



# 2022 SUSTAINABLE AGRICULTURE MARKET INTELLIGENCE REPORT

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## GreenCape

GreenCape is a non-profit organisation that drives the widespread adoption of economically viable green economy solutions from the Western Cape. We work with businesses, investors, academia, and government to help unlock the investment and employment potential of green technologies and services, and to support a transition to a resilient green economy.

## Acknowledgements

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# LIST OF ABBREVIATIONS AND ACRONYMS

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<b>4IR</b>	Fourth Industrial Revolution
<b>AfCFTA</b>	African Continental Free Trade Area
<b>AFOLU</b>	Agriculture, Forestry and Other Land Use
<b>CA</b>	Conservation Agriculture
<b>CBS</b>	Citrus Black Spot
<b>CEA</b>	Controlled Environment Agriculture
<b>CRC</b>	Claim Research Committee
<b>DALRRD</b>	Department of Agriculture, Land Reforms and Rural Development
<b>DFFE</b>	Department of Forestry, Fisheries and the Environment
<b>DHET</b>	Department of Higher Education and Training
<b>dtic</b>	Department of Trade, Industry and Competition
<b>EnMS</b>	Energy Management Systems
<b>EPA</b>	Economic Partnership Agreement
<b>ESO</b>	Energy Systems Optimization
<b>EU</b>	European Union
<b>EV</b>	Electric Vehicles
<b>F2F</b>	Farm to Fork Strategy
<b>GAP</b>	Good Agricultural Practices
<b>GDP</b>	Gross Domestic Product
<b>GG</b>	Government Gazette
<b>HACCP</b>	Hazard Analysis Critical Control Points
<b>HIV</b>	Human Immunodeficiency Virus
<b>ICT</b>	Information and Communications Technology
<b>IoT</b>	Internet of Things
<b>JCRC</b>	Joint Constitutional Review Committee
<b>kWh</b>	kilowatt hour
<b>kWp</b>	kilowatt peak
<b>Li-ion</b>	Lithium ion
<b>NA</b>	National Assembly

<b>PV</b>	Photovoltaic
<b>RA</b>	Regenerative Agriculture
<b>R-CTFL</b>	Retail – Clothing, Textile, Footwear and Leather
<b>SA</b>	South Africa
<b>SAHPRA</b>	South African Health Products Regulatory Authority
<b>SF6</b>	Sulphur hexafluorides
<b>SMME</b>	Small-, Micro- and Medium-sized Enterprises
<b>TB</b>	Tuberculosis
<b>TDCA</b>	Trade Development Cooperation Agreement
<b>UNFCCC</b>	United Nations Framework Convention on Climate Change
<b>WC</b>	Western Cape
<b>WCDoA</b>	Western Cape Department of Agriculture

**Exchange rate used:**

1 US Dollar = R15



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# EXECUTIVE SUMMARY

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The South African agricultural sector offers numerous opportunities for investors, agricultural and green technology manufacturers, service providers, distributors and others in the value chain.

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South Africa's agriculture primary production consists of a dual economy with (1) a well-developed commercial sector responsible for the vast majority (~80%) of the country's food production and (2) subsistence and smallholder farms who, mainly produce for their own consumption.

South African national and provincial governments continue to place the growth of South Africa's agriculture sector at the centre of their economic and job growth strategies and are focussed on ensuring that growth is inclusive. The intersection of the Fourth Industrial Revolution (4IR) and agriculture could accelerate the growth of South Africa's agriculture sector, opening up the opportunity for smaller producers to leapfrog hurdles like market access and food losses with the use of agricultural technology (Agtech).

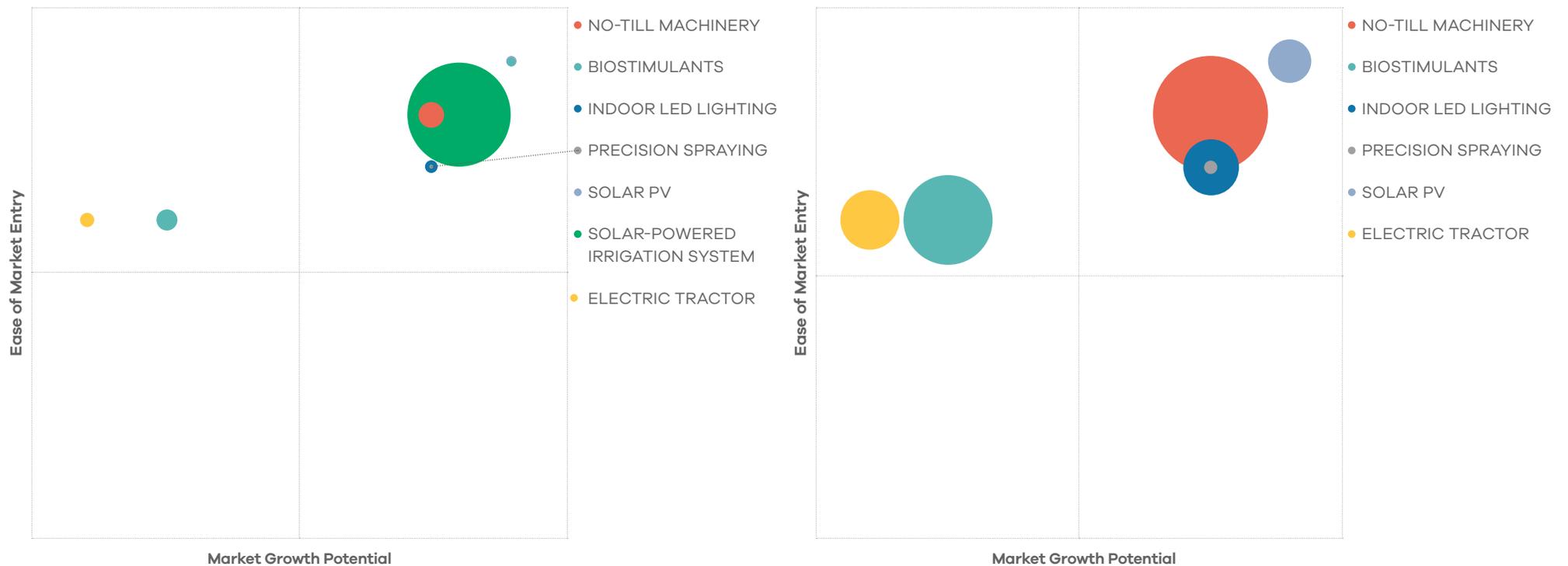
South Africa's sustainable agriculture sector has an exciting future ahead of it. Production forecasts, commodity prices and business confidence remain high, especially as initiatives put into place by industry associations and government start to bear fruit. Based on these positive notes, South Africa's agriculture sector is primed for investment by producers, investors, technology manufacturers, service providers, distributors and other players in the agricultural value chain.

The key market opportunities in sustainable agriculture discussed further in this report are:

- Energy efficiency.
  - Renewable energy.
  - Regenerative agricultural practices.
  - Controlled environment agriculture.
  - Smart farming/precision agriculture.
  - Electric equipment.
-



**Figure 1** offers insight into the market sizes of specific technologies within the market opportunities listed above. The relative size of the markets for the technologies is indicated by the bubble sizes. These technologies can be considered prime for investment due to improved appetite on the demand-side, the existence of local industries that can expand production to include agri-specific products and increasing research and development of technologies and their applications.



**Figure 1:** Investment opportunities according to market growth potential and ability to overcome market entry barriers (a.) with solar powered irrigation systems (SPIS) (b.) without with solar powered irrigation systems (SPIS)

**Table 1:** Summary of 2022 sustainable agriculture market opportunities

Opportunity	Market size (SA)	Drivers	Barriers	Macro environment
<b>Renewable energy (RE)</b> Solar PV	Small-scale solar PV: R150 million.	<ul style="list-style-type: none"> <li>15% increase in Eskom tariffs (2021).</li> </ul>	<ul style="list-style-type: none"> <li>Maintenance requirements.</li> </ul>	<ul style="list-style-type: none"> <li>EU Green Deal/Farm to Farm (F2F) strategy and RSA's Carbon Tax Act will dis-incentivise farming operations driven by fossil fuels.</li> </ul>
	Solar powered irrigation system: R17 billion.	<ul style="list-style-type: none"> <li>Ongoing loadshedding – CSIR reports that loadshedding will last for the next 3 – 5 years.</li> </ul>	<ul style="list-style-type: none"> <li>Significantly high capital cost.</li> <li>High security risk – particularly in urban and peri-urban areas.</li> <li>Misalignment between high generation periods (i.e. midday) and irrigation times (early morning/late afternoon).</li> </ul>	
<b>Regenerative agriculture (RA)</b> Soil remediation	No-till machinery: R1.07 billion.	<ul style="list-style-type: none"> <li>Emergence of local no-till machinery manufacturers.</li> </ul>	<ul style="list-style-type: none"> <li>Need to retrain farm workers in no-till practices.</li> <li>High capital costs partially due to the importing of most no-till tractors.</li> <li>Dip in yields during transition from till to no-till.</li> </ul>	<ul style="list-style-type: none"> <li>Growth in tractor sales (30% y/y increase in the first 8 months of 2021), shows greater capital availability for machinery purchases.</li> </ul>
	Biostimulants: R650 million.	<ul style="list-style-type: none"> <li>Increased interest from RA farmers to boost microbial activity in soil.</li> <li>Increased number of soil remediation projects for post-mining land.</li> </ul>	<ul style="list-style-type: none"> <li>Commercial product ranges remain limited.</li> <li>Lack of industry standards in South Africa.</li> <li>Biostimulants fall under the subcategory of fertiliser by definition; there is considerable administrative red-tape for certifying products for commercial use.</li> </ul>	<ul style="list-style-type: none"> <li>Significant research on biostimulants by Stellenbosch University for stone, citrus and pomme trees.</li> </ul>
<b>Controlled environment agriculture (CEA)</b>	LED lighting: R236 million (for the cannabis market).	<ul style="list-style-type: none"> <li>SAHPRA<sup>1</sup> issued 42 licences for cultivation and export issued by Aug 2021.</li> </ul>	<ul style="list-style-type: none"> <li>High capital costs.</li> <li>Competition with cheap Chinese imports.</li> <li>Very young/nascent agri-LED market – small but growing.</li> </ul>	<ul style="list-style-type: none"> <li>Cannabis Act (2020) estimates that cannabis industry is valued at approx. R21 billion.</li> </ul>

<sup>1</sup> South African Health Products Regulatory Authority



Table 1 continued...

Opportunity	Market size (SA)	Drivers	Barriers	Macro environment
<b>Smart farming (SF) / Precision agriculture (PA)</b> Precision spraying	Drones: approx. R12 million/season (in the Western Cape).	<ul style="list-style-type: none"> <li>Increased attention to reducing overuse of pesticides.</li> </ul>	<ul style="list-style-type: none"> <li>Min. viable size &gt; 10 ha.</li> <li>High capital investment.</li> <li>Tight regulations and licencing requirements for drone pilots.</li> </ul>	<ul style="list-style-type: none"> <li>South African Civil Aviation Authority (SACAA) regulates the uses of drones.</li> <li>Remotely piloted aircraft (RPA) must be registered in terms of Part 101 of South African Civil Aviation Regulations.</li> <li>Remote pilots must also apply for pilot licences at a SACAA-approved training organisation.</li> </ul>
<b>Electric equipment</b>	Electric tractors: R267 million.	<ul style="list-style-type: none"> <li>Cost of Lithium ion (Li-ion) batteries progressively decreasing.</li> </ul>	<ul style="list-style-type: none"> <li>High capital costs (R400 000 – R500 000).</li> <li>Addition infrastructure investment required.</li> <li>Consistent, cheap electricity supply is key for financial feasibility of investment.</li> <li>Specialised technicians required (esp. for maintenance).</li> </ul>	<ul style="list-style-type: none"> <li>Increased assembly of Li-ion batteries in RSA.</li> <li>Growth in demand for EV and EV infrastructure in passenger car market.</li> </ul>



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# WHAT'S NEW?

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In 2021, the Sustainable Agriculture MIR described investment opportunities within the adoption of sustainable farming practices, particularly those found in regenerative, conservation and organic agriculture. Additional opportunities highlighted were within renewable energy, precision farming and undercover farming.

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The 2022 Sustainable Agriculture MIR delves deeper into these, highlighting technologies that investors should see as emerging investment opportunities, such as drones, solar-powered irrigation systems and electric tractors.

New readers are advised to first read the 2019 – 2021 MIRs for more in-depth information on established opportunities.

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# **INTRODUCTION AND PURPOSE**

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This market intelligence report (MIR) highlights opportunities for greening agriculture production and is written for investors, particularly new investors, exploring the South African agtech market.

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GreenCape's Agriculture Sector Desk was established in 2014 in partnership with the Western Cape Department of Agriculture (WCDa). The desk aims to support the development of a sustainable and competitive agricultural value chain through the uptake of agricultural technology (agtech<sup>2</sup>) and sustainable production practices. This is achieved by raising awareness of the benefits of agtech uptake (i.e. driving demand within agriculture) and highlighting opportunities for agtech investors, manufacturers and service providers (i.e. supporting supply).

This MIR provides updates on key issues and opportunities identified in previous MIRs and highlights new opportunities related to technologies and practices that:

- Increase input resource efficiency in primary production;
- Benefit the environment, primarily by conserving resources, reducing negative impacts such as soil degradation and pollution;
- Increase resilience to climate change; and
- Have the potential to attract international investment.

In what follows, there is a **sector overview (Section 2)** that provides a national and provincial economic overview of agriculture, with the focus on macro-economic trends. This is followed by an overview of **policies and regulations (Section 3)** that guide and affect investors in the agriculture sector. Key **opportunities, trends, and barriers** are highlighted (**Section 4**). The final sections provide information on available **finance and incentives (Section 5)**, present the case for the **Western Cape as Africa's emerging greentech hub (Section 6)**, and explain GreenCape's work in the green economy (**Section 7**). For assistance, or if you have any questions after reading this MIR, please contact the agriculture team at [agri@greencape.co.za](mailto:agri@greencape.co.za).

