Sustainable Agriculture
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2018
Market Intelligence Report
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GreenCape

GreenCape

GreenCape is a non-profit organisation that supports and promotes the green economy – low carbon, resource efficient and socially inclusive – in the Western Cape, South Africa. We assist businesses and investors focusing on green technologies and services to remove barriers to their establishment and growth.

Acknowledgments

We thank Inge Kuschke and Jana Jordaan for the time and effort that went into compiling this market intelligence report. We also thank Louw Pienaar and the Association for Vertical Farming for their feedback on earlier drafts of this document.

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Layout and design:	Deep Agency

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List of acronyms and abbreviations

ARC	Agriculture Research Council
CA	Conservation Agriculture
CARA	Conservation of Agricultural Resources Act
CCAFS	Climate Change, Agriculture and Food Security
CCC	Confronting Climate Change
CEA	Controlled Environment Agriculture
CoCT	City of Cape Town
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DWS	Department of Water and Sanitation
EE	Energy Efficiency
EIA	Environmental Impact Assessment
ELU	Existing Lawful Use
ESCo	Energy Services Company
EU	European Union
GDP	Gross Domestic Product
Greentech	Green technologies
GHG	Greenhouse Gas
Ha	Hectares
IB	Irrigation Board
IBI	Index-based insurance
ICT	Information and Communication Technology
IGDP	Integrated Growth and Development Path
kW	Kilowatt
kWh	Kilowatt-hour
kW_p	Kilowatt-peak
Mha	Million hectares
MIR	Market Intelligence Report
NCPC	National Cleaner Production Centre
NDP	National Development Plan
NEMA	South Africa National Environmental Management Act
NWA	National Water Act
NWRS2	National Water Resource Strategy 2nd Edition

PA	Precision Agriculture
PQRS	Power Quality and Renewable Services
PV	Photovoltaic
PwC	PricewaterhouseCoopers
R&D	Research and Development
RE	Renewable Energy
REEEP	Renewable Energy and Energy Efficiency Partnership
SANEDI	South African National Energy Development Institute
SME	Small- and Medium-sized Enterprise
SA	South Africa
SEZ	Special Economic Zone
UAV	Unmanned Aerial Vehicles
USA	United States of America
V&V	Validation and Verification
VSD	Variable Speed Drive
WC	Western Cape
WCDoA	Western Cape Department of Agriculture
WCWSS	Western Cape Water Supply System
WMA	Water Management Agency
WSA	Water Services Act
WWF	World Wide Fund for Nature
ZAR	South African Rand

Executive summary

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

The South African agriculture sector is a competitive and robust sector in which to invest. Despite losses due to the recent drought in South Africa (SA), agricultural exports have continued to grow from R106.8 billion in 2015 to R131.9 billion in 2016.

The Western Cape (WC) province dominates agricultural export production and contributes 24% to SA's agricultural Gross Domestic Product (GDP), with agriculture and agro-processing responsible for 18% of all formal employment opportunities in the province. The province also offers a healthy investment climate as it has sound agricultural (and other) infrastructure, support systems and programmes.

There are opportunities in the agriculture sector for investment in controlled environment agriculture and drone technologies, and emerging opportunities in mobile applications and software programmes for agriculture. There are also opportunities in energy efficiency, renewable energy, and conservation agriculture.

- **Controlled environment agriculture:** The current market for controlled environment agriculture (CEA) is conservatively valued at R28 million (for low-tech CEA) to R600 million (high-tech CEA), with growth predicted to be 15% a year. In the past year, the market size for CEA increased by at least R128 million in the WC. There are opportunities for manufacturers, suppliers, installers, and operators.

- **Drones:** The South African drone industry, a key component of precision agriculture, generated an estimated R2 billion in 2017. There are opportunities for various cross-cutting industries, particularly service providers.

- **Mobile applications:** Between 2010 and 2015 there was an increase of 400%, from 300 000 to 1.5 million, in mobile apps for agriculture. There are opportunities for various role-players, such as app developers and entrepreneurs in agriculture and other cross-cutting sectors.

- **Energy efficiency:** Although there have been minor market developments in SA's agri-related energy efficiency (EE) market, the known investment to date is R3.6 million with an estimated market value of R266 million. There are opportunities for farmers, energy consultants and service providers in EE.

- **Renewable energy:** SA's agri-related solar PV market has grown substantially from previous years with 8 395 kWp of solar PV installations in 2017, of which 2 233 kWp (26%) was installed in the WC. The estimated market size for this sub-sector in the WC is between R120 million and R190 million. There are opportunities for various players along the value chain, including solar PV developers, installers, service providers and farmers.

- **Conservation agriculture:** Globally, conservation agriculture (CA) covers 180 Mha (12% of global annual cropland), representing an increase of 15% increase from the previous year. In SA, uptake varies greatly across the country. The WC is leading uptake with 80% of grain production cropland under CA; KwaZulu-Natal is second with an uptake of 70%. Uptake in the rest of the country's grain areas is at 20%. The main greentech opportunity is for no-till equipment manufacturers and distributors.

The main drivers of these opportunities include:

- **water availability** in the agricultural sector; and
- the need for improved **resource efficiency** to reduce inputs and improve productivity.

Water availability is critical for agriculture. Various parts of SA experienced droughts over the last three years, with ongoing drought conditions in many regions. The WC is currently experiencing one of the worst droughts on record. The drought is in its third year and the winter rainfall season of 2017 delivered significantly less rainfall than the long-term average. This has highlighted the urgency to adapt to this 'new normal' for SA in light of:

- climate change predictions, which indicate a drier climate and greater rainfall variability across southern Africa; and
- a growing urban population, causing further pressure on water allocation to agriculture.

Resource efficiency and availability are critical in agriculture. Agriculture production takes place in a highly competitive global market and greater efficiencies are necessary for producers to stay competitive. Rising input costs (such as diesel and electricity) and deteriorating natural resources, particularly soil health, are driving the uptake of a number of opportunities highlighted here. With few incentives available for investment in greentech and practices, the promising business case for resource efficiency (i.e. greater profits due to lower input costs), predominantly drives uptake of greentech and services by the agriculture sector.

What's new?

The 2018 Sustainable Agriculture MIR discusses the economic impact of the drought on Western Cape agriculture & highlights water scarcity as a key driver for the uptake of greentech in South African agriculture. It specifically highlights:

- market growth in controlled environment agriculture (CEA),
- driven by the need to mitigate production losses, and;
- greentech that supports precision farming.

The 2018 Sustainable Agriculture MIR provides key updates for energy efficiency, renewable energy and conservation agriculture opportunities explored in detail in the 2017 report. It also provides greater insight into the local opportunities in CEA and drone technology applications in agriculture production. Insight on emerging opportunities in information and communication technology (ICT), in particular mobile applications and software programmes for agriculture, are also discussed in this report.

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

1 –
Introduction and purpose

This market intelligence report (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 the South African sustainable agriculture sector.

GreenCape's Agriculture Sector Desk was established in 2014 in partnership with the Western Cape Department of Agriculture (WCDoA). The desk aims to support the development of sustainable and competitive agricultural value chains through the uptake of green technologies (greentech) and sustainable production practices[1]. This is achieved by raising awareness of the benefits of greentech uptake (i.e. driving demand within agriculture), and highlighting opportunities for greentech manufacturers and service providers (i.e. supporting supply).

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

- increase production efficiency (i.e. producing more with fewer inputs);
- benefit the environment, primarily by conserving resources, reducing negative impacts such as pollution, and increasing resilience to climate change; and
- have the potential to attract international and cross-sector investment.

