. They offer opportunities to engage with and influence policy and legislative environment, to improve commercial and sustainable agribusiness environment including trade and investment and agricultural finance, to encourage emerging agribusinesses and players in the agro-food value chain and to create relevant accessible agribusiness and market intelligence. They have a website offering detailed market updates and	South Africa

							advice on all aspects of agribusinesses including the enabling environment and financial support.		
■					Agricultural Research Council (ARC) Hub App	Agricultural Research Council	✓	<p>ARC Hub App of the South African Government. The ARC Hub app is an all-round information source for Farmers, Extension Practitioners and Researcher. Its features include 158 manuals related to plant production, animal production, agro-processing, plant health as well animal health developed by researchers across the ARC. The app also provides info on training services offered by the ARC, up-to-date weather forecasts and early warning system that allows cross sharing between farmers and researchers.</p> <p>The Hub App was launched in 2018 and has 3,759 active and registered users and provides digital advisory 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., An advisory services app supports and enhances on-farm decision-making through providing accurate and timely information required at every stage of the agricultural value chain, using ARC's research output developed by ARC researcher across the organization. It uniquely bridges the information gap between research and extension and the intention is that the next phase of it will include digital market information linked directly from the Department of Agriculture to enable farmers to make informed marketing decisions. The service relies on Computers, smartphones, and is delivered through website, dashboard and portal and utilizes cloud-based databases. Challenges faced include product development or translation into a local language for greater understanding by end users to address planning, inputs, on-farm production, storage, post-Harvest processing, Transport and eventually market access. They have reached a level of sustainable scale and widescale adoption and the Hub was developed through government and donor grants which it will remain dependent on for some time. It is challenging to manage stakeholders responsible to assist with integration especially related to market data and the technology used is inclusive of those disadvantaged groups.</p>	South Africa

■		■	■	■	Agriagistics	Agriagistics	X	Your farm operating system enables tracking employee activities from planting to harvesting using rugged Android devices and RFID tags, Measure the yield for every cultivar and view the profitability of each field on your farm and helps farmers Learn from historic data and improve their strategies. This agricultural monitoring solution has been available since 2018 and allows farmers to oversee their entire farming operation without necessarily being present. It addresses planting, crop protection, harvesting, transportation, and packing. The whole system is accessible using smartphones, with a user-friendly interface and includes both labor monitoring as well as input applications, fuel consumption, packhouse monitoring. It can be implemented on labor intensive farms including software designed for fruit, vegetables, nuts, citrus, herbs, spices, dairy, and coffee bean farms. It is proactive integrating seamlessly into farming operations and captures data in an easy and simple way.	South Africa
■		■	■	■	Agrihub	Agrihub	X	Agrihub is an independent legal entity that has been established between South African fruit industry representatives and competing software solution providers to service the South African fruit industry's information needs. It was established because the industry's information needs were not fully serviced. Accurate, complete, and timely information is essential to the industry decisions makers at various levels. Three grower's organizations namely, Citrus Growers Organization (CGA), Hortgro, South African Table Grape Industry (SATI) with the Fresh Produce Exporters Forum (FPEF) are the industry shareholders with four competing software solution providers namely, Dipar, Farsoft, Paltrack and Prophet making up the other 50% shareholding. All parties have equal shareholding and a healthy balance between industry and commercial interests have been struck. Agrihub is currently focused on the dispatch (What has gone where?) statistical information requirements of its various industry stakeholders but it is envisaged that the range of services will be extended over time.	South Africa
■					Agri-Intel	CropLife South Africa	X	The Agri-Intel website offers easy access to a comprehensive database of all chemical, biological, and natural crop protection and public health products registered for use in South Africa including product labels, SDSs and information on maximum residue limits and withholding periods.	South Africa

							Agri-Intel is owned and managed by CropLife South Africa. CropLife SA is a non-profit company representing the plant science industry, including most responsible manufacturers and suppliers of crop protection products as well as industry associated entities such as analytical laboratories and the pest control industry. Agri-Intel provides web-accessible, current, and correct plant protection information to various stakeholders in the agricultural and export industries to assist in the mitigation of production and marketing risks related to the use of plant protection products. Registered users can view this information by selecting Label information (Database) and Residue management (MRLs) from the menu.		
				■	AgriLed	AgriLed	X	AgriLed is a sustainable off-grid food security solution making use of Controlled Environment Agriculture (CEA) within shipping containers. They produce high-quality crops with great nutritional value using our LED Grow Lamps. They offer Controlled Environment Agriculture (CEA) solutions consisting of hydroponics systems, LED Grow lamps and automation within shipping containers. This solution saves water and space. They combine the CEA system with a community center which includes access to computers, the internet, education, and waterless sanitation. Or a packing & distribution hub for the commercial farmer. Making use of CEA (Controlled Environment Agriculture) they localize the food supply, which cuts logistic cost. For ease of mobility and remote provision, the Sustainers system is housed in shipping containers, also ideal for the limitations faced in urban environments. The Sustainers system is designed to optimize the nutrition of the plant in the growing stages, and is also in line with several UN Sustainable development goals	South Africa
			■	Agri-M	Agri-M	X	Agri-M - Input supplier of Staden Plastic System (plastic pipes for borehole equipment), Solar Pumps, Submersible Pumps, KSB Pumps, Centrifugal Pumps, Electrical motors, Irrigation necessities and Drip & Floppy Irrigation using smart meters and sensors.	South Africa	

■		■	■	■	Agrimate	Box Fusion	X	Agrimate uses NDVI, sentinel 2 Infrared Satellite Images, Computer Vision and Artificial Intelligence to calculate Expected Yields and Credit Losses in Agriculture. This is also integrated into a Value Chain management system that manages the day to-day farming operations giving a 360 view of value chain in real time.	Namibia, South Africa, Zimbabwe
■					Agrimotion	Agrimotion	X	Agrimotion strives to set the standard for best practices in soil management and fruit production, through ethical and sustainable solutions.	South Africa
	■				AgriTask GIS	AgriTask	✓	Agritask GIS by Hollard is a digital innovation and digital insurance solution for Index/Parametric Insurance connected to Meteosat satellite GIS platform and can remotely activate a smartphone to collect GPS data or points of agricultural plots and finally estimate the plot size. Using this innovation Hollard remotely get information about the size of agricultural plot and use this information to assess farmer eligibility for agricultural credit or insurance access and can enroll farmers. It addresses farmers being able to plan effectively and ensure that they can produce efficiently and gain access to markets. The company Hollard operate in Botswana, Lesotho, Mozambique, Namibia, and South Africa and launched Agritask in 2020. They have 10 active users so far and 34,000 registered users. The service enables access to insurance products and in doing so access to financial services. The digital innovation relies on GPS, Smartphones and GEO data. It uses spreadsheets (Excel, to cloud-based SQL, third party SaaS software providers and IBM Watson AI platforms. The innovation is transitioning to scale and was developed using donor grants from government or foundations. Currently still dependent on program support Swiss Capacity Building Facility. Their recent feasibility study on livestock insurance in Namibia, Botswana and Mozambique looks at index-based insurance and agricultural loans and their bundling as part of a potential public sector program focused on areas prone to drought. Their technology is inclusive of disadvantaged groups.	Botswana, Lesotho, Mozambique, Namibia, South Africa
■	■	■	■	■	AgroMate/ AgriFusion	Chartered Systems Integration	X	AgroMate from AgroMate (Agri Fusion) have created a unique platform that links farmers with off takers and financial institutions which provides the risk management of farmers to guarantee delivery of the product to the off takers. This is the first platform of its kind that addresses financing of farmers, aggregating orders from off takers and allocating them to farmers to plant the crop and applying Agri VAS with	Eswatini, Mozambique, Namibia, South Africa,

							Artificial Intelligence for the ongoing monitoring and evaluation of the farming activities. This allows the financier to use this data to calculate expected credit losses for each offtake agreement in real-time. Banks are now able to offer purchase order factoring to finance farmers with a high degree of predictability of the risk and outcomes. This data can also be used for crop insurance to reduce the risk of non-performance of the crop. This innovation has not been validated on the ground and did not fill out the survey.	Zambia, Zimbabwe	
■			■	■	Aquacheck	Aquacheck	X	<p>Aquacheck is an established company which supplies premium quality soil monitoring equipment that has been designed to optimize the management of water. All products including software are manufactured in South Africa, using specialized, premium quality components.</p> <p>This company has a global footprint, supported by some of the world’s biggest names in agriculture, we’re the producers of soil moisture monitoring equipment and irrigation management software of choice.</p> <p>An all-inclusive package consisting of soil moisture probes, telemetry, software, and agronomy support – AquaCheck provides a fully integrated system to help farmers make the best irrigation decisions. Telemetry devices are manufactured in South Africa. Rugged and robust, they offer three key telemetry options which can accompany your soil moisture probe, depending on location and needs.</p> <p>An example is the AquaLink S-200 & S-300: Solar Powered 2G & 3G Option. It is robust and designed to withstand most weather conditions. The unit is attached to each soil moisture probe and works on cellular technology – 2G and 3G – to automatically transmit data from the probe to soil moisture management software (such as AquaCheck).</p>	South Africa
■				■	Carbon Calculated	Carbon Calculated	X	The Carbon Calculated team helps companies understand their carbon footprints as the first step. They provide business leaders with appropriate tools they need to	Botswana, South Africa