CONTACT THE  
AGRICULTURAL  
TEAM HERE

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<sup>2</sup> Agtech represents the application of technology – especially software and hardware technology – to the field of farming





# SECTOR OVERVIEW

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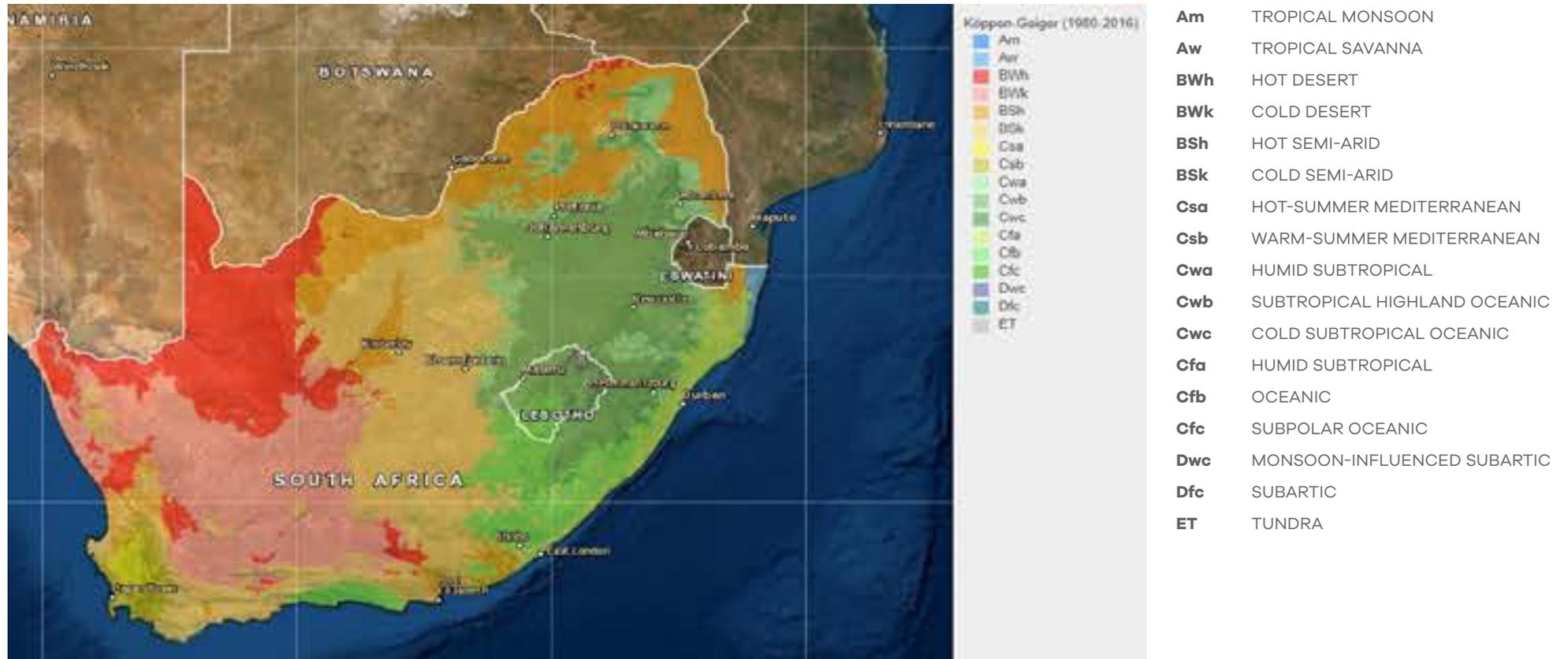
This section provides an overview of the South African and Western Cape (WC) commercial agricultural sectors. This includes an overview of the sector's structure, macro-economic trends, key players and drivers of green technology and practices in agriculture.

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## 2.1. Physical geography and climate

South Africa (SA) is a resource-scarce country and classified as semi-arid with only ~11% of land in SA is considered arable, of which only ~3% is truly fertile soil. According to the Köppen-Geiger Climate classification<sup>3</sup>, SA is dominated by Oceanic climate types, followed by hot and cold semi-arid climates.

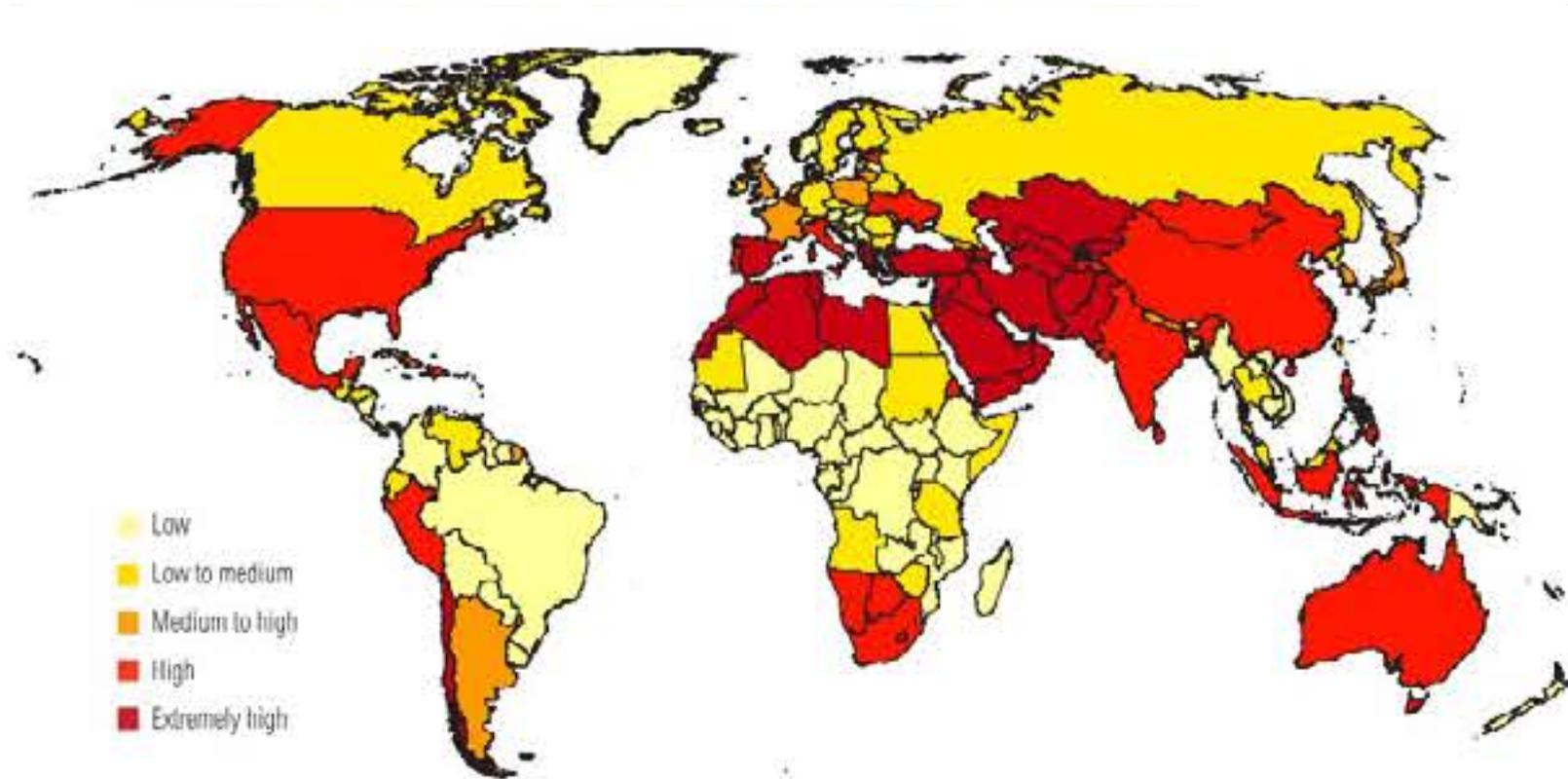


**Figure 2:** Köppen-Geiger Climate classification of South Africa (1980 – 2016)

Source: Services 2021

<sup>3</sup> Köppen’s classification is based on a subdivision of terrestrial climates into five major types, which are represented by the capital letters, A, B, C, D and E

Additionally, SA is increasingly vulnerable to water shortages as global average temperatures continue to increase; this poses a threat to SA's agricultural sector, where most productive land is rain fed and a mere 1% has the right climate and soil combination for rain-fed crops.



**Figure 3:** Country-Level Water Stress in 2040 under the Business-As-Usual Scenario

Source: Luo, Young, and Reig. 2015

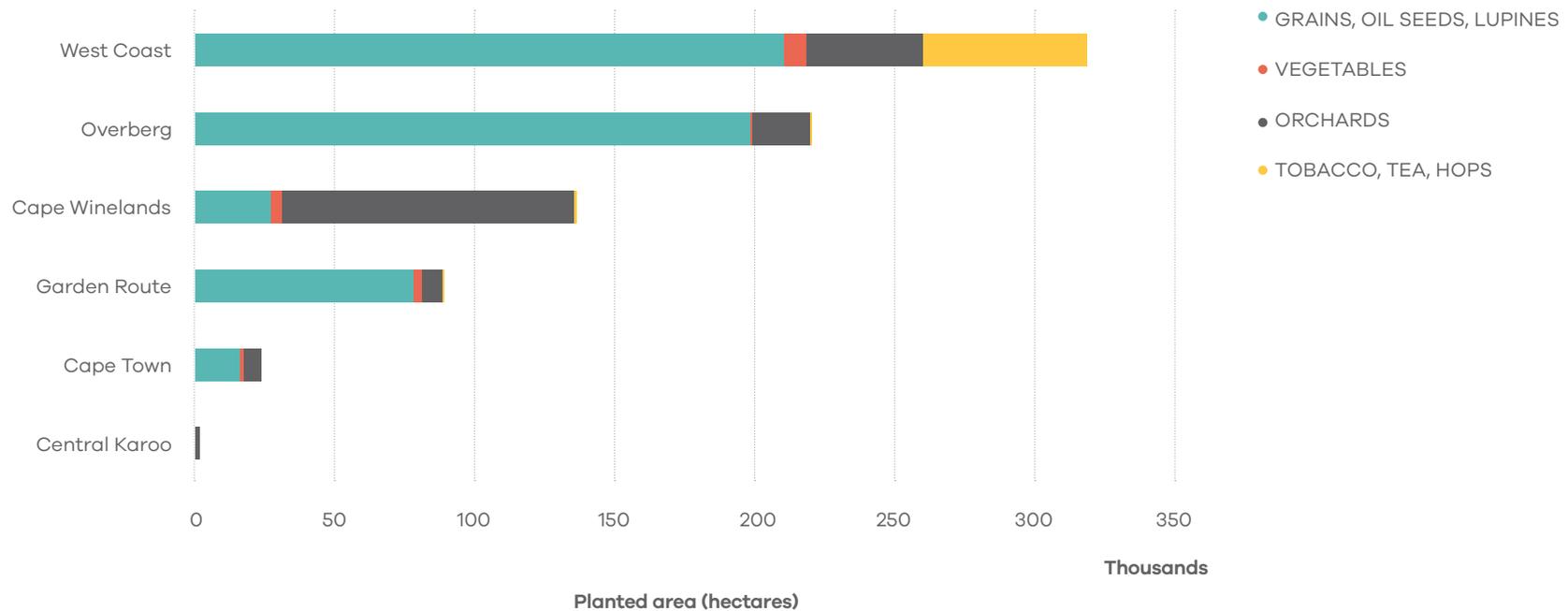
The increase in temperature volatility, environmental disasters and population growth has also resulted in increased competition for key resources, constraining an already overburdened agricultural sector.

**2.1.1. Western Cape’s physical geography**

The WC’s climate is markedly different from the rest of SA, with a mix of Mediterranean climatic regions on the coast and a semi-desert inland.

It also experiences winter rainfall, and this allows for the stable production of a unique mix of agricultural produce (Partidge, Morokong, and Sibulali 2020).

Approximately 2 million hectares of agricultural land are under production, the largest share of which was used for wheat production (17%), followed by wine grapes, canola, barley, rooibos tea, apples, tables grapes, pears and oranges. As observed in **Figure 4**, most agriculturally productive land can be found on the West Coast that is dominated by grain, oilseeds and lupine production.



**Figure 4:** Geography of WC crops planted, 2017

Source: Partidge, Morokong, and Sibulali 2020

## 2.2. Overview of the agricultural economy

### 2.2.1. Farming enterprise structure and types

SA's agricultural economy can be characterised as a dual economy, with an advanced commercial agricultural community supplying the majority of SA's food and subsistence/smallholder farmers who farm primarily for their own consumption. **Figure 5** shows how farmers can be viewed on a continuum (LandBank).



**Figure 5:** Classification of South Africa's farming sector (Source: LandBank)

### 2.2.2. South African agriculture economy

Agriculture is a backbone of SA's economy and has shown resilience during the first year of the COVID-19 pandemic. Agriculture was the only sector with positive and consistent economic growth.

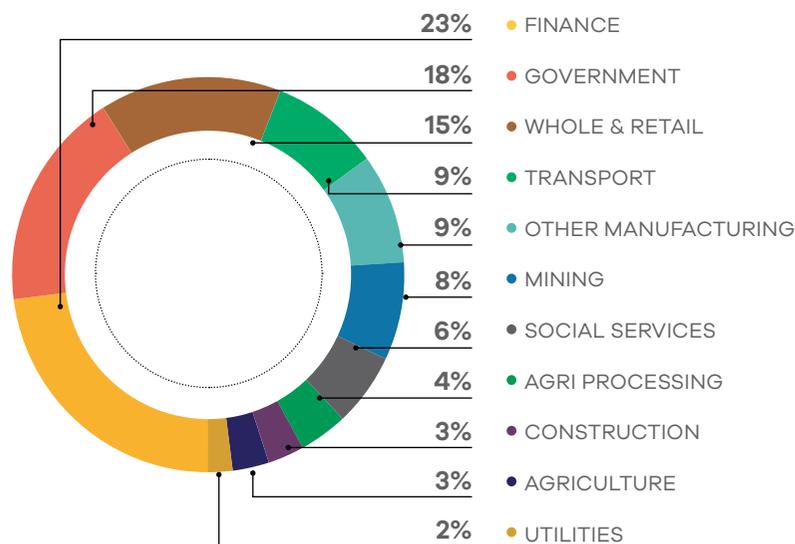
Its growth was crucial in offsetting some of the economic and job losses in other sectors of the economy, whilst also contributing to the food security of the region. Net farming income in SA's agricultural sector rose by 46%, from R108 billion (June 2019 to June 2020) to R157 billion (June 2020 to June 2021) (Directorate: Statistics and Economic Analysis 2021).

The impact of the pandemic varied across agricultural subsectors, with the informal sector affected most, together with the fast food and restaurant sector. This had a domino effect on the agricultural sector, where farmers were left without markets for their produce. The tourism sector as a whole was also negatively affected by the lockdown restrictions, and the impact was felt in the agro-tourism<sup>4</sup>

sector due to the limited movement of people and the ban of large gatherings. Another effect the lockdown had on the South African economy was the diesel shortage experienced at the end of May 2020, as a result of the lockdowns implemented in the early stages of the COVID crisis in SA. As a result, many producers' operations were negatively impacted.

<sup>4</sup> Agro-tourism refers to those who visit working farms and other agricultural operations for the purpose of recreation, education etc.

Overall, agriculture as an essential services sector was however not as adversely affected as other sectors of the economy. Nationally, primary agriculture (excluding forestry and fisheries) contributed 2% to the economy and agri-processing 4% for the financial year of 2020 (Figure 6). Combined, these sectors accounted for 6% of the economy, positioning agriculture as one of the important sectors (Quantec 2021).