The main focus is on controlled environment agriculture (CEA) and drone technology applications in agriculture production. Investment in information and communication technology (ICT), in particular mobile applications and software programmes for agriculture, is also discussed as an emerging trend. Updates are provided on the areas explored in detail in the 2017 MIR: energy efficiency, renewable energy 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 and trends** are then highlighted (Section 4). The final sections outline various **finance and investment incentives** (Section 5), present the case for the **Western Cape as a potential greentech hub** for Africa (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 on telephone +27 (0)21 811 0250 or email agri@greencape.co.za.

1 | In this context, greentech and sustainable production practices are those that increase resource efficiency and decrease greenhouse gas emissions.

2 – Sector overview

This section provides an overview of the South African and Western Cape agricultural sectors and their structure, macro-economic trends, key players, and drivers of green technology and sustainable production practices in agriculture.

2.1. Physical geography and climate

South Africa (SA) is a semi-arid country, making water a key constraint to production. Water availability and the business case for improving water efficiency in agricultural production are examined in Section 2.4.1.

Climatic regions in SA include Mediterranean, subtropical and semi-desert, enabling the production of a wide range of agricultural commodities. A detailed overview of the physical geography and production of commodities in SA is available in GreenCape's 2016 Agriculture MIR.

Detailed analysis of production areas and climate change trends in the Western Cape (WC) province is provided by the SmartAgri[2] publications for farmers, policymakers, agricultural organisations and researchers.

2.2. Economic overview

This section provides an overview of the agricultural economy in SA and the WC, with the focus on the sector's economic contribution, value of commodities and production trends. For a more detailed overview, refer to the 2016 Agriculture MIR and as the latest Bureau for Food and Agricultural Policy (BFAP) Baseline Report[3].

2.2.1. South African agriculture

The agricultural sector only contributes 2.5% to the overall South African economy's Gross Domestic Product (GDP) (Quantec 2017). However, the sector plays a significant role in SA in terms of creating employment opportunities, generating foreign reserve income through exports, and ensuring a stable food supply to the country. For these reasons, the National Development Plan (NDP) has highlighted the importance of this sector to drive rural development and create additional jobs.

The agriculture sector has been affected by various exogenous factors, which have put pressure on its output performance. These include the 2015/16 drought, which affected major parts of the grain producing regions of the country. This can be seen in Figure 1 below, which shows sustained contractions in value added by the sector for six consecutive quarters. However, due to improved weather conditions in large parts of the country and a recording-breaking maize harvest, the sector has seen a strong rebound in 2017. This turnaround, together with growth in the mining sector, has ensured a positive balance for the aggregate SA economy after having experienced a technical recession in the previous two quarters.

South African agricultural exports have continued to rise despite the drought, growing from R106.8 billion in 2015 to R131.9 billion in 2016 (Business Day 2017). Africa remained SA's largest export market in 2016, accounting for 44% of exports. Growth was also seen in the Asian (13%), European Union (EU) (5%) and American (5%) markets. The main export products were beverages, spirits, fruit, and wine. These figures bear testimony to a resilient sector with a strong global demand for the country's agricultural products.

Investment trends

Investment in agriculture is widely recognised as a key driver in achieving various goals relating to increasing agricultural production, improving food security and reducing poverty (Lowder et al. 2015). Current barriers to investment in SA agriculture include relatively high labour costs, water insecurity, rising electricity costs, rural security concerns, and the quality and availability of export-commodity seedlings.

Gross fixed capital formation (GFCF) in SA's agricultural sector has increased in the past decade, but there have been worrying declines in the past two years.

2 SmartAgri publications can be found at https://goo.gl/kvoVxc

3 BFAP's purpose is to objectively inform and support decision-making by stakeholders in the agro-food, fibre and beverage sectors of Africa. It provides independent, rigorously tested, research-based market and policy analyses. BFAP consists of a network of associates and researchers at universities across the African continent. The latest report (2017) can be found at https://goo.gl/PWPA8a.

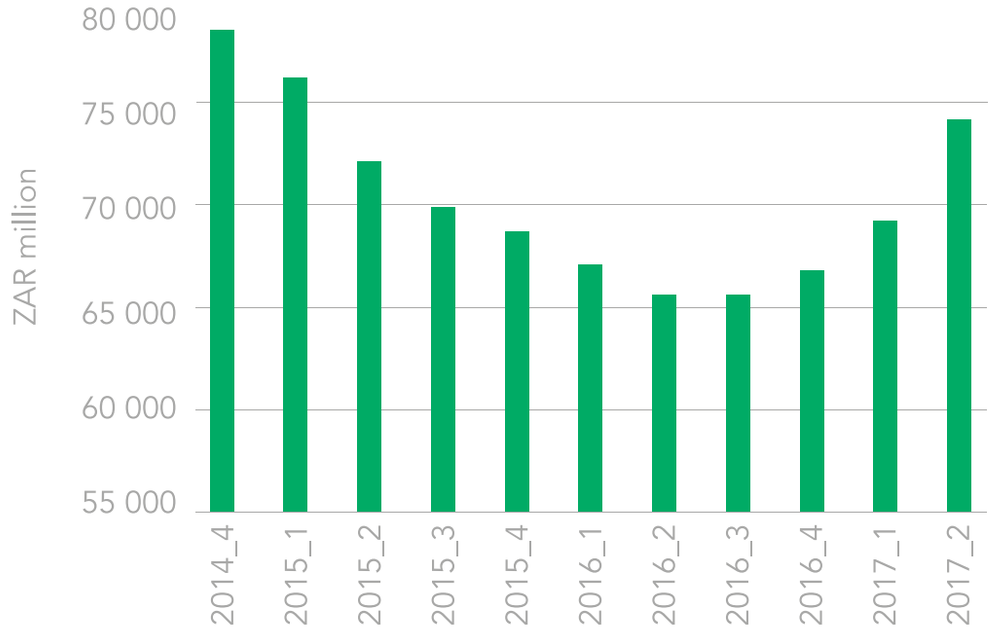


Figure 1: South Africa GDP contributions from agriculture (ZAR million per quarter)
Source: WCDoA (2017)

However, SA financial institutions report that foreign agriculture businesses are investing in South African horticulture to diversify their supply base. Global companies are primarily investing in land, production and packing infrastructure, including controlled environment agriculture (CEA) infrastructure, with less investment in value-add through processing. Land is strategically selected and often rented to local farmers or agri-businesses who are responsible for production, but not for the land or infrastructure.

Another investment trend is local private equity investment in small and medium-sized enterprises (SMEs) with scalable business models, particularly in fast growing industries in sub-Saharan Africa. These investments capitalise on the consolidation of agri and food businesses in Southern Africa. They link with established agri businesses that are already operating in the market and that have the infrastructure and scale to do business in Africa. Investments have focused on the following:

- **Grain:** provision of agri services (financial, mechanisation and irrigation), grain storage, milling, packaging and logistics in regional grain concentrated markets.
- **Dried fruit:** packaging and logistics to distribute a wide range of selected dried fruit, nuts and related products to local and regional markets, as well as export of high-quality dried fruit as healthy snack food.
- **Livestock:** livestock agri services (finance, auctioneering and logistics), and marketing of wool and mohair.

Other investors are focusing on providing CEA infrastructure to improve seedling supply, and on selective breeding of high feed efficiency livestock, such as Boerbok goats, for the global halal market.

2.2.2. Western Cape agriculture

The WC agricultural sector contributes 24% of the total national 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 contribution to the total economy is ~4%, upstream and downstream linkages increase this to ~9.4% (Quantec 2017). Furthermore, 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. The province's agricultural sector operates in a unique climate compared to rest of the country and this Mediterranean winter-rainfall region produces fruits and wines that are mainly destined for high-value export markets. As shown in Table 1 below, eight of the top ten products exported from the WC are fresh or processed agricultural products (Quantec 2017).