								reduce the impact of greenhouse gas (GHG) emissions and, at the same time, provide the business-side advantages of carbon management.	
				■	Culturafresh	Cultura Fresh Pty Ltd	X	The company uses its water-efficient growing technology where it uses 10% of the water required for conventional land-based agriculture. Culture Fresh is a Western Cape based hydroponic vegetable producer supplying major national retailers with a range of high-quality fresh produce and using smart and precision tools for cauliflower, lettuce, and other leafy greens.	South Africa
■	■	■			Digital Insurance Solution for Index/Parametric Insurance	CelsiusPro	✓	Celsius Pro is a Swiss Insurtech company specializing in index solutions to mitigate the effects of adverse weather, climate change and natural catastrophizes. Since 2016, they are registered private sector company with presence in Mozambique, South Africa, and Zambia. End-to-end digital platform to structure and administer index/parametric solutions (e.g., agriculture insurance). Includes an Environmental Monitoring System that sources all relevant remote-sensing (satellite) data for weather, climate, and natural disasters. Also digitalizes insurance policy documentation and payments. They provide specialist services that provide regional and localized weather forecasts. This sub-category may include weather-adaptive and climate-smart advice. Digitally enabled agricultural insurance services that help smallholder farmers mitigate the risks associated with external shocks such as weather events and pest and disease outbreaks. Agricultural insurance includes weather index, area yield index, multi-peril, livestock, and livestock index insurance products. The solution enables improved efficiency of parametric agriculture insurance processes including access to rural regions basing products on satellite data. Increasing financial inclusion and resilience to climate related natural disasters and crop yield losses. The innovation uses computers, smartphones and basic feature phones, and channels including SMS, smartphone Apps, Website, dashboards, and a portal. Challenges include user affordability, digital literacy and farmer uptake/use/behavior change, and regulatory and policy environment factors affecting the operational environment. Scaling stage to other geographies.	Mozambique, South Africa, Zambia
■		■	■	■	Dipar Systems	Dipar Systems	X	Dipar Systems is a technology solutions provider. This private business has been in operation since 1992, and as an independent company since 2002. Focusing mainly	South Africa

							<p>on tailor-made solutions for the Fruit Industry. They are experienced in many different aspects of the Fresh Produce Industry, although focused mainly on Information Systems. They have pioneered the use of offline capable, database driven mobile applications in the South-African fruit industry. Their Mobile & Web applications are being used from the development of new varieties all the way through the supply chain including conducting overseas arrival inspections. DiPAR Systems has several systems that combine Web, Mobile and Dynamic Reporting to give clients ultimate flexibility with regards to remote access as well as online and offline access. Their Dynamic Reporting Tool further supports the flexibility provided by their applications. They also do customized development for individual clients on request. DiPAR Systems provides system solutions to Farms, Pack-Houses, Cold Stores, Marketing Agents (or Exporter), Quality Inspectors, Inspection Agencies, Breeders, PPECB, Nurseries, Sterile Insect Technologists, Importers and Variety Evaluators or Developers, with electronic data flow between many of these supply chain players and agents.</p>		
■		■		■	Electromagnetic Induction Soil Scanning Services	Revolute Systems	✓	<p>Electro-magnetic Induction Soil Scanning of Revolute Systems. EMI soil scanning, launched in 2017 involves an innovative method of creating highly detailed maps of soil variation. This is done by dragging an EMI scanner behind an ATV across the soil surface, creating maps of variation in soil electrical conductivity, in return indicating where changes in soil texture exist. Used to create target soil sample positions and drainage designs and improve irrigation block planning. Also used to help with soil moisture probe placement and targeted mulching. There are 30 active users and 140 registered users of this technology which focuses on digital advisory, digital record keeping replacing paper-based systems and digitizing transactions between farmers and agribusinesses and smart farming applications. Their digital advisory is Agri VAS based one to many, they also provide climate and weather information on IVR and helplines and text SMS and USSD. The smart advisory is based on tailored farm level agro-climatic and crop specific information and decision support to maximize productivity and reduce costs. Sensors, satellite, and drones as well as AI are utilized. Increased productivity by creating detailed map of soil variation, to be used in from planning new developments, and management of existing ones. Can be used for targeted soil samples, drainage design, probe placement, irrigation block design and</p>	South Africa

							mulching. The innovations rely on computers, sensors (weather stations, IoT, satellite geodata) and channels include website, dashboard, and portal with cloud based and AI platforms and software as a service. Challenges include understanding the market and user needs, affordability, digital literacy, lack of technical capacity within and outside the company and systemic factors such as regulatory policy, lack of mobile coverage, and product translation into local languages. The innovation has reached sustainable scale and widescale adoption. Wide adoption by some of the biggest agricultural co-ops in table and wine grapes, apples, citrus industries in South Africa, with yearly returns by them to do more surveys of their production areas. Challenges include understanding the market and user needs, procurement of technology vendors, digital literacy, data collection issues, operational constraints, trust, and product development into local languages for greater understanding by end users.		
	■				eSusFarm	eSusFarm Eswatini	X	eSusFarm is an Agri-fintech that specializes in tracking and providing advanced agricultural statistical data to smallholder farmers and the entire Agri-value chain for the purpose of increasing agricultural productivity, smallholder market and credit access and increase the efficiency of the Agri-value chain. They have a Facebook page in Eswatini, which highlights a USSD String *700# which utilizes the Eswatini Mobile Network. eSusFarm collects agricultural data through a mobile feature phone and enables linking farmers to market, credit provider and an existing track record and enabling them to link to other stakeholders such as tractor services and Transport, Input suppliers (e.g., fertilizers), buyers of produce, banks and insurance companies, development partners, governments, IoT providers and drones and satellite services. The farmer gets connected without the need for Wi-Fi, mobile data or a smart phone. eSusFarm declined to fill in the survey tool.	Eswatini, South Africa
■					Extension Suite On-line	Manstratais Agricultural Intelligence Solutions	X	Extension Suite Online is an internet-based application developed by Manstrat Agricultural Intelligence Solutions (Pty) Ltd to provide an important linkage and information transfer mechanism between Agricultural Research and Extension Services, and the farmers that they serve. As such the system facilitates and enhances the transfer of information between these parties by collecting, collating, interpreting, and transforming scientific agricultural related data into useful and user-friendly formats for use by Extension Practitioners and Farmers. The information	South Africa

								and content in Extension Suite Online is well organized allowing the Advisor to find the relevant information quickly and respond to farmers' requests within a short period. There is direct access to experts through Extension Suite Online and if you cannot find a solution on the system you will find a solution from an appointed expert in the relevant field. Manstrat has, through Extension Suite Online, developed the means to, not only reduce the many constraints in the dissemination of relevant and timeous information to farmers via Extensionists, but to do so cost effectively. The online application specifically aims to facilitate easy access to, and the effective dissemination of; agricultural related information and best practices to break down informational, geographical, and political borders and constraints that currently hinder growth. The core system is automatically available as part of any system tailored to the specific needs and requirements of a client and contains a wide range of component	
■				■	Farm Pin	Incubated by Afro labs and Agro Innovation Lab	X	FarmPin is a small startup with a big vision to help farmers pinpoint plant performance using satellites the cloud and very smart Agri experts. Incubated by AfroLabs and Agro Innovation Lab they are based in Cape Town. Using their plant health and moisture maps issued every five days and covering the past two seasons, Farmers have already started to see, Crop stress area, Plant moisture distribution zones and where clogged nozzles may be. These services are currently being charged as an annual subscription of ZAR9000 pa.	South Africa
■			■	■	Farmforce	Paltrack	X	Paltrack is a leading supplier of software solutions, product coding and integration services to the South African agricultural industry. Its focus is on supply chain visibility from producer to port and building and source software solutions that meet unique customer's needs through all market verticals. Paltrack's primary clients are in the fruit and aquaculture industries, but the software is agile and customizable for many traceability requirements. Farmforce is a cloud-based platform for managing farming activities, establishing traceability, and ensuring compliance. With the Farmforce app installed on their smartphones or tablets, users in the field can quickly and accurately record information about farming activities – including planting, fertilizing, harvesting, selling and more. This information, and the visibility it is providing, can be shared with other authorized users on their mobile devices or	South Africa

							personal computers. Farmforce integrates with Paltrack’s farm, packhouse and exporter solutions. The PALFARM features software functionality is intended to satisfy the farmer’s requirements with regards to label printing and document generation.		
			■		Farmio	Qurima (Pty) Ltd	✓	An ecommerce platform where agricultural buyers flight their requirements and invitations to tender, and producers bid to supply.	South Africa
		■			Food Processing Software	Matrix Software	✓	Matrix Software is a meat and food matrix software solution for stock control, yield management, traceability, productivity, and cost margin management. Matrix Software is a service-led private company that provides software services predominantly to the livestock and meat industry and established in 2019. These are digital, mobile and tablet-based systems for yield and stock control and statistics leading to costings and profitability. Matrix software utilizes android mobile scanners and their associated applications, RFID integrated solutions, automated weighers, and third-party integration. This reduces the initial capital outlays and good implementation support for feedlots, abattoirs, deboning plants, and meat processing plants including others such as fish, poultry, butcheries, and retail outlets. Matrix Software has been located/incubated in the AgVentures Hub in South Africa. This regional solution is deployed in 10 SADC countries (Botswana, Eswatini, Lesotho, Mauritius, Namibia, Seychelles, South Africa, Tanzania, Zambia, and Zimbabwe), but also in counties as Australia and New Zealand. Matrix Software solutions have reached a stage of replication and adaptation in other geographies and are in the Scaling state of development.	Botswana, Eswatini, Lesotho, Mauritius, Namibia, Seychelles, South Africa, Tanzania, Zambia, Zimbabwe
■			■	■	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	Malawi, South Africa, Zambia