**Figure 6:** South Africa's sectoral break-down by share of GDP in 2020

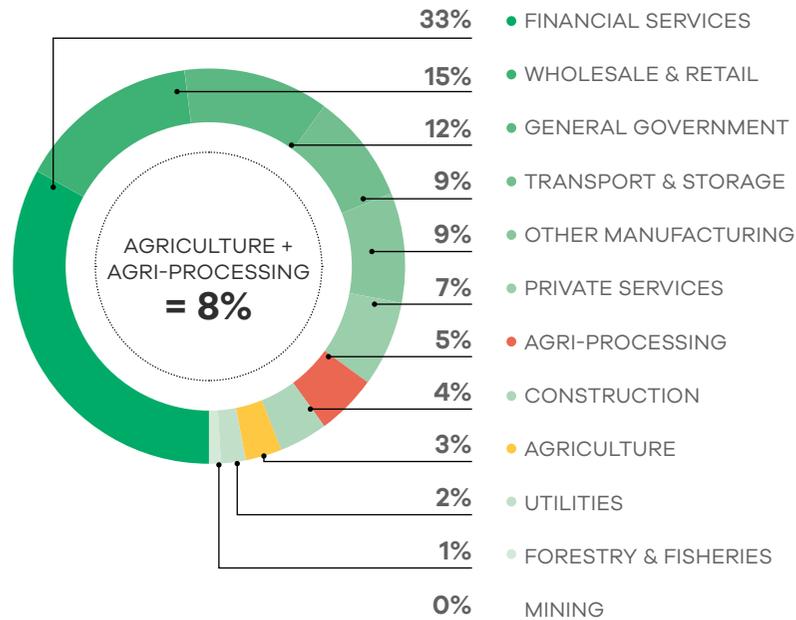
Source: Quantec 2021

Some of the cross-cutting challenges affecting the South African economy during 2021 included ongoing load shedding leading to unreliable electricity supply, the impact of COVID-19 lockdown regulations and the social unrest in KwaZulu-Natal and Gauteng during July 2021. Improvements in connectivity infrastructure (roads and railway) and limited capacity of the ports to process high volumes of fruits and other goods destined for export markets are some of the trade-related challenges that also still need to be addressed by national government and state-owned enterprises such as Transnet and Sanral.

### 2.2.3. Western Cape agriculture

**Figure 7** illustrates the breakdown of the WC's leading sectors by the share contribution to the economy in 2020.

The Financial Services sector contributed 26%, Wholesale and retail 17%, General government 13%, Transport and storage 10%, Other manufacturing (excluding food, beverage and tobacco) 9%, Private services 7%, Agri-processing 6%, Construction contributing 5%, Agriculture and Utilities each 3%, Forestry & Fisheries 1%, and Mining less 1%.

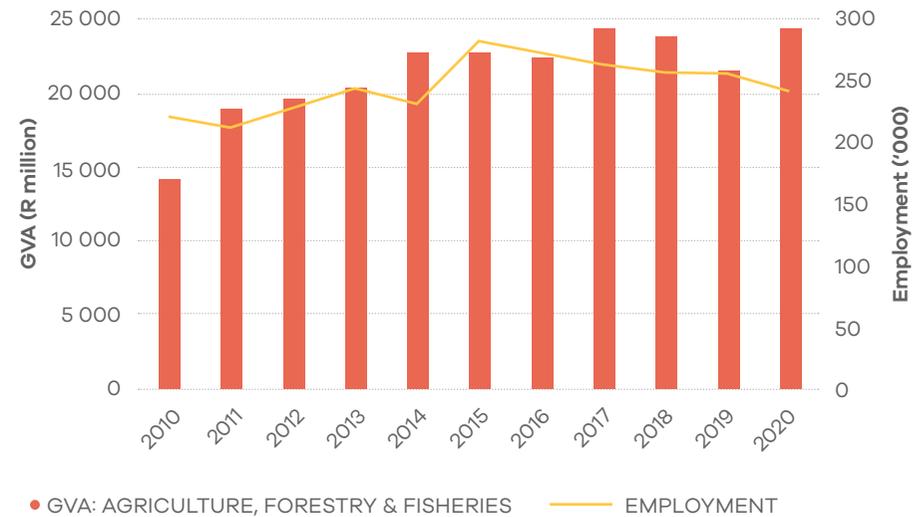


**Figure 7:** Western Cape sectoral breakdown in 2020

Source: Quantec 2021

The combined contribution of the agricultural value chain formed by Agriculture and Agri-processing accounts for 8% of the provincial share.

**Figure 8** illustrates the WC agricultural Gross Value Added (GVA) in 2010 constant prices and employment during the period 2009 to 2020. Overall, the sector shows an increasing employment trend for the period under observation, with 2019 taking a dip due to the lingering impact of the drought.



**Figure 8:** Western Cape agricultural gross value added (R million) and employment

Source: Quantec 2021

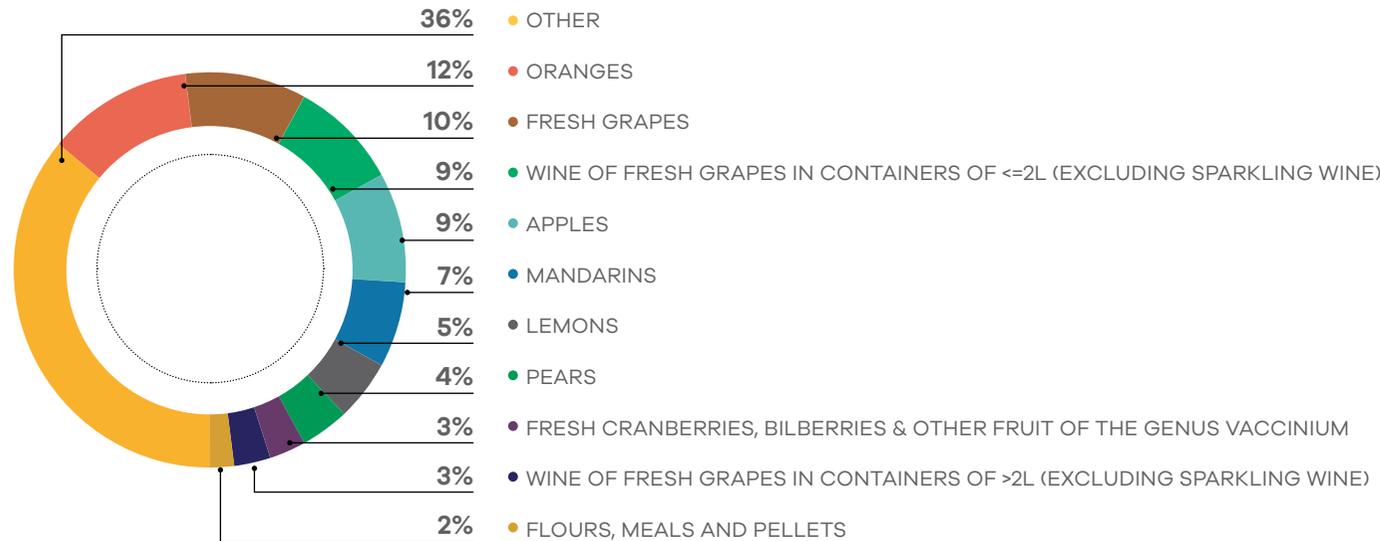
Statistics South Africa also changed the survey method for collecting employment statistics from face-to-face surveys to Computed Assisted Telephonic Interviews in the second quarter of 2020 to mitigate the risk of COVID-19.

Following these changes in the method of data collection, the comparison of employments numbers needs to be done with caution.

The drop in numbers could well indicate the impact of COVID-19 and/or the change in approach to data collection. However, with the improved rainfall conditions in the WC and accelerated vaccination programs, it is expected that the sector will continue on its path to recovery. The WC has an export-oriented market for its agricultural products. **Figure 9** presents major agricultural exports by share of the total value of exported agricultural products.

Orange exports accounted for 12% of total agricultural exports. It is not surprising, as the citrus industry experienced record-high exports for four consecutive seasons. Table grapes accounted for 10%, wine of fresh grapes in a container of <= 2L (excluding sparkling wine) and apples each at 9%, mandarins 7%, lemons 5%, pears 4%, fresh cranberries 3%, wine of fresh grapes in a container of > 2L (excluding sparkling wine) at 3%, flour meals and pellets 2% and other products account for 36%.

The WC also has substantial agricultural production and agri processing infrastructure, making agricultural and agri processing in the province attractive due to the relatively easy access to infrastructure that supports agricultural production and further value add (**Table 2**).



**Figure 9:** Western Cape agricultural exports

Source: Quantec 2021

**Table 2:** List of agricultural infrastructure in Western Cape (2019)

Type	#	Type	#	Type	#
Abattoirs (red meat)	55	Dairies	752	Nurseries	224
Abattoirs (white meat)	26	Dams	31 492	Packhouses	982
Aquaculture	50	Feedlot – beef	19	Piggeries	125
Breweries	63	Feedlot – sheep	34	Shade netting	1 887
Distillery	14	Fruit packers	88	Silo bags (commercial)	259
Cellars (olives and wine)	663	Fruit cool chain facilities	153	Silo bags (non- commercial)	1 084
Chicken batteries – broilers	1 076	Grain bunkers	25	Silos (commercial)	671
Chicken batteries – layers	650	Grain dams	30	Silos (non-commercial)	175
Chicken hatcheries	10	Livestock Auction Facilities	35	Tea processing	75
Cold chain facilities	64	Millers	44	Tunnels	7 290

### 2.3. Drivers of sustainable technologies and practices in agriculture

The key drivers of sustainable technology and innovation in the sector are:

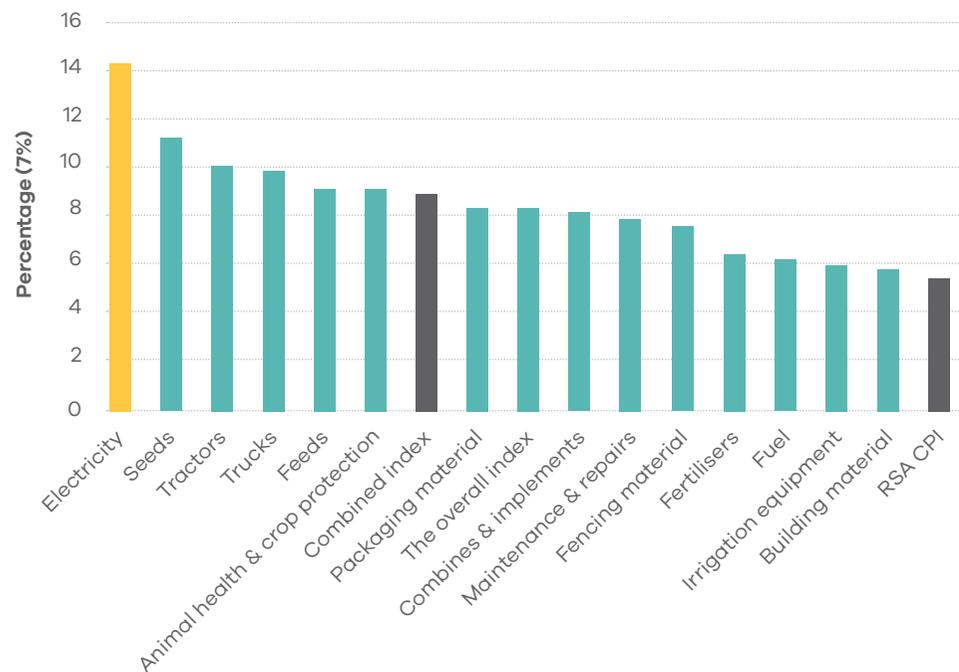
- Increasing production costs.

- Natural resource scarcity.
- Market pressures and changing consumer preferences (particularly the implementation of the EU’s Farm to Fork strategy (F2F) and its implications on the agricultural produce headed for EU markets).

#### 2.3.1. Increasing production costs

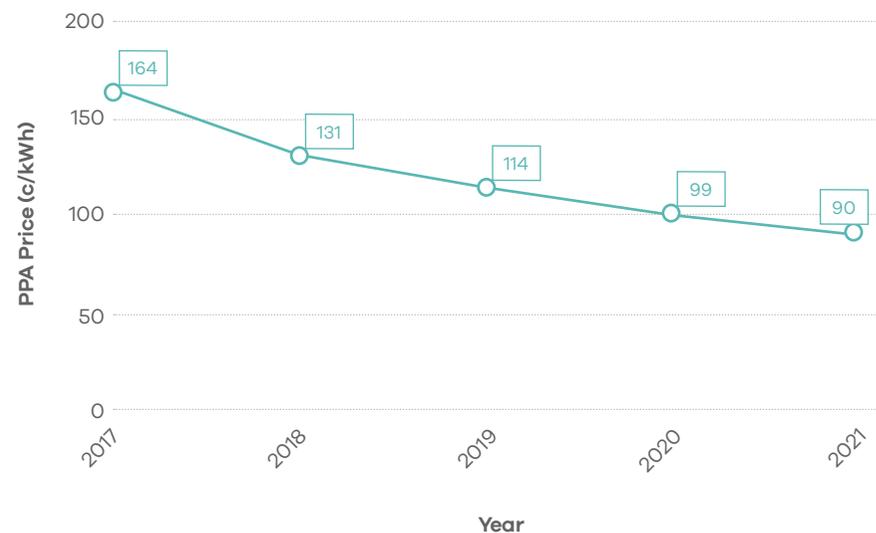
SA’s agricultural sector has had to contend with higher than inflation cost increases of key inputs, particularly electricity (**Figure 10**).

On the other hand, cleantech such as solar PV has been decreasing in cost and is becoming a competitive alternative to Eskom supplied electricity (as can be seen in **Figure 11**).



**Figure 10:** Cost inflation in SA's farming sector from 2009 to 2019

Source: GreenCape, 2021



**Figure 11:** Declining cost of electricity via solar PV power purchase agreements (PPAs) from 2017 - 2021 for a 400 kWp rooftop solar PV system

Examples like these are driving SA farmers to invest in practices and technologies that will reduce input costs and/or increase the efficiency of resource use, as high inputs costs decrease their profit margins.

**2.3.2. Natural resource scarcity**

As stated in [Section 2.1](#), the land and water constraints experienced by the agricultural sector have been exacerbated by climate change and population growth. As resource scarcity intensifies, farmers are shifting to sustainable agricultural practices and efficient technologies to protect resources and build greater climate change-resilience.

**2.3.3. Changing consumer preferences and market pressures**

Consumers are showing greater consciousness regarding how their food is farmed and packaged and what impact those practices have on the environment. This pressure has driven retailers to adopt objectives that include sustainability matrices for

procurement and has pressured governments to enact greater regulation around carbon emissions, traceability, etc. International policy, specifically the EU Green Deal and F2F, are key pieces of legislation that could significantly impact SA farmers, particularly those who export fresh produce. [Section 3.2](#) expands on this more comprehensively.





## **POLICIES AND REGULATIONS**

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SA has an extensive range of policies and regulations governing the country's agricultural sector.

