



Sustainable Agriculture

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2019

Market Intelligence Report

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GreenCape

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. Working in developing countries, GreenCape catalyses the replication and large-scale uptake of these solutions to enable each country and its citizens to prosper.

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18 Roeland Street, Cape Town, 8001, South Africa

Authors: Inge Kuschke and Adila Cassim
Editorial and review: Cathy Pineo, Salomé Bronkhorst and Nicholas Fordyce
Images: GreenCape, Western Cape Department of Agriculture and Catherine Pineo
Layout and design: Tamlin Lockhart Art Direction

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List of acronyms and abbreviations

Agtech	Agricultural technology
APAP	Agricultural Policy and Action Plan
CA	Conservation Agriculture
CO ₂ eq	Carbon Dioxide Equivalent
CSA	Climate Smart Agriculture
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DWS	Department of Water and Sanitation
FAO	Food and Agriculture Organisation
GDP	Gross Domestic Product
GFT	Gravel-Flow Technique
GHG	Greenhouse Gas
Ha	Hectare
ICT	Information and Communications Technology
IGDP	Integrated Growth and Development Plan
IRP	Integrated Resource Plan
kWh	Kilowatt hour
LRAD	Land Redistribution for Agricultural Development
MWp	Megawatt peak
NDC	Nationally Determined Contribution
NDP	National Development Plan
NEMA	National Environmental Management Act
NGP	New Growth Path
PA	Precision agriculture
PLAS	Proactive Land Acquisition Strategy
ROC	Remote Operating Certificate
RPAS	Remotely Piloted Aircraft Systems
SA	South Africa
SN	Shade netting
SPLAG	Settlement Production Land Acquisition Grant
SSEG	Small-scale embedded generation
UF	Undercover farming
UN	United Nations
WC	Western Cape
WCDoA	Western Cape Department of Agriculture
WCWSS	Western Cape Water Supply System
WMA	Water Management Area
WUA	Water Use Association
WWF	Worldwide Fund for Nature

Exchange rate used

1 USD = R13.20 (avg Jan – Nov 2018)

Executive summary

The South African and Western Cape agriculture sectors offer numerous opportunities for investors, agricultural and green technology manufacturers, service providers, distributors, and others in the value chain.

Although agriculture contributes a relatively small share (2.5%) to the total gross domestic product (GDP) in South Africa (SA), it is important in providing employment and earning foreign exchange. When taking into account the whole agricultural value chain, the sector is estimated to contribute about 12% to the national GDP.

Water scarcity due to drought, declining rainfall and/or an over demand for water, is the key driver for the uptake of agricultural technology (agtech) in SA. SA is ranked as the 30th driest country in the world, making water a key constraint to agricultural development.

The Western Cape (WC) province of SA experienced one of the worst droughts on record from 2014/15 to 2017/18, which resulted in water restrictions and large economic losses. Despite this, there has been an expansion in land use under high-value export crops. In the Western Cape, from 2013 to 2017, there was growth in the production areas of citrus (35%), berries (33%), sub-tropical fruits (21%), and nuts (79%).

This is an important trend, particularly when coupled with growing water scarcity. International market pressure for low carbon, environmentally-friendly products is an increasingly important driver for the uptake of practices and technologies that also reduce the use of chemical inputs and carbon dioxide emissions.

Given this shift, there are emerging investment opportunities in: **remote sensing technologies** for precision agriculture applications (driven specifically to improve water efficiency and climate adaptation); **undercover farming (UF)**, which includes low-tech infrastructure such as shade netting and higher-tech controlled environment agriculture systems; and well-established investment opportunities in **renewable energy (RE) and conservation agriculture**.

- **Remote sensing applications for precision agriculture:** There are emerging opportunities

for companies offering bespoke services in aerial-data analytics for farmers. The current conservative market estimate (from revenue from bespoke services for one company) is R11 million per season for two commodities (macadamias and citrus). The estimated potential value of bespoke services, based on hectares under high-value export fruit production is R131 million. There are further opportunities for software developers, and manufacturers and sellers of remote sensing hardware.

Although this is an emerging opportunity in SA, there has been significant uptake overseas. The global agriculture drones market for remote-sensing tech and services was ~USD 670 million (R8.8 billion) in 2015, and it is predicted to grow at a compound annual growth rate (CAGR) of 18.5% to 38% from 2018 to 2023.

- **Undercover farming (UF):** There has been rapid market growth in low-tech UF infrastructure, with a 171% increase in production area under shade netting and a 55% increase in tunnel structures recorded in the WC over the last five years. The potential market for low-tech UF is estimated at R38 billion in SA, with R1.4 billion in the WC. The market for medium- to high-tech systems (e.g. hydroponics and indoor farming) is worth more than ~R1 billion in SA. UF provides numerous opportunities for suppliers and manufacturers of UF components, as well as consultants, especially in high-tech UF.
- **Energy:** The market for RE in agriculture in SA is estimated to be 60 MW — a market of between R630 million and R960 million.
- **Conservation agriculture (CA):** Between 15% and 20% of commercial grain farmers and 5% of smallholder farmers have adopted conservation agriculture practices; thus there is considerable scope for scale-up and market growth of

associated equipment and services. The WC has the highest adoption of CA with ~70% of grain farmers practising reduced tillage. The main agtech opportunity in CA is the manufacturing and sale of no-till machinery, which is mostly imported into SA. The estimated market size for no-till machinery in SA ranges from R136 million to R747 million.

The main drivers of these opportunities are:

- **Rising input costs** for energy (particularly electricity and diesel), fertiliser and pesticides.
- **Increasing awareness** of available sustainable practices and technologies, as well as their benefits.
- **Climate change**, forcing the sector to adopt more sustainable practices to increase its resilience. Climate change also exacerbates water scarcity through increasing evaporation and occurrences of droughts.
- **Detrimental environmental effects** associated with conventional (i.e. traditional) inputs and practices, specifically pollution and soil degradation, leading to lower production yields, loss of arable land and reduced resilience.
- **Decreasing costs** of greentech, such as solar panels.
- **Scarce natural resources** (particularly arable land and water) that are primarily affected by climate and farming practices.



What's new?

This 2019 Sustainable Agriculture Market Intelligence Report (MIR) discusses the **economic impacts of external factors** on the sector, particularly the Western Cape drought (2015 – 2018). The drought, characterised by significant decreases in rainfall over three years, again emphasised that water is a key constraint to agricultural development. The report further highlights that **water scarcity** (through drought, declining rainfall, and over-demand) is one of the biggest drivers for investment in sustainable agricultural technology and practices.

The MIR further investigates flyover data obtained from the Western Cape Department of Agriculture (WCDa) to identify **trends in production and infrastructure investment from 2013 to 2018**. Key developments discussed include the growth in production area for:

- high-value export crops such as berries, fruits and nuts; and
- undercover farming.

The **growth in UF** interlinks with the expansion of production for high-value fruit and an increasing demand for sustainable solutions to comply with export market regulations and consumer preferences.

The MIR also discusses the **market growth for remote-sensing applications** (drone and satellite imagery) in precision agriculture in SA, as well as updates on key sustainability opportunities in the sector, namely RE and conservation agriculture.

For new readers, we advise that you first read the 2017 and 2018 Agriculture MIRs for an in-depth understanding of the opportunity areas.

1

Introduction and purpose

This MIR has been compiled by GreenCape's Agriculture Sector Desk. It highlights opportunities for greening agriculture production and is written for investors – particularly new entrants to South Africa or the sustainable agriculture sector.

GreenCape partnered with the WCDoA in 2014 to support the development of sustainable and competitive agricultural value chains. This is achieved in part through the uptake of agricultural technology (agtech¹) and sustainable production practices, and has been driven by raising awareness of the benefits of agtech uptake (i.e. driving demand within agriculture) and highlighting opportunities for agtech manufacturers and service providers (i.e. supporting supply to agriculture).

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, and reducing negative impacts such as soil degradation and pollution;
- increase resilience to climate change; and
- have the potential to attract international investment.

The main focus is on remote-sensing applications for precision agriculture (PA) and UF. Updates are also provided for two areas explored in detail in the 2018 MIR: RE and conservation agriculture.

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 and key players. 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 +27 21 811 0250 by email at agri@greencape.co.za.

¹ Agtech is the use of technology for farming that is developed to improve efficiency and profitability.



2

Sector overview

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

2.1. Physical geography and climate

South Africa has a wide range of agro-climatic regions as shown in Figure 1 (FAO 2010). Climatic regions include Mediterranean, subtropical and semi-desert, enabling the production of a wide range of agricultural commodities.

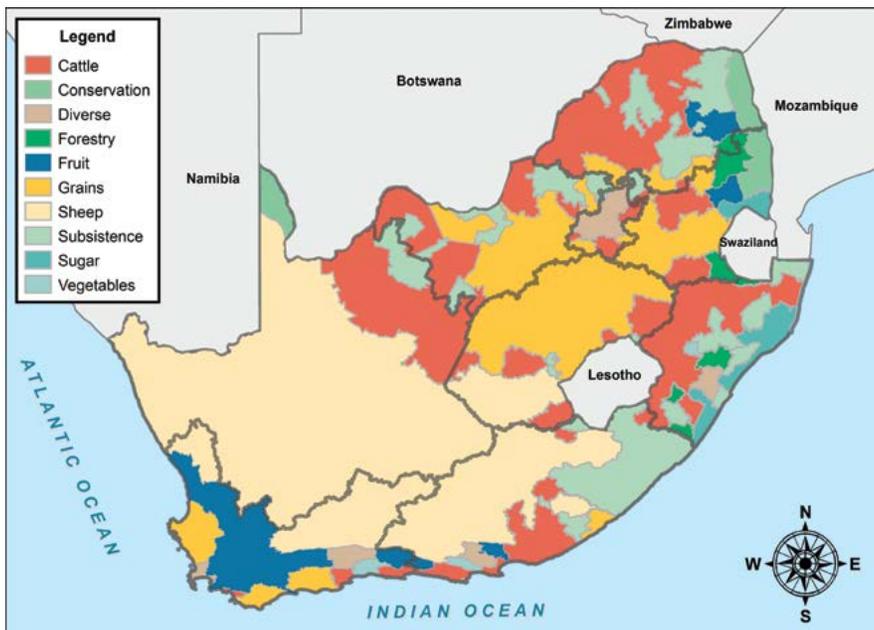


Figure 1: South African agricultural regions

2.1.1. Western Cape agriculture

Fruit dominates agricultural production in the WC (see Figure 2), of which a large percentage is considered high value and destined for export markets. The WCDoA's Flyover Project, which serves as a regional agricultural census, shows a clear trend toward the increased production of high-value export crops from 2013/14 to 2017/18. Growth in production area can be seen for citrus (35%), berries (33%), sub-tropical fruits (21%), and nuts (79%).

There has been an exponential rise in the WC in the production of high-value crops between 2013 and 2018, in citrus, berries, tropical fruits, and nuts.