								<p>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, evapotranspiration, 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 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.</p>	
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■		■		■	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 GeoTerralmage 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. GeoTerralmage have reached wide scale sustained adoption and operate in Angola, Botswana, Comoros, DRC, Eswatini, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Tanzania, Zambia, and Zimbabwe. Through specialized software, proprietary algorithms, and application GeoTerralmage 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.	Angola, Botswana, Comoros, Democratic Republic of Congo, Eswatini, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Tanzania, Zambia, Zimbabwe
■	■		■	■	Global Farmers Connect	Global Farmers Connect	X	Global Farmers Connect operates in South Africa, Zambia, Zimbabwe. Global Farmers Connect is an artificial intelligence tool used to provide farmers with a platform to reach and sell their agricultural products directly to end consumers. Farmers also have access to information about their daily requirements such as farm equipment, greenhouse needs, animal farming, fertilizers, feeds and qualified agronomists' advice.	South Africa, Zambia, Zimbabwe
				■	Green Excel	Future Vision	X	GreenExcel is a liquid bio-stimulant that can be applied through drip, Micro and other irrigations for irrigated plants or as a drench or in furrow at plating for dry land cultivated plants. The application of GreenExcel as part of a biological farming strategy enables the farmer to improve fertilizer use to increase the root zone.	South Africa

■	■			■	GreenFingers Mobile	GreenFingers Mobile	X	GreenFingers Mobile from GreenFingers Mobile in Tanzania, South Africa, Zambia, and Zimbabwe. GreenFingers Mobile is a mobile-first Software-as-a-Service (SaaS) technology platform, to manage and finance large groups of smallholder farmers. Developed by a team of agricultural value chain experts, the platform easily adapts to different crop types and use cases.	South Africa, Zambia, Zimbabwe, Tanzania
■					Hippocampus	Hippocampus	X	Hippocampus Education launched in 2020 use machine learning to fine tune learning through adaptive and improving difficulty. Their solution is available on-line and delivered through mainstream channel for students particularly. It is effectively a personal digital tutor and an ed-tech chatbot that incorporates active learning using AI to keep improving.	South Africa
				■	InteliSeeds	InteliSeeds	X	Intelliseeds is an integrated brand of InteliChem group, offering complete integrated crop solution service. They are seed suppliers, and advice on disease treatment. They are a local distributor for Syngenta vegetable seeds and canola, pasture, maize and soy crop market seeds. The supply sunflower, soy, and canola through dedicated partnerships. Their IntelliGro Crop Solution specialists complement this work. They also provide seed treatment solutions and their specialists support growers countrywide.	South Africa
	■	■			Jumo	JUMO	X	Jumo is a market leading banking as a service platform, launched in 2015, which enables real-time access to funds at the lowest possible operating costs. They offer high quality providers of financial services products to connect entrepreneurs to world's growing markets. They also offer loans, savings, and a range of financial choices. They have a core next-to-end generation banking infrastructure. And Unify which is a machine learning capability to analyze the data to reduce the cost and risk of lending by building accurate credit scores and target people who do not have a formal financial identity, collateral or credit record. They also use automated algorithms to ensure they don't overextend themselves and have built protective safeguards into the heart of our technology. They have served 18M+ individuals and small businesses, with 120M loans and \$3.5b+ dollars disbursed. They are active in Ghana, Tanzania, Kenya, Uganda, Zambia, Cote	South Africa, Tanzania, Zambia

							d'Ivoire, and Pakistan with an operational tech hub in Cape Town, Nairobi, Porto and London.		
		■	■		Khula	Khula App Pty Ltd	X	<p>Khula Ecosystem comprises of three Apps (Khula Inputs App, Khula Fresh Produce Trader App, Khula-Funders Dashboard). Khula was founded in 2018. Khula provides small-scale and commercial size farmers with software and a marketplace to grow their business, unique solutions for Buyers, Farmers, and funders all under the Khula ecosystem. Khula is an online marketplace and ecosystem for agriculture products. It provides a platform for farmers to list out their products for sale and the consumers to place the order from preferred producers and suppliers. Khula marketplace includes seed, fertilizer, Agro-chemicals, animal health products and more than 3000+ Products and can compare over 3000 products from local and international suppliers. They have a network of 130+ Depots & 190+ Crop Advisors Nationwide giving them the ability to deliver in every province and even major agricultural regions in SA. Over 3000 farmers and 100 suppliers have signed up on the Khula Ecosystem. Khula wants to tackle issues faced by small scall and emerging farmer at once and provide farmers with liquidity, access, and a market. The platform is an ecosystem made with three products. The Inputs App allows farmers to access approved agricultural inputs and services from local and international suppliers.</p> <p>The second is the Fresh Produce Marketplace, targeted at farmers with challenges low market prices, high transport and logistics cost and Expensive Middlemen. It allows farmers to sell produce directly to local and international formal bulk buyers. By allowing farmers to engage and negotiate prices with suppliers, the platform aims to reduce the access middlemen have that has led to the exploitation of farmers. Then, the Funder Dashboard connects institutional investors with farmers who meet their funding mandates. This year, the startup was accepted into the Google for Startups Accelerator Class 6 alongside 14 other African companies. While the company is just announcing this investment, it closed the round last year. It was led by AECL, one of the continent's biggest agrochemical companies. South African impact investor E Squared Investments also participated.</p>	South Africa

■			■	KWIBI	Fox-Croft Holdings (Pty) Ltd	✓	<p>KWIBI from Fox-Croft Holdings (pty) Ltd which is a private sector company active in Botswana and South Africa. Kwibi is a mobile tracking app that addresses problems facing modern conservation in situations of human-wildlife conflict. The App benefits local communities by providing livestock farmers with advance warning of predators in the area. The app also enables wildlife data collection, wildlife poaching and the illegal wildlife trade. This App is still in the research and development phase but also provides digital advisory particularly on pest and disease management, including plant disease and advisory on strategies to treat diseased plants and mitigate future outbreaks. Most services are accessible via mobile and require farmers to upload pictures of an infected plant for diagnosis. Some services are accessible by USSD, and the information provided also includes national and regional level pest and disease early warning systems. Smart applications using digital tools enable farmers to monitor herds remotely to determine their location and track their health including when in estrus or about to calve. Also enabled are tracking and monitoring feeding habits of fish in aquaculture, disease detection, controlling water quality and automating feeding. The innovation uses Smartphones, a Smartphone App, website, Dashboard and Portal and local databases (MS Access). The innovations address low productivity and mitigating climate change in on-farm production. The innovations are for the primary user and company revenue is based on individual subscription fees, business subscription fees and donor support (which will continue to be required). Stakeholders such as business, entrepreneurs have been involved in its development and the innovations have taken no specific actions to ensure the inclusion of disadvantaged groups so far.</p>	Botswana, South Africa
	■		■	Livestock Wealth	Livestock Wealth (Pty) Ltd	X	<p>Livestock Wealth was founded in 2015, is led by South African born entrepreneur, Ntuthuko Shezi, and backed by an experienced advisory board. Livestock Wealth is a registered credit provider with the NCR and is also regulated as a registered agricultural producer agent with the APAC and SAMAC. They generate crowdfunded options to enable farmers to own assets. Livestock Wealth introduced South Africa to Crowd farming back in 2015 and since then have been refining its product offering, streamlining processes, and helping investors grow their wealth the African way. The platform has helped clients to invest in tangible, growing assets at the click of a button. Livestock Wealth aims to expand its product range and to become the</p>	South Africa

							<p>foremost Crowd farming platform in the world. The crowd funding platform was made popular by their flagship product, an investment in pregnant cows. They have also diversified into:</p> <ul style="list-style-type: none"> • Macadamia nut tree investments, 6-year tenure, ZAR2000 initial investment and a 95% profit margin • Free Range Oxen, 6 months Tenure, ZAR 11000 Initial investment, and a 5%-7% Profit margin • Connected Garden, 5-year tenure, ZAR8200 initial investment and 61% profit margin <p>The returns on farming are competitive compared to conventional investment options. Investing in living, breathing livestock, and growing crops. These types of assets are always in demand.</p>		
				■	Lixodex	Lixodex	X	<p>Lixodex is a developer of fence sensor, PIR sensors, Guard Tracking Units, Trip Wire and Tactical PIR Sensors and RADAR that can be used to deliver critical operational information via mobile phones, tablets, and computers for real-time readings and security. Also used in marine farming systems.</p>	South Africa
				■	Lynx Fruit Grading Systems	AME Fruit Sizers and Allied	X	<p>Lynx Fruit Grading system are a distributor of Packline equipment for fruits. They offer a cost-effective way forward for a new sizer, retrofit upgrade or complete packline at a lower cost than complete structural imports. They also offer complete packline projects as required. Also, a prime distributor of Ellips of Holland Fruit grader weight and vision systems to which they provide online support and backup.</p>	South Africa
■					Mobiz	Mobiz	X	<p>Mobiz was set up in 2014 by digital marketers to introduce a creative way of mobile marketing and by developing a platform that seamlessly integrates hyper-personalization into dynamic pages. This mobile communication engagement is at the next level particularly if SMS campaigns, with graphics and video, advocating sales or on-line payments and surveys are necessary. They work with large MNOs and portals and MS. They deal with digital agri-advisory, bulk SMS and communicate</p>	South Africa

							directly to farmers. They work with a marketing cloud that allows businesses to send out a multitude of personalized SMS messages to attract new customers.		
	■	■	■		Mukuru App	Mukuru Africa	✓	<p>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).</p> <p>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.</p>	Botswana, Democratic Republic of Congo, Eswatini, Lesotho, Malawi, Mauritius, Mozambique, South Africa, Tanzania, Zimbabwe
	■				Nomanini	Nomanini	X	<p>Nomanini is a fintech platform that connects financial service providers and consumer goods companies to retail medium and small and medium enterprises. Their digital platform enables digital banking and supply chain financing mechanisms which enable cash collections, merchant credit and savings, and cash deposit, supplier payments and prepaid and bill payments. These aspects are particularly useful for agribusinesses and Agrovet and Agro-input dealers in the agricultural value chain. They can leverage value chain relationships to ensure rapid deployment and low-cost acquisition of retail business banking customers and</p>	South Africa