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### 3.1. South Africa's agricultural policies and regulations

The national entities primarily responsible for SA's agriculture sector and activities therein are the Department of Agriculture, Land Reform and Rural Development (DALRRD) and the Department of Forestry, Fisheries and the Environment (DFFE). Both DALRRD and DFFE support the development of sustainable agriculture in SA, particularly in a manner that addresses historical inequities and drives inclusive job creation.

This sector highlights agri-specific policies and regulations that have been updated or introduced to Parliament for consideration. A comprehensive list can be found on the [GreenAgri portal](#) under the Plans and Policies tab<sup>5</sup> as well as in previous Sustainable Agriculture Market Intelligence Reports (MIRs)<sup>6</sup>.

#### 3.1.1. Land Reform

The 2020 Sustainable Agriculture gave an overview of the final recommendations of the Joint Constitutional Review Committee (JCRC), which advised that Section 25 of the Constitution of SA should be amended to allow for expropriation of land without compensation. Following that, a draft amendment bill titled *Draft Constitution 18th Amendment Bill (Section 25 amendment)* was published for public comments. The Expropriation Bill describes the circumstances upon which "just and equitable for nil compensation to be paid where land is expropriated in the public interest", where:



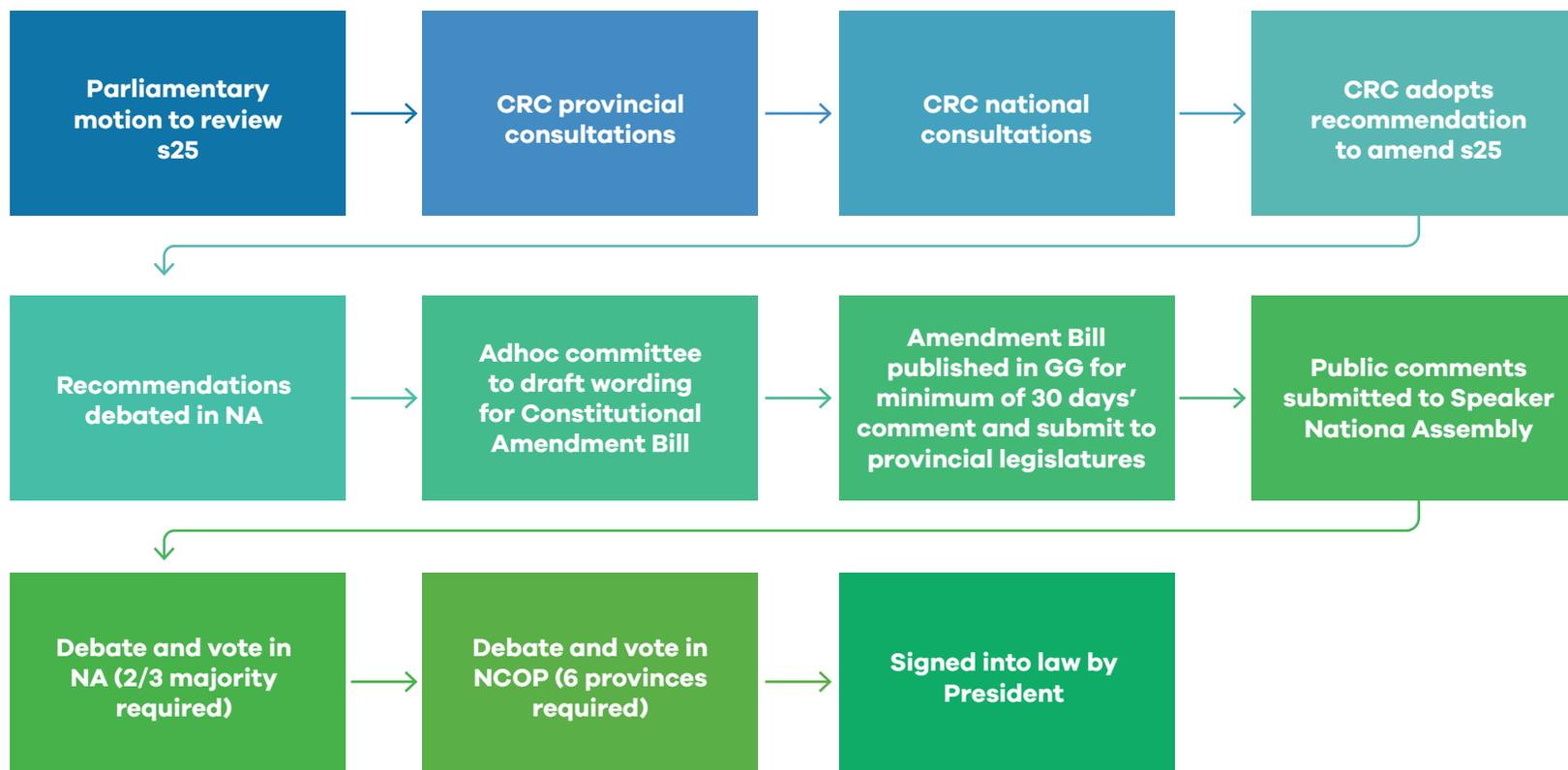
- Land is not being used and the owner's main purpose is not to develop the land or use it to generate income, but to benefit from the increase of its market value;
- A government institution holds land, which it obtained for free, is not using the land for its "core functions", and is not reasonably likely to require the land for its future activities in that regards;
- An owner has abandoned the land by "failing to exercise control over it";
- The market value of the land is equivalent to, or less than, the present value of direct state investment or subsidy in the acquisition and beneficial capital improvement of the land; and
- The nature or condition of the property poses a health, safety or physical risk to persons or other property.

The Bill had been submitted to the National Assembly (NA) in December 2021 (as per the steps outlined in [Figure 12](#)) but failed to obtain the required 2/3 majority. However, this Amendment Bill is one piece of a larger policy framework that covers land reform, including an Expropriation Bill, which has followed a similar path and is due for debate in the NA in 2022. There are several outstanding issues still to be addressed to enable land reform (Purchase, Boshoff, and Sihlobo 2021), including the following:

- Land Donations, Beneficiary Selection and Land Allocation policy
- Restitution of Land Rights
- Land Reform (Labour Tenants) Act 3 of 1996
- National Policy on Comprehensive Producer Support

<sup>5</sup> <https://www.greenagri.org.za/action-plans-and-policies/>

<sup>6</sup> <https://www.green-cape.co.za/market-intelligence/>



**Figure 12:** Process flow for the review of section 25 of the Constitution

Source: Purchase, Boshoff, and Sihlobo 2021

### 3.1.2. Cannabis legislation

Following the amendments to the schedules<sup>7</sup> of the Medicines and Related Substances Act, No 101 of 1965 (Medicines Act), the DALRRD and South African Health Products Regulatory Authority (SAHPRA) provided updates on the National Cannabis Master Plan and Future Policy Direction for SA in 2021. The commercial cultivation of cannabis for medicinal use and manufacturing is permitted, but still requires Section 22C(1)(b) license issued by SAHPRA and Section 22(9)(a)(i) permit from the Director General of Health for schedule 6 manufacturing (Omarjee 2021). As of 1 October 2021, the SAHPRA had issued 41 licenses for cannabis cultivation<sup>8</sup>.

The DALRRD estimated that the potential market size of the cannabis industry in SA is about R28 billion, with the potential to create 10 000 – 25 000 jobs across the value chain (Ramashala 2021).

The Draft Cannabis Master Plan seeks to provide a broad framework for the development and growth of the South African cannabis industry with these key objectives:

- Establish an inclusive, sustainable and globally competitive cannabis industry in SA.
- Increase the volumes and variety of cannabis products destined for both local and export markets.
- Establish and increase the capacity of South African farmers to produce dagga and hemp.
- Create opportunities for creation of small- and medium-sized enterprises across the cannabis value chain.
- Increase investments in research and technology development to support increased production, productivity and competitiveness of the cannabis industry.

- Establish and increase the manufacturing capacity of the South African cannabis industry.

- Designate cannabis and hemp products with the designated local content legislative framework.

## 3.2. Other relevant policies and regulations

### 3.2.1. Climate Change Bill

In October 2021, the Climate Change Bill was tabled in Parliament. Essentially, the Bill hopes “to enable the development of an effective climate change response and a long-term, just transition to a climate resilient and low carbon economy and society for South African in the context of sustainable development” (DFFE 2021). The Bill provides a comprehensive national response to climate change and its impacts. It provides for the Minister (in consultation with the relevant state departments) to:

- Set national adaptation objectives.
- Develop a National Adaptation Strategy.
- Develop adaptation scenarios.
- Determine a national greenhouse gas emission trajectory.
- Develop (with the Ministers responsible for energy and trade and industry) a plan to phase down or phase out the use of synthetic greenhouse gases such as hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and Sulphur hexafluorides (SF6).

In the light of COP26<sup>9</sup>, the draft document communicates the best available science, evidence and information upon which these adaptation and mitigation efforts are based and further demonstrate SA’s international commitments and obligations to combating climate change.

<sup>7</sup> In terms of the Medicines and Related Substances Act (Act 101 of 1965), a ‘schedules substance’ is defined as “any medicine or other substance prescribed by the Minister under section 22A”

<sup>8</sup> <https://www.sahpra.org.za/cannabis-cultivation-licences/>

<sup>9</sup> The 26th UN Climate Change Conference in Glasgow, 2021

The agricultural sector features prominently in South Africa's Nationally Determined Contribution under the Paris Agreement<sup>10</sup>: agriculture is a sector recommended for prioritisation not only because it is a critical sector for attracting foreign direct investment, job creation and economic activity but also due to its vulnerability to volatility in weather parameters (such as extreme rainfall, temperature events, etc.) due to climate change.

Some efforts identified to support the long-term adaptation of the sector to climate change are the development of Climate Change Needs and Response Assessments, the operationalisation of the National Climate Risk and Vulnerability Assessment Framework and the rollout of specific climate-smart agriculture tools and early warning systems.

### **3.2.2. Carbon Tax Bill**

The first phase of the South African Carbon Tax Act (No 15 of 2019) came into effect in June 2019, running until December 2022, with the second phase coming into effect from 2023 until 2030.

The carbon tax rate was set at R120/tCO<sub>2</sub>e in 2019, rising to R127 and then R134 in 2020 and 2021 respectively, due to inflation.

The Carbon Offset Administration System<sup>11</sup> (COAS) provides for two objectives: 1.) to define the procedures through which project developers submit eligible projects and list their credits; and 2.) to provide a platform through which emitters can surrender carbon credits against their tax obligations. As the agricultural sector is exempted from phase one, farmers have the opportunity to generate revenue by obtaining carbon credits through carbon offsetting.

Based on carbon offsets regulation, a project qualifies as an approved project if it complies with eligibility standards based on existing international standards such as Clean Development Mechanism (CDM), Verified Carbon Standard (VCS) and the Gold Standard (GS). National Treasury has published an indicative positive (eligible) project list, described below in **Table 3**.

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<sup>10</sup> <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/South%20Africa%20First/South%20Africa%20updated%20first%20NDC%20September%202021.pdf>

<sup>11</sup> <http://carbon.energy.gov.za/Home.aspx>

**Table 3:** Indicative Eligible Project List for Carbon Offsetting

Source: National Treasury 2020

Sector	Eligible projects
<b>Energy (except projects claiming the energy efficiency tax incentive, 12L)</b>	<ul style="list-style-type: none"> <li>• Energy efficiency in the residential and commercial sector.</li> <li>• Energy efficiency in buildings.</li> <li>• Community-based and municipal energy efficiency and renewable energy.</li> <li>• Fuel-switching projects.</li> <li>• Electricity transmission and distribution efficiency.</li> <li>• Small-scale renewable energy projects.</li> </ul>
<b>Transport</b>	<ul style="list-style-type: none"> <li>• Public transport.</li> <li>• Transport energy efficiency.</li> </ul>
<b>Agriculture, forestry and other land use (AFOLU)</b>	<ul style="list-style-type: none"> <li>• Restoration of sub-tropical thicket, forests and woodlands.</li> <li>• Restoration and management of grassland.</li> <li>• Small-scale afforestation.</li> <li>• Biomass energy.</li> <li>• Anaerobic biogas digesters.</li> <li>• Reduced tillage.</li> </ul>
<b>Waste</b>	<ul style="list-style-type: none"> <li>• Municipal waste projects</li> </ul>

The most relevant projects would fall under those listed in the AFOLU sector; however, projects such as small-scale renewable energy projects and transport energy efficiency would have applications within the agricultural industry.

### 3.2.3. Energy

Loadshedding continues to undermine economic activity in SA and will continue for the foreseeable future, which will have severe impact on the agriculture sector. Above-inflation increases in electricity prices also undermines the financial health of the agricultural sector.

Policies in the energy sector that would impact the agriculture sector are detailed in the **Energy Services and Utility Scale Renewable MIRs**; a few notable ones for agriculture can be found in the 2021 Sustainable Agriculture MIR.

In August 2021, amendments to Schedule 2 of the Electricity Regulation Act 4 of 2006 were gazetted following President Ramaphosa's earlier announcement on 10th June 2021.

The Amendment increased the threshold for generation projects that do not have to apply for licences from the National Energy Regulator of South Africa (Nersa) to 100 MW. This update to the electricity regulations allows businesses to increase their own capacity to meet their energy needs or to utilise electricity generated by other parties enabled by “wheeling” through the grid.

The **Energy Services and Utility Scale Renewable MIRs** provide more details on distributed and embedded generation, as well as wheeling.

### 3.2.4. South African Master Plans

There have been several master plans developed to support the Reimagined Industrial Strategy for SA, through Public Private Growth Initiatives (PPGIs) – a partnership between National Government and the private sector.

As noted by the DTIC, “The primary objective of the Master Plan process is to develop an agreed-upon set of actions, with time frames, that all stakeholders in a sector or value-chain commit to implementing for the benefit of the sector or value-chain. The objectives of the Master Plan include encouraging sector growth, investment, job creation and competitiveness.”<sup>12</sup>

**Table 4** presents a list of Master Plans of interest in the agricultural sector.

**Table 4:** List of Master Plans of relevance to the agricultural and forestry sectors

Name	Responsible Department(s)	Date of implementation	Description
<b>The South African Poultry Sector Master Plan</b>	DTIC & DALRRD	November 2019	The Poultry Sector Master Plan provides a framework for a determined effort to grow the output (and jobs) in the industry, offering important opportunities for economic development, including: 1.) potential expansion of both maize and soya production; 2.) growing small-scale poultry farming and local production networks; 3.) commercial-scale contract farming supplying large integrated producers; 4.) growth in industrial-scale food processing, leading to increased employment and exports; and 5.) the supply of affordable protein to South African households.
<b>South African Sugar Value Chain Master Plan 2030</b>	DTIC & DALRRD	November 2020	The Master Plan has been designed as a phased approach to managing SA’s sugar industry through restructuring and diversification for growth. Opportunities identified in the Plan include: 1.) bioethanol for fuel blending (subject to a viable economic model); 2.) bio-jet fuel; 3.) potable, industrial and pharmaceutical-grade bioethanol; 4.) Biomass/co-generated electricity; 5.) biogas; 6.) No- and low-calorie sweeteners; and 7.) Various platforms and specialty chemical and bio-based polymers for application in different sectors, i.e. plastics, packaging, automotive, industrial, textiles, etc.