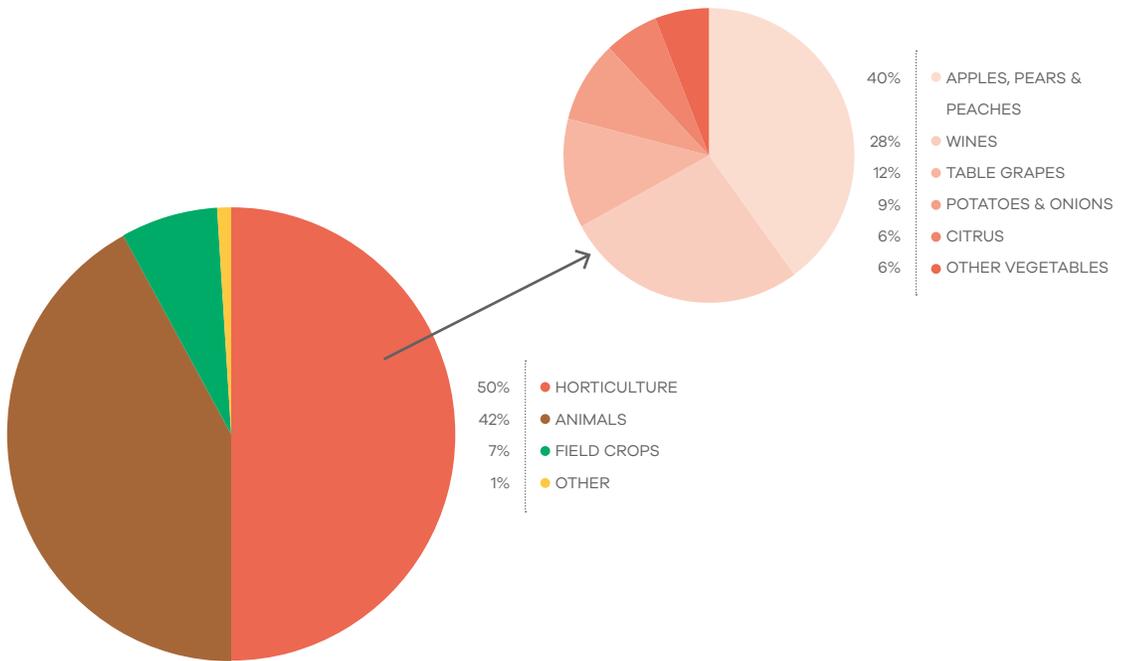


Figure 2: Proportion of agricultural commodities produced in the Western Cape

This is an important trend in terms of sustainable agriculture, as international market pressure for low-carbon, environmentally-friendly products is an increasingly important driver for the uptake of practices and technologies that reduce the use of chemicals, and a product's carbon and water footprint. Technologies and practices to achieve this are discussed in detail in [Section 4](#) of this report.

2.2. Overview of the agricultural economy

This section provides an overview of the agricultural economy in SA and the WC, with a focus on the sector's economic contribution, export trends, and the effect of the recent drought on agricultural output.

2.2.1. South African agriculture

South Africa is a semi-arid country, ranked as the 30th driest country in world, making water a key constraint to agricultural development. Water scarcity (drought, declining rainfall and over-demand for water) is one of the biggest drivers for investment in sustainable practices and agtech. Water scarcity as a driver is discussed in [Section 2.4](#).

Agriculture contributes a relatively small share to the total GDP (2.5%), but is important in providing employment and earning foreign exchange. However, when taking into account the whole agricultural value chain, the sector is estimated to contribute about 12% of the national GDP (DAFF 2013).

The agriculture sector has been affected by various external factors, predominantly adverse climatic conditions, putting pressure on its output performance. [Figure 3](#) (StatsSA 2018) shows quarterly performance of the agricultural sector over the past three years. Drought conditions in 2015 across all major grain-producing areas in the country affected the sector's output, as shown in the figure. This national drought was

Water scarcity due to drought, declining rainfall and over-demand for water is one of the biggest drivers for investment in sustainable practices and agtech.

followed by one of the worst droughts on record in the WC, lasting three years.

As shown in Figure 3, agricultural GDP in SA recovered as summer rainfall production areas recovered from drought in the 2016/17 season, but

again contracted in the first and second quarter of 2018. This was the result of significant losses due to the WC drought in the 2017/18 season, hail damage in Mpumalanga, and a delayed harvest in the summer-crop growing areas due to the late start to the season.

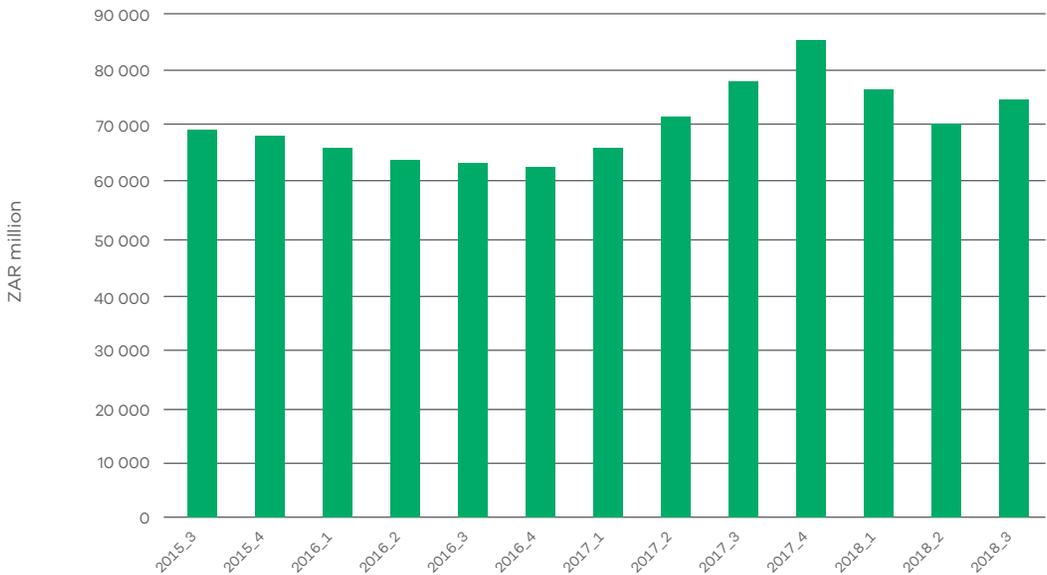


Figure 3: South African GDP from agriculture (ZAR million per quarter)

The agriculture sector was the main contributor to overall GDP decline for SA in the second quarter of 2018, where agriculture output shrank by 22.2% and decreased GDP by 0.08 percentage points. The decline in agriculture’s contribution may have been larger considering the wider value chain, as agriculture is interconnected with the rest of the economy. A large portion of agricultural output is used as intermediary productions in other sectors, e.g. food and beverages. The sector bounced back in the third quarter and recorded a 6.5% rise. The South African GDP as a whole also showed growth of 2.2% in this quarter.

The persistent drought conditions over the past several years have highlighted the need for increased resource efficiency, especially for relevant water efficiency technologies that are cost-effective. This is important as:

- climate change models predict that **extreme weather** events such as droughts and floods will occur more frequently in the future;

“Higher air temperatures and lower rainfall will have a huge negative impact on the sustainability of viticulture, particularly in terms of water supply. The dilemma will be aggravated if lower rainfall reduces the available irrigation resources. Furthermore, climate change will most probably result in reduced irrigation water allocations and increased water tariffs.” Myburgh, 2018.

- climate change will lead to a **drier climate** in the winter rainfall region; and
- **population increase** will lead to increased competition for water resources.

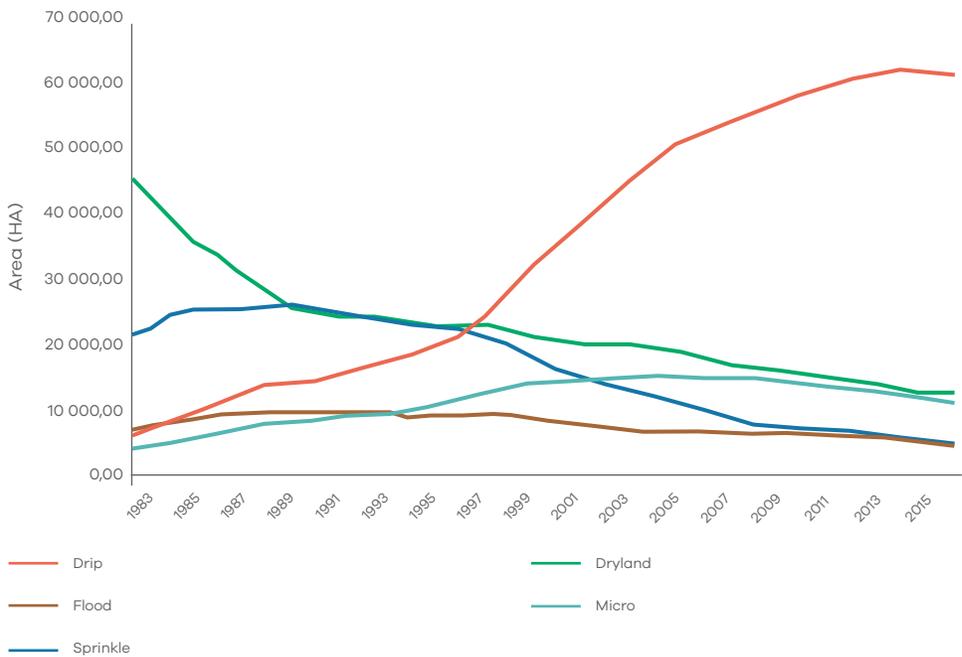


Figure 4: Change in irrigation system for wine production in South Africa

Agriculture will need to adapt to this ‘new normal’ and is increasingly investing in water-efficient technologies. Figure 4 (SAWIS 2018), for instance, shows an increase in the uptake of more resource-efficient technologies over time, specifically drip irrigation, a system that uses less water than other systems by applying water directly to the root zone of the plant. It also provides water at slower rates than other systems, minimising evaporation losses.

Investing in water-efficient agtech has various benefits, including:

- Decreasing energy inputs:** On irrigated farms, energy costs are high because of the energy used to pump irrigation water. With rising energy costs in SA, investing in water-efficient technology is important for the financial sustainability of farms. Furthermore, it decreases the farms’ CO₂ emissions, which are expected to play a significant role in export markets and carbon taxes.
- Decreasing the farmer’s risk related to water uncertainty.** Population increases and climate change mean increased competition for water resources. Water trade-offs are becoming more customary, making water allocation to the agricultural sector increasingly uncertain.

- Improving water efficiency:** This in turn addresses the detrimental effects of over-irrigation such as increased salinity and topsoil losses.