								provide digital solutions for banking. Their embedded supply chain financing solution enables financing of stock onto the shelves of traders and pairs stock advances with data to optimize supply chain management.	
		■	■	■	Plan-A-head	Plan-A-head Software	X	Plan-A-head is a private company that develops and supports software management for the agricultural and commercial sector. They offer administration, livestock, and Crop management software solutions. Their systems assist farmers to make more informed management decisions based on their actual data. By linking hardware and apps they streamline the collection of data to avoid unnecessary administration. They provide Farm vehicle management software as an administrative package. Various Livestock packages that include beef, pig, sheep, and dairy management software. The Crop management package offers management solutions on sugar cane, macadamia, vegetables, citrus, grain, and timber management software. Besides south Africa, these services are also provided to other countries including Zambia, Mozambique, Swaziland, Nigeria, Namibia, Sierra Leone, and Kenya.	South Africa
	■			■	Planet42	Planet42	X	Planet42 provides rent to buy vehicle rental to South Africans, of pre-owned cars and vehicles. They charge monthly payments and can organize payment terms according to budgets. Rental rates include third party insurance and trackers. The service enables mobility for people who cannot secure loans and are able to buy vehicles through a subscription service increasing accessibility and transport options. These options, whilst not specifically designed for rural or agricultural customers, often enable them to pursue transport options they would otherwise not have access to.	South Africa
■		■		■	RevScout Mapping Technology	Revolute Systems	✓	RevScout Fruit Load Mapping of Revolute Systems is a real time and Fruit Sizing Software for Pack House Planning. Revolute Systems is a private company in South Africa. Real time fruit mapping launched in 2020, is done through mounting two cameras on ATV/Tractor and driving through orchard rows. The cameras recognize fruit and maps counts with GPS. All data is automatically transferred after the survey to our RevToolbox online platform to view results, compare to other data layers like soil EC and crop health maps, as well as create yield estimations. They currently have 15 active users and 25 registered users and is focused on digital advisory, digital procurement solutions and smart farming. Their digital advisory is Agri VAS based	South Africa

							<p>one to many, they also provide climate and weather information on IVR and helplines and text SMS and USSD. The smart advisory is based on tailored farm level agro climatic and crop specific information and decision support to maximize productivity and reduce costs. Sensors, satellites, and drones as well as AI are utilized. Digital tools also 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. Equipment monitoring includes remote control of irrigation systems and farming operations leading to a reduction on water consumption and wastage. The smart tools also enable asset sharing such as leasing of tractors, drones, or other mechanized farming equipment. The innovations rely on computers, sensors (weather stations, IoT, satellite geodata) and channels include website, dashboard, and portal with clous based and Ai platforms and software as a service. Challenges include understanding the market and user needs, affordability, digital literacy, lack of technical capacity within and outside the company and systemic factors such as regulatory policy, lack of mobile coverage, and product translation into local languages. The innovation is at the scaling stage of replication in other geographies and relies on individual subscription, business subscriptions and premium services to generate revenue. They are struggling to procure processors for the equipment to seal more units. Medium scale field trials have been conducted in Western Cape fruit growers with efficacy. Their innovation was developed together with Adagin, and engineering technology company simplifying precision technology for all to use and creating innovative solutions for the agricultural industry.</p>		
■				■	RevToolbox Data Portal	Revolute Systems	✓	<p>RevToolbox of Revolute Systems is an orchard management software through creating insights and actionable tools for farmers from orchard data. The platform has an advanced satellite monitoring system, giving a near live feed of variation in orchard health. This data is combined with our other services like EMI soil scanning and Fruit variation mapping. Combining this data, farmers can investigate factors effecting yield and effectively intervene. The innovation was launched in 2019, has 30 active and 50 registered users and focuses on digital advisory, smart farming, and Increased efficiency, through high detail mapping of orchard variation in canopy and fruit, as well as digitizing soil and terrain data, effective problem identification can be</p>	South Africa

							<p>done interventions plan zone specific. Their digital advisory is Agri VAS based one to many, they also provide climate and weather information on IVR and helplines and text SMS and USSD. The smart advisory is based on tailored farm level agro climatic and crop specific information and decision support to maximize productivity and reduce costs. Sensors, satellites, and drones as well as AI are utilized. Equipment monitoring includes remote control of irrigation systems and farming operations leading to a reduction on water consumption and wastage. The smart tools also enable asset sharing such as leasing of tractors, drones, or other mechanized farming equipment. The innovations rely on computers, sensors (weather stations, IoT, satellite geodata) and channels include website, dashboard, and portal with cloud based and AI platforms and software as a service. Challenges include understanding the market and user needs, affordability, digital literacy, lack of technical capacity within and outside the company and systemic factors such as regulatory policy, lack of mobile coverage, and product translation into local languages. The innovation has reached sustainable scale and widescale adoption. Wide adoption by some of the biggest agricultural co-ops in table and wine grapes, apples, citrus industries in South Africa, with yearly returns by them to do more surveys of their production areas. Challenges include understanding the market and user needs, procurement of technology vendors, digital literacy, data collection issues, operational constraints, trust, and product development into local languages for greater understanding by end users. The parent company has relied on private funds from bootstrapping and friends and family. The innovations enable them to generate revenue through business subscriptions fees and they developed their innovations with entrepreneurs and commercial agriculture companies and research institutes. There is wide adoption by Western and North Cape fruit producers and their toolbox is seen as the most user friendly and holistic platform available.</p>		
			■		Rovert Foods	Rovert Foods	X	Rovert Foods of Rovert Foods Convenient and safe fresh and dry foods delivery service within Lusaka, Zambia.	South Africa, Zambia

■	■		SHERPA	Blue North Sustainability	✓	<p>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, 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</p>	Malawi, South Africa, Zimbabwe
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							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 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.	Malawi, Mozambique, Namibia, South Africa, Zimbabwe
■	■	■	■	■	Smart Farmer	Riskflow DBS	✓	Smart Farmer of Riskflow DBS, a private sector company, was launched in 2019. Smart Farmer is an agriculture value chain connector, linking agricultural communities to value adding services through networks with markets, suppliers, service providers, other farmers, and relevant government departments. It achieves this through the provision of user friendly, efficient, and flexible ICT-based services which cut across many functions and access channels. The value of Smart Farmer is	Botswana, Lesotho, Malawi, Mozambique, South Africa, Tanzania,

							<p>in assisting farming communities and other stakeholders in doing things smarter, with transparency, accountability, and efficiency, while driving profitability. As a response to the problems faced by agricultural communities, Smart Farmer provides the following services: Peer-to-Peer communication for Farmer-to-Farmer Interaction, Funder-to-Farmer Communication, Government-to-Farmer Communication, Price tracking and reporting, Agricultural alert systems (sending and receiving), Commodities offer and bid facilitation, Location services for service providers, Production information systems e.g., best practices, planning, 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.</p> <p>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.</p> <p>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</p>	Zambia, Zimbabwe
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								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.	
				■	SmartFarming SA	SmartFarming SA	X	SmartFarming SA deal with greenhouses, hydroponic systems, aquaculture, aquaponics, poultry farming and horticultural systems such as strawberry and lettuce farming. They deal with the application of modern technologies including systems and computers to manage temperature, humidity, water spray systems, water flow control.	South Africa
■			■		SwiftVee	Swif Tech Law	X	Swiftvee’s mission is to reinvent agriculture through technology because the future is food and finding better ways to produce it. They pride themselves in being pioneers of online livestock trading in South Africa and the largest independent livestock trading platform. They are a Google Launchpad company bringing award winning technology to your operation. Our passion is to serve others. SwiftVEE (Livestock) is an Agri-platform addressing water scarcity, food security and market efficiency for the livestock sector. It brings the Agri-sector into industry 4.0. by offering substantial profit margins that facilitate sustainability and social impact. SwiftVEE has been recognized internationally for technology innovation and shortlisted as one of South Africa’s top 100 most innovative companies (TT100). Its solution provides intuitive data and analytics with capacity to scale globally. The agricultural technology for industry 4.0 has arrived. SwiftVEE is a proudly South African solution for the global economy. As the world moves towards a digital reality the agricultural industry remains unchanged. Populations continue to rise which intensifies resource scarcity, food security and trade vulnerability. SwiftVEE provides technology to meet these challenges and enhance market efficiency. Through competitive innovation SwiftVEE ensures business is done better with higher profit margins and wider social impact.	South Africa
			■	■	The SunExchange	The Sun Exchange	X	The SunExchange which was formed in 2015 is the world’s first peer-to-peer solar leasing platform, where one can own solar-energy producing cells and build an enterprise by leasing these cells to power businesses, with installations and	South Africa

							<p>maintenance taken care of by one of Sun Exchange’s carefully selected installation partners. They leverage financial innovation through crowdsourcing to drive sustainable energy to enable social and economic benefits of accessible and affordable energy for all. They have 40+ solar crowd sales achieved and members across 180 countries, with over 1m solar cells sold totaling 5.2GW of clean energy. P2P solar leasing marketplace, where businesses, schools, and even some individuals can benefit from the use of solar power, without paying the potentially crippling installation fees themselves.</p>		
■		■	■	■	Virtual ranching farming programme	VIRTUAL FARMING PTY LTD	✓	<p>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 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.</p>	Botswana, Malawi, South Africa
	■				Yoco	Yoco	X	<p>Yoco is an African technology company providing payment applications mainly meant to create opportunities for entrepreneurs to get paid and be more successful. It is establishing new markets; building business tools and financial services that work for entrepreneurs. Offers mobile card machines that work with 3g Data, on-line cardless payments, on-line link payments. Also used as a business tool, as a source of capital and allows use of portal and POS integration. It also assists by making payments accessible for small businesses – often for the first time. and has raised over \$100M from some of the world’s leading technology investors, who have backed companies like Nubank, Square and Stone. Yoco is popular with rural farmers in south Africa who use their services to transact at local Spaza Shops (convenient shops), which are used as last mile delivery for inputs by large retail and wholesale companies. Yoco has bridged the gap of the unbanked Market specifically in the farming communities.</p>	South Africa