<sup>12</sup> [http://www.thedtic.gov.za/wp-content/uploads/Masterplan-Forestry\\_Sector.pdf](http://www.thedtic.gov.za/wp-content/uploads/Masterplan-Forestry_Sector.pdf)

Table 4 continued...

Name	Responsible Department(s)	Date of implementation	Description
<b>Master Plan for the Commercial Forestry sector in SA</b>	DTIC & DFFE	September 2021	The Master Plan focuses on increasing investment, jobs and competitiveness, underpinned by greater inclusivity in the Forestry sector and its principal sub-sectors in the value chain: 1.) Primary sector; 2.) Pulp and paper; 3.) Sawn timber; 4.) Board products; 5.) Utility poles and treated products.
<b>Masterplan for the South African Furniture Industry</b>	DTIC	April 2021	This Master Plan plans to rebuild the industry for locally manufactured furniture and for greater supply chain consistency. An Action Plan to address raw material shortages could see greater growth in the local commercial forestry sector.
<b>South African Retail-Clothing, Textile, Footwear and Leather (R-CTFL) Value Chain Master Plan to 2030</b>	DTIC	November 2020	This Master Plans focuses on CTFL feeding into SA's major retailers. Although the full value chain expands beyond the agricultural industry, the commitment to greater local procurement has the opportunity to stimulate growth in primary agriculture products.

### 3.3. Tabled and Draft Bills

There are several Bills that are in progress that apply to the agriculture sector. Below provides a list<sup>13</sup>:

**Table 5:** Tabled and Draft Bills of relevance to the agriculture sector

Bill Name	Progress	Bill's details
<b>Animals Protection Amendment Bill B1-2021</b>	In progress	<ul style="list-style-type: none"> <li>Amendment to the Animals Protection Act, 1962, to insert a definition for "cosmetic".</li> <li>Provision for a new offence related to the testing of a cosmetic, or part of or ingredient of a cosmetic on an animal.</li> </ul>
<b>Preservation and Development of Agricultural Land Bill B8-2021</b>	In progress	<ul style="list-style-type: none"> <li>Provision of the principles for the management of agricultural land.</li> <li>Provision for agricultural land evaluation and classification (nationally and provincially).</li> <li>Provision for the declaration of protected agricultural areas through objectives of agro-ecosystem management and authorizations.</li> </ul>

<sup>13</sup> <https://pmg.org.za/bills/all/year/2021/>

Table 5 continued...

Bill Name	Progress	Bill's details
<b>Land Court Bill</b> B11-2021	In progress	<ul style="list-style-type: none"> <li>• Provision for the establishment of a Land Court and a Land Court of Appeal.</li> <li>• Provision for the administration, judicial functions and budgetary matters of the Land Court and Land Court of Appeal.</li> </ul>
<b>Plant Health (Phytosanitary) Bill</b> B14-2021	In progress	<ul style="list-style-type: none"> <li>• Provision for phytosanitary measures to prevent the introduction, establishment and spread of regulated pests in the Republic.</li> <li>• Provision for regulating the movement of plants, plant products, etc. into, within and out of the Republic.</li> </ul>
<b>Agricultural Product Standard Amendment Bill</b> B15-2021	In progress	<ul style="list-style-type: none"> <li>• Amendment of the Agricultural Product Standards Act, 1990, to provide for auditing of a product for management control systems.</li> <li>• Provision for setting tariffs by assignees on a cost-recovery basis.</li> </ul>

### 3.4. International regulations

SA is an active member of the global community and participant in global trade, with trade in the third quarter of 2021 to have increased 8% y/y and the value of SA's agriculture, food and beverage exports totalling \$9.6 billion for the first 3 quarters of 2021 (Sihlobo 2021).

However, there are several international regulations whose implementation will have a significant impact on South African exports. The the following regulations will be notable for the agriculture sector in SA for this coming year.

#### 3.4.1. African Continental Free Trade Area (AfCFTA) implementation

The beginning of 2021 heralded the start of intra-African trade under the African Continental Free Trade Area (AfCFTA).

Intra-continental trade in Africa remains low (at 17% of African exports), especially in comparison Asia (59%) and Europe (68%), but the AfCFTA could unlock a potential market of 1.3 billion people, across 55 countries with a combined GDP at \$3.4 trillion (Kende-Robb 2021).

The main drivers of demand for agricultural goods under the AfCFTA are the emergence of the middle class in Africa, rapid urbanisation and fast-changing dietary preferences that have transformed food systems (Majola 2021; Morokong, Pienaar, and Sihlobo 2021).

The major limitations of the success of trade under the AfCFTA is lack of logistical infrastructure across borders, limited movement of people and goods between borders and continued persistence of non-tariffs barriers on goods and services (Kpodo 2020).

In SA, there is a potential threat of cheaper fresh produce from other nations such as Tanzania or Egypt, undermining local markets; however, SA has a relatively more developed agro-processing sector in the comparison with the rest of Africa and thus could enter sparsely populated markets with higher valued goods.

### 3.4.2. EU Farm to Fork Strategy

The EU is SA's second biggest market for agricultural products, receiving 27% of the country's total agricultural exports. SA transitioned from Trade Development Cooperation Agreement (TDCA) to the Economic Partnership Agreement (EPA) in October 2016, and since then SA's exports to the EU increased by 25% from US\$2.2 billion to US\$2.8 billion (from 2017 to 2020) (Kapuya and Sihlobo 2021).

The F2F<sup>14</sup> falls within the EU's larger Green Deal that scopes the trajectory towards making Europe climate neutral in 2050. The Farm to Fork (F2F) seeks to revolutionize Europe's agri-value chain by building a food chain that works for consumers, producers, the climate and environment through these main goals (European Commission 2020):

- Ensuring sustainable food production.
- Ensuring food security.
- Stimulating sustainable food processing, wholesale, retail, hospitality and food services practices.
- Promoting sustainable food consumption and facilitating the shift to healthy, sustainable diets.
- Reducing food loss and waste.
- Combating food fraud along the food supply chain.

It should be noted that businesses, including SMMEs<sup>15</sup>, within those sectors will have to address several challenges in maintain access to EU markets, including the costs associated with remaining compliant to regulatory standards through certifications such as GAP, HACCP, CBS measures, etc. (Kapuya and Sihlobo 2021).

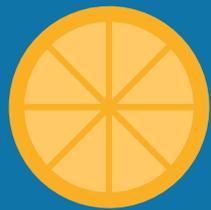
<sup>14</sup> See: [https://ec.europa.eu/food/horizontal-topics/farm-fork-strategy\\_en](https://ec.europa.eu/food/horizontal-topics/farm-fork-strategy_en)

<sup>15</sup> See <https://www.green-cape.co.za/content/project-documents-trade-opportunities-for-sa-green-smmes-in-the-eu-green-deal/> and <https://www.green-cape.co.za/assets/Final-farm-to-fork-2-pager.pdf>

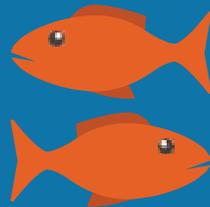
# Sectors Affected

*Agriculture, food processing, labelling and packaging are central to this strategy*

South Africa and other SADC EPA States may be affected



Edible Fruits  
& Nuts



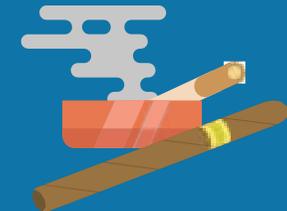
Fisheries



Meat



Beverages



Tobacco  
Products

**Figure 13:** Sectors in SA affected by the EU Farm to Fork Strategy

Source: Hartzenberg 2021



## **EMERGING OPPORTUNITIES, DRIVERS AND BARRIERS**

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This section presents an overview of investment opportunities in sustainable agriculture such as energy efficiency, renewable energy, regenerative agriculture, smart farming, CEA and electric machinery. Greater in-depth analysis of these opportunities can be found in previous Sustainable Agriculture MIRs – this MIR will focus more on notable technologies within each opportunity.

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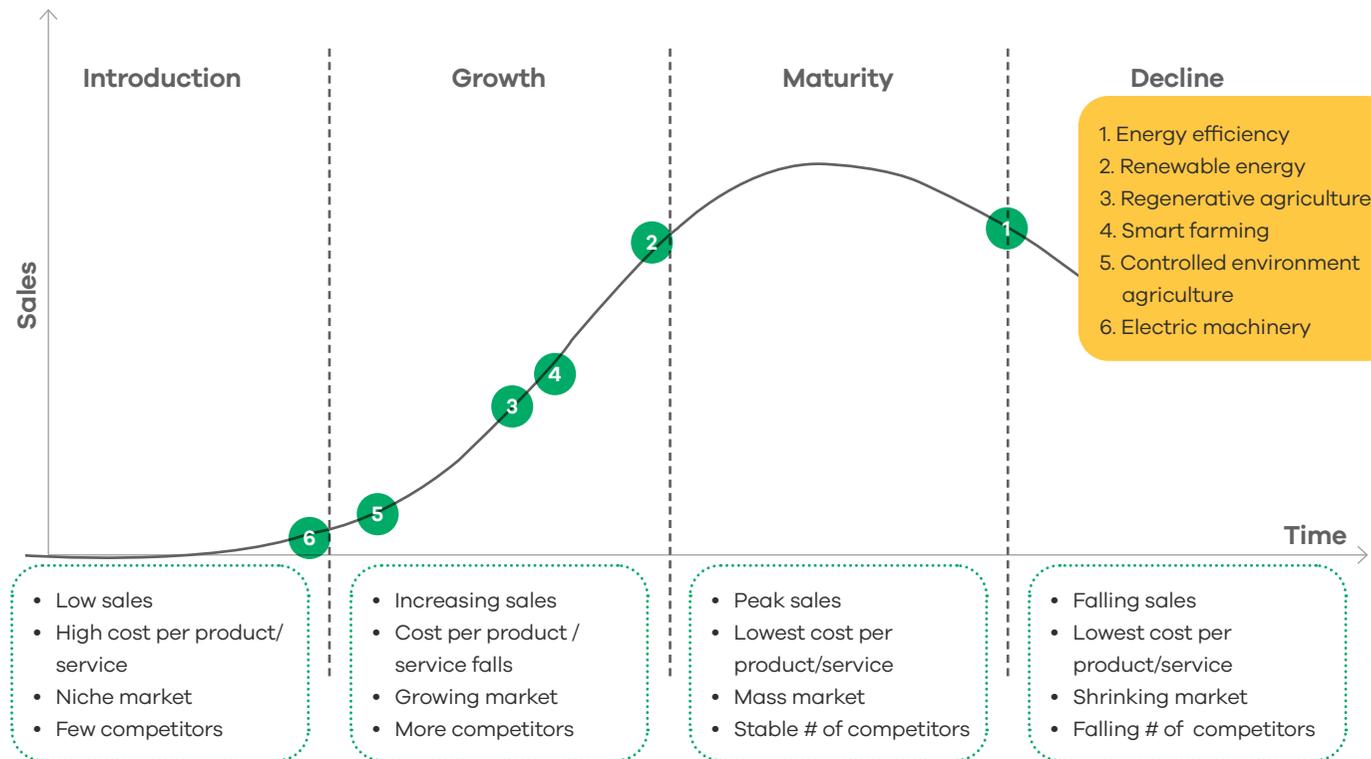


In this section, updates will be provided for the market opportunities identified in previous MIRs. This section will delve deeper into key technologies within those opportunities and analyse investment opportunities that can further unlock the green economy within sustainable agriculture. **Figure 14** shows the position of each opportunity within its product lifecycle.

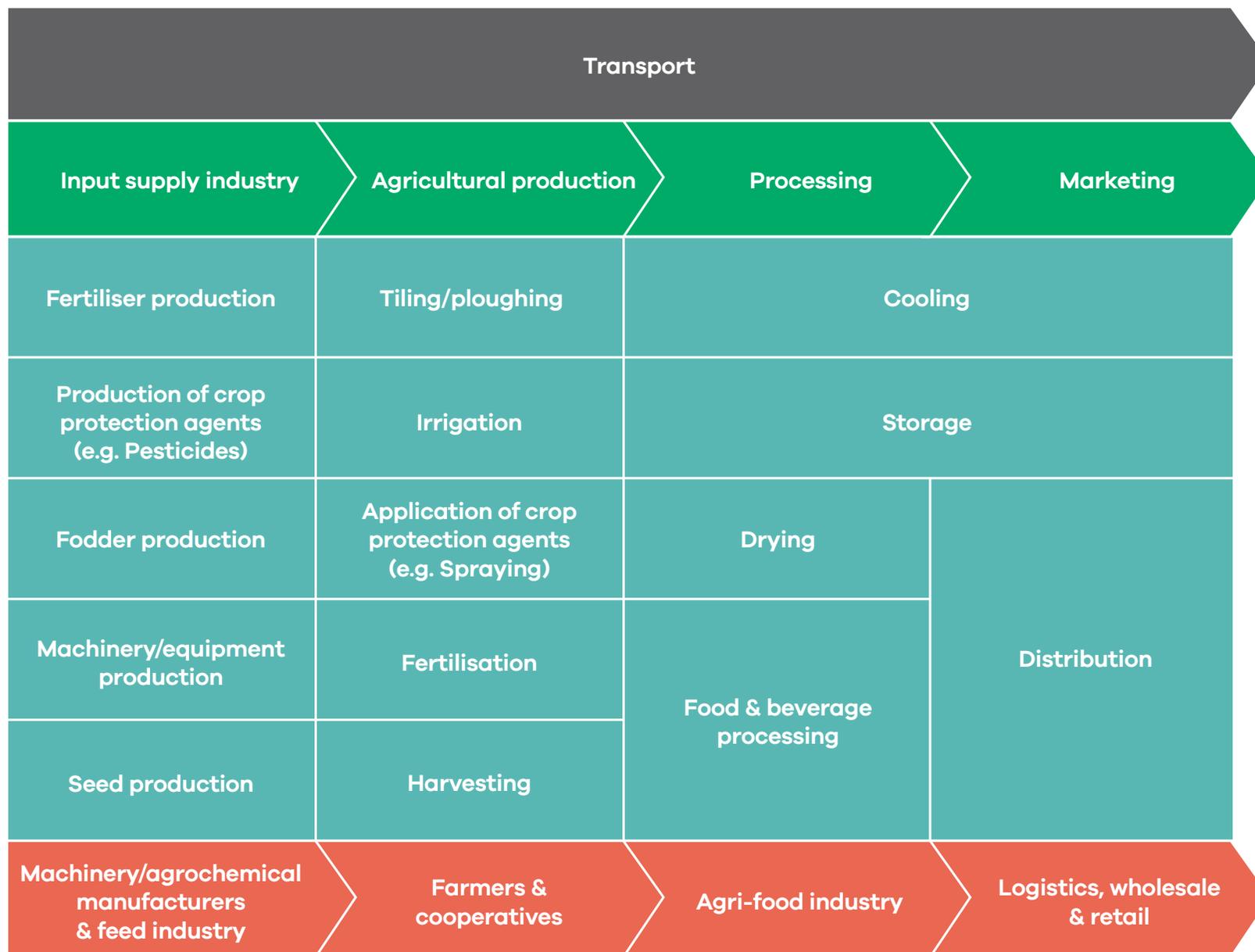
#### 4.1. Energy efficiency applications in agriculture

In agricultural production, energy is consumed in 2 main forms, namely: (a.) indirect energy inputs in the forms of fertilisers and pesticides; and (b.) direct inputs, including diesel for tractors or electricity, operating systems in irrigation, heating, air conditioning etc.