2.2.2. Western Cape agriculture

The Western Cape agricultural sector operates in a unique climate compared to the rest of the country. This Mediterranean winter-rainfall region produces fruits and wines that are mainly destined for export markets. The province’s agricultural value contributes 23% to SA’s total agricultural GDP.

Agricultural value chains play a significant role in contributing to the provincial economy by generating foreign reserve income and employment. Although the WC agricultural sector’s contribution to the WC economy is ~4%,

The fastest growing export sector in 2017 in the Western Cape was agriculture, increasing by 15.2% from 2016.

when including upstream and downstream linkages it increases to ~9.4% (Quantec, 2017).

Agriculture and agro-processing are responsible for 18% of all formal employment opportunities in the province. The WC dominates much of SA's agricultural export production by providing high-value products such as wine grapes and fruit (e.g. apples). The fastest growing export

sector in 2017 in the Western Cape was agriculture, increasing by 15.2% compared to 2016.

Figure 5 (Quantec 2018) shows the export value and growth of key commodities from the Western Cape. This growth coincides with increases in the production of high-value commodities discussed earlier.

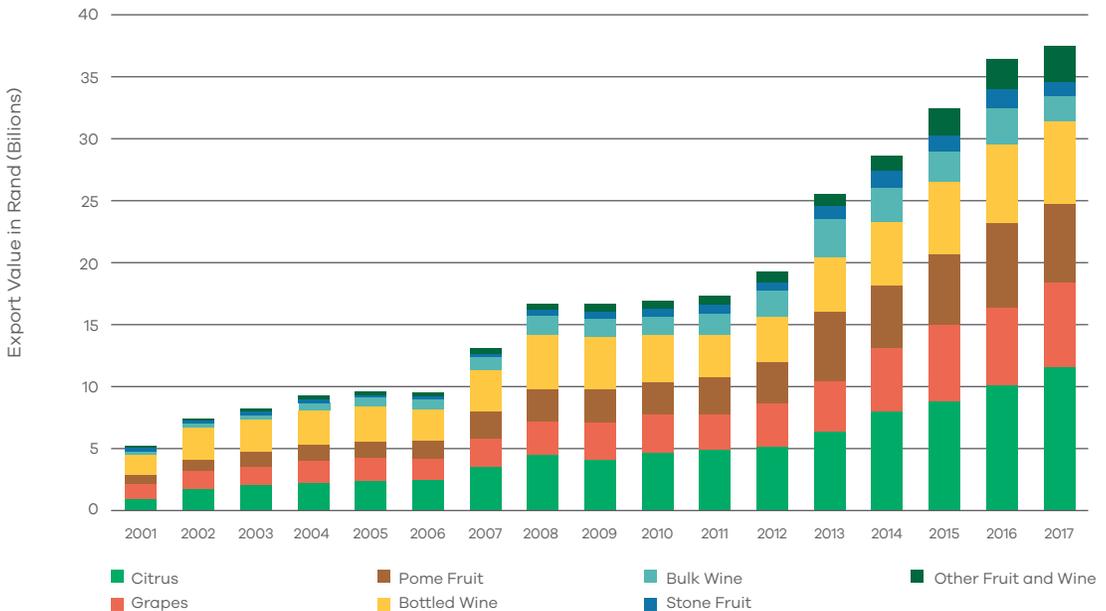


Figure 5: Fruit and wine value of exports in the Western Cape

Western Cape drought

The WC is recovering from a severe drought, with the winter rainfall season of 2017 delivering the lowest rainfall since 1933. The drought in 2017/18 resulted in overall agriculture losses of R5.9 billion and 30 000 jobs.

However, water systems are showing signs of recovery after better rainfall in 2018. WC dam levels were 64.1% at the end of the 2018 hydrological cycle (31 October) compared to 35% the previous year. Furthermore, the Department of Water and Sanitation (DWS) announced that it would decrease agriculture water restrictions from 60% to 10% in the Western Cape Water Supply System (WCWSS) at the end of November 2018.

Despite this, water scarcity will continue to drive the uptake of agtech, especially as:

- it is estimated that rainfall in the WC will decrease by 30% by 2050; and
- the WC population is predicted to rise by 30% over the next 15 years, which will increase pressure on water resources (Roux 2018).

For more information on the water sector, see GreenCape's 2019 Water MIR. For detailed analysis of production areas and climate change trends in the WC, see [SmartAgri's publications](#).

2.3. Key players

As shown in Table 1, key players in the agriculture sector can be divided into six broad categories: producers, research/academia, input suppliers, technology suppliers, industry associations and labour organisations. SA's national Department of Agriculture, Forestry and Fisheries (DAFF), governs the whole industry.

- **Producers/farmers** produce commodities and in most cases do their own harvesting, storage, and transport.
- **Research institutions** like universities investigate all aspects of the value chain.
- **Input suppliers** produce inputs such as fertiliser, seeds, pesticides, packaging, and machinery. Suppliers of green technology such as conservation agriculture equipment, and solar PV manufacturers also belong to this category.

- **Technology suppliers** are found across the value chain, from inputs, production, harvesting processing, logistics, and waste processing (bio-digesters and composters).
- **Industry associations** are involved in all aspects of the value chain. They support farmers and provide them with relevant and reliable information regarding regulations, logistics, cultivar development, etc. They also do or support research in various fields, including soil, water, production practices and cultivars.
- **Labour organisations** provide support for employees in the agricultural sector by assisting them in attaining the best possible financial and social position in all employment positions along the entire value chain.

Table 1 shows a simplified value chain with key role players involved.

Table 1: Key role players in agriculture

R&D	Inputs	Production	Harvesting	Storage	Transport	Processing	Wholesale, retail & exports	Waste
Government								
Producer								
Research institutions								
Input suppliers								
Technology suppliers								
Industry associations								
Labour organisations								

Key role-players for various agtech opportunities will be discussed in detail in Section 4.

2.4. Drivers of sustainable technologies and approaches in agriculture

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

- **Rising input costs** for energy (particularly electricity and diesel), fertiliser and pesticides.
- **Scarce natural resources** (particularly arable land and water) that are primarily affected by climate and farming practices.
- **Detrimental environmental effects** associated with conventional (i.e. traditional) inputs and practices, specifically pollution and soil degradation, leading to lower production yields, loss of arable land, and reduced resilience.
- **Climate change**, forcing the sector to adopt more sustainable practices to increase its resilience. Climate change also exacerbates water scarcity through increasing evaporation and occurrences of droughts.
- **Market pressure** through increasing consumer demand for sustainable products driving stricter regulations, particularly for chemical usage.
- **Decreasing costs** of cleantech such as solar panels.
- **Increasing awareness** of available sustainable practices and technologies, as well as their benefits.

These drivers are discussed in more detail in the [2017 Agricultural MIR²](#).



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² <https://bit.ly/2QvQu5X>



3

Policies and regulations

South Africa has an extensive and robust range of policies and regulations governing the country’s agricultural sector.

The agricultural policy framework endeavours to create a sustainable agriculture sector that is dynamic in regulatory approach for a greener economy.

3.1. South Africa’s agricultural policies and regulations

The Department of Agriculture, Forestry and Fisheries (DAFF) and the Department of Environmental Affairs (DEA) are national entities

responsible for overseeing and supporting the development of the agricultural sector in South Africa. Support by the DAFF and DEA is guided by the vision of a sustainable agricultural sector that addresses agricultural policy distortions of the past, with reformative policies that create an enabling agricultural sector for the future. South Africa’s agricultural sector is governed by a suite of key policies and legislation outlined in [Table 2](#) below.

Table 2: Key policies and legislation

Name of policy	Key objectives
The National Development Plan 2030 (NDP 2012)	<ul style="list-style-type: none"> ■ Elimination of poverty ■ Reduction of inequality ■ Highlighting the importance of agriculture to the green economy
The Strategic Plan for the Department of Agriculture, Forestry, and Fisheries (DAFF 2015)	<ul style="list-style-type: none"> ■ Provides an effective framework to address various challenges facing the sector ■ Sets targets for the departmental programmes from 2015/16 to 2019/20 ■ Focuses on advancing food security, job creation, economic growth and transformation of the sector through innovative, inclusive and sustainable policies, legislation and programmes
The Agriculture Integrated Growth and Development Plan (IGDP 2012)	<ul style="list-style-type: none"> ■ Plans to develop equitable, productive, competitive, profitable and sustainable agriculture, forestry and fisheries sectors ■ Emphasises that the sector needs to benefit all South Africans
The Agricultural Policy Action Plan (APAP 2014)	<ul style="list-style-type: none"> ■ A programmatic response to key policy documents, including the National Development Plan (NDP) and the New Growth Path (NGP)
The National Environmental Management Act 107 of 1998 (NEMA 1998)	<ul style="list-style-type: none"> ■ NEMA is the overarching legislative framework for environmental governance. Core values are reflected through the following principles: <ul style="list-style-type: none"> – Environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably – Development must be environmentally, socially and economically sustainable

A comprehensive list of key policies and regulations influencing the agricultural sector can be found on the GreenAgri portal under the Action Plans and Policies section³.

This section of the MIR provides an overview of policy updates and implications for agriculture in sectors and policy areas such as water, carbon tax, land reform, the Integrated Resource Plan, conservation agriculture, and climate smart agriculture.

3.2. Water

The regulatory landscape of the water sector in 2018 was predominantly influenced by the prolonged drought experienced across the country. The policy updates were characterised by the need for agricultural water users to subsequently reduce their water consumption, monitor their water usage, and comply with metering installation enforcements and reporting requirements specified by the National Department of Water and Sanitation (DWS).

3.2.1. Water policy updates for agriculture

There were two main updates within the water policy arena that influenced the agricultural sector:

General water use restrictions

In December 2017, the DWS introduced a 50% to 60% reduction measure on all agricultural water use within the Breede-Gouritz and Berg-Olifants Water Management Areas (WMA). In addition, the DWS implemented restrictions on releases from the Berg River, Voëlvlei and Theewaterskloof dams. By January 2018, the DWS declared that water restrictions would only be relaxed if the Western Cape Water Supply System (WCWSS) reached a total of 85% by 01 November 2018. By this date, the system had recovered in capacity by 73.64%. Therefore, in December 2018 the DWS decided to reduce but maintain water restrictions, which resulted in a 10% restriction for agricultural water usage.

Groundwater restrictions and water use measurement

During January 2018, the DWS curtailed groundwater abstraction rates within the Breede-Gouritz and Berg-Olifants WMAs by 60%

compared to the previous five years. All water users were instructed to install electronic water measurement devices to monitor water usage, storage and abstraction rates, and submit such records to the DWS on a weekly basis.

In some regions, the DWS restricted non-compliant farming irrigation boards with regard to the volume of groundwater they were allowed to abstract. In addition, the Western Cape Provincial Head was authorised to discontinue WCWSS dam releases to agricultural bulk water user associations, irrigation boards, or individual users under conditions of overconsumption. By February 2018, irrigation boards and water use associations (WUA) were likewise required to install water measuring devices to monitor water usage and submit measurement records to Provincial Heads of the DWS.