Eight of the top ten products exported from the WC are fresh or processed agricultural products

Economic impact of the drought on WC agriculture

SA is ranked the 30th driest country in the world. As such, water scarcity possess a great risk to agricultural production and growth of the economy, especially when a natural disaster exacerbates scarcity. This is evident for users reliant on the Western Cape Water Supply System (WCWSS). During a non-drought year, most water from the WCWSS is consumed by the City of Cape Town (CoCT), followed by the agriculture sector for irrigation purposes. The system also supplies some water to towns in the Overberg, Boland, West Coast and Swartland areas in the WC.

Table 1: Top 10 products exported by the Western Cape in 2016
Source: Quantec 2017

Ranking	Ranking	Value (R million)	Avg growth (% 2012-2016)
1	Refined petroleum oils and oils obtained from bituminous minerals	13 897	8.66%
2	Citrus, fresh or dried	10 099	0.89%
3	Wine	9 320	-2.51%
4	Apples, pears and quinces, fresh	6 970	3.54%
5	Grapes, fresh or dried	6 163	1.85%
6	Flat-roll products of iron or non-alloy steel, of a width of 600 mm or more	2 570	4 624.29%
7	Fruit juices	2 277	4.41%
8	Fruit, nuts and other edible parts of plants	2 273	-1.07%
9	Cigars	1 818	16.17%
10	Fish fillets and other fish meat	1 650	2.65%
Total		**121 089**	**2.27%**

Most of the WCWSS's water is supplied by six major dams. The water is integrated and collectively managed to allow for transfer between dams and catchment systems, and to help optimise the use of water resources in the region. Dams are recharged by rainfall in their catchment areas during the cooler winter months of May to August. Dam levels decline during the warm, dry summer months of December to February, during which urban and agricultural water use increase.

In 2015 the Western Cape experienced a drought, the first of three consecutive years of dry winters brought on by the El Niño weather pattern and climate change. Overall rainfall in 2017 was the lowest since 1933 and significantly lower than the long-term average. This has severely affected dryland production, resulting in record losses in wheat production for the 2017/18 season from 1.1 million tonnes in 2017 to 586 800 tonnes in 2018. This decline has resulted in a R2.4 billion loss in income to the grain sector, while overall income losses in the grain industry amounted to R2.8 billion (WCDoA 2018).

In response to the resulting water shortages, the WC agricultural sector's water allocation, since the start of 2018, has been cut by more than 60%, and in some cases such as the Lower Olifants River by up to 86%.

This, and previous allocation restrictions (~30%), resulted in the production decreases for the following major commodities in the 2017/18 season compared to the 2016/17 season (WCDoA 2018):

- Wine grapes (20%)
- Table grapes (18.1%)
- Pome fruit (8.7%)
- Stone fruit (8.2%)
- Citrus (7.7%)
- Major vegetables[4] (20.2%)

Overall, monetary losses at primary production level due to the drought for the 2017/18 season was R 5.9 billion, while job losses amounted to approximately 30 000.

Further interventions to reduce water consumption include restricting the use of groundwater[5] resources. Farmers that reached their allocated limit have had (and will continue to have) their water supply cut off, with the Lower and Upper Berg River areas cut off from irrigation access to the Berg River in early February 2018.This is likely to have a significant impact on crop yields and output in 2017/2018.

At the time of writing (March 2018), the reductions in water consumption by the CoCT and WCWSS users appear to be sufficient to avoid reaching "Day Zero" in 2018[6]. Agricultural water consumption is expected to drop further as the sector reaches its allocations. The CoCT has also received 10 billion litres of water reallocated from the Groenland Water Users Association in Elgin and Grabouw. This substantial contribution has added an additional 20 days to the City's supply.

The persistent drought conditions have effectively highlighted the need for increased resource efficiency. Water efficiency technologies in particular are crucial to the agriculture sector. The business case for water efficiency in agriculture and its key role in driving greentech uptake is discussed in Section 2.4.1.

4 Potatoes, Onions, Butternut, Pumpkin, Carrots, Cabbage
5 For more information, please see section 3 of this report, which gives a detailed overview of policies and regulations.
6 Day Zero will be declared when the water level of the City's major dams reaches 13.5%. When this occurs, municipal water supplies will be largely switched off, and residents will rely on water collection points around the city to collect a daily ration of 25 litres of water per person.

2.3. Key players

As shown in Table 2, key players in the agriculture sector can be divided into seven broad categories: government, producers, research/academia, input suppliers, technology suppliers and service providers, industry associations, and labour organisations. SA's national Department of Agriculture, Forestry and Fisheries (DAFF) governs the whole industry.

- **Government** provides support through various initiatives, including research, practical infield assistance, market development, regulatory development and monitoring and financial support.
- **Producers/farmers** produce commodities and largely do their own harvesting, storage and transport.
- **Academic research institutes** investigate all aspects of the value chain.
- **Production input suppliers** provide production inputs such as fertiliser, seeds, pesticides and biological control agents.
- **Technology suppliers and service providers** are found across the value chain, i.e. inputs, production, processing, logistics and waste processing. They include machinery and greentech suppliers, such as solar photovoltaic (PV) manufacturers, and precision agriculture services, such as drone data analyses.
- **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 benefits in all employment positions along the entire value chain.

Table 2 shows a simplified value chain with key role players involved. A detailed list of role players can be found in the 2017 Agriculture MIR[7].

2.4. Drivers of green technologies and approaches in agriculture

The key drivers of greentech and innovation in the agriculture sector include[7]:

- **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, pollution and soil degradation, which leads to lower production yields, loss of arable land and reduced resilience;
- **climate change**, which 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 greentech such as solar panels.

Table 2: Key role players in agriculture

R&D	Inputs	Production	Harvesting	Storage	Transport	Processing	Wholesale, retail & exports	Waste
Government								
		Producers						
Research institutions								
Production input suppliers								
Technology suppliers & service providers								
Industry associations								
Labour organisations								

7 | Refer to the 2017 Agriculture MIR for a more detailed discussion of the drivers of green technology and innovation in agriculture. Available at www.greencape.co.za/market-intelligence

2.4.1. Water scarcity as a driver for greentech uptake in agriculture

SA has an average annual rainfall of 470 mm, compared to the world average rainfall of 857 mm. Water is the key limiting factor to agriculture growth in SA (WWF 2010). Water supply and efficiency is, and will continue to be, a driver for greentech uptake, particularly in the WC, which is currently in a severe drought.

Many farmers in the WC rely on surface water and associated bulk water infrastructure. The table below shows water availability for the four major catchments in the WC as at October 2017. It indicates that the current demand for water is higher than the supply of surface water.

Future water availability remains uncertain, particularly as climate change predictions suggest that the province will experience[9]:

- more frequent severe weather events;
- increases in temperature in many regions and resulting changes in precipitation patterns;
- more flooding events resulting in less infiltration and recharge of ground water; and
- population increases of 30% in the next 15 years.

It is estimated that by 2050 rainfall is likely to have decreased by 30% in the WC. Thus, the WC cannot rely on surface water alone. It is crucial to develop alternative sources such as water reuse and groundwater[10], and to reduce water demand.

Large-scale augmented water supply has been slow to come online and deliver in the drought crisis. As a result, municipalities have remained reliant on the bulk infrastructure that services the entire region, limiting the overall available water supply. In response to the water shortage, farmers are diversifying water supply sources and investing in small-scale water supply systems and water demand management.

Water supply

As desalination is not currently economically viable for farmers, with costs at >R40/kl water, farmers have increasingly sought to access groundwater. Although this drought-buffered resource has been important to sustain farmers (to some extent), it is acknowledged that it needs to be collectively and carefully managed.