Energy costs continue to rise in SA and energy efficiency is one of the key opportunities farmers can take advantage of in order to reduce energy usage and realize energy savings. **Figure 15** illustrates the areas along the agricultural value chain where potential energy efficiency measures can be implemented (energy-consuming agricultural activities are illustrated in blue).



**Figure 14:** Selected market opportunities in relation to the product life cycle



**Figure 15:** Energy use along an agricultural value chain

Source: Energypedia 2020

### 4.1.1. Market update for energy efficiency

The business case for energy efficiency services is strong, and this has been validated by medium- to large-scale farmers who implemented principles in Energy Management Systems (EnMS) and Energy Systems Optimization (ESO) to achieve significant energy savings. There are a significant number of well-established competitors in the market offering energy-efficiency services. However, there are still opportunities in manufacturing of energy efficient technologies highlighted below in **Table 6**.

**Table 6:** The main energy efficiency options and opportunities in on-farm

Agricultural activities	Energy efficiency options
Lighting	<ul style="list-style-type: none"> <li>• LED bulbs</li> <li>• Light timers</li> <li>• Light sensors and dimmers</li> </ul>
Refrigeration	<ul style="list-style-type: none"> <li>• Door, window insulation</li> <li>• Heat exchangers</li> <li>• High-efficiency refrigerants</li> </ul>
Heating	<ul style="list-style-type: none"> <li>• High-efficiency electric motors</li> </ul>
Venting and air conditioning	<ul style="list-style-type: none"> <li>• Air filters</li> </ul>
Irrigation	<ul style="list-style-type: none"> <li>• Capacitor banks</li> <li>• Variable Speed Drives</li> </ul>
Equipment and Machinery	<ul style="list-style-type: none"> <li>• Electric machinery</li> </ul>

## 4.2. Renewable energy applications in agriculture

### 4.2.1. Market opportunities

Energy is one of the key inputs in agricultural operations and as electricity prices soar whilst supply consistency wanes, farmers are taking up renewable energy as their primary energy source. Solar PV remains the most popular choice, particularly due to the price, technical maturity and ease of implementation.

Moreover, with the rise in popularity of solar PV, many more financing options have become available, making the capital investment in the technology much less of a barrier to investment. Solar powered irrigation systems are becoming more economically viable options for farmers, not only for reducing energy costs, but integrating solar PV with efficient irrigation systems provides for greater water-savings. **Table 7** expands on the scope of the investment opportunities of these technologies.

**Table 7:** Renewable energy investment opportunities in agriculture

Opportunity		Key technologies	Key drivers	Barriers	Term	Market size	Macro environment
Renewable energy	Solar PV	Small-scale solar PV	<ul style="list-style-type: none"> <li>Expanding payment models for accessing solar PV.</li> <li>Rising electricity and diesel costs.</li> <li>Decreasing costs of solar PV.</li> <li>Increased farmers' interest due to energy insecurity.</li> </ul>	<ul style="list-style-type: none"> <li>Maintenance requirements.</li> </ul>	Short	Market Size = R94 – 150 million (2020 MIR valuation).	<ul style="list-style-type: none"> <li>15% increase in Eskom tariffs (2021).</li> <li>Load shedding – CSIR reports that load shedding will last for the next 3 – 5 years.</li> <li>EU Green Deal/Farm to Fork Strategy and RSA's Carbon Tax Act will dis-incentivise farming operations driven by fossil fuels.</li> </ul>
		Solar-powered irrigation system	<ul style="list-style-type: none"> <li>Irrigation is a significant energy user (for irrigated field crops).</li> <li>Rising electricity and diesel costs.</li> <li>Decreasing cost of solar PV.</li> </ul>	<ul style="list-style-type: none"> <li>Significantly high capital cost.</li> <li>High security risk – particularly in urban and peri-urban areas.</li> <li>Misalignment between high-generation periods (i.e. midday) and irrigation times (early morning/late afternoon).</li> </ul>	Short – medium	Est. 1.6 million ha under irrigation in SA (BFAP 2021) 10% conversion <sup>16</sup> = 160 000 ha. System cost = R108 000/ha (Parker 2019). Market Size = R17 billion.	

<sup>16</sup> According to the International Finance Corporation, a 10% conversion is a realistic estimate (IFC 2015)

## 4.2.2. Market insights and updates for renewable energy applications in agriculture

### Increasing number of payment model options

The high capital cost of paying upfront for a solar PV system was often cited as a barrier for farmers to install solar PV systems. However, there are several different payment models now available that have made this less of a hurdle. These options are detailed in **Table 8** below:

**Table 8:** Procurement options for solar PV systems

Source: GreenCape 2021b

Procurement options	Description	System size			
<b>Balance sheet (per kWp)</b>	The solar PV system is funded by the customer; the cost is high, but in return, the client gets all of the savings' benefit. The client takes ownership of the annual costs of running the solar PV system.	R11 000 – R15 000	R10 500 – R13 000	R10 000 – R12 000	R8 000 – R9 500
		< 100 kWp	100 – 500 kWp	500 kWp – 1 MW	> 1 MW
<b>Debt finance (5 – 10-year period)</b>	Banks offer loans for solar PV installations for a period of between 5 – 10 years and monthly payments are a fixed fee. The collateral requirement for the debt funding is often taken against the underlying property of the system (asset).	Above amortized plus 5 – 8% interest pa			
<b>Lease-to-own (per month excl. escalation pa)</b>	The installation, maintenance and management of the solar panel and its components are paid and its fixed monthly lease payment for the duration of the lease term. The fixed monthly payment is determined based on the estimated annual production of the solar system and not on the solar energy produced or consumed.	R7 000 – R14 500	R12 000 – R60 000	R50 000 – R100 000	R85 000 – R250 000
<b>Power Purchase Agreement (PPA) (per kWh)</b>	The solar PV system is installed at no upfront cost. The solar services provider fully covers the installation and O&M of the system. This funding mechanism includes insurance and performance guarantees, with the biggest advantage being reduced electricity costs from day one.	R0.90 – R1.20	R0.80 – R1.00	R0.60 – R0.90	R0.56 – R0.70

## Emerging opportunities

As the renewable energy market matures in SA, more agri-specific applications are emerging as solutions for high energy activities. Solar drying is one such application. Similar to a solar geyser, a solar dryer operates by heating air via solar radiation and directing it to a drying chamber (Gorijian et al. 2020).



Farmers in the grain industry could benefit from the potential energy savings of this technology.

Additionally, dual-purpose solar systems that can switch between different activities at a time (e.g. between irrigation and cold storage refrigeration) are also gaining interest and could become popular in the coming years.

Other emerging opportunities exist within distributed generation, energy storage and biogas which have been detailed extensively in the 2021 Sustainable Agriculture MIR ([sections 4.4.3](#), [4.4.4](#) and [4.4.5](#)).

The 2022 Energy Services and Utility-scale Renewable Energy MIRs also provide updates on these opportunities in the renewable energy industry.

## 4.3. Regenerative agriculture

### 4.3.1. Market Opportunities

Previous MIRs have focused on conservation agriculture (CA) as a key opportunity within sustainable agriculture but in more recent years expanded to focus on regenerative agriculture (RA).

CA is a framework for using practices and technologies that preserve the health of soil during farming. RA is a more holistic farm management concept that not only includes maintaining current soil health but also rehabilitating soil that has been degraded due to exploitative production practices. The three main principles of CA are minimum soil disturbance, permanent soil cover and crop rotation (FAO 2021), and RA expands on this to include additional principles of living roots and animal integration. The transition stages involved in moving from conventional agriculture to RA are illustrated in [Figure 14](#)<sup>17</sup>.

<sup>17</sup> HEI = High External Inputs, LEI = Low External Inputs



**Figure 16:** Seven steps towards regenerative agriculture (Source: WWF-SA 2018b)

SA has seen a slight increase in cropland under no-or minimum-tillage (25% in 2021 compared to 23% in 2015) (Smith 2021); however, SA continues to lag behind other nations, particularly compared to MERCOSUR<sup>18</sup> countries, which had a CA adoption rate of over 70% of total cultivated crop area in 2013. This shows that there is space for this opportunity to grow significantly.

**Table 9:** Extent of Adoption of conservation agriculture (CA) in South Africa

Source: Smith 2021

Province	Total annual crop area (ha)	Area under CA in 2021 (ha)	CA adoption (2021)
Western Cape	1 569 277	804 866	51%
North West	890 437	330 464	37%
Mpumalanga	850 484	205 598	24%
Free State	2 196 986	73 520	3%
KwaZulu Natal	164 620	62 956	38%
Limpopo	255 866	68 834	27%
Gauteng	173 435	57 649	33%
Eastern Cape	160 307	3 194	2%
Northern Cape	69 498	0	0%
<b>TOTAL</b>	<b>6 330 910</b>	<b>1 607 081</b>	<b>23%</b>

<sup>18</sup> Southern Common Market (MERCOSUR in Spanish) is a South American trade block consisting of Argentina, Brazil, Paraguay and Uruguay as full member countries



As interest in RA continues to grow, it opens investment opportunities for the manufacturing and sale of both no-till machinery as well as biostimulants. In **Table 10**, these investment opportunities are unpacked.

**Table 10:** Investment opportunities in regenerative agriculture

Opportunity	Key technology	Drivers	Barriers	Term	Market size	Macro environment	
Regenerative & conservation agriculture	Soil remediation through no till	No-till machinery	<ul style="list-style-type: none"> <li>Increased water use efficiency.</li> <li>Reduced water runoff and erosion.</li> <li>Reduced diesel usage.</li> <li>Greater weed control.</li> <li>Opportunities to generate carbon credits through carbon sequestration.</li> </ul>	<ul style="list-style-type: none"> <li>Need to retrain farm works in no-till practices.</li> <li>High capital costs partially due to the importing of most no-till tractors.</li> <li>Dip in yields during transition from till to no-till.</li> </ul>	Short - medium	6 687 tractor units sold in South Africa (2020). 20% conversion <sup>19</sup> = 1 337 tractor units. Average price no-till tractor = R800 000. Market Size = R1.07 billion.	<ul style="list-style-type: none"> <li>Growth in tractor sales (37% y/y increase in Oct 2020), shows greater capital availability for machinery purchases.</li> <li>Emergence of local no-till machinery manufacturers.</li> </ul>
	Soil remediation through increased bioactivity	Biostimulants	<ul style="list-style-type: none"> <li>Reduces yield dip timeframe associated with shifting from conventional to regenerative agriculture.</li> <li>Improved quality, quantity and consistency of yield.</li> <li>Effective treatment for transplant shock of fruit trees.</li> </ul>	<ul style="list-style-type: none"> <li>Commercial product ranges remain limited.</li> <li>Lack of industry standards in South Africa.</li> <li>Biostimulants fall under subcategory of fertiliser by definition; therefore, there is administrative red-tape for certifying products for commercial use.</li> </ul>	Medium - long	Sprays within foliar applications at 2-4 L/ha. 1 607 081 ha under CA. Biostimulants = R135/L. Market Size = R 650 million.	<ul style="list-style-type: none"> <li>Significant research on biostimulants by Stellenbosch University for stone, citrus and pomme trees.</li> </ul>

<sup>19</sup> Southern Common Market (MERCOSUR in Spanish) is a South American trade block consisting of Argentina, Brazil, Paraguay and Uruguay as full member countries

### 4.3.2. Market insights and updates for regenerative agriculture (RA)

Producers continue to cite the high capital cost of investing in CA machinery as well as the long return-on-investment when shifting from conventional, intensive agriculture to RA as barriers to the uptake of RA. However, several positive developments have occurred to counterbalance these hurdles, and these are expanded on further, below.

#### Growth in knowledge about the importance of RA and CA

Previous MIRs cited the lack of understanding of the implementation and/or benefits of RA practices as a significant barrier to uptake.

However, in recent years, a growing number of industry associations have invested in programmes that promote and advance the uptake of RA in SA and address the lack of knowledge around the business case. For example, GrainSA has several projects for smallholder farmers under their Conservation Agriculture Farmer Innovation Programme; Woodlands Dairy has partnered with Trace & Save to support their farmers move to greater sustainable farm management using the SWAN system<sup>20</sup>. Furthermore, retailers like Woolworths have used their programme, “Farming for the Future”, to encourage their suppliers to invest in soil health and sustainable practices.

#### Lack of incentives, such as policy and certification, to convert to RA

The maturation of SA’s carbon credit market can be considered as an opportunity for players in the agricultural sectors. Companies that specialise in carbon credits have partnered with farmers using regenerative agricultural practices to develop carbon projects that generate carbon credit units through carbon sequestration. However, due to the administrative costs of soil tests and third-party verification processes, as well as the current carbon price in SA’s regulated market, most projects are only feasible for farms larger than 300 ha.