	■			YouFarm	YouFarm	X	<p>YouFarm is a Start Up enterprise and provides farmers with access to finance by getting people to crowdfund and invest in crops and livestock and share the profits with the farmers when the produce goes to market. This enables people without access to land to earn money by partnering up with farmers to engage in the agricultural value chain and production system. The platform is completing beta testing and has over 100 registered farmers and 600 registered crop and livestock investors in South Africa. They provide finance for farmers through an agent model, and through their digital platform, many from all parts of the world can invest. There are three revenue streams, the agents have an annual agency fee of which 20% profit margin is made by the business and a 3% success fee for every project that earns a profit. Profits are shared when produce is sold, farmers take 40% of the profit, investors share 20% and YouFarm Agents take 20% of the profit. They are looking for investment capital.</p>	South Africa
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3.3 RESULTS FROM INNOVATION SURVEY RESPONDENTS

All identified innovators received a survey and 16 innovations implemented in South Africa responded. The answers on the survey are self-reported. Of the innovations surveyed, five were operational in South Africa only and the remaining 11 operated in multiple countries in the region. All identified innovators were reminded several times by email and by phone to complete the survey. However, the amount of time the study team had to complete the survey was insufficient given the country’s large size, diversity of innovations, and the inability of the team to conduct face-to-face meetings. The response rate of the survey for South Africa was 28% (16 out of 57 identified innovations responded).

USE CASES AND SUB USE CASES

The division of GSMA use cases shows that in South Africa multiple use cases are most common. 11 out of 16 respondents provided multiple services and only five respondents provided a single use case. Figure 8 below presents the division of use cases provided. Digital advisory was the most common use case cited by 12 survey respondents; digital procurement followed with nine respondents. Smart Farming came next (8), followed by Agri e-commerce (5) and agri digital financial services was the least common in respondents with only four.

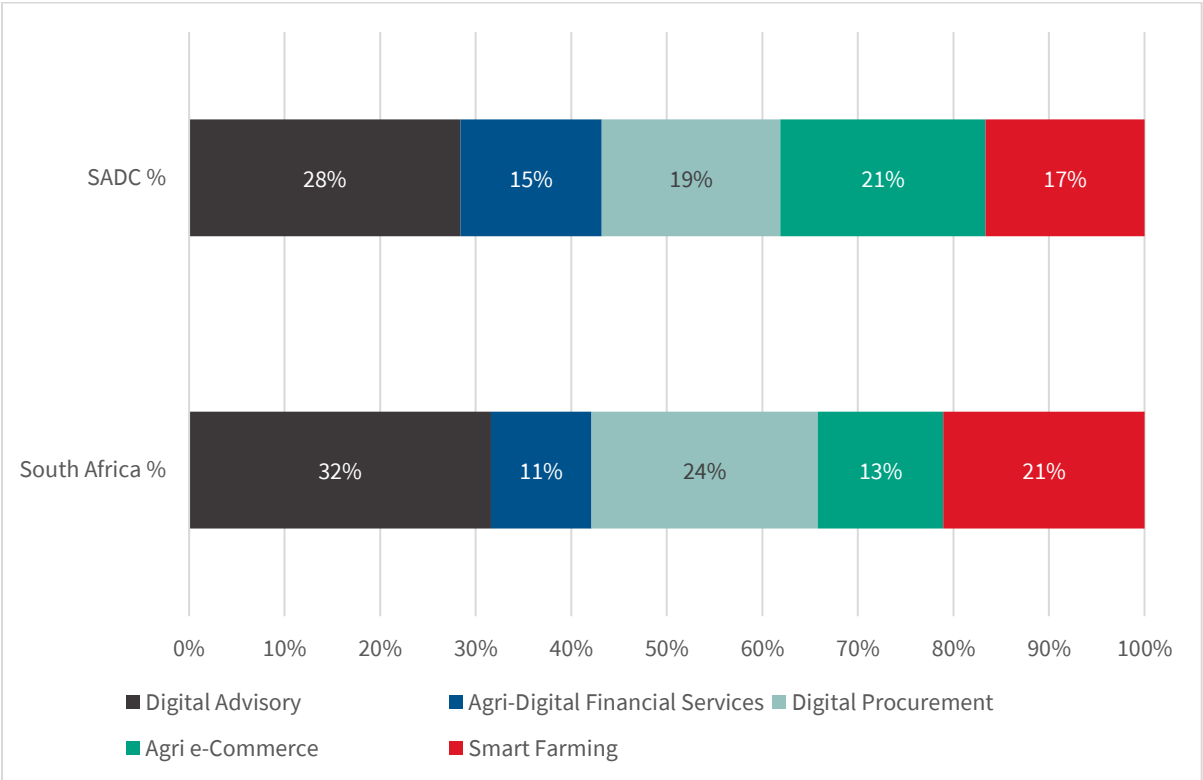


FIGURE 8 DIVISION OF USE CASES FOR SURVEY RESPONDENTS IN SOUTH AFRICA VS. IDENTIFIED INNOVATIONS IN SADC

Figure 8 also illustrates a comparison of use cases to the rest of the identified innovations in the SADC region. Most innovations that responded to the survey were developed by private sector companies (14), but innovations were also developed by Government and through a public-private partnership.

The innovations surveyed in South Africa provide a large variety of sub use cases as presented in figure 9 below.

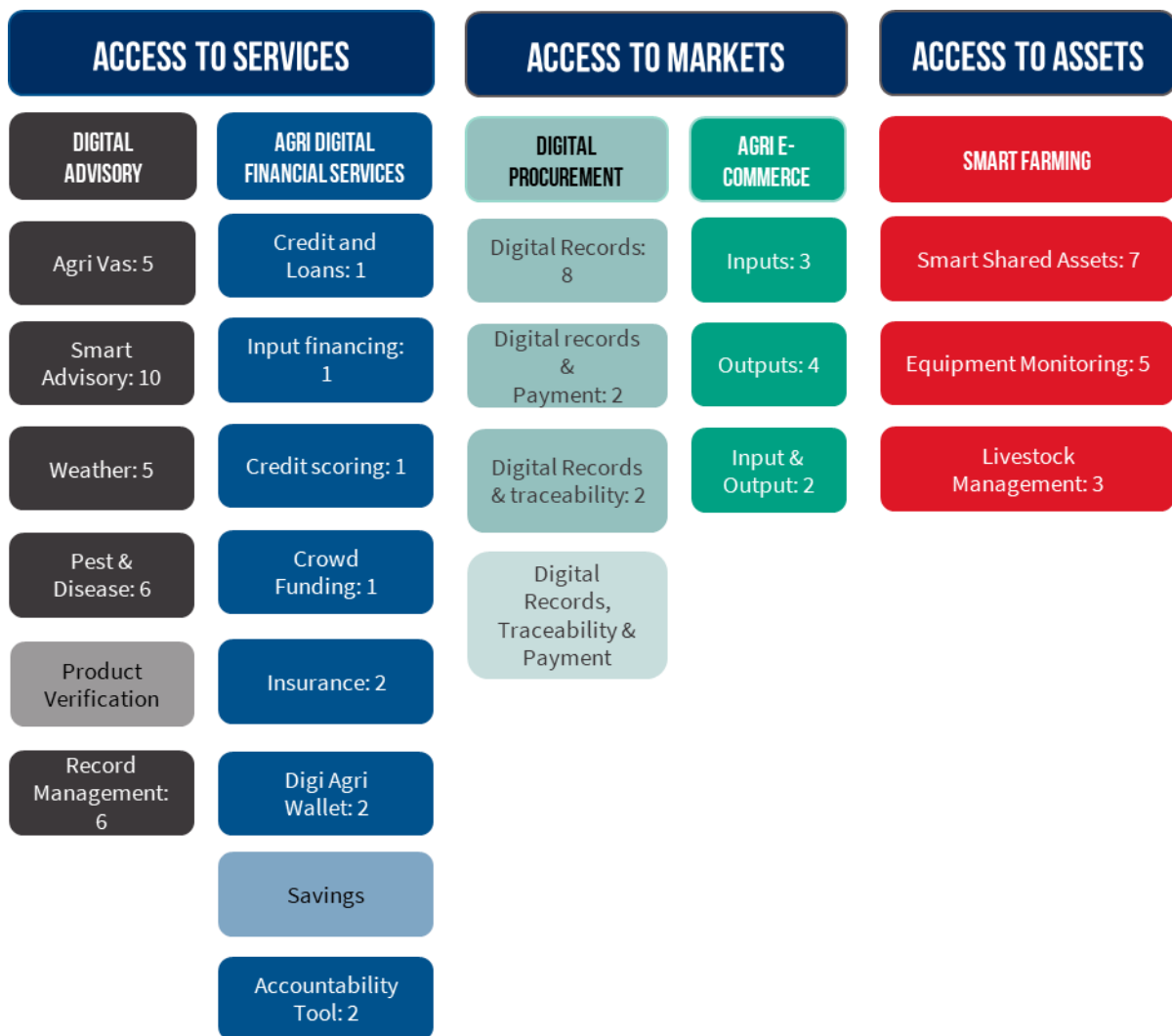


FIGURE 9 OVERVIEW OF SUB USE CASES PRESENT IN SURVEYED INNOVATIONS IN SOUTH AFRICA

The innovations targeted a wide range of anticipated outcomes to address pain points in the agricultural system. The knowledge gap (9) and low productivity (8) were the most mentioned categories for which solutions were targeted, followed by climate change (7), poor access to markets (5), and financial exclusion (3).