Water demand management

Many farmers have been proactive in conserving water. Common on-farm water saving practices are:

- installing monitoring systems, e.g. soil moisture probes;
- installing water-efficient irrigation systems, e.g. drip irrigation;
- introducing measures to retain soil moisture and reduce evaporation, e.g. uptake of mulching and use of netting systems.

In addition to these interventions, the drought has forced farmers to consider irrigation trade-offs, e.g. only irrigating orchards that will result in the highest income, or removing blossoms and less productive trees.

Table 3: Water availability in the Western Cape (million m^3 per year)

Source: WCDoA (2017)

Water Management Area	Natural MAR[8]	Ecological Reserve	Yield	Irrigation use	Other use	Total use	Balance
Gouritz	1 679	325	275	254	84	338	-63
Olifants / Doorn	1 108	156	335	356	17	373	-35
Breede	2 472	217	668	576	56	632	36
Berg	1 429	217	678	301	403	704	-26

8 | MAR: Mean Annual Runoff
9 | According to studies done by the Western Cape Department of Agriculture
10 | For more information see GreenCape's Water MIR available from the GreenCape website (www.greencape.co.za)

The business case for water efficiency

Monetary and other benefits related to improved on-farm water efficiency are highlighted in the figure below.

These benefits drive the demand for the uptake of greentech that improve water efficiencies. Water efficiency will always be an extremely (if not the most) important factor to consider when one invests in greentech in SA agriculture. For updates on water efficiency related opportunities, see the 2018 GreenCape Water MIR, which focuses on opportunities stemming from the drought in the province.

In agriculture, water and cost savings are driving a number of greentech opportunities, including:

- **practices and systems to decrease water use for irrigated crops**, resulting in reduced electricity use and costs;
- **controlled environment agriculture**, which can save up to 95% water compared to conventional open systems;
- **conservation agriculture**, which improves soil health, allowing for better water-holding capacity and infiltration, improving yields of rain-fed grains; and
- certain **ICT applications** (precision agriculture), which improve irrigation efficiency.

These are discussed in detail in Section 4.

Precision agriculture[11] in particular can reduce inputs, and thus input costs. By using satellite imagery, for example, farmers can reduce water use by at least 10%. This in turn has reduced energy costs, which are often significant as it requires less water to be pumped for irrigation. Further evidence for this is shown in Table 4 overleaf, which highlights the expected benefits per hectare for different crops, assuming a 10% increase in yield and a 10% reduction in the cost of water, fuel, fertiliser and chemicals. The savings sharply contrast with the low cost of Fruitlook, an open access satellite-based portal that supports precision agriculture, at R150 per hectare.

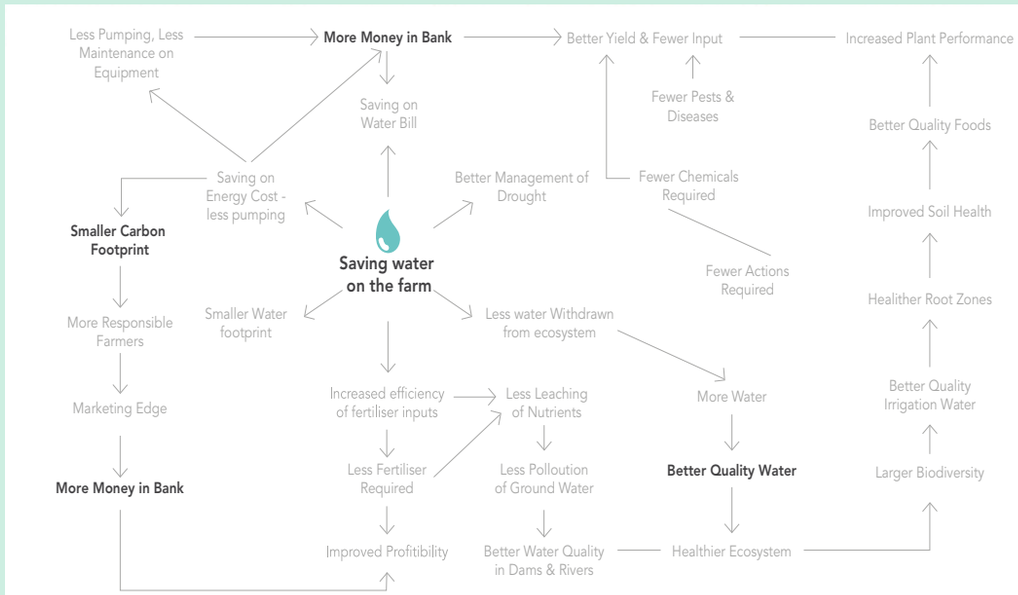


Figure 2: Benefits of saving water on farm

[11] Precision agriculture involves the observation, impact assessment and timely strategic response to fine-scale variation in causative components of an agricultural production process. This farming-management concept is based on observing and measuring spatial and temporal characteristics of a number of crop variables. The goal of precision agriculture is to have a management strategy that results in optimisation of returns on inputs, while preserving resources.

Table 4: Potential costs and savings associated with the application of satellite farming[12]

Source: WCDoA (2015)

Crop	Cost saving per hectare
Wine grapes	R4 130
Table grapes	R23 590
Deciduous fruit trees	R25 160

2.5. Support available in the Western Cape

An enabling environment increases technology uptake and supports the growth of agriculture and related sectors. The table below summarises the programmes, initiatives and tools available to develop the sector and support investors; including farmers, agri-businesses and other role players in the WC. More information on the support environment for investment in the WC can be found in Section 6 of this report.

Table 5: Support for Western Cape agriculture

Programme / initiative / tool	Purpose
Research and Development Programme – Western Cape Department of Agriculture (WCDoA)	WCDoA provides support in six districts of the Western Cape through timely and relevant research and development (R&D) services. This ensures agricultural role players are provided with the most advanced scientific and technical advice. WCDoA can collaborate with international partners to explore opportunities and develop local innovative solutions.
LandCare Programme (WCDoA)	A main function of the programme is to ensure that the national Conservation of Agricultural Resources Act (CARA: Act 43 of 1983) is executed. Through regulations under this Act, public funds can be used to subsidise land users for specific conservation work and can incentivise multi-sectoral partnerships.
SmartAgri Initiative (WCDoA & UCT)	SmartAgri has provided a road map for actionable and prioritised initiatives that will direct the agricultural sector towards greater resilience in the face of climate challenges. It is committed to six priority projects to catalyse the early adoption of important climate change response interventions with high impact. These include: ▪ driving the uptake of conservation agriculture; ▪ restoring ecological infrastructure; ▪ enabling collaborative integrated catchment management; ▪ supporting improved energy efficiency and uptake of renewable energy; ▪ climate-proofing the growth of agri-processing in the WC; and ▪ providing climate-smart agricultural extension services.
GreenAgri (WCDoA & GreenCape)	GreenAgri is an updated, curated, one-stop online information portal for all farmers, researchers, private and non-governmental agencies interested in smart agricultural practices, initiatives and research.
FruitLook (WCDoA)	FruitLook provides relevant and timeous satellite-based information to the fruit and wine production sectors to help increase water use efficiency.
CapeFarmMapper (WCDoA)	CapeFarmMapper is an online mapping tool designed to assist with spatial information queries and decision making in the fields of agriculture and environmental management.
Western Cape AgriStats (WCDoA)	AgriStats is a tool providing aggregated summaries of the 2013 WC Agricultural Commodity and Infrastructure Census. These statistics are disaggregated per local municipality. Information categories include agri-tourism, crops, infrastructure and livestock.
Carbon Footprint Calculator (Blue North)	The Confronting Climate Change (CCC) initiative is a carbon footprinting project. It was developed to support the SA fruit and wine sectors to identify and respond to the risks and opportunities associated with carbon emissions.