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<sup>20</sup> The SWAN system™ is a method of comprehensively measuring indicators of sustainability on a farm; namely Soil, Water, Atmosphere and Nutrients

## 4.4. Controlled environment agriculture

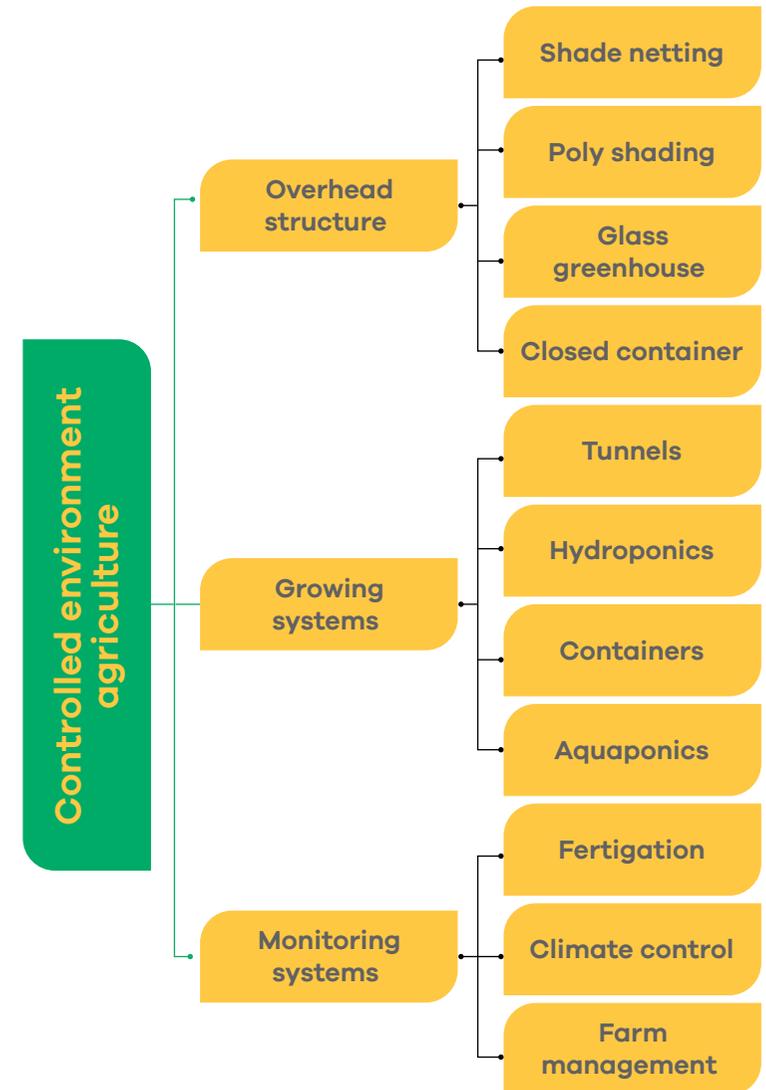
### 4.4.1. Market Opportunities

Controlled environment agriculture (CEA) is the production of plants and animals in an environment where growing conditions are controlled. The key benefits of CEA are:

- Reduced use of inputs such as water, pesticides and fertilisers.
- Higher yields of produce at better quality.
- Potential year-round production with greater production volumes (compared to conventional farming at an equivalent size).

Previous MIRs spoke about similar opportunities in *Undercover Farming*, which falls under the umbrella of CEA. The components of CEA systems are illustrated in **Figure 17**.

There are several opportunities in the manufacturing and supply of both high- and low-tech components of CEA. **Table 11**, illustrates how SA's LED lighting manufacturers, in particular, are well-positioned to take advantage of the growing market for agri-LEDs, both for growing crops such as cannabis as well in livestock applications (e.g. chicken broiler sheds, piggery sheds, etc.).



**Figure 17:** Components of a CEA system

Source: GreenCape 2021c

**Table 11:** Investment opportunities in controlled environment agriculture

Opportunity		Key technology	Drivers	Barriers	Term	Market size	Macro environment
Controlled environment agriculture	High tech CEA (i.e. closed container, hydroponics, and full monitoring systems).	LED lighting	<ul style="list-style-type: none"> <li>• A growing cannabis, medicinal mushrooms, plant-based protein manufacturing industry (primarily farmed indoors).</li> <li>• Lighting accounts for up to 25% capital investment in indoor farming.</li> <li>• Greater energy efficiency of LED vs incandescent, CFL alternatives.</li> <li>• Increased research around endogenous clocks and lighting requirements – use of LED lighting is more efficient.</li> </ul>	<ul style="list-style-type: none"> <li>• High capital costs.</li> <li>• Competition with cheap Chinese imports.</li> <li>• Very young/nascent agri-LED market – small but growing.</li> </ul>	Short – medium	<p>Registered cannabis licenses (SA) = 42<sup>21</sup>.</p> <p>Min. viable size of cannabis cultivation farm = 1000 m<sup>2</sup>.</p> <p>Four hundred and forty-four 610W<sup>22</sup> lamps required.</p> <p>Cost 610W lamps = R13 000.</p> <p>Market Size (Cannabis) = R242 million.</p>	<ul style="list-style-type: none"> <li>• Cannabis Act (2020) estimates that cannabis industry is valued at approx. R21 billion.</li> <li>• SAPHRA issued 41 licenses for cultivation and export issued by Aug 2021.</li> </ul>

#### 4.4.2. Market insights and updates for controlled environment agriculture

##### Growing markets

There are a growing number of producers in the cannabis cultivation, black soldier fly farming and plant-derived protein manufacturing sectors. These products require high levels of biosecurity and, as a result, indoor farming production is the most suitable growing method for production. Key drivers for these markets are:

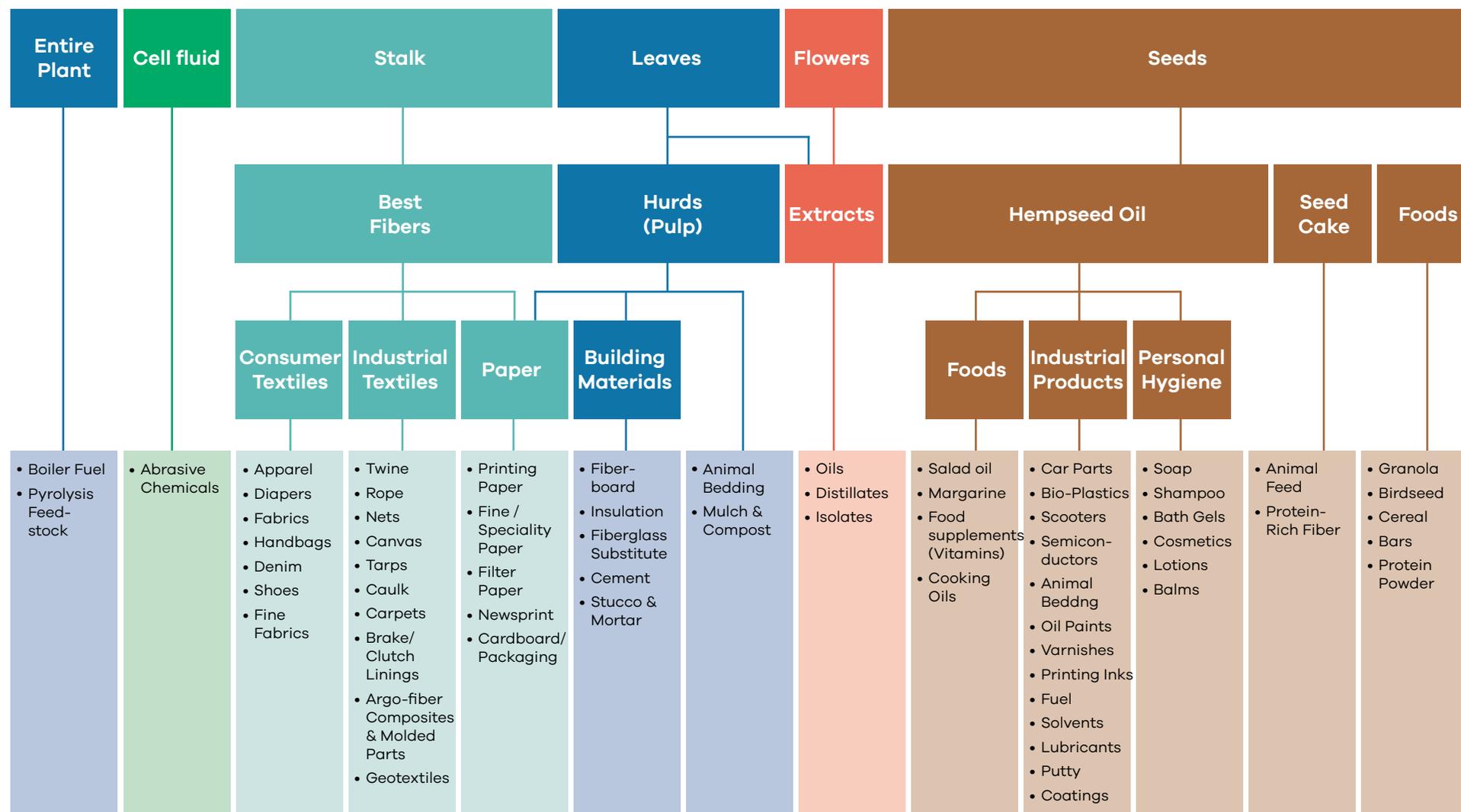
- Legalisation of cannabis production
- COVID-19 pandemic

<sup>21</sup> SAHPRA-issued cannabis cultivation licences as of 31 October 2021 (<https://www.sahpra.org.za/cannabis-cultivation-licences/>)

<sup>22</sup> 610W lamps can cover approximately 2.25m<sup>2</sup>

## Legalisation of cannabis production

SA's chronic high unemployment and poverty rates have been drivers for the legalisation of cannabis production. Governments see cannabis as a cash crop for alternative income streams – particularly due to the ability to process different parts of the plants into various products (Keenan et al. 2019).



**Figure 18:** Uses of hemp

Source: McCann et al. 2019

- COVID-19 pandemic

The COVID-19 pandemic brought SA's vulnerabilities into focus, as a nation without an extensive or diversified vaccine production capacity (Makenga et al. 2019). In response, national government, led by the Department of Higher Education and Training (DHET), invested heavily in building SA's local human vaccine capacity, particularly in plant-derived vaccine manufacturing (Caelers 2021).

Due to the significant biosecurity requirements, all production must be based in a completely controlled environment. As more SA companies enter into 'biopharming' and its applications extend beyond COVID-19 to illnesses such as HIV, TB, etc., local manufacturers of components of CEA are well-located to serve this industry.

### Lack of technical skills

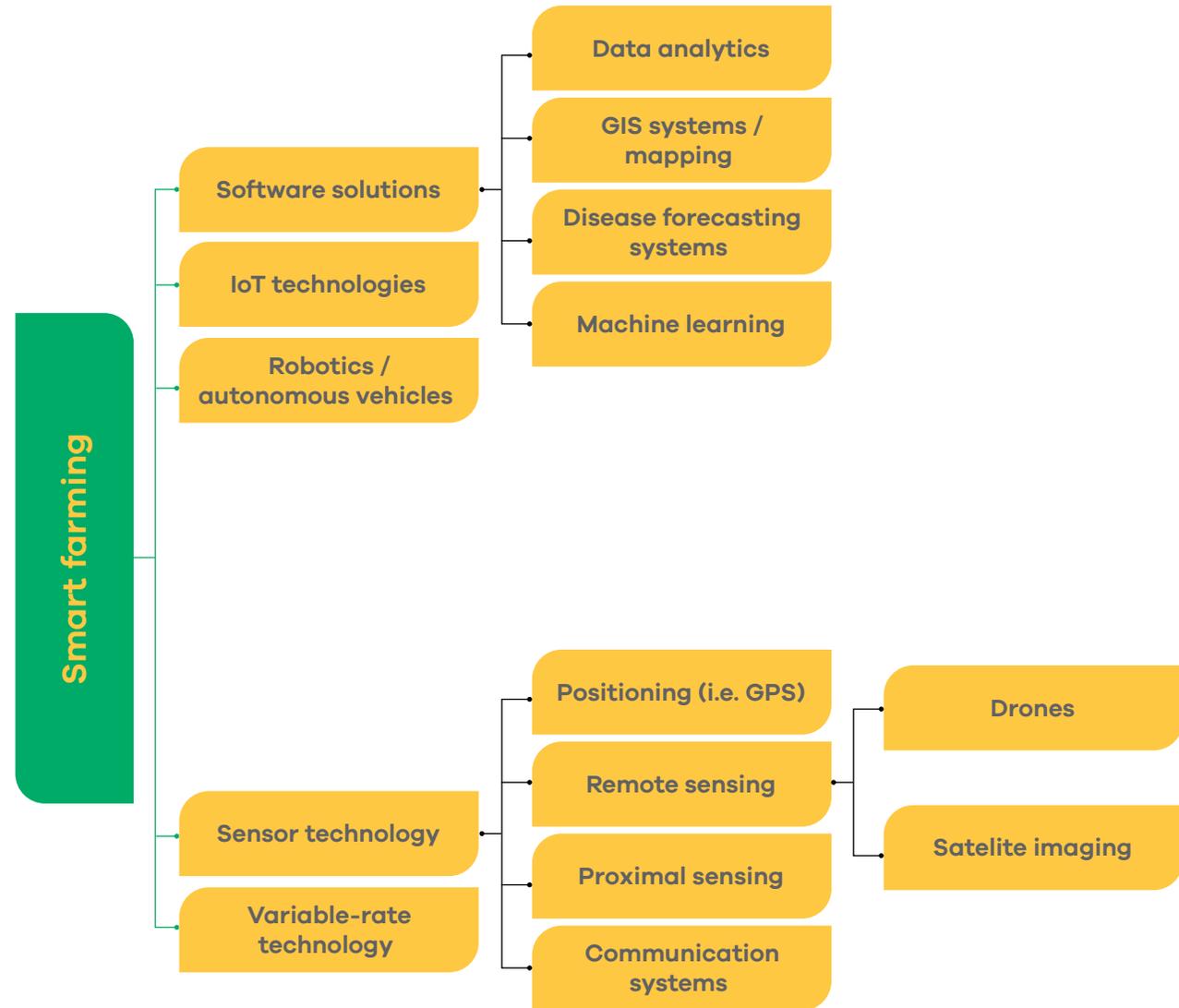
CEA requires producers to invest in skills that are not readily available in the agricultural labour force. Most notable are required skills are based in areas such as ICT, electrical engineering, civil engineering, mechanical engineering and chemistry. It is important for agricultural vocational education stakeholders to note this shift and amend training offerings to better prepare and train agricultural graduates.



## 4.5. Smart farming/ Precision agriculture

### 4.5.1. Market opportunities

Smart farming looks at the use of technology to better inform where and how resources, such as inputs, labour and capital, are dispensed on a farm. There are several technologies which can fall within this opportunity; **Figure 19** illustrates this.



**Figure 19:** Aspects of smart farming

Source: GreenCape 2021a

Over recent years, more local suppliers of smart farming technology have emerged, and previous hesitancy seen among farmers has eased as these applications become more tailored to SA farmers' needs and experience.

**Table 12:** Investment opportunities in smart farming

Opportunity		Key technologies	Drivers	Barriers	Term	Market size	Macro environment
Smart farming/Precision agriculture	Precision spraying	Drones	<ul style="list-style-type: none"> <li>Reduced use of pesticides.</li> <li>Reduced runoff into rivers/streams, limiting pollution into local water systems.</li> <li>Cheaper alternative to spraying via planes.</li> <li>More efficient than conventional, manned-spraying, particularly with tall crops such as sugar, wheat, etc.</li> </ul>	<ul style="list-style-type: none"> <li>Min. viable size &gt; 10 ha (&gt;5 ha for invasive species).</li> <li>High capital investment.</li> <li>Tight regulations and licencing requirements for drone pilots.</li> </ul>	Short - medium	<p>10% conversion.</p> <p>Planted wheat (WC) = 338 588 ha.</p> <p>Cost = R300/ha Market Size (Wheat) = R 10 million/season (WC).</p> <p>Planted fruit trees (WC) = 39 927 ha.</p> <p>Cost = R450/ha.</p> <p>Market Size (Fruit trees) = R1.8 million/season (WC).</p>	<ul style="list-style-type: none"> <li>South African Civil Aviation Authority (SACAA) regulates the uses of drones.</li> <li>Remotely Piloted Aircraft (RPA) must be registered in terms of Part 101 of South African Civil Aviation Regulations.</li> <li>Remote Pilots must also apply for pilot licences at a SACAA-approved training organisation.</li> </ul>

#### 4.5.2. Market insights and updates for smart farming

##### Growing interest from farmers

As indicated, farmers are starting to see the benefit of investing in smart farming technologies, particularly in the face of increasingly unpredictable climate change. Other drivers of increased farmer interest have been the clear financial savings technology suppliers have been able to show farmers.