CHALLENGES

By far the biggest challenges in the application of the technology for end users were a combination of poor digital literacy in South Africa (10) and poor farmer uptake/behavior change (8). Other challenges include the lack of mobile coverage (6), understanding the market and user needs (5), and data collection issues (5). A lack of trust (4) is the next most important challenge felt by digital innovators.

TECHNOLOGY USE AND CHANNELS

A Website / Dashboard / Portal is the most common technology channel for consumers and end users (14) followed by GeoData (9) and Smartphone Apps (7). Cloud-based databases (14) and cloud-based software (11)

are the most popular digital technologies or tools used, followed by AI platforms (7) such as the IBM Watson platform, and finally spreadsheets (6).

VALUE CHAIN PHASES COVERED

Innovations in South Africa are tailored across the entire value chain and ensure an integrated ecosystem. The majority of innovations targeted on-farm production (12) and planning (12), followed by inputs (10), post-harvest processing (6), and access to markets (4). There were also innovations targeting transport in this country.

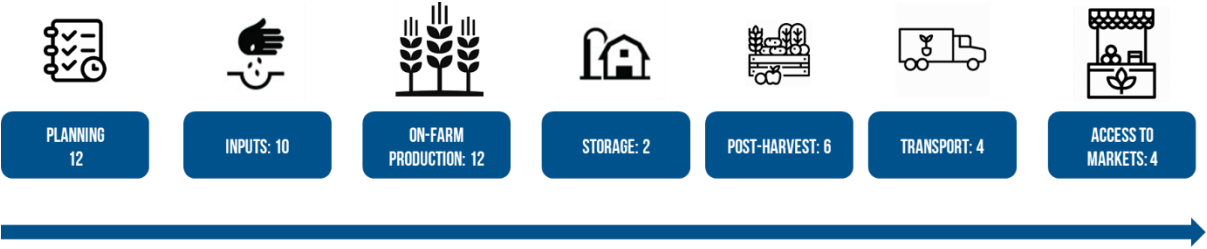


FIGURE 10 SURVEYED INNOVATIONS PRESENCE IN THE VALUE CHAIN IN SOUTH AFRICA

SCALING AND DEVELOPMENT

Most innovations were launched in 2019, followed by 2017, and 2020/21. The oldest innovation is a food processing application from Matrix Software from 2002 and FruitLook of eLeaf of 2010.

Most digital innovations in South Africa are in advanced stages of growth based on the Insights on Scaling Innovation report, which is accessible [here](#)²¹. A healthy 73% have reached scaling based on replication in other geographies or sustained wide scale adoption, and 20% have transitioned to scale after having demonstrated small scale success. Only one innovation is at the concept development phase.

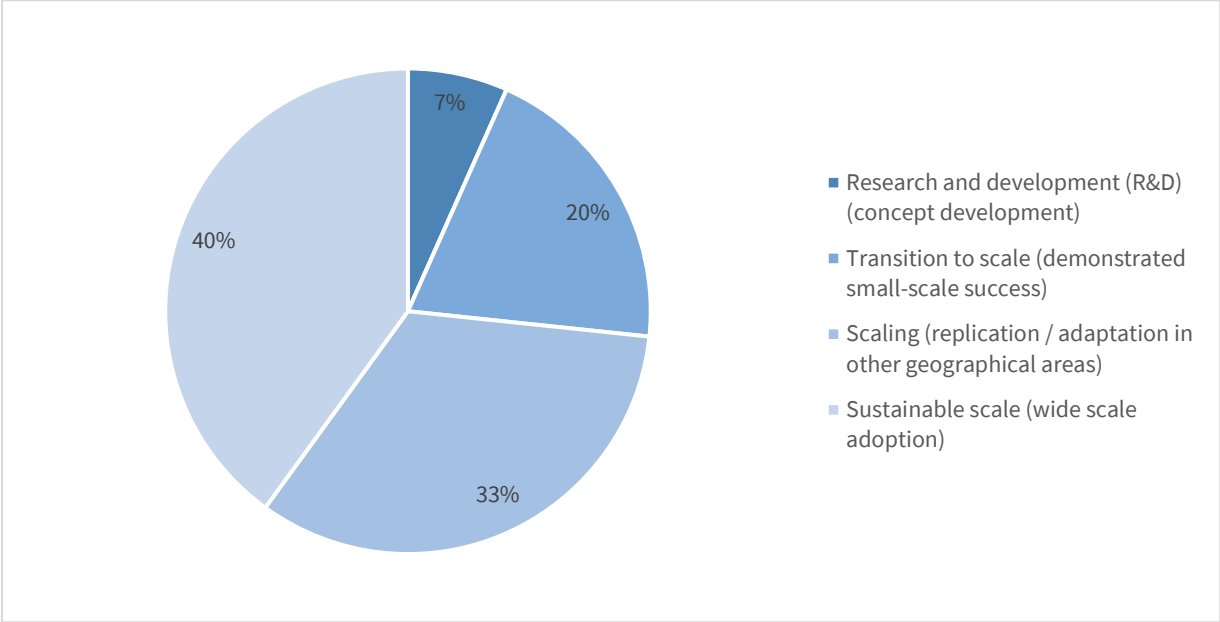


FIGURE 11 SCALING STAGES FROM SURVEYED INNOVATIONS IN SOUTH AFRICA

FINANCE AND REVENUE

Most private sector companies are financed by friends and family (4) or received impact investments (3), but some also rely on government or donor funds (3) or are self-funded (2). This characteristic of multiple sources of funding is more common in South Africa. Networking (2), business development (2) and training opportunities (3) are also forms of support often utilized in incubators or accelerators. Angel investors, crowd funding, challenge prizes were also cited once. The most common sources of revenue are business subscription fees and transactional fees. Many respondents (8) suggest that further subsidies in the form of donor funding and support will continue to be necessary.

INCLUSIVITY

Most innovators have not made explicit attempts to ensure their innovations were inclusive, and some even suggest that their technology may be less inclusive for those with limited literacy levels or poor smallholder farmers. Most of the companies thought their innovation was inclusive of all groups and four had taken explicit steps to include women, smallholder farmers, and those with limited literacy.

4 DIGITAL AGRICULTURAL SKILLS AND ENTREPRENEURSHIP TRAINING

The following policies and strategies reflect the significant importance that the National Government places on digital skills for young people to build a strong and vibrant industrial and modern agricultural sector. There is also reference made to building a significant productive digital services sector as part of South Africa's digital economy²².

[South Africa Connect](#) targets the realization of digital opportunities through education measured in schools and tertiary education institutions. Marginalized populations are supposed to receive a special program to receive digital skills trainings. Furthermore, research institutions are expected to create the basis for technological innovation and entrepreneurship. Multi-disciplinary programs should meet the requirements of the ICT ecosystem. Incubators and mobile application laboratory programs for professionals and postgraduates are intended to support entrepreneurship and innovation.

The [National Integrated ICT Policy Green Paper \(January 2014\)](#) states the importance of digital education for economic growth and employment. The quality of digital skills education, training and innovation is planned to be improved through the training of educators and learners at all levels of formal education. Curricula and further education plans in the ICT sector are to be revised, developed, and implemented. Furthermore, on-the-job training and adult training is supposed to be improved.

South Africa's [Strategic Plan \(2015-2020\)](#) developed by the Department of Telecommunications and Postal Services recognizes the need to stimulate digital skills education to develop digital opportunities in the country. E-readiness programs in schools, formal skills development curricula, general awareness and e-literacy campaigns are planned to foster the information society and to achieve economic growth.

The [National Integrated ICT Policy White Paper \(2016\)](#) names digital access as one of the three fundamental pillars for South Africa's transformation to a digital society. Digital access is to ensure the participation of the citizens in the digital society. Digital skills trainings are expected to increase digital literacy and e-astuteness. E-skills programs should be integrated into all levels of formal education and be extended to the post-school education and training sector. To enhance entrepreneurship, digital and IT skills are to be built among the population. [National e-Strategy Digital Society South Africa \(November 2017\)](#) sets the goal of the development and implementation of a National e-Skills Plan to foster a digital literacy rate of 70% in the country.

The [Tertiary Education and Research Network of South Africa](#) (TENET) was established in August 2000 by the public universities of South Africa. TENET is one of the most mature NRENs in Africa. It is the mechanism for, collaborative inter-networking by South African universities, science councils and other related institutions. TENET operates the SANReN network and provides internet connectivity and additional services customized to the needs of the South African higher education and research communities. TENET provides Internet and related services to more than 350 campuses of 85 South African institutions.

In 2019, the [International Telecommunication Union \(ITU\) World Telecommunication/ICT Indicators Database](#) reported that 68% of the South African population was using the internet. In 2020, the [Network Readiness Index](#) rated South Africa 64 out of 134 countries in the technology pillar. The technology pillar considers a country's access to technological infrastructure, content, and usage against the vision for future technologies.

These ratings provide an indication that South Africa has made progress but still requires support to prepare for a successful digital agricultural future.

4.1 AGRICULTURAL SYLLABI UNIVERSITIES

14 Universities were approached to respond to the survey and/or KIIIs:

- Central University of Technology (CUT) (Free State)
- Crop Culture Group
- North-West University
- South Africa (SA) College
- Stellenbosch University
- Tshwane University of Technology
- University of Fort Hare
- University of Free State
- University of Limpopo
- University of Mpumalanga
- University of Pretoria
- University of South Africa
- University of Venda for Science and Technology
- Walter Sisulu University

Only four universities replied to the survey. Crop Culture Group and SA College responded that they do not offer agricultural skills training which excluded them from further assessment. CUT and the Walter Sisulu University answered all the questions in the survey.