3.2.2. Water policy impacts and implications

Agricultural water users had to comply and adapt to the new sets of regulations issued by the DWS due to the severity of the drought, particularly within the WC. Although substantial restriction rates were enforced, agricultural users reduced their water usage, adapted to producing crops with higher return rates, and introduced water-efficiency technologies to monitor usage. A key element of accountability was evident from the DWS transferring decision-making directives to the Western Cape Provincial Head in controlling dam release rates, and in holding irrigation boards and WUAs responsible for water metering, monitoring and reporting.

3.2.3. Other water rights updates

Producers on the West Coast, an area hard hit by the WC drought, have won a landmark court case concerning water rights that will have consequences for SA agriculture.

The Western Cape High Court ruled on 26 October 2018 that it was lawful for the Lower Berg Irrigation Board to approve applications for the temporary transfer of water rights from one farm to another⁴. The transfer of water rights between farmers (with properties in the same vicinity) had always been allowed through irrigation boards prior to January 2018, when DWS notified irrigation boards that they no longer had the authority to do so. Many farmers,

³ <http://www.greenagri.org.za/>

⁴ Read more about the court case at <https://goo.gl/E7GKGF>

especially in times of drought, cannot function without water rights.

The effect of the judgment is that irrigation boards around the country will be empowered once more to take decisions regarding water use.

3.3. Carbon tax

The Carbon Tax Bill was tabled by the Minister of Finance before the National Assembly during the Medium Term Budget Policy Statement in November 2018. The Minister announced a postponement of the carbon tax implementation from 01 January 2019 to 01 June 2019. This amendment was determined through business and labour feedback obtained during hearings in 2018 convened by the Parliamentary Standing Committee on Finance. At the publication stage of this MIR, the State President is set to sign and promulgate the Bill.

Apart from the postponement of the carbon tax implementation date, the greenhouse gas (GHG) emission taxation phase measures remain in place. Agriculture, forestry (plantations and natural forests under 100 ha), and other land use and waste sectors will be exempt from direct GHG emission taxation during Phase 1 (2020 to 2022), but will be taxed indirectly for fuel and energy usage.

Agriculture, forestry, and other land use and waste sectors will be exempt from direct GHG emission taxation during Phase 1 (2020 to 2022), but will be taxed indirectly for fuel and energy usage.

Post-2022 emission taxation measures are somewhat uncertain. However, agriculture, forestry and other land use sectors exceeding emissions of 100 000 tonnes of carbon dioxide equivalent (CO₂eq) per year can expect to be taxed after Phase 1. Under this relatively high emission threshold, very few agricultural enterprises can expect to be taxed. Secondary tax implications will be experienced through other sectors bearing

association to agriculture, e.g. logistics and inputs.

Although implementation of the carbon tax bill is set to introduce a financial expense, the policy should incentivise the transition to climate smart agricultural practices as an alternative.

3.4. Integrated Resource Plan

In August 2018, the Minister of Energy published the draft Integrated Resource Plan 2018 for public comments. Interested persons and organisations were invited to submit written comments on the draft IRP to the Director-General of the Department of Energy within 60 days of the publication date, i.e. in the period September-October 2018, before a final version would be adopted by Cabinet. RE will be the key focus over the next decade, and plans to expand SA's nuclear capabilities are off the table for now.

Ultimately, a policy push for RE will be beneficial for greening SA agriculture.

For more information on this policy, please see GreenCape's Renewable Energy MIR⁵.

3.5. Land reform

South Africa adopted the White Paper on South African Land Policy in 1997 to address the historical discriminatory injustices in land dispossession during colonialism and apartheid, which transpired into inequalities in land ownership and land use. The White Paper was one of the earliest pieces of democratic legislation to emphasise the need for sustainable use of land. It also introduced the three fundamental components of land reform as restitution, redistribution, and tenure reform. Various policies have since been introduced by the State to support successful land reform transitions. These include the Land Redistribution for Agricultural Development (LRAD) programme, the Proactive Land Acquisition Strategy (PLAS), and the Settlement Production Land Acquisition Grant (SPLAG).

3.5.1. Land reform policy updates

There have been some key updates within the land reform policy arena during 2018:

Land expropriation and redistribution

In his State of the Nation Address of 2018, the President highlighted the need to accelerate the land redistribution programme in order to redress

⁵ <https://www.greencape.co.za/market-intelligence/>





historical land dispossession and enable availability of land for cultivation. The President also emphasised that the approach of land expropriation without compensation would be implemented in a manner that enhances agricultural production, improves food security, and unlocks access to land.

In an effort to determine the public sentiment on State-led land expropriation, the National Assembly and National Council of Provinces instructed the Joint Constitutional Review Committee (JCRC) to issue a public process of collective national input. By November 2018, the JCRC adopted the review process recommendations and put forth the proposal to Parliament. It was subsequently debated and adopted in December 2018 in favour of the report on land expropriation.

Empirical data for land reform strategies

DAFF, together with Statistics South Africa (StatsSA), launched a "Farmer Producer/Register Campaign" in September 2018 to gather more information on the country's smallholder farmers. It would assist government in measuring the progress of land reform by using the data to inform its strategies. The census would be conducted in two parts, focusing on commercial farmers in 2019 and smallholder farmers in 2020. The amount of R10 million has been invested in the census database.

Policy impacts and implications

Outcomes from the State of the Nation Address and National Assembly vote on land expropriation suggest that the government is committed to land reform and redress in line with the country's constitution. To date, reviewing Section 25 of the Constitution has followed due processes through inclusive, comprehensive, and consultative public procedures. Furthermore, initiatives to understand the agriculture sector through the likes of the DAFF Farmer Producer/Register Campaign will contribute to the government's goal of developing efficient interventional strategies and mechanisms for measuring the progress on land reform with empirical-based evidence and data. In addition, the Campaign incentivises farmers to register for the census as a prerequisite to qualifying for other agricultural benefits.

The South African Government has stated that commercial farms producing goods for the agro-food market will not fall under the land

expropriation policy. However, it is predicted that the policy will influence investor confidence in the sector.

3.6. Conservation agriculture updates

DAFF released the Draft Conservation Agriculture Policy for public comment in February 2018. The draft policy objective is to promote and establish ecologically and economically sustainable agricultural systems to increase food security. The draft policy is rooted in the notion that conventional farming systems are not sustainable, emphasising the need for more sustainable agricultural production systems. Such systems should focus on fostering synergies between agricultural production, conservation and enhancing rural livelihoods.

Conservation agriculture (CA) is correspondingly recommended as a sustainable and cost-effective agricultural system with emphasis placed on natural biological processes and reduced external input dependency for improved ecosystems. The draft policy recommends that government offer incentives to producers to adopt conservation agriculture measures, and that tax rebates are provided to manufacturers of conservation agriculture equipment.

3.6.1. Policy impacts and implications

There are several environmental benefits identified within the Draft Conservation Agriculture Policy. These include a reduction in GHG emissions, replenishment of soil organic matter, land rehabilitation through improved water filtration and subsequent improved groundwater quality and levels, increased agricultural production and lower production costs, and improved biological and ecosystem functioning. In practice, CA would undoubtedly favour both the environment and climate conditions.

3.7. Climate smart agriculture

3.7.1. Climate smart agriculture policy updates

During August 2018, the DAFF issued a Draft Climate Smart Agriculture Framework for public comment. The framework outlines the role of climate smart agriculture (CSA) practices in addressing climate change related vulnerabilities facing the agricultural sector. The importance of integrating mitigation and adaptation strategies into production systems and the need for resource investment in

indigenous knowledge systems are also highlighted.

3.7.2. Policy impacts and implications

The Draft Climate Smart Agriculture Framework is recommended to guide government, investors

and developmental partners in integrating CSA within projects and programmes. The framework encourages efficient natural resource use practices and promotes low carbon based developments to ensure resilience to climate and weather system shocks.



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4 Opportunities and barriers

Renewable energy and conservation agriculture solutions continue to offer opportunities for investors and businesses. Emerging opportunities with significant growth potential include technologies for precision and undercover agriculture. The main market drivers are climate adaptation and water risk mitigation.

This section starts by providing brief updates on agriculture-related market opportunities in renewable energy (RE) and conservation agriculture (CA). Opportunities are then addressed in more detail for:

- **precision agriculture**, in particular the growing demand for bespoke advisory services; and
- **undercover agriculture**, including the high growth opportunities related to low-tech systems, and emerging opportunities in medium-to-high tech systems.

These services have capitalised on the **emerging opportunities in software development and data analytics**, and add value to relatively mature technologies – specifically remote sensing technologies such as sensors, drones and satellite imaging.

These opportunities are mapped across different growth stages in the figure below.

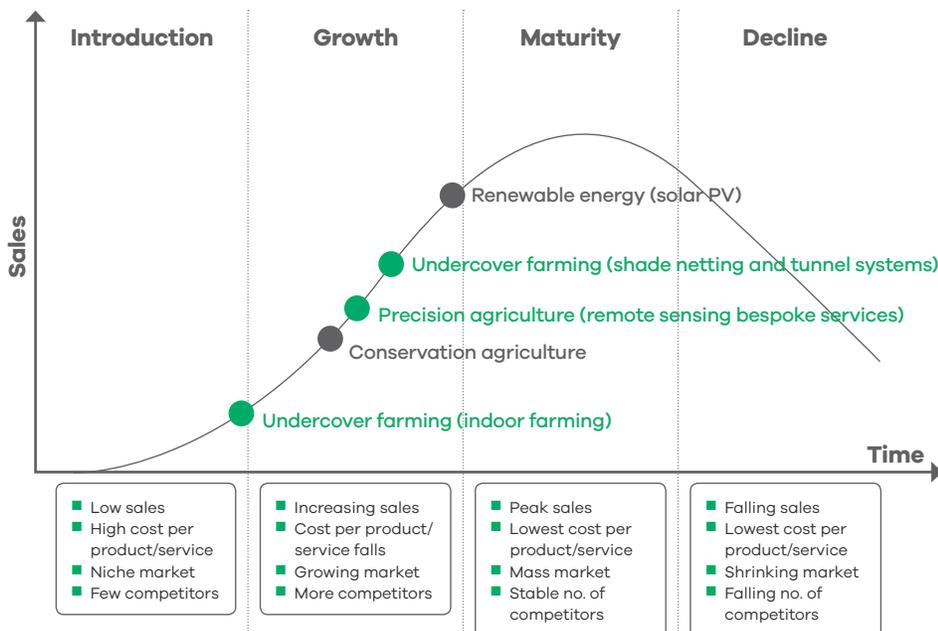


Figure 6: Opportunities highlighted in the 2019 Agricultural Market Intelligence Report

4.1. Market updates for 2019

This section provides market updates on the opportunities for RE and conservation agriculture (CA) within agriculture. For a more in-depth

analysis of these opportunities, including energy efficiency in agriculture, refer to the 2017 and 2018 Agriculture MIRs.