More information on the programmes can be found on the GreenAgri portal[13] and the WCDoA web page[14].

[12] Derived from Fruitlook, an open-web portal for fruit and wine grape growers, provided by the Western Cape Department of Agriculture (WCDoA), to assist irrigators with optimising water use.
[13] www.greenagri.org.za/
[14] www.elsenburg.com/

3 – Policies and regulations

With South Africa's extensive and diverse agriculture sector comprising various commodities and stakeholders, there is a range of policies and regulations that directly and indirectly affect the development of the sector.

Many of these have specific relevance to the sustainability of the sector, as they aim to protect natural resources such as land and water. They are also relevant to investors, greentech suppliers and service providers as they guide the developmental pathway of the agricultural sector.

3.1. Agriculture policies and regulations

The national Department of Agriculture, Forestry and Fisheries (DAFF) and the national Department of Environmental Affairs (DEA)[15] are primarily responsible for legislation related to the agricultural sector. Table 6 summarises the relevant acts and policy documents.

More information on key policies and legislation is provided on the GreenAgri portal[16] under Action Plans and Policies and the Green Compliance Tool.

The Green Compliance Tool, funded by the WCDoA, was developed in 2017 with the aim to simplify key legislative processes. The tool provides information on processes, timelines and key contacts for environmental impact assessments (EIAs), application for water use licences, the water use validation and verification (V&V) process, disaster and risk management processes and conservation of agriculture resources (CARA).

3.1.1. Carbon tax

The South African Government is committed to reducing greenhouse gas (GHG) emissions by 34% and 42% below its business-as-usual growth trajectory by 2020 and 2025 respectively (National Climate Change Response Policy 2011). South Africa ratified the Paris Agreement in November 2016 and endorsed its nationally determined contribution (NDC) requiring that SA's greenhouse gas emissions peak in 2020 to 2025, plateau for the period from 2025 to 2035 and decline from 2036 onwards (National Treasury 2017). Part of the strategy to achieve this is the enforcement of a carbon tax, encouraging all sectors and activities, including agriculture, to adopt mitigation strategies[17]. It is determined that the carbon tax would lead to an estimated decrease in emissions of 13 - 14.5% and 26 - 33% by 2035, compared with business-as-usual (National Treasury 2017). The Paris Agreement comes into operation in 2020.

Background

The national Department of Environmental Affairs (DEA) has developed a Mitigation, Reporting and Verification (MRV) strategy as well as baselines towards 2050 for the agriculture, forestry and other land uses sector (Agri SA 2017). This does not only provide guidance for GHG reduction by the sector, but also forms the foundation for developing the proposed carbon tax and offset schemes.

Updates and implications

The Second Draft Carbon Tax Bill was issued for public comment on 15 December 2017 and is expected to be formally tabled in Parliament in mid-2018. In the budget speech on 22 February 2018, the Minister of Finance announced the date of implementation of the carbon tax to be 1 January 2019. A grace period will be given to companies to comply with the law and bring their emissions down, with the first set of taxes to take effect in January 2020. The implementation will be accompanied by a package of tax incentives and revenue recycling measures.

Apart from the forestry sector where plantations and natural forests exceed 100 ha, agriculture, forestry and other land use and waste sectors will be exempt from direct GHG emissions taxation during phase one (2020 to 2022), but will be indirectly taxed for energy and fuel use. Although there are uncertainties post 2022 or after phase one, taxation of direct GHG

15 | DEA is specifically involved in EIAs, natural resource protection (e.g. wetlands) and legislation on invasive species.
16 | www.greenagri.org.za/
17 | A breakdown of the carbon tax system is provided in the Second Draft Carbon Tax Bill of 2017.

Table 6: Selected acts and plans relevant to the agricultural sector

Name	Relevant objectives/purpose
The Conservation of Agricultural Resources Act 43 of 1983 (CARA 1983)	▪ Use of natural agricultural resources ▪ Conservation of soil ▪ Conservation of water sources ▪ Combating weeds and invader plants
The National Development Plan 2030 (NDP 2012)	▪ Elimination of poverty ▪ Reduction of inequality ▪ Highlighting the importance of agriculture to the green economy
The Agriculture Integrated Growth and Development Plan (IGDP 2012)	▪ 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)	▪ A programmatic response to key policy documents, including the National Development Plan (NDP) and the New Growth Path (NGP)
The Medium Strategic Framework (MTSF 2014-2019)	▪ Outcome 4 – Decent Employment through Inclusive Growth ▪ Outcome 7 – Comprehensive Rural Development and Food Security ▪ Outcome 10 – Environmental Assets and Natural Resources Protected and Continually Enhanced
Strategic Plan for the Department of Agriculture, Forestry and Fisheries (DAFF 2013)	▪ Provides an effective framework to address various challenges facing the sector ▪ Sets targets for the departmental programmes from 2012 to 2017 ▪ Focuses on building a leading, dynamic, united, prosperous and people-centred sector
The Spatial Planning and Land Use Management Act (SPLUMA 2013)	▪ Provides for a uniform, effective and comprehensive system of spatial planning and land use management for South Africa ▪ Provides for sustainable and efficient use of land ▪ Redresses the imbalances of the past and ensures equity in the application of spatial development planning and land use management systems
National Environmental Management Act 107 of 1998 (NEMA 1998)	▪ NEMA is the overarching legislative framework for environmental governance ▪ Core values are reflected through the following principles: ▪ 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
National Environmental Management Biodiversity Act 10 of 2004 (NEMBA 2004)	▪ Provides for the management and conservation of biodiversity within the framework of NEMA ▪ National protection of species and ecosystems that warrant national protection ▪ Sustainable use of indigenous biological resources ▪ Fair and equitable sharing of benefits arising from bioprospecting involving indigenous biological resources ▪ Establishment and functions of a South African National Biodiversity Institute (SANBI)

emissions from the agriculture, forestry and other land uses sector is expected to apply only to farms and enterprises that exceed 100 000 tonnes of carbon dioxide equivalent (CO_2eq) per year (Agri SA 2017). This threshold is comparatively high, which suggests that very few agricultural enterprises will be taxed through the direct GHG emissions route. However, they will experience the knock-on effects of the tax on other sectors, e.g. those associated with agricultural inputs and logistics.

Large-scale carbon sequestration and storage projects may provide opportunities for the sector[18]. Several local institutions are actively trying to unlock this opportunity, but to date there have been few successes. Among others, the correct policy and financing tools (incentives / offset schemes) would be needed. Further information on the carbon tax and its potential implications for the agriculture sector can be found in 'Implications of a carbon tax and offset system for Agriculture in South Africa'[19] presented by Agri SA (2017).

3.1.2. Water

There were several new regulatory developments for water and its use in 2017 that have ultimately driven the need for improved water management. Table 7 provides an overview of some of the main acts regulating the water sector, with the 2017 regulatory developments discussed thereafter. For more information on water legislation and regulation, refer to the 2018 Water MIR[20].

Agriculture will be exempt from direct GHG emissions taxation during phase one (2020 to 2022), but will be indirectly taxed for energy and fuel use.

Table 7: Main water-related legislation

Name	Selected objective / purpose
National Water Act 36 of 1998 (NWA)	Redefines water rights in SA to stimulate inclusive growth.
Water Services Act 108 of 1997 (WSA)	Defines the role of the national government as a regulator, the role of water boards as bulk providers, and the role of municipalities as service providers.
The National Water Resource Strategy 2 of 2013 (NWRS2)	Assists in the implementation of the NWA while protecting, developing and controlling water resources in a sustainable and equitable manner.