THE CENTRAL UNIVERSITY OF TECHNOLOGY [CUT] (FREE STATE)

FACULTY OF HEALTH & ENVIRONMENTAL SCIENCES

The [Central University of Technology \(CUT\), \(Free State\) – Faculty of Health & Environmental Sciences](#) offers various onsite and online digital training courses. The CUT does not provide information on the year these courses started. Regarding the levels of digital training implementation, eight are delivered at B.Sc. level, six at M.Sc. level, six at Ph.D. level. In the area of digital agriculture, one course is delivered at the B.Sc. level.

The University does not provide training on new digital skills for agriculture. The CUT has a central unit that handles digital training for the whole university. In the field of digital entrepreneurship, CUT provides training in Agri Digital Finance, e-Extension, Smart Farming, precision farming and agricultural management through their experimental farm. This provides students with the necessary skills to launch an enterprise, find a job as an employee, work for the public sector, or work in advanced research. Furthermore, CUT has an Idea Generator unit at the university which serves all departments. The university states that South Africa has a huge informal sector which needs to be supported. Smart Farming is very expensive and needs optimal infrastructure which is why it is not suitable for every community.

WALTER SISULU UNIVERSITY

RISK AND VULNERABILITY SCIENCE CENTER

The [Walter Sisulu University - Risk and Vulnerability Science Center](#) offers onsite and online digital training courses since 2019. Regarding the levels of these digital trainings implemented, six of them are delivered at certificate level, 13 at B.Sc. level, two at M.Sc. level, one at Ph.D. level and ten at the college incubator. In the area of digital agriculture, five courses are delivered at the B.Sc. and one at the M.Sc. level, all are taught onsite and online. They teach the following new digital agriculture skills: big data for analytics, artificial intelligence, internet of things, programming and coding for agricultural systems and digital entrepreneurship.

The Walter Sisulu University - Risk and Vulnerability Science Center offers entrepreneurship training for digital businesses in the sector of small and medium enterprises. These skills enable participants to launch an enterprise, work in advanced research and write business plans and strategies. For the university, equipping young people in data collection, agri digital financial services, digital procurement, agri-e-commerce, e-Extension, and smart farming will facilitate their inclusion into South Africa’s agricultural labor market. Student associations and clubs are considered important facilities for digital training by the University. They have developed an institutional digital strategy due to the changes caused by the Covid-19 restrictions. More generally, the Covid-19 pandemic has accelerated the process of adapting to digital training and assessments.

TABLE 7 OVERVIEW OF RESPONSES FROM SURVEYED UNIVERSITIES IN SOUTH AFRICA

SOUTH AFRICAN UNIVERSITIES	
The Central University of Technology CUT (Free State) – Faculty of Health & Environmental Sciences	
Digital Agri Skills	None
Digital training courses updated	Unsure
Digital entrepreneurship trainings	Agri Digital Financial services E-extension Smart Farming Precision farming and agricultural management
Type of Skills building	Launch an enterprise Find a job as an employee Work for the public sector Work in advanced research
Most important digital Agri skills	None
Most important facility for digital trainings	None
Aligned with institutional strategy	Unsure
Walter Sisulu University - Risk and Vulnerability Science Center	
Digital Agri Skills	Big data for analytics Artificial intelligence Internet of thing Programming and coding for agricultural systems Digital entrepreneurship
Digital training courses updated	Yes
Digital entrepreneurship trainings	Small and Medium Enterprises
Type of Skills building	Launch an enterprise Work in advanced research Write business plans and strategies
Most important digital Agri skills	Data collection Agri digital financial services Digital procurement Agri-e-commerce e-Extension Smart farming
Most important facility for digital trainings	Student associations and clubs
Aligned with institutional strategy	Unsure

4.2 INCUBATORS AND INNOVATION HUBS

The study team mapped 21 business support organizations, out of which nine operate in the agricultural sector.

The general business support organizations without focus or activity in the agricultural sector that were identified are JoziHub, Meltwater Foundation, Black Girls CODE, The Silicon Cape Initiative, The Eastern Cape

Information Technology Initiative, The Durban Technology Hub t/a SmartXchange, House4Hack, OceanHub Africa, Injini, Knife Capital, Awethu Project Holdings and RaizCorp South Africa. For these organizations we did not find evidence of trainings or incubation activities dedicated to agricultural entrepreneurs, and therefore they were not targeted for the key informant interviews (KIIs).

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

- [Impact Amplifier](#)
- [Softstart BTI](#)
- [mLab South Africa](#)
- [StartUp 90 accelerator](#)
- [The Innovation Hub](#)
- [Innovation Technology Business Incubator \(InvoTech\)](#)
- [Akro](#)
- [Timbali Technology Incubator](#)
- [The AGCO Agriculture Foundation](#)

These organizations support entrepreneurs and youth in South Africa to build their digital and entrepreneurial capacities and skills in the agricultural sector. Two business support organizations accepted requests for KIIs and provided further information.

THE AGCO AGRICULTURE FOUNDATION - AFRICAN AGRIBUSINESS QUALIFICATION (AAQ)

Established in September 2021, [The AGCO Agriculture Foundation](#)'s African Agribusiness Qualification (AAQ) is a skill development program for agricultural professionals. The skill development program in agribusiness is funded by the AGCO Agriculture Foundation (AAF) and hosted by the Gordon Institute of Business Science – the business school of the University of Pretoria in South Africa and the Harper Adams University in the UK. The program has some aspects of digital agriculture, but it is not the sole focus. The AGCO does humanitarian work such as education and training and they are currently launching the second cohort of their AAQ. AGCO is implementing the training with other partners. The program is only open to South African residents. Twenty participants have been selected. Furthermore, they teach the end users of the products. They also have a training center in Zambia.

The program is 80% online but they provide a hosting space for face-to-face interaction for the managerial support. They also provide entrepreneurial and managerial training, and ICTs/Digital agricultural training in precision agriculture. Furthermore, they provide management support and are planning to connect students with the industry to foster the development of networking relationships. The provided training is completely funded. The trainings are delivered by external partners – i.e. The Cerealis Technology Institute (SA) (manages their precision agriculture trainings), the Gordon Institute of Business Science and the Harper Adams University (UK).

The selected students for the AAQ predominantly work in the protein (chicken, pigs), maize, and soybean value chains.

AGCO target graduates, young and aspiring agriculture entrepreneurs, young entrepreneurs, farmers and agro dealers (agri machinery) with their trainings. They did not provide any information on the digital skills trainings of their program but declared within their course on farm business management that they teach digital advisory, agri digital financial services and agri-e-commerce. Within their precision agriculture course, they teach smart farming.

The AAQ is a private initiative and does not receive government funds. It is funded by the AGCO Foundation.

MLAB SOUTH AFRICA

Established in 2012, [mLab South Africa](#) is an accelerator and a non-profit organization founded by the World Bank and Ministry of Foreign Affairs of Finland, now partnering with the Department of Innovation of the local government. It is based in Polokwane in the province of Limpopo. mLab is a mobile technology accelerator, grown as an open innovation lab, providing facilitation programs like coding academy for students and acceleration for technology startups with incubation facilities and funding. They also have an innovation lab for early-stage ideas. Their AgriTour project is part of mLab's innovation facilitation, but the project has its own donors (CSIR/Scientific Research Institute of SA). The objective of the project is to establish an ecosystem in Limpopo to solve problems in tourism and agriculture using technologies. mLab is providing the technologies and support for the startups for the project. They also collaborate with higher education colleges, other hubs, digital industries, provinces, and institutions. To date, mLab has supported about forty agricultural startups. Currently, they have twenty agricultural startups in their portfolio. mLab is hosted by the government in Limpopo. They do not employ any digital agriculture experts but outsource this expertise. They provide digital trainings in:

- Business resources and technology tools
- Digital marketing skills
- Coding academy
- Robotics, 3D printing, hardware, chatbot
- Mobile and web development

Their training program in digital agriculture includes digital advisory, agri digital finances, digital procurement, agri-e-commerce (because most of the startups are trying to sell online) and smart farming. mLab delivers the training themselves and collaborates with external private consultants and NGOs. They target graduates, researchers, young agriculture entrepreneurs (some of them are small scale farmers, they establish markets selling to customers directly), aspiring agriculture entrepreneurs and SMEs for their trainings.

mLab collaborates with the University of Venda, the Tshwane University of Technology and the University of Limpopo. mLab's AgriTour project is a government run project (Department of Science and Innovation). The Council for Scientific and Industrial Research (CSIR) is a government agency for carrying out research and development in different sectors linked with policies improvement. CSIR fund mLab to raise awareness of agri technologies and to stimulate the AgriTech and travel tech ecosystem. They are mostly funded by the government and government entities but also receive support from private businesses.

TABLE 8 OVERVIEW OF RESPONSES FROM INTERVIEWED INCUBATORS IN SOUTH AFRICA

SOUTH AFRICAN INCUBATORS	
AGCO Agriculture Foundation - African Agribusiness Qualification (AAQ)	
Year of Establishment	2021
Agri startups incubated	N/A
Target of Digital Agri trainings	Graduates Young agriculture entrepreneurs Aspiring agriculture entrepreneurs Farmers Agro dealers
Digital Skills trainings	N/A

Digital Agri Tools taught	Digital Advisory Agri Digital Financial services Agri-e-commerce Smart Farming
Collaboration with Universities and Colleges	Cerealist Technology Institute Gordon Institute of Business Science Harper Adams University (UK)
Supported by the Government?	No
mLab South Africa	
Year of Establishment	2012
Agri startups incubated	40
Target of Digital Agri trainings	Graduate Researcher Young agriculture entrepreneurs Aspiring agriculture entrepreneurs SMEs
Digital Skills trainings	Business resources and tech tools Digital marketing skills Coding academy Robotics, 3D printing, hardware, chatbot Mobile and web development
Digital Agri Tools taught	Digital Advisory Agri Digital Financial services Agri-e-commerce Smart Farming
Collaboration with Universities and Colleges	University of Venda Tshwane University of Technology University of Limpopo
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

South Africa ranked top out of 16 in the benchmark assessment which suggests that it has a robust and mature digital economy which could provide guidance on some best practices. 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. South Africa ranked consistently in the top two ranking of most of the assessment pillars and surpasses the African and Global median for all but digital skills where it ranked tenth.