Table 3: Market update for renewable energy

Opportunity	Updated market size for agriculture ⁶	Developments and insights	Barriers to uptake
<p>The current opportunity driving the uptake of RE is the replacement of expensive grid electricity (Eskom) with relatively 'cheap' alternative energy, and the growing ability to connect and feed into the grid.</p> <p>There are specific solar PV opportunities for manufacturers and service providers, which include:</p> <ul style="list-style-type: none"> ■ manufacturing of components/products, ■ installation of systems ■ energy services (specifically performance-based electricity supply contracts) 	<ul style="list-style-type: none"> ■ SA: R630 – R960 million ■ WC: R94 – R144 million (see Figure 7) ■ The sector is predicted to grow at 10% annually. ■ 10% of all installations are in the agricultural sector. 	<ul style="list-style-type: none"> ■ According to PQRS data⁷, installed solar PV capacity for SA agriculture was 40 MWp in 2017. ■ An additional 20 MWp was installed in 2018 (i.e. total installations of 60 MWp for SA agriculture). ■ Three additional WC municipalities (and so 22/25 municipalities) allow small-scale embedded generation (SSEG tariffs when feeding into the grid). ■ Although many old farm buildings have asbestos roofing, which can weaken the business case for solar PV, agriculture exporters (who make up a large percentage of investors) are not allowed to have asbestos roofing in their facilities. 	<ul style="list-style-type: none"> ■ High capital cost (although technology prices are decreasing). ■ Scepticism and lack of understanding about what Energy Services Companies (ESCos) can offer through their funding models (see case study below).

⁶ Based on capital costs of R10 500 – R16 000 per kWh for solar PV (larger units become cheaper per unit of energy) and an industry-projected uptake of 10% per year.

⁷ PQRS was created to be a training, information and data platform with the intention of providing data for investors, suppliers, installers and industry bodies. Installed capacity has been collected from a combination of sources. A blend of three categories of installations are contained in the data: solar borehole pumps, government concession programmes / installations, and individually listed systems (both grid tied and off-grid).

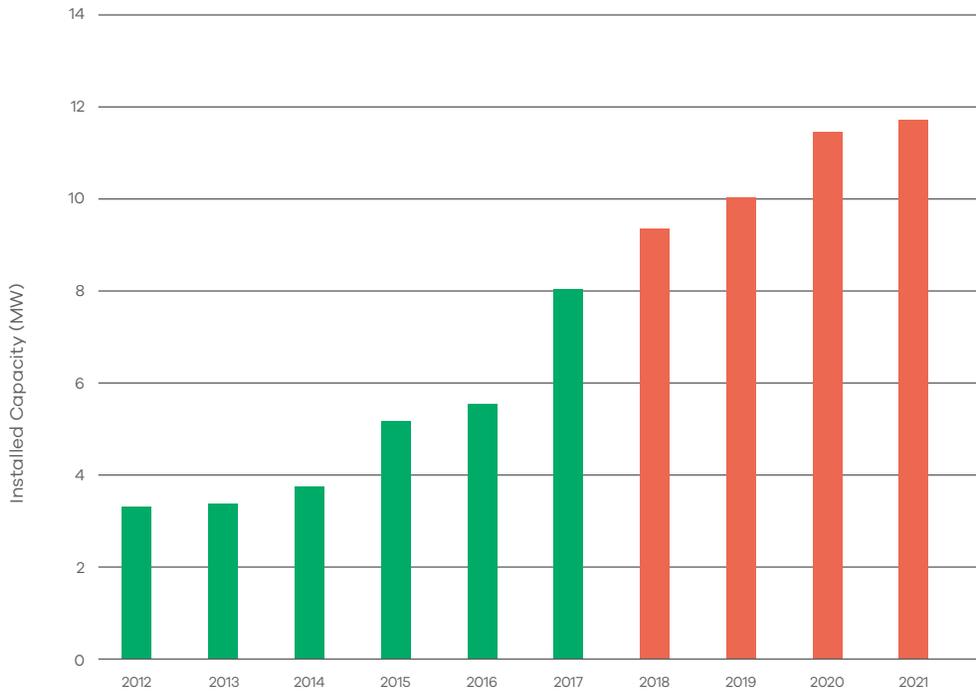


Figure 7: Solar PV currently installed in Western Cape agriculture (in green) and the predicted uptake (in red). GreenCape analysis (2018).



Case study: Solar PV investment in the South African fruit sector

New Southern Energy recently installed a state-of-the-art microgrid solution at Marlenique, a farm located just outside Franschhoek on the famous Route 45 in the Drakenstein Municipality. The farm produces export quality fruit and runs an award-winning wedding and function venue.

Due to rising energy prices and a high energy demand from its cold storage, irrigation and venue facilities, a microgrid system provided the best long-term solution for the farm. This decision was also made by taking into consideration the input costs, power reliability and sustainability as key contributing factors to the success of the business.

The solution includes:

- an internal AC reticulation upgrade and consolidation of connection points;
- the installation of a backup generator to run the internal grid in the event of power outages;
- a 534 kWp ground mounted solar system to supply RE through the day;
- a 60 kWp floating solar system for the farm's dam to supply RE through the day, as well as minimise land usage and reduce evaporation from the dam; and
- provision for infrastructure to allow for a battery system to be included during phase two to take the site completely off-grid.

The system has been fully operational since 1 February 2019, with the floating solar system being the first such commercially operational system to be installed in Sub-Saharan Africa.

The project was financed through Nedbank Agriculture. The savings from the system allow the farm to operate cash-flow positive from day one, while paying the asset off over 10 years. With a long-lasting lifespan, the benefits of the system will be passed on for generations to come.

© New Southern Energy



Table 4: Market update for conservation agriculture

Opportunity	Updated market size	Developments and insights	Barriers to uptake
<p>Conservation agriculture (CA) is a way of farming that aims to decrease input costs and improve yields through improving soil health.⁸</p> <p>The main agtech opportunity in CA is the manufacturing and sale of no-till machinery, which is mostly imported into SA. There are emerging opportunities for advisory service providers in cover crops, as it starts playing an important role in dryland crop production globally, especially in arid and semi-arid areas.</p>	<ul style="list-style-type: none"> ■ There is considerable scope to scale up CA: only 15% to 20% of commercial grain farmers and 5% of smallholder farmers in SA have adopted CA (WWF 2018). ■ The estimated market size for no-till machinery in SA ranges from R136 million to R747 million⁹. 	<ul style="list-style-type: none"> ■ The carbon sequestration impact of reduced tillage on 20% of SA's cultivated areas is ~1.2 million tonnes CO₂e (WWF 2018). Proving that CA practices sequester a significant amount of carbon, could strengthen the business case for farmers to convert to more sustainable practices as opportunities such as offsetting carbon credits arise. ■ The Department of Agriculture, Forestry and Fishing (DAFF) released a Draft Conservation Agriculture Policy¹⁰ in 2017, which identifies policy support measures to promote CA adoption, including financial incentives. ■ Two recent innovative finance instruments have the potential to support CA adoption in SA: <ul style="list-style-type: none"> – The Banking Association of South Africa and its commercial bank members are working with DAFF on a blended finance instrument that will include promoting natural resource management. – A recently approved European Investment Bank Credit Line to the Land Bank includes a portion of credit earmarked for climate-smart agriculture. 	<ul style="list-style-type: none"> ■ A lack of knowledge regarding the importance of implementing all three aspects of CA, namely minimum soil disturbance, permanent soil cover, and crop rotation ■ A lack of suitable planters for local conditions (e.g. rocky soils), especially in the WC. ■ A delay between investment and realisation of financial return through improved yields (relatively long return on investment of ~6 years). ■ The high capital cost of equipment. ■ Currently no supporting policy environment (although this is being addressed).

⁸ See 2017 Agriculture MIR for more detail, including definitions and evidence of uptake.

⁹ Assuming cost of machinery ranges from R400 000 to R2.2 million; 3.4 million ha under cereal production and average farm size of 2 113 ha.

¹⁰ Available at <https://goo.gl/VuJZCU>

4.2. Precision agriculture: Using remote sensing technologies for resource efficient farming

4.2.1. Overview

Precision agriculture (PA), also called ‘smart farming’, ‘satellite farming’ or ‘site-specific crop management’, enables producers to accurately apply inputs such as water, fertiliser and

pesticides through certain technologies. PA uses sensor technology, including satellites, drones (i.e. remotely piloted aircraft systems); and positioning technology (GPS) to rapidly gather data about a farm or crop. The data is then used to make more informed decisions that are tailored to a specific farm, part of a farm, and crop field. Figure 8 (USB 2018) below shows the different components used for PA.

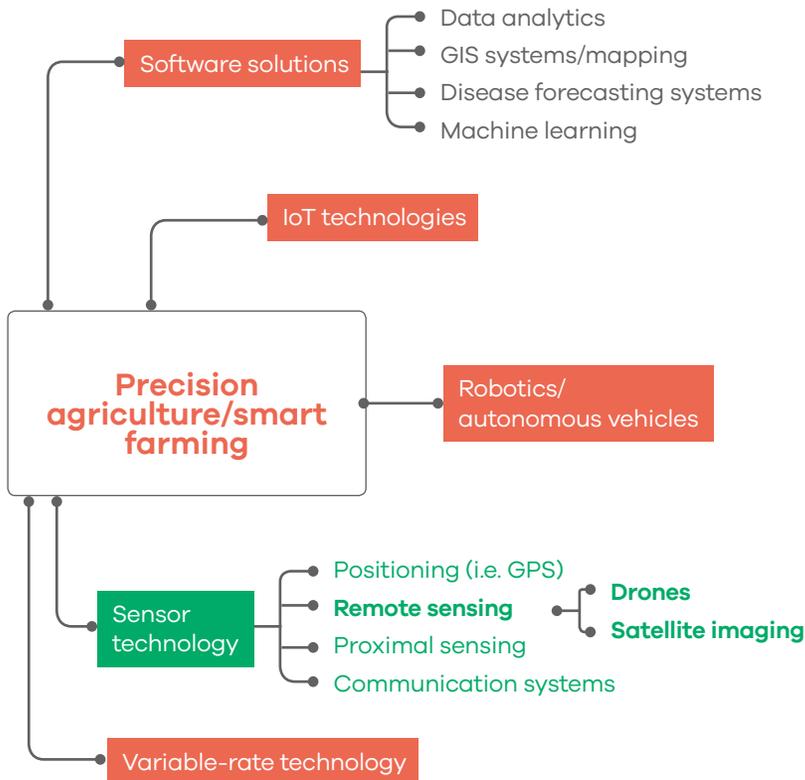


Figure 8: Aspects of precision agriculture and smart farming

This section focuses on the opportunities created for investors through the demand for remote sensing technologies that are used with software solutions, which communicate real-time information as actionable insights to a farmer.