18 | The Agri SA Commodity Chamber has recommended that agricultural enterprises that exceed the emissions threshold should be allowed to offset their emissions by submitting carbon storage / sequestration inventories.
19 | https://goo.gl/iapXKM
20 | www.greencape.co.za/market-intelligence/

Updates to regulations and implications for agriculture

There have been two major updates:

- **Water restrictions:** In response to the drought, the national Department of Water and Sanitation (DWS) has curtailed agricultural water use by 60% in the WC, with the extent of the restrictions varying per region (DWS 2018). In addition, the DWS curtailed groundwater resources for agricultural water use by 60% in the Berg-Olifants and Breede-Gouritz Water Management Areas (WMA) (DWS 2017a). As water is a key input to agriculture and the critical factor constraining future growth, restrictions on its use have a significant impact on the sector.

- **Measurement, recording and reporting of water consumption:** On 17 February 2017 the DWS, in terms of Section 26 of the National Water Act, required 'the taking of water for irrigation purposes [to] be measured, recorded and reported' (DWS 2017b). The regulation specifies the requirements and procedures for measuring the irrigation water extracted from all water sources.

Agricultural producers had to comply with the new regulations at very short notice. However, as the Irrigation Boards (IB) or Water User Agency (WUA) act as the controlling authorities, the institutional structures and infrastructure are in place to some extent to facilitate compliance. By monitoring water meters, the IB and WUA are in a position to exercise control over water abstraction, although monitoring of irrigators abstracting directly from river and ground water sources remains a great challenge (Keuck 2017). This has resulted in access to irrigation water being cut in some areas, specifically the Berg River area, in February 2018.

The DWS is continuing the roll-out of the water use validation and verification (V&V) project. The V&V project determines existing lawful use (ELU) to which each property was entitled under the old Act (pre-1998) and to determine each property's entitlement under the NWA of 1998. All industrial and commercial water users, including those in the agricultural sector, are expected to verify their water use.

The V&V for the Breede-Gouritz WMA is being finalised, while the V&V for the Berg-Olifants area is underway. Any water use not part of the ELU (determined from the V&V) will be considered unauthorised, except where a water use licence has since been obtained or a general authorisation applies. The V&V project requires a signed application form for each property.

The GreenAgri portal[21] provides more information on the water use V&V process under the Green Compliance Tool.

3.1.3. Land reform

The White Paper on South African Land Policy (1997) addresses the injustices and land inequalities that came about during colonialism and apartheid. As the 2017 Agriculture MIR identified, this has had some implications for investors in the agricultural sector, particularly uncertainty over land rights and fears of unconstitutional land expropriation.

In response, several support strategies have been put in place over the past few decades to ensure successful transition of land under land reform. New landowners receive support in the form of infrastructure, inputs, extension services and training. Various policies have been introduced, including the Land Redistribution for Agricultural Development (LRAD) programme, the Settlement Production Land Acquisition Grant (SPLAG), and the Proactive Land Acquisition Strategy (PLAS).

On 27 February 2018, the SA parliament passed a motion to look at the feasibility of amending Section 25 of the Constitution, also known as the 'property clause', to allow for land expropriation without compensation. There is much speculation around the approach to implementation; however, the government has assured that the approach (which is still to be decided upon at the time of writing) will safeguard food security and the continued growth of the economy and agricultural production sector. Government leaders have insisted that farming activities and investment should continue as normal.

More information is available from the Department of Rural Development and Land Reform[23].

21 | http://www.greenagri.org.za/
22 | https://goo.gl/uAd8J9
23 | http://www.drdlr.gov.za/

Industrial, commercial and agricultural water users are required to verify their water use to determine their existing lawful use (ELU). Any water use not part of the ELU, and not corroborated by a water licence or general authorisation, will be deemed unauthorised.

3.1.4. Initiatives promoting sustainable production

In 2017, the deciduous fruit industry signed the Bee and Pollination Charter. This agreement prevents producers from spraying pesticides while bees are active. The charter also requires chemical representatives to provide products with clear instructions to producers. This is a positive move by the agro-chemical industry to help protect the bee population.

3.2. Investment policies and regulations

There are several key policies and regulations of direct relevance to investors in SA. Detailed information can be obtained from Wesgro, the official tourism, trade and investment promotion agency for the WC. Wesgro has developed a document, Doing Business in South Africa[24], which includes information on corporate tax rates and access to finance.

In 2016/17 Wesgro developed an Invest in Cape Town[25] report that provides key insights for investment in Cape Town and the WC. The report contains information on the WC's support for agro-processing through Project Khulisa, a WC government initiative that supports the economic sectors in the province that are growing the fastest and have the potential to create job opportunities, of which agro-processing is one. It also highlights key interventions to promote the sector, including a focus on halal exports, increasing exports of wine and brandy, and improving local capacity to process agricultural produce.

24 | https://goo.gl/7TyJV9
25 | https://goo.gl/xVbM9F

4 – Opportunities and barriers

The fields of energy efficiency and renewable energy, conservation agriculture and controlled environment agriculture offer attractive opportunities for investors and businesses. Likewise, there are opportunities in drone and ICT technologies and applications for improved farm management.

This section starts by providing brief updates on agriculture-related market opportunities in energy efficiency (EE), renewable energy (RE) and conservation agriculture (CA). Opportunities in controlled environment agriculture (CEA) and drone technology use in precision agriculture are addressed in more detail. New trends follow, including the use of ICT applications in agriculture and index-based insurance for smallholder farmers.

Agri-related solar PV grew notably in 2017, with over 8 MW of installations in SA, and over 2 MW in the WC.

4.1. Market updates for 2018: energy efficiency, renewable energy, and conservation agriculture

While there have been minor market developments in agri-related EE (Table 8), the agri-related solar PV market has grown notably from previous years, particularly in the WC.

- An additional 8 395 kWp of solar PV was installed in SA agriculture in 2017, with the WC having installed 26% (2 233 kW_p) (see Table 9 and Figure 3).
- Twenty-one (21) WC municipalities now have rules, regulations and tariffs in place for solar PV installation, as compared to 15 in 2016 (Figure 4).

Table 8: Energy efficiency market update

Opportunity	Updated market size for SA agriculture and agri-processing	Developments and insights	Barriers to uptake
There is a strong business case for investment in EE[26]. Key opportunity areas: ▪ irrigation systems ▪ packhouses ▪ cold stores ▪ cellars Key interventions: ▪ energy audits ▪ energy management practices ▪ EE technologies for buildings and processing	Known investment to date (based on available case studies) is R3.6 m[27]. Estimated market value is R76 million[28]. It includes a significant market for services and technologies in the WC with over 22 000 agricultural facilities[29].	Increasing interest and implementation of EE technologies and practices, specifically of variable speed drives[30] (VSD) and energy management practices. On-farm housing offers additional opportunities[31].	Scepticism and lack of understanding about Energy Service Company (ESCo) models compared to ownership and potential savings.

Table 9: Renewable energy market update

Opportunity	Updated market size for agriculture	Developments and insights	Barriers to uptake
Solar PV opportunities for manufacturers and service providers include: ▪ manufacturing of components/ products, ▪ installation of systems ▪ energy services, (specifically performance-based electricity supply contracts). The drivers of RE uptake are: ▪ replacement of expensive electricity (Eskom) with relatively 'cheap' energy, and ▪ the growing ability to connectt and feed into the grid. For more information, refer to the 2018 Energy Services MIR[32].	R20 m – R190 m[33] for WC R420 m – R640 m for SA	According to Power Quality and Renewable Services data (PQRS 2017)[34] shown in Figure 3: ▪ 31 780 kW_p of solar PV was installed by agri sector prior to 2016. ▪ 8 395 kW_p of additional solar PV was installed in the agri sector since 2016. ▪ 2 233 kW_p (26%) was installed in the WC, the highest amount compared to other SA provinces. 12B tax benefit now allows for a 100% accelerated asset depreciation within the first year for RE installation[35]. Seven additional WC municipalities allow smallscale embedded generation (SSEG) to feed into the grid (see Figure 4).	Scepticism and lack of understanding about ESCo models compared to ownership. Many old farm buildings have asbestos roofing.