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. South Africa makes up part of Group 1, as it is a front-runner in the region for unlocking a digital economy. Countries that make up part of Group 1 have been the most successful to date at advancing their policy and enabling environments and all have agriculture sectors contributing less than 10% of GDP and employ less than 5% of their population in productive agriculture. There may be many more people engaged in the food system itself including retail, processing, trade, storage, logistics, marketing, and food preparation. These front-runners provide good areas of potential learning in certain foundational pillars necessary for a vibrant digital economy. Specific focus and investigation should be made to understand what is working within these countries in the implementation of their policies and legislation, how it is working, and the levels of enforcement with regards to the policy, regulatory and legal frameworks.

The benchmark illustrates the variation in the strengths and weaknesses across the region. Some caution is also necessary given the complexity of these themes because a strong candidate such as South Africa, which excels in the ranking and is identified as advanced even at a global level, lags in digital skills according to the assessment.

POLICY ENVIRONMENT

South Africa's proliferation of strategies, policies and plans are encouraging. There is an extensive catalogue of ICT and digital plans that address the ambition for South Africa to become an inclusive and productive digital economy. Three recurring observations come out from the stock take of ICT strategies and plans:

- **Policies and regulatory frameworks usually feature as one of the first objectives** and validate the countless documents published by a variety of government departments. It is frequently cited within the documents that South Africa has strong and achievable plans and policies in place, but these are frequently hampered by slow implementation, regular reviews, and poor enforcement.
- **There is a strong focus on development and social inclusion** (most notably in South Africa Connect) that not only includes mentions of women, persons with disabilities and the youth, but there is a deliberate inclusion of diversity, multilingualism, and local content creation to not only increase the competitiveness of ICT goods and services but also not to stifle innovations by relying on imports of these goods and services.
- **There is a concerted effort to include and identify where the private sector can best support the digital economy.**

It is evident that digitalization has been whole-heartedly embraced within the policy environment of South Africa, however the sheer number of frequent strategies and plans does raise questions around the clarity of the overall vision, potential fragmentation and duplication in departments, and the effectiveness of these strategies. Determining the enforcement and effectiveness of these policies would be useful but is outside the scope of this study.

Notwithstanding the proclamation in the ICT Policy White Paper that sector specific strategies and plans (including in agriculture) should be developed to increase uptake and usage of ICTs, it does seem that through the Agriculture Research Council there has been a noticeable uptake of ICTs. As referenced in the introduction, a lack of policies and strategies does not inhibit the creation of innovations, but it can impact their scalability and sustainability.

South Africa likely has a strong environment to encourage digital agriculture, but this is not accurately reflected in their ICT plans and strategies. This is likely due to the complex nature of the policy environment and the involvement of cross-sectoral departments for the inclusion of issues such as market access or taxation, for example. There is a risk that if the public sector is not pushing a clear agenda for digital agriculture, which will ultimately improve productivity and efficiency, then there is the possibility that a lack of integration between farmers and digital solutions will stifle the adoption of technology by smallholder farmers.

DIGITAL AGRICULTURE INNOVATIONS

A large number of innovations (57) were identified in this situational study, and their breadth and depth are likely to be far greater given the time that was available for their identification. The environment for digital entrepreneurship is improving significantly and national and provincial government support programs for this are likely to benefit digitally enabled startups with grants, industrial innovation awards, R&D tax incentives and with the establishment of the Technology Innovation Agency. There is a vibrant sub-sector of developing AgriTech with dedicated accelerators, co-working spaces and investment. Fintech businesses are leading this way and beginning to adopt Sandbox licenses such as those in Mauritius that facilitate minimizing regulatory requirements until a business case is proven. From the [Digital Trends in Africa 2021 Report](#), South Africa *'leads the continent in AI adoption with a robust ecosystem that includes numerous technology hubs, research groups and forums such as the AI Summit and Singularity University's South Africa Summit. There are an estimated one-hundred-plus companies in South Africa that are either integrating AI solutions into their existing operations or developing new solutions using AI.'* This trend in Smart Farming and its integration with machine learning is borne out by the observations on the variety and maturity of South African AgriTech solutions. There are a

greater number of AgriTech applications that are oriented towards commercial agriculture and facilitate adaptations and variations that would foster and encourage opportunities in all parts of the agricultural value chain for smallholder or new black entrepreneurial farming groups. From the data collected, a high proportion of digital innovations identified included digital advisory and digital procurement solutions as well as agri e-commerce. The greatest proportion of innovations identified were private sector organizations, followed by government. Many of these innovations were launched more recently in the past 3-4 years and covered all aspects of the use cases included in this study. Whilst most innovations sought to address the knowledge and productivity gap from survey responses analyzed, there were many innovations addressing access to markets and climate change effects combining Geodata with sensors and integrating digital tools.

Interestingly from the survey responses obtained, most of the innovations (73%) were at advanced stages of growth, either transitioning to scale or adapting to other geographic regions or wide scale adoption. As expected, many of these private companies begin with their own finance and have also benefitted from training and impact investment funds to enable them to grow signaling the availability of multiple sources of finance for these types of businesses.

DIGITAL AGRICULTURAL SYLLABI AND ENTREPRENEURSHIP TRAINING

Despite the vitality of the ecosystem for entrepreneurship, including innovation districts, incubators, accelerator programs, innovation hubs, event organizations and foundations, a smaller proportion are believed to target digital entrepreneurship²³ although this may have changed considerably due to the impact of Covid-19. From the [South Africa Digital Economy Assessment of 2018 report](#), impact remains limited, due to the concentration of support in early-stage spaces in more affluent areas (Gauteng and the Western Cape), quality of services is low (mentors lacking and monitoring and evaluation lack meaning) and programs are not well tailored to the South African context or for accessing foreign markets. Whilst early and growth-stage finance has increased, the context of difficult access to credit for SMEs persists.

Companies with significant job creation and e-commerce opportunities face restrictions, such as the high cost of data and high costs for processing online payments.

Entrepreneurial culture and talent are embraced in South Africa, with strong start up communities and events that are becoming more inclusive and widespread, but jobs rather than growth remain the main motivation and collaboration between organizations across the ecosystem remains limited, as does the diversity of business owners and actors. Digital talent and skills were believed to be bottlenecks for the growth of digital startups in 2018 but this picture is changing as digital skills are being embraced by higher education institutions as reflected in this study. It is believed that these are far more elaborated than captured by this study as a result of inordinate pressures that Higher Education institutions were under during the time of this study due to Covid-19.

The potential of digital agriculture in South Africa is huge. Digital skills education is included in the country's policy framework. The incubators interviewed seem to acknowledge the importance of digital agricultural entrepreneurship and they have integrated digital agricultural tools in their trainings, although it does not seem to be well integrated into the curricula of the Universities interviewed. 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. For the incubators interviewed, CCARDESA and other international partners could better support the development of digital skills for agricultural youth entrepreneurship in the SADC region in the following ways:

- Implementing trainings to tackle the lack of skills in every branch of the agricultural sector.
- Fostering the possibilities for students to do internships within digital agricultural organizations.
- Offering scholarship programs for young entrepreneurs to upskill their competences in the sector (like the Apprenticeship Program in South Africa).
- Addressing the needs of entrepreneurs and supporting them in their skills development.
- Implementing programs to upskill, bring awareness, and fund projects.
- Bring awareness on the food security subject to make agriculture “cool” to the youth.
- Promote projects in the rural areas to empower remote areas.
- Lobby the SADC governments to prioritize the expansion of internet connectivity to rural and remote communities in order to make digital agriculture a reality.

5.2 REFLECTIONS FROM THE SITUATIONAL ANALYSIS REPORT

This document has presented the available data collected for South Africa 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 South Africa include:

- **An agriculture sector specific digital strategy and roadmap is necessary with clear objectives, milestones, timelines, and funding requirements to tie in the sector performance with a digital economy advancement.** A lack of a guiding policy or strategy was a barrier for stakeholders to implement innovations or digital solutions that would be sustainable. A clear agriculture sector specific strategy or roadmap can address some of the key challenges raised by stakeholders consulted during this study. **It also provides a blueprint to enable the development of an ecosystem made up of stakeholders from significantly different backgrounds who can complement each other and work collaboratively to advance the roadmap or strategy.**
- **Four country groups highlighted through the benchmark assessment exhibited differences in both the number of innovations per group and the distribution of use case by group.** Group 1 (South Africa, Mauritius, Seychelles) had the highest number of innovations in the group. Group 1 and Group 2 have Digital Procurement as the most common use case and have a slightly larger proportion of the innovations in the category of Smart Farming applications. These use cases focus on more sophisticated users, and B2B business models underpinning their innovations. These business users are generally both more digitally literate and more business savvy.
- **Low digital literacy hinders the adoption of new technologies especially in an aging rural population.** The most common challenge that survey respondents encountered was digital literacy levels of their users. If farmers have limited access to digital solutions or are unable to use them, because they lack digital skills further uptake is likely to be significantly impeded.

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**DIGITAL AGRICULTURE
COUNTRY STUDY ANNEX TO
THE SITUATIONAL ANALYSIS
REPORT OF THE SADC REGION**

Centre for Coordination of Agricultural Research
and Development for Southern Africa

World Bank Group