- **Remote sensing technologies**, such as drones, can be equipped with multispectral cameras, which can help analyse plant health and act as an early warning system for farmers.
- For **software solutions**, algorithms take various variables into account to optimise input requirements. In the case of irrigation requirements, these typically include soil

moisture levels, crop factors and climatic variables to determine evapotranspiration.

The majority of South African players offer bespoke services to farmers through data analytics. Companies are usually made up of multi-disciplinary teams, from software developers to agronomists. They will typically use remote sensing hardware – a relatively mature technology in SA – on a contract basis.

For example, Aerobotics (an aerial-data analytics start-up company) usually hires a licensed

Remote Operator Certificate (ROC ¹¹) operator to do the physical flyover, while Aerobotics will analyse the imaging through their software. Drone operators must be registered and licensed when using drones for commercial processes. The registration process is reportedly too time-consuming and expensive, which is partly why companies offer analytical services rather than supplying the hardware directly to farmers.

The main drivers for the uptake of remote sensing in agriculture are:

- **rising input costs**, particularly of energy, pesticides and fertilisers;
- **the falling cost of new technologies**; and
- **export market requirements** for minimum chemical residue.

4.2.2. Market size

Global market

There is a strong and growing global market for remote sensing technologies and services. AgFunder, an online investment marketplace, provides a detailed overview of the global trends in investment into agrifood technology companies, including investments in technological applications for the agriculture and/or food industry. As stated in AgFunder's recent annual report (AgFunder 2017), investment in 2017 in the agtech category, 'farm management software, sensing and Internet of Things (IoT) management systems' (which includes precision agriculture applications) showed a 27% year-on-year increase and comprised 134 deals worth USD 464 million (~R6 billion).

The global market for agriculture drones was estimated to be USD 670 million (R8.8 billion) in 2015. It is predicted to grow at a CAGR of 18.5% to 38% during 2018-23 (Mordor Intelligence 2018a).

Japan and the US have been early adopters of aerial agriculture tools, including satellite imaging, aerial crop dusting, and agriculture drones, while currently there is limited acceptance of aerial agricultural tools in Southeast Asia and China. That said, China is leading the manufacturing of agricultural drones, globally. Adoption is relatively low in the developing countries as the images collected by drones require analysis by skilled and knowledgeable personnel (Mordor Intelligence 2018a).

South African market

Remote sensing is an emerging market in SA. The business case shows that the financial benefits exceed the cost of services at scales greater than 40 ha when using drones and 50 ha when using satellite technology.

There is a good business case for remote sensing for land areas greater than 40 ha when using drones, and 50 ha when using satellite technology.

The current conservative market estimate (from revenue from bespoke services for one company) is R11 million per season for two commodities (macadamias and citrus). The estimated potential value of bespoke services, based on hectares under high-value export fruit production is R131 million (see Table 6). There are further opportunities for software developers and manufacturers, and sellers of remote sensing hardware.

All drones used for commercial purposes (RPAS) and the companies that own them (ROCs) in South Africa have to be registered under the South African Civil Aviation Authority (SASAA). An [industry report by Rocketmine](#) (2018) conveyed the industries where SA's ROCs currently operate. The report found that:

- the SA drone industry was set to generate R2 billion in 2017 (Rocket Mine 2018);
- within the top four owners, training is a critical priority (47% of RPAS), indicating that the aim is still to grow the industry significantly through upskilling and equipping the rest of the industry;
- surveying is a key focus industry, with at least six ROCs and 29% of RPAS registered; and
- agriculture is an emerging industry for at least two ROCs and 3% of RPAS registered.

Most RPAS used in agriculture in SA are fitted with multispectral and thermal imaging cameras to provide agricultural indices for improved farm management and optimisation of water resources, fertilisation, disease management, and land drainage.

¹¹ An ROC is required for a commercial drone operating company. Such companies also need to have registered drones or unmanned aircrafts to fly them commercially.

Case study: Aerobotics

Although SA's uptake of precision agriculture has been slower than those of developed countries, global trends align with what is seen in SA's current agtech environment. Businesses interested in agtech report that there is opportunity; however, it requires patience and large investments. Interest in capitalising on these kind of opportunities has emerged locally, with one of SA's largest commercial banks, Nedbank, investing in the local agtech company, Aerobotics. This points to a strong business case for precision application of inputs (pesticides in this case).

Success factors for this investment include:

- **alignment with investors strategies**, e.g. Nedbank's focus on reshaping agri finance¹²;
- a **technically and commercially balanced product development team** with some background and experience in agriculture;
- **demonstrated traction in their local market**; and
- a solution that has **strong network effects** within the agriculture sector, i.e. disease monitoring encourages word-of-mouth sales.

Aerobotics is currently tracking five million trees. It has captured nearly 20% of the SA citrus market in less than 24 months, and 40% of the SA macadamia market in six months¹³. The estimated revenue per season¹⁴ is more than R7 million for citrus and nearly R4 million for macadamias. The uptake in the macadamia market is particularly significant in terms of potential growth, as SA is currently the world leader in macadamia production, with demand set to double globally over the next four years.

We expect that the uptake of remote sensing technologies will be mostly in high-value export crops (shown in the table below). This is partly due to the need to reduce chemical use to comply with export markets, water scarcity, and rising input costs. However, both irrigated and dryland grain production can benefit from remote sensing applications for precision agriculture, having experienced uptake to a lesser extent. The table below shows the current market captured by the leading aerial data analytics company, Aerobotics, based on known data, as well as the estimated potential value of bespoke remote sensing services:

¹² Drones allow the bank to gather on-farm data from large commercial clients and develop new agriculture finance products. Yield estimates, which can be determined through data analytics, coupled with forward price estimates, could be used to determine forward cash flows and biological asset valuations. Such information could be used for credit and risk modelling, and even to provide credit based on the valuation of individual trees.

¹³ Market size is based on the hectares under production covered by their service compared to total production hectares in SA.

¹⁴ Revenue estimates are based on value of service (R500/ha/season), percentage of the market captured, and known hectares of citrus and macadamia production.



Table 5: Estimated value of bespoke services in remote sensing in South Africa

Commodity	Captured market (hectares)	Potential market (hectares) ¹⁵	Estimated value / season
Citrus	14 546 (20% of total production area)	58 185	R34 million
Macadamias	7 800 (40% of total production area)	11 700	R9.8 million
Wine grapes	No data	94 545	R47 million
Table grapes	No data	26 739	R13 million
Stone fruit ¹⁶	No data	17 926	R9 million
Pome fruit ¹⁷	No data	36 491	R18 million
Total	22 346	245 586	R131 million

The business case for tools that reduce pesticide application is strong. These tools help farmers comply with minimum residue levels for the export market and can save them a lot of money. The average pesticide cost/ha for pome

and stone fruit is R12 000 and R7 000, respectively. Thus a reduction in pesticide application of ~10% per ha¹⁸ can save the farmer money, even after the service cost is deducted.

¹⁵ Hectares under production / commodity is based on most recently available data and may change year on year.

¹⁶ Apricots, nectarines, peaches and plums.

¹⁷ Apples and pears.

¹⁸ At R500/ha/season, farmers will profit in savings if pesticides application is reduced by ~10%.

Case study: FruitLook: a remote sensing tool improving water efficiency

FruitLook is a free web-based tool created by the Western Cape Department of Agriculture (WCDoA) to help farmers in their water and production management via intelligent satellite data products. It was created for farmers to mitigate rising input costs (especially energy) and water scarcity. The tool has expanded from serving only certain fruit producing areas in 2014, to all areas in 2018.

FruitLook uses the latest satellite-based technology to help producers precisely

monitor and manage crop production and water use. It provides crop growth and actual water use information, shows how efficient the water use is, and whether any plant stress (evapotranspiration deficit) has occurred.

Figure 9 shows the uptake of FruitLook in hectares covered over time for key commodities in the WC. There has been an increase in the use of the tool from 2014/15 to 2016/17, as shown by the growth in production area covered for citrus (33%), table grapes (24%), and wine grapes (38%).



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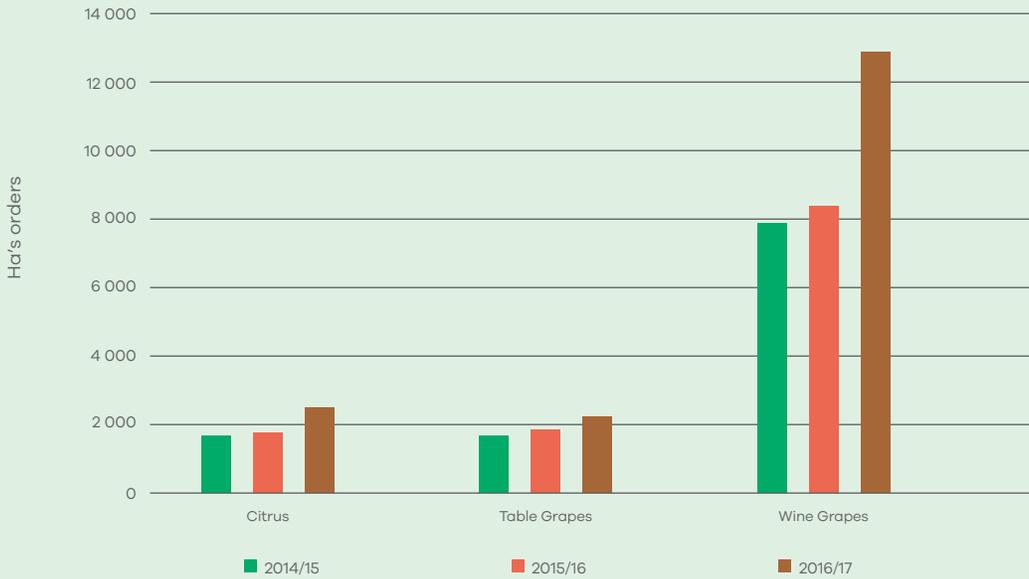


Figure 9: Uptake of FruitLook use expressed as hectares ordered over time

Feedback from producers indicate that FruitLook is an extremely valuable tool to provide an overview of crop water use and requirements. In a block or field level questionnaire from early 2018, 71 of the 100 respondents indicated that using FruitLook

improved their water management. In previous surveys, farmers reported minimum water savings of 10%. Table 7 shows the estimated savings to farmers, using the reported minimum saving of 10%, and highlighting the business case for different commodities per season.

Table 6: Potential savings (ZAR/ha/season) using remote sensing to improve water efficiency

Commodity	Savings / ha ¹⁹ (ZAR)	Captured hectares	Potential hectares
Apples	817	7 146	17 066
Pears	817	2 062	10 217
Apricots	700	94	2 744
Nectarine	700	341	1 790
Peaches	700	698	6 640
Plums	817	513	4 580

¹⁹ Based on a 10% cost reduction in electricity used for pumping irrigation water. Costs based on crop budgets (Hortgro 2016).