26 The 2017 Agriculture MIR contains a case study on EE interventions at Durbanville Hills wine estate.
27 The known investment was calculated from case studies published by (a) the National Cleaner Production Centre's (NCPC) Industrial Energy Efficiency (IEE) Project (NCPC 2014); (b) Confronting Climate Change (CCC 2013); and (c) the Renewable Energy and Energy Efficiency Partnership and the South African National Energy Development Institute (REEEP & SANEDI 2016).
28 Conservative estimate calculated by GreenCape (2017a). Total energy use for SA agriculture = 5 513 GWh (IEA 2017). Rand per kWh value was calculated at R1.38 / kWh through known investments and kWh energy savings. Thus, total energy cost for SA agriculture is 5513,000,000 kWh X 1.38 / kWh = R7.6 billion. Assuming a conservative 10% uptake within the agriculture sector and 10% energy savings, the market is 1% of the total cost, i.e. R76 million. Note that a cost saving of 10% is a conservative estimate provided by industry experts. The average energy efficiency cost savings have proved to be higher: approximately 35% for commercial and industrial businesses (NBI 2016).
29 Numbers obtained from WCDoA Agri Stats; they include abattoirs (80), fruit packhouses (44), fruit cold chain facilities (29), wineries (568) and homesteads (19 425) (WCDoA 2013).
30 Note: Although there is a strong business case for VSDs in agriculture, savings through VSD are situation specific.
31 GreenCape stakeholder interview: KBC Industrial.
32 https://www.greencape.co.za/market-intelligence/
33 According to PQRS 2017 data, the current installed solar PV for the agriculture industry is approximately 40 000 kW_p, given that systems costs range from R10 500 / kW_p for a system size greater than 500 kW_p and R16 000 / kW_p for a system smaller than 100 kW_p. System cost range is supplied by the Energy Sector Desk at GreenCape.
34 The PQRS database is a local, voluntary database of solar PV installations (see www.pqrs.co.za).
35 For more information, see the 2018 Energy Services MIR or contact the Energy Sector Desk at GreenCape.

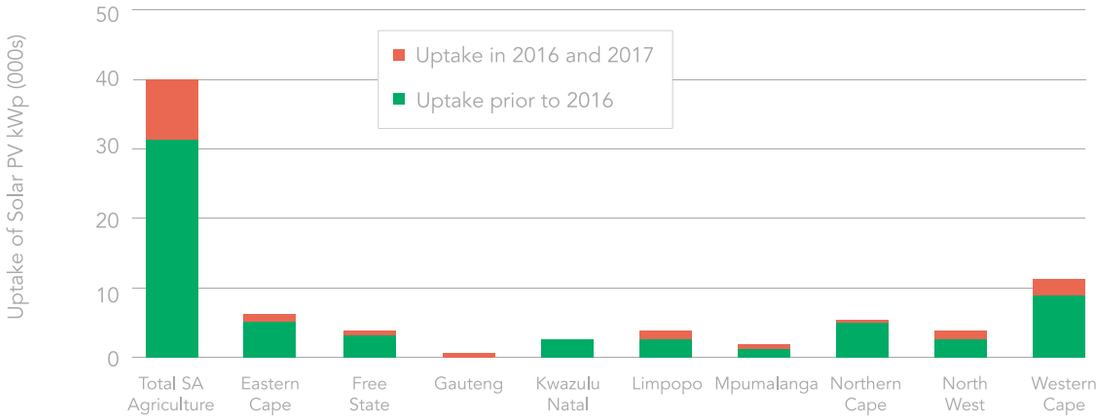


Figure 3: Uptake of solar PV by the agriculture sector

Case study: Senwes Group installs solar PV on grain silo system

In June 2017 the agricultural company Senwes Group installed the first solar PV silo system in South Africa. The installation is located at the company's Hennenman silo in the Free State Province. It has reduced the company's electricity demand from the local municipality and provides 62% of its electricity consumption.

The solar PV system is equipped with an advanced control and monitoring system that allows it to operate with a diesel generator in the event of a power outage. The plant currently does not use battery storage; however, this is under investigation.

When energy consumption is lower than the potential production by solar PV, the output of the system is reduced to exactly match the demand. This allows the system to operate at zero export (or zero feed-in) to the grid, seeing that the local municipality, Matjhabeng, currently does not have feed-in tariffs.

Key lessons learnt:

- Ensure proper planning of the space to be used and the impact of the installation on operations.
- Consider security for ground installations.
- Use a qualified and accredited engineering firm to design the system and obtain authorisation for grid connection.

Size of installation		**358kW$_p$**
Energy generated		472 460 kWh a year (62% of electricity consumption)
Panels	**Number**	1 120 (240 roof and 880 ground)
	Make	Jinko 320M-72
Inverters		SMA STP 25 000
Reduction in GHG emissions		472.5 tonnes of CO^2eq a year

36 | Information provided by GreenCape 2017a.

Municipality	SSEG tariffs	SSEG policies
Beaufort West	Yes	Council resolution
Bergriver	No	In progress
City of Cape Town	Yes	Yes
Drakenstein	Yes	Yes
George	Yes	Yes
Mossel Bay	Yes	Yes
Oudshoorn	Yes	Yes
Overstrand	Yes	Yes
Stellenbosch	Yes	Yes
Swartland	Yes	Yes

Theewaterskloof	Yes	Yes
Langeberg	Yes	Yes
Breede Valley	Yes	Yes
Saldana Bay	In progress	Yes
Witzenberg	In progress	Interim policy
Prince Albert	Council resolution	Council resolution
Laingsburg	Council resolution	Council resolution
Cederberg	Yes	In progress
Cape Agulhas	Yes	Yes
Kannaland	In progress	In progress
Hessequa	In progress	In progress

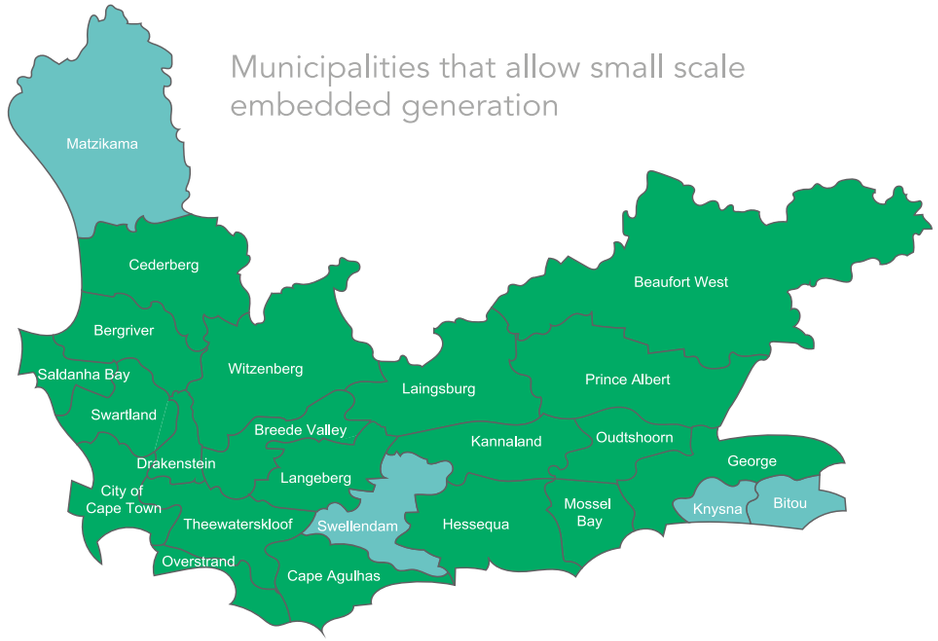


Figure 4: Small scale embedded generation in the Western Cape[36]

There are several case studies of solar PV uptake in agriculture, particularly for wineries and fruit packhouses (see the 2017 Agriculture MIR for details). Another example is the installation of solar PV on the Senwes Group's grain silo system to provide more than 60% of the silo's electricity needs (see the case study).