As export markets such as the EU implement stipulations around traceability and reduced carbon emissions, it can be expected that farmers will increasingly adopt more smart farming technologies to assist them in managing farm records and implementing climate-smart, money-saving practices.

##### ICT access and usage in rural areas

According to the McKinsey Global Institute Industry Digitisation Index, agriculture and hunting industries have the lowest levels of digitisation across all metrics that cover assets, usage and labour (McKinsey 2016).

This is exacerbated by poor connectivity in rural areas where most agricultural production occurs- in 2018 Research ICT Africa (RIA) conducted a survey that indicated 53% of South Africans have access to internet and that a big gap existed between urban and rural internet users (Aguera et al. 2020).

In 2021, the mobile internet penetration has now increased to 60.71% (Statista 2021), but this still means that smart farming technologies that are mobile app-based could miss out on a key segment of agricultural producers.

## 4.6. Electric equipment

### 4.6.1. Market opportunities

In agriculture, most machinery such as tractors, sprayers, harvesters, etc. run on diesel fuel. Not only is this costly, but the carbon footprint of such activities could have serious ramifications for those who export their produce.

As markets, such as the EU, implement stricter stipulations on carbon emissions for imports (e.g. through the F2F), SA farmers who export their goods will need to consider electric machinery as a way of reducing their carbon emissions.

Electric vehicles (EVs) are a small but growing market in SA.

The Department of Trade Industry and Competition (DTIC) issued a draft policy paper around boosting domestic production of EVs and supporting the competitiveness of SA's automotive production industry (Mills 2021). Agriculture tends to not feature in discussions about EV, but there is a significant business case to be made for investment in the growth of EV technologies.

**Table 13:** Investment opportunities in electric equipment

Opportunity	Key technologies	Key drivers	Barriers	Term	Market size	Macro environment
<b>Electric machinery</b>	Electric tractors	<ul style="list-style-type: none"> <li>Estimated payback period of &lt; 6 years.</li> <li>Lower maintenance costs vs. diesel.</li> <li>Greater energy efficiencies in low-energy applications. – most applicable to horticulture sector.</li> <li>Possible market within agritourism.</li> </ul>	<ul style="list-style-type: none"> <li>High capital costs (R400 000 – R500 000 ).</li> <li>Additional infrastructure investment required.</li> <li>Consistent, cheap electricity supply is key for financial feasibility of investment alternatives.</li> <li>Specialized technicians required.</li> </ul>	Medium - long	<p>6 687 tractor units sold in South Africa (2020).</p> <p>10% conversion = 669 tractor units.</p> <p>Average price = R400 000.</p> <p>Market Size = R267 million.</p>	<ul style="list-style-type: none"> <li>Cost of Li-ion batteries progressively decreasing.</li> <li>Increased assembly of Li-ion batteries in RSA.</li> <li>Growth in demand for EV and EV infrastructure in passenger car market.</li> </ul>

## 4.6.2. Market insights

### Low-energy, high-torque applications

According to a report by WWF-SA (2018), electric tractors could replace 7 400 tractors within the horticulture industry by 2030, due to the lower overall lifetime cost of EVs compared to diesel-run equivalents. EVs are well-suited for the stop-start, low-speed activities on horticultural farms, especially citrus farms.

These benefits, alongside lower maintenance costs and reduction of diesel use, result in a payback period of less than six years (if the tractor is purchased upfront).

Moreover, EVs could have a broader appeal within other agricultural sectors, such as game farms, wine vineyards and other agritourism markets (WWF-SA 2018a).

### Significant capital investment

This opportunity, however, requires significant capital, not only in the purchasing of the tractors, but in investing in infrastructure such as charging ports and/or additional battery storage.

Battery storage, most notably Li-ion batteries, can drive up the price of EVs by over 60% compared to diesel-fuelled equivalents.

Additionally, farms using EVs must invest in charging stations that can cost up to R110 000 (including installation).

Farmers may also need to consider their source of electricity, and if they are willing to make additional investments in off-grid alternatives, like a solar PV system, to reap the further energy saving rewards.





# **FUNDING AND INCENTIVES**

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A range of general and sector-specific funding solutions and incentives is available to investors, manufacturers, and service companies in the green economy. It covers Development Finance Institutions (DFIs), local public and private sector financiers and investors, and a considerable range of tax incentives.

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South Africa ranks as one of the top 15 nations in the world in terms of driving the green growth agenda (ahead of Australia, Singapore, and Finland). This drive is on the back of a range of funding solutions and tax incentives available to green technology manufacturers and service companies, as well as those who use or procure such goods and services.

**The South African Climate Finance Landscape looks at detailed project-level data, understanding in detail the source, disbursement, instrument and use.** The insights can support public and private role-players with information to shape sectoral strategies and selected policies and improve coherence and coordination between public and private level spending in the sectors. The South African Climate Finance Landscape has tracked R62.2 billion in annual climate finance invested in SA. Find out more here.

## 5.1. General database web page

The GreenCape Finance Desk hosts a web page with a number of Green Finance resources that cover funding and incentives available to companies operating in the green economy. A few of the available database are highlighted below.

The Green Finance Desk (GFD) primarily acts as a facilitator in the financing of green projects and green business. The GFD works across all sector desks at GreenCape. For more support please visit <https://www.greencape.co.za/content/sector/green-finance>

ACCESS TO THE SOUTH  
AFRICAN CLIMATE  
FINANCE LANDSCAPE

### 5.1.1. Green Finance Database

In conjunction with the Western Government Department of Economic Development and Tourism, GreenCape maintains a database of funding sources and incentives that may be relevant to green economy investors. The database contains information on more than 150 funding opportunities, including an overview of the opportunity and relevant contact details and links. It is ideal for any entity seeking a broad range of funding solutions and financial incentives, with South African institutions being the main source of opportunities. The database is available to view and download online<sup>1</sup>.

### 5.1.2. Government funding and incentives database

An updated document focused on South African government funding and incentives is available to view and download online<sup>2</sup>. These incentives cover local manufacturing, critical infrastructure grants, small enterprise development and a diverse set of sector specific incentives (i.e. Aquaculture Development and Enhancement Programme).

<sup>1</sup> <https://www.green-cape.co.za/content/focusarea/green-finance-databases>

<sup>2</sup> <https://www.greencape.co.za/assets/Uploads/Government-Funding-and-Incentive-Booklet.pdf>

### 5.1.3. Finfind database

Finfind<sup>3</sup> is an innovative online finance solution that brings together SMME finance providers and finance seekers. With a focus on finance readiness, Finfind has more than 200 lenders and over 350 loan products available to SMEs. The database is ideal for South African SMMEs who are seeking funding and/or business advisory services, and those who want to improve their understanding of finance.

Wesgro has partnered with Finfind to assist local companies seeking finance for their business. See more here: <https://wesgro.finfind.co.za/quiz/disclaimer/wesgro>

### 5.1.4. AlliedCrowds database

AlliedCrowds<sup>4</sup> is the first complete aggregator and directory of alternative finance providers in the developing world. Sign-up is free and allows users to access a global database where one can filter for sector (including greentech, agriculture and social impact), type of capital (equity, lending, grant), and type of funding (crowdfunding, angel investing, venture capital, impact investing). In addition:

- Themed databases around the Sustainable Development Goals (SDGs) and the World Green Economy Organisation (WGEO) are available.

- Reports, including a number specifically about African funding sources, can also be downloaded for free.
- Businesses / organisations can also contact Allied Crowds to create a customised funding database. This resource is ideal for any entity seeking a broad range of financial solutions on a global scale.

Click the buttons below to access the relevant content

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GREEN FINANCE  
DATABASE

GOVERNMENT FUNDING  
AND INCENTIVE BOOKLET

FINFIND WEBSITE

ALLIED CROWDS  
WEBSITE

<sup>3</sup> <https://www.finfindeasy.co.za/>

<sup>4</sup> <https://alliedcrowds.com/>



# **THE WESTERN CAPE: AFRICA'S GREENTECH HUB**

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The Western Cape is a world-class investment destination.

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The province provides businesses and investors with prime locations, modern infrastructure, a skilled workforce, low operational costs and an abundance of natural resources. It is also a sought-after place to live, with unrivalled natural beauty, vibrant culture, excellent schools and universities, and an outstanding quality of life.

In 2017, Cape Town was ranked among the top 21 global investment destinations by Foreign Direct Investment (fDi) Intelligence, a division of the Financial Times.

### A great place for green business

There are compelling reasons why the Western Cape Province is viewed by many as Africa's green economy hub. Coupled with a strong and rapidly growing market for green technology and services in South Africa and beyond, the Western Cape offers:

- Africa's renewable energy and cleantech hub, with a critical mass of leading companies present.
- Local presence of major professional services and financiers.
- Significant market opportunities for businesses and investors in agriculture, energy services, utility scale solar and wind, waste, water, bioeconomy and resource efficiency.
- A supportive government that has made ease of doing business and the green economy key priorities.
- Five universities with comprehensive R&D capabilities and dedicated green economy skills programmes.
- A range of investment incentives in the Atlantis Special Economic Zone (SEZ) for Green Technologies.

### Supporting businesses and investors

The province also offers dedicated support for businesses and investors focusing on greentech and services, including:

#### **Western Cape Department of Economic Development & Tourism:**

Driving the green economy policy landscape in the Province.

**InvestSA One Stop Shop:** Offers convenient investor support on permits, licensing and registrations - all under one roof.

#### **City of Cape Town Enterprise and Investment:**

Creates an enabling environment to attract investment that generates economic growth and job creation in Cape Town

**GreenCape:** Provides dedicated support and market intelligence to green economy sectors.

**Wesgro:** The official investment and trade promotion agency for the Western Cape.

**SAREBI:** A business incubator providing nonfinancial support to green entrepreneurs.

**SARETEC:** Offers specialised industry-related and accredited training for the wind and solar industries.

### Market opportunities in the province and South Africa

Some of the major market opportunity areas in the province and South Africa in the next five years are outlined in the graphic on the next page (see individual MIRs and the GreenCape website for more information).

### R&D capabilities and skills

The region's five universities – University of Cape Town, Stellenbosch University, University of the Western Cape, the Cape Peninsula University of Technology and the George campus of the Nelson Mandela Metropolitan University – underpin all of this with comprehensive research and development (R&D) capabilities and dedicated green economy skills programmes.

## ATLANTIS SPECIAL ECONOMIC ZONE FOR GREEN TECHNOLOGIES

The Atlantis SEZ is a zone dedicated to the manufacturing and provision of services in the green technology space - technologies that reduce or reverse the impact of people on the planet. Wind turbines, solar panels, insulation, biofuels, electric vehicles, materials recycling and green building materials are all examples of green technologies that will be welcomed to the zone.

The zone welcomes manufacturers, service providers, suppliers and other players in the value chains of different green technologies. The SEZ is situated in the Atlantis industrial area north of Cape Town, south of Wesfleur, east of Dassenberg Road, and west of the Witsand community.

## Why invest in the Atlantis SEZ?

**There are strong and growing South African and African markets for greentech.** The South African greentech manufacturing market is worth at least R30bn; with a growing greentech market in the neighbouring countries. South Africa has opportunities in energy, waste, agriculture, transport and other sectors and is a great entry point for the whole of Africa, in particular the SADC region.

**Atlantis is a great location and development ready.** 94 hectares of zoned development-ready land is available for leasing to investors. Bulk infrastructure is in place and Atlantis has new public transport and shipping links, whilst boasting fibre connectivity too. Atlantis is also close to major ports, roads, universities and greentech markets.

**Investors have access to extensive investment support** through the One Stop Shop for investor support and the rest of the investor support ecosystem, which includes InvestSA, GreenCape, the City of Cape Town, and Wesgro. Together the ecosystem provides information and advocacy; market intelligence; facilitated access to permits and licenses, planning and development approval; and skills training.

**Investors and tenants are accessing attractive incentives** in the form of tax relief and allowances, employment tax incentives, fast-tracked development approvals, fee exemptions and subsidies.

**There is an attractive, wide-ranging skills base to recruit from** with 5 universities and many more colleges in the province, and a large range of unskilled, semi-skilled, technical and professional candidates.

FOR MORE INFO, CLICK TO EMAIL THE ATLANTIS SEZ BUSINESS DEVELOPMENT EXECUTIVE



CLICK TO VIEW THE ATLANTIS SEZ WEBSITE

VISIT THE GREENAGRI PORTAL



# GREENCAPE'S SUPPORT TO BUSINESSES AND INVESTORS

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GreenCape is a non-profit organisation that works at the interface of business, government and academia to identify and remove barriers to economically viable green economy infrastructure solutions. Our vision is a thriving prosperous Africa, mobilised by the green economy

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GreenCape is a non-profit organisation that works at the interface of business, government and academia to identify and remove barriers to economically viable green economy infrastructure solutions. Our vision is a thriving prosperous Africa, mobilised by the green economy

Working in developing countries, GreenCape catalyses the replication and large-scale uptake of green economy solutions to enable each country and its citizens to prosper. We work with businesses, investors, academia and government to help unlock the investment and employment potential of greentech and services, and to support a transition to a resilient green economy.

We assist businesses by removing barriers to their establishment and growth and provide our members with:

- free, credible and impartial market information and insights
- access to networks of key players in government, industry, finance and academia
- an advocacy platform to help create an enabling policy and regulatory environment for green business

We assist local, provincial and national government to build a resilient green economy by providing:

- support on the development of standards, regulations, tools and policies
- expert technical knowledge on key sectors in the green economy
- access to networks of key players across business, academia, and internationally

Since inception in 2010, GreenCape has grown to a multi-disciplinary team of over 40 staff members, representing backgrounds in finance, engineering, environmental science and economics.

Our market intelligence reports form part of a working body of information generated by sector desks and projects within GreenCape's three main programmes – energy, circular economy and resources.

### Benefits of becoming a GreenCape member

We currently have over 2 500 members, and offer free membership. Becoming a member of GreenCape will give you access to the latest information regarding developments in the various sectors; access to tools, reports, and project information; and offer you the opportunity – through our networking events – to meet and interact with various stakeholders in the green economy.



We have facilitated and supported ~R42bn of investments in renewable energy projects and manufacturing. From these investments, more than 19 000 jobs have been created.

Through our WISP (industrial symbiosis) programme, by connecting businesses with waste / under-used resources:



**435 000 fossil GHG emissions** saved (equivalent to the electrical usage of 117 840 households in SA);



**Over R150 million in financial benefits** (additional revenue, cost savings and private investments);



**398 economy wide jobs.**





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