4.2.3. Local market players providing agricultural remote sensing services

Current market players offering remote sensing applications to improve agriculture production efficiencies include:

- Aerobotics
- AeroVision
- Agri-Sense
- DRONESIX
- FarmPin
- FruitLook
- Terracam

Both Aerobotics and FarmPin have incorporated satellite imagery into their service offering after an initial focus on drones. However, FarmPin exclusively focuses on satellite imagery and targets a wider market within agriculture. This is mainly due to its increased capabilities (such as higher resolution and thermal bands), together with the decreasing cost of using satellite technology.

4.2.4. Barriers and risks

An important aspect of remote sensing applications in precision agriculture is Information and Communication Technology (ICT) software, and the interface that makes communication of data collected by remote sensing hardware possible. Barriers to the uptake of remote sensing in PA include:

- **Licensing and regulation of drones²⁰:** The response of the industry to the initial regulations was unenthusiastic. Other countries that have integrated UAVs into their spaces have less onerous and complex legislation in place than SA.
- **Cost of technology:** Although technology prices are decreasing, it is still seen as expensive, especially when incorporating additional technology such as multispectral cameras for the agriculture sector.
- **Insufficient support environment:** Rapid evolution of the ICT²¹ ecosystem requires sufficient capacity in the organisations driving and supporting investment and growth. There is currently limited capacity dedicated to agtech.
- **Limited funding opportunities:** Early seed funding for startups in SA, including agtech startups, is extremely limited.

- **Lack of integration²²** between various disciplines and the inclusion of the end user in developing ICT solutions. This results in limited understanding of the end user's actual needs. This is particularly problematic for agtech as the technological skills are generally concentrated in urban areas and developers have little or no interaction with farmers.
- **Lack of awareness** by farmers on technology available and its benefits.
- **Mind-set:** Changing from conventional practices takes time as production has been done in a certain way for generations. There is also a perceived high risk associated with new technology.
- **Lack of agri-industry collaboration²³,** particularly between the science community and commercial agriculture. This collaboration is essential in order to form a new research agenda.
- **Lack of local technical knowledge** resulting in hardware and software components being imported. Also, there is a relatively low level of digital literacy and limited technical sophistication compared to other countries, particularly in the agricultural sector.

As with any new technology penetrating an existing and mature market, there are many challenges to overcome. A large amount of capital is required to start a regulated and licensed operation, particularly for drones. Thus, it is critical to demonstrate that a business can remain profitable within an ever-changing landscape; spending money where it counts while maintaining high levels of safety and compliance.

4.3. Undercover farming

4.3.1. Overview

Undercover farming (UF) is a way of farming that allows for more favourable growth conditions, compared to open field farming. It aims to improve input efficiencies and quality of produce, and is largely driven by climatic uncertainties. As shown in [Figure 10](#) below, UF includes several forms of agriculture, e.g. controlled environment agriculture (CEA), indoor farming, and vertical farming.

²⁰ Find relevant legislation under "Knowledge base" at www.cuaasa.org, website of the Commercial Unmanned Aircraft Association of Southern Africa (CUAASA).

²¹ ICT in our context involves software and the interface that make communication of data collected by remote sensing hardware possible.

²² From engagement with Silicon Cape.

²³ According to the WCDOA's 4IR report.

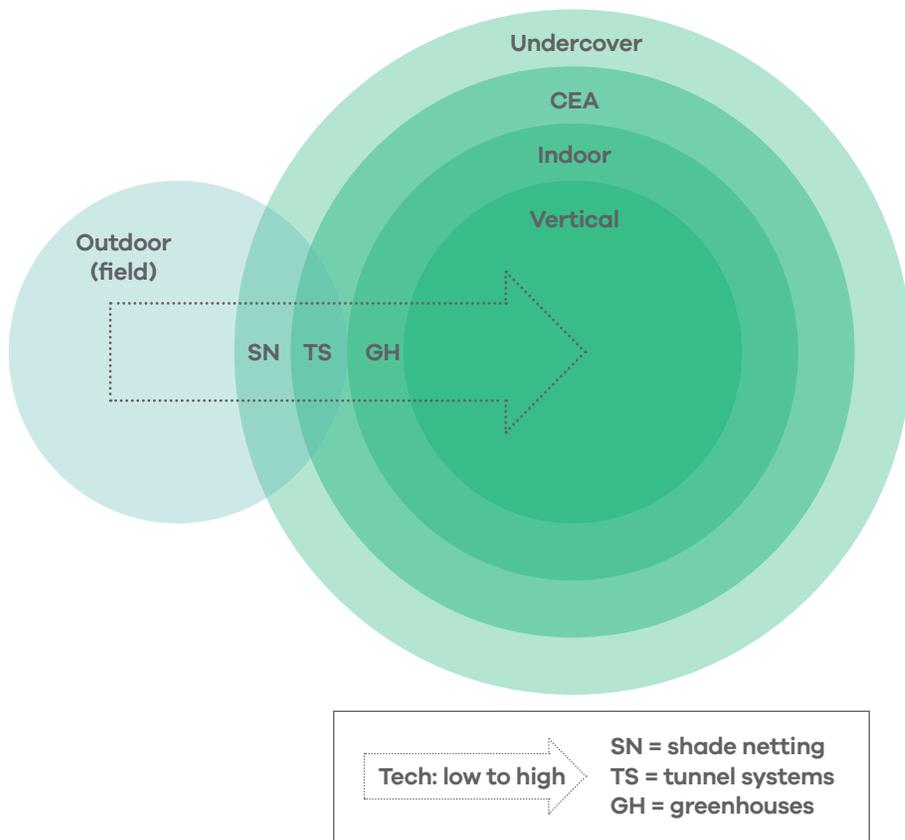


Figure 10: Undercover farming and its various forms

UF ranges in technology use and, as such, the amount of control the grower has over environmental factors.

- **Low-tech systems**, such as shade netting, are predominantly used to protect plants from harmful UV rays in soil-based systems. Shade netting is also a climate adaptation approach; it reduces evaporation and thus increases soil moisture. Shade netting comes in different densities and colours, which can have a significant effect (up to 7°C) on temperature.
- **Tunnel systems (TS)** are categorised as low- to medium-tech UF in this MIR, as TS allow for climate control through ventilation design (open soil-based systems), and include closed systems with ventilation control (fans) and hydroponic systems.
- **High-tech systems**, such as those used for CEA, involves growing plants inside a greenhouse and grow room, where the grower maintains the proper light, carbon dioxide, temperature, humidity, water, pH levels, and nutrients to produce crops year-round. CEA ranges in technology use and can include

hydroponics (most common), aeroponics, aquaponics, soil based systems, or a combination of these. Space can be further optimised with vertical structures.

Drivers for the uptake of UF include:

- **Higher profits** can be realised when producing higher quality produce and producing out of season.
- **Climate change** models predict an increase in the frequency of extreme weather events, such as hail, floods, droughts, and the number of hot days.
- **Scarce natural resources (particularly water and land):** UF optimises water and land use. Dwindling natural resources are under further pressure due to climate change and an increasing population.
- **Market pressure** to reduce or eliminate use of chemicals in food production.
- **Urbanisation:** CEA and technology, especially vertical systems, make it possible to produce food in cities where the majority of the population live. Currently 55% of the global

population live in cities, and this is predicted to increase to 68% by 2050 (UN, 2018). The business case for urban farming is strengthened further by shorter transport distances, which reduce fuel costs and the product's carbon footprint.

4.3.2. Market size

Global market

The uptake of UF is increasing globally, with both indoor and outdoor vertical farming predicted to

grow the fastest. Significant scaling of indoor farming is required to improve its business case, as producers need to recover their current high capital and operating cost, resulting in significantly higher retail prices compared to conventional farming. However, continually improving technologies are enabling great advances in this space, especially LED lighting technology. We look at some key UF technologies and their market trends in [Tables 7 and 8](#) (Mordor Intelligence 2018) below:

Table 7: Global market uptake of selected undercover farming components

Industry	Current global market (latest available figure)	Predicted growth: Controlled Annual Growth Rate (CAGR) for 2018 – 2023	Other insights
Indoor farming ²⁴	USD 106.6 billion / R1.4 trillion ²⁵ (2017)	CAGR 3.4%	<ul style="list-style-type: none"> North-America accounted for nearly 44.2% of the global market in 2017.
Hydroponic farming	USD 21.2 billion / R279.8 billion (2016)	CAGR 6.5%	<ul style="list-style-type: none"> Common crop types include tomato, cucurbits, lettuce and peppers. The Netherlands is the largest producer of hydroponic crops and is expected to maintain the lead for the next 10 years .
Vertical farming ²⁶	USD 1.5 billion / R19.8 billion (2016)	CAGR 23.02%	<ul style="list-style-type: none"> Asia-Pacific is presently the largest and leading region in using vertical farming. Key drivers: farmland shortage, population growth, and demand for pesticide residue-free food.

²⁴ Indoor farming ranges in technology use and can include hydroponics, aeroponics, aquaponics, soil based systems or a combination of these, flat or vertically structured.

²⁵ Average exchange rate for 2018 as on 30 November 2018 (R13.2 to USD 1).

²⁶ Indoor and outdoor vertical farming.

The global indoor farming market in 2017 was worth USD 106.6 billion (R1.4 trillion²⁷). The global uptake is increasing and rapid growth is predicted for vertical farming, with a CAGR of more than 20%. However, the UF systems are limited in the types of commodities that can be grown.

South African market

UF consists of various components and ranges in the sophistication of the technology and system. As a result, UF creates opportunities in numerous industries. One undercover hydroponic farmer estimated using 15 different companies to erect his infrastructure. As a result, there are opportunities for manufacturers and suppliers of:

- steel;
- plastic (especially polyethylene, which is mostly used in SA tunnel production);
- netting;
- hydroponic equipment, including pumps and pipes;

- growth medium (such as gravel, sawdust and peat);
- air conditioning and lighting; and
- automation systems and ICT solutions.

Furthermore, in especially high-tech systems, there is opportunity for training and consulting as the systems are relatively new in South African agriculture.

There are also suppliers such as Haygrove and Greener Solutions offering turnkey solutions, which include design, supply, installation, and professional advice. Many companies, especially in urban and peri-urban hydroponic production, offer training throughout the value chain, i.e. in production, transport, marketing, and retail. Examples of such organisations include Future Farms and WIBC.

There has been rapid growth in the market for low- and medium-tech UF in SA, as illustrated for the WC in [Table 8](#) (WCDaA):

Table 8: Undercover farming market uptake in the Western Cape

UF component	Indicator	Value
Shade netting	Total area of production: 2013	918 ha
	2017	2 494 ha
	Increase in production area	1 575 ha
	Increase (%)	172%
Tunnel systems	Total structures: 2013	4 704 structures
	2017	7 290 structures
	Increase in structures	2 586 structures
	Increase (%)	55%

²⁷ Average exchange rate for 2018 as on 30 November 2018 (13.2)

This data, provided by the WCDoA, shows a significant increase in the area under shade netting and amount of tunnel structures. A conservative estimate for the current market size for low- and medium-tech UF in the Western Cape is R1.4 billion (2018)²⁸. The rapid uptake of tunnel systems and shade netting can be attributed to:

**The WC market for low- and medium-tech undercover farming is conservatively estimated at R1.4 billion (2018).
The SA market for low-tech undercover farming is R38 billion.**

- **An increase in the production area of high-value export fruit:** Shade netting (SN) yields better quality fruit as fruit is protected from harmful UV rays. It also serves as insurance for these high-value assets against weather events such as hail. An additional SN driver is high crop insurance costs in SA.
- **Climate change adaptation and the recent drought** (see [Section 2](#) of this report).

The potential market for low-tech UF in South Africa is estimated at R38 billion²⁹ (including captured market), considering that the area under deciduous fruit and citrus amounts to 152 479 ha.

SA, as with many developing countries, has been slow in adopting high-tech UF systems. According to industry experts, greenhouse production in SA is 50 years behind that of Europe and elsewhere. Some of the most popular plants grown indoors are usually crop plants like lettuce, tomatoes, peppers, and herbs. In SA, maize, wheat, sugar, sunflowers, deciduous fruit and citrus are grown widely, most of which is not suitable for

The current conservative market for high-tech undercover farming in the Western Cape is R827 million.

greenhouse production. High-tech UF, although emerging, has seen significant and increasing investment in SA. A conservative estimate for high-tech UF in the WC is R827 million³⁰ and has a potential market of over R1 billion for SA.

When looking at medium-tech UF in SA (undercover systems that use hydroponics), the most common system is the open bag culture system, or drain-to-waste system. In this production type, tomatoes, cucumbers and sweet peppers are mostly produced in tunnels or multi-spam structures, and grown in plastic bags or containers filled with media such as pine sawdust or cocopeat. The second most popular system is the closed, gravel-flow technique system (GFT). In GFT, vegetables such as lettuce and celery are produced in troughs filled with gravel, normally under shade-cloth.

Increasingly, the business case for hydroponic production in SA is being understood. The estimated infrastructure cost of a 200 m² vertical hydroponic operation under SN in SA is R250 000 and has an expected return on investment of one year, depending on produce and distribution channels.

Customised systems are more expensive than gutter systems where PVC pipes are used; however, PVC pipes emit heavy metal toxins when temperatures are high, causing water quality issues. Water quality, quantity, and reliability are the most important considerations when using hydroponic systems.

4.3.3. Barriers and risks

Shade netting and tunnel systems are well known in SA agriculture and, as such, there are fewer uptake barriers. The largest barrier is high capital costs. It is particularly problematic for emerging farmers trying to gain access to finance as they do not have the necessary credit and production history.

High-tech UF is still seen as an emerging technology, and barriers to its uptake include:

- **High capital costs:** Specialised equipment is often imported.
- **Offtake agreements:** Retailers are often unwilling to enter into supply contracts until

²⁸ Based on known prices for shade netting (SN) in fruit production in the WC.

²⁹ Based on known costs and assuming highest potential in deciduous fruit and citrus industry.

³⁰ Based on known investment and an estimated growth of 15% per year according to industry experts.

quantity and quality can be demonstrated. Interviews with the local industry suggest that the current market for premium produce is relatively small in South Africa's retail sector; however, restaurants are willing to pay a premium price for high quality produce.

- **Lack of access to finance** is the main barrier to the uptake of hydroponic systems. This is due to the perceived risk of emerging technologies, and commercial funding institutions not taking into account the lower production risk that comes with more controlled systems.
- There is a **lack of public funding for R&D**, leading to privately funded R&D that results in little to no information sharing.
- Emerging farmers **lack specialised skills and**

knowledge to operate systems for primary production. Emerging UF farmers often lack the proper working knowledge of markets (what to produce, where and when).

- The main cause of failed projects in SA has been linked to **poor feasibility studies, and components and systems that are not suitable for local conditions.**
- High-tech UF projects are **energy intensive.** Electricity plays a significant role in keeping the system functioning, i.e. cold storage, regulating water temperature in aquaculture. Rising energy prices in SA are thus expected to influence the uptake of high-tech CEA, but may provide opportunities for systems that include renewable small-scale embedded generation (SSEG).



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5

Funding and Incentives

A range of general and sector-funding solutions and incentives is available to investors, manufacturers and service companies in the green economy.

It covers international sources, such as Development Finance Institutions (DFI), local funding pools including the public and private sector, and a considerable range of tax incentives.

5.1. General database web page

The GreenCape Finance Desk hosts a web page³¹ with a number of Green Finance resources that cover funding and incentives available to companies in the green economy. A few of the available database are highlighted below.

5.1.1. Green Finance Database

In conjunction with the South African National Energy Development Institute (SANEDI), GreenCape maintains a database of funding sources and primarily dti-driven incentives that may be relevant to green economy investors. The database contains information on more than 100 funding opportunities, including an overview of the opportunity and its 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 online³².

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 online³³.

5.1.3. Finfind database

Finfind³⁴ is an innovative online finance solution that brings together SME 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.

5.1.4. AlliedCrowds database

AlliedCrowds³⁵ 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.
- You can also contact Allied Crowds to create a customised funding database for you.

This resource is ideal for any entity seeking a broad range of financial solutions on a global scale.

³¹ <https://www.greencape.co.za/content/focusarea/green-finance-databases>

³² <https://www.greencape.co.za/assets/Uploads/GreenCape-Finance-Database-v6.xlsx>

³³ <https://www.greencape.co.za/assets/Uploads/Government-Funding-and-Incentive-Booklet.pdf>

³⁴ www.finfindeasy.co.za

³⁵ <https://alliedcrowds.com/>



6

The Western Cape: Africa's green economy hub

The Western Cape is a world-class investment destination.

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 (RE) 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:

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

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 non-financial 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.

Major market opportunities: Western Cape and South Africa

Agriculture

Precision agriculture

Tools, data analysis, local manufacturing & financing.

Solar energy for agriculture

Minimum market of R120 million (WC) and R420 million (SA) for solar PV in agri & agri-processing.

Controlled environment agriculture

R600 million potential market (WC), 15% annual growth (WC).

Energy services (SA-wide)

Solar PV systems & components

600MWp installed capacity; R1.7bn additional investment in 2018 (R7.7bn to date)

Local manufacturing & assembly

Solar PV systems and components – systems require compliance with local content regulations

Energy storage

Keystone of future energy services market; ~R5bn market for demand side management and back-up power by 2035

Utility scale renewable energy (SA-wide)

Independent power production

6.3GWp independent power procured, 13.7GWp additional capacity by 2030, based on updated IRP (5.67GWp solar, 8.1GWp wind).

Rest of Africa

Greater uptake of RE & decentralized systems. Off-take guarantees and local currency debt innovation needed.

Local manufacturing

Refined local content requirements, with specific components obligated to be locally manufactured e.g. wind towers, tower internals, panel laminating, PV mounting structures

Waste

Municipal PPP

Public-private partnership projects of R1.3bn (WC)

Organic waste treatment

Landfill ban require treatment technologies to process 1 m/t p.a. of organic waste (WC)

Alternative waste treatment

Cape Town has highest landfill cost in SA & good business case for AWT. R1bn+ invested by solution providers since 2016 (SA)

Water

Industrial and Commercial

Water intense food & bev sectors expected gross capital formation of ~R14bn by 2021

New developments

Green building certifications increased 25-fold since 2010 (SA)

Municipal

Significant opportunities in metro markets incl. new R5.8bn (417 MLD) Cape Town augmentation programme (WC)

Bioeconomy & resource efficiency

Food value retention

At least R600m retained through improved cold chain management & waste reduction (SA)

Solar thermal

Already installed: R33m (WC), R135m (SA); ~R3.7bn potential market in agri-processing

Biogas

For electricity, heating & transport; R100m of installations expected by 2023

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 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 SADC market.

Atlantis is a great location and development ready. 93 hectares of zoned City of Cape Town

land is available for leasing to investors. Bulk infrastructure is in place and Atlantis has new public transport and shipping links and fibre connectivity. 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 information, contact the SEZ's Investment Promotion Facilitator, Jarrod Lyons: jarrod@greencape.co.za



7

GreenCape's support to businesses and investors

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.

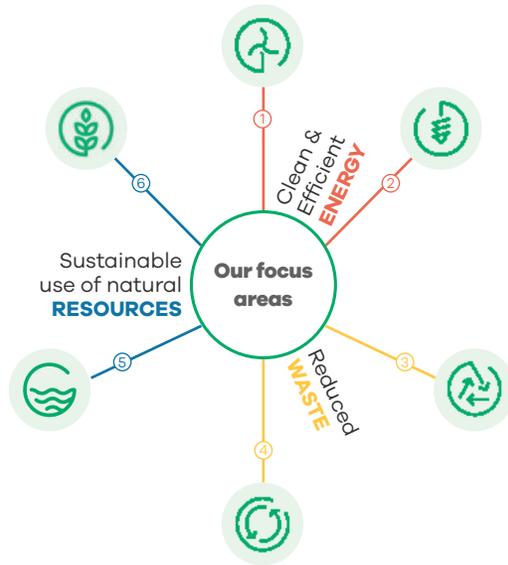
We have facilitated and supported R17bn of investments in renewable energy projects and manufacturing. From these investments, more than 10 000 jobs have been created. Through our WISP (industrial symbiosis) programme, by connecting businesses with waste / under- used resources, we have to date diverted nearly 63,000 tonnes of waste from landfill.

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, waste and resources.

Figure 11 below shows the different focus areas within each of our programmes.

Benefits of becoming a GreenCape member

We currently have over 1100 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.



① Renewable Energy

Utility-scale projects, localisation of component manufacturing, incentives & financing options, wheeling & energy trading.

② Energy Services

Energy efficiency & embedded generation, electric vehicles, alternative basic electrification, incentives & financing options.

③ Alternative Waste Treatment

Municipal decision-making & policy & legislative tools on alternative waste treatment options; small-scale biogas, recycling & reuse (dry recyclables, construction & demolition waste).

Figure 11: GreenCape's focus areas

Support through the International Cleantech Network

GreenCape's membership of the International Cleantech Network (ICN) gives our members access to international business opportunities in countries where other cleantech clusters are based (mainly Europe and North America).

④ Western Cape Industrial Symbiosis Programme (WISP)

The team matches businesses to share unused resources, cut costs & create value. They also support entrepreneurs to identify & realise new business opportunities in the waste industry.

⑤ Water

Water provision & economic development; greentech opportunities for water use efficiency, treatment & reuse, business water resilience.

⑥ Sustainable Agriculture

Precision-, conservation- and controlled environment- agriculture; valorisation of wastes to high value bio- products, including bio-energy.

To become a member or to get your ICN passport, please contact GreenCape or visit our website: www.greencape.co.za



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