In conservation agriculture (CA) there have been institutional developments, e.g. the establishment of local CA farming organisations and investment into CA R&D (Table 10). These will support the growth of associated CA markets, such as CA equipment and machinery.

Table 10: Conservation agriculture market update

Opportunity	Updated market size[37]	Developments and insights	Barriers to uptake
CA is a way of farming that aims to decrease input costs and improve yields through improving soil health[38]. The main greentech opportunity is the manufacturing and sale of no-till machinery, which is mostly imported into SA.	The global CA cropland area increased by ~68% since 2008/09 and by ~15% since 2013/14 (see Figure 5, Kassam et al. 2017). In 2015/16, CA covered some 180 Mha million hectares, or 12.5% of the total global annual cropland. CA adoption in SA as a % of grain farmers per SA province: ▪ WC: 80% ▪ KwaZulu-Natal: 70% ▪ Free State, North West and Mpumalanga: max 20% each.	There is a wide range of CA initiatives implemented in SA, of which many are successfully driven by local CA farmer groups such as: ▪ No-Till Club in KwaZulu-Natal ▪ CA Western Cape ▪ Ottosdal No-Till Club in North West There has been a significant amount of investment in CA research in SA through the Maize Trust, Grain SA, the Agricultural Research Council (ARC), and several other stakeholders.	Ignorance about 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, i.e. relatively long return on investment (ROI) of approx. six years is particularly challenging as little financial support is available. High cost of imported equipment, although local production is now addressing this barrier to some extent. No supporting policy in place (although a national draft policy is being developed).

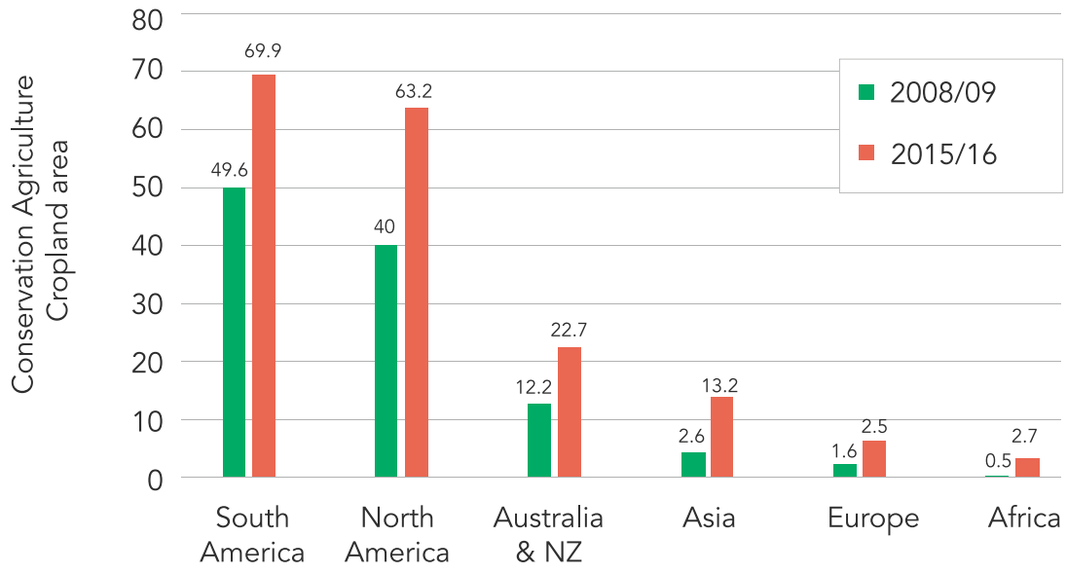


Figure 5: Cropland area taken up by conservation agriculture from 2008/09 to 2015/16

37 | The most recent statistics on the global uptake of CA were obtained from abstracts for the 7th World Congress on Conservation Agriculture available from http://www.blwk.co.za/

38 | See 2017 Agriculture MIR for more detail, including definitions and evidence of uptake: https://www.greencape.co.za/market-intelligence/

The main conservation agriculture opportunity is in the manufacturing of no-till machinery

For more information on the EE, RE and CA opportunities, please see the 2017 Agriculture MIR.

4.2. Controlled environment agriculture

Based on known investments, the WC market for CEA is conservatively estimated to range between R28 million (low-tech) and R600 million (high-tech). Growth is expected to exceed 15% per year, with recent investments of over R128 million (medium-tech) in the WC.

This market creates opportunities for investors, greentech manufacturers, consultants and importers in areas such as:

- affordable high-tech automated systems, specifically for high-value crops;
- skills development;
- increased affordable finance; and
- import substitution of components.

4.2.1. Overview

Application of CEA technology in SA is on the increase. CEA refers to types of greentech such as undercover farming that help producers increase resource efficiency (particularly water), reduce production losses and increase resilience to climate change.

SA producers have implemented various CEA technologies, ranging from netting and basic tunnels to fully automated systems. The uptake of CEA is mainly in the production of high-value soft and stone fruit, citrus, leafy and other above-ground vegetables, and flowers for local and export markets. CEA is vital for the high-value export industries to expand and remain competitive, particularly in the WC. For example, with the area planted with blueberries expanding by an average of more than 30% per year in the last 5 years, the SA berry industry has become a major adopter of CEA.

As illustrated in Figure 6, of the total area planted with blueberries in SA, ~61% is grown under shade netting and ~14% in tunnels (Sikuka 2017).

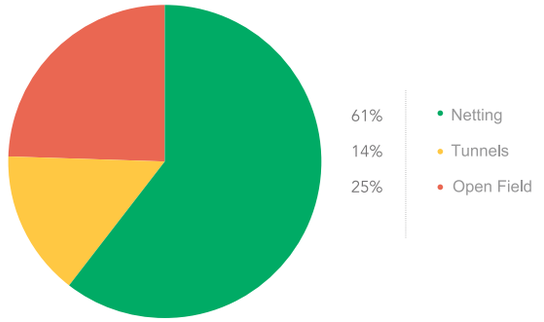


Figure 6: Types of blueberry production systems in South Africa

CEA yields a higher percentage of grade-one produce due to protection from hail, rain and heat damage, compared to open field production. This is a key factor for international exports, as is demonstrated in the case study below. Local and international market pressures for high-quality produce and sustainability of supply are further drivers in uptake.

Researchers and commodity associations have started to quantify benefits. It has been demonstrated that netting cover over citrus orchards results in higher quality fruit due to reduced sunburn. It has also led to 20% to 30% savings in water use (Steyn et al, 2017). Furthermore, farmers using CEA have reported revenue increases of up to 60% owing to higher yields and longer production cycles. This allows both earlier and later penetration into competitive markets as compared to conventional farming.

As identified in the 2017 Agriculture MIR, which focused on the WC market, the greatest uptake of CEA has been in peri-urban and rural agricultural regions.

4.2.2. Market update

The 2017 Agriculture MIR estimated an annual growth of 8% in the uptake of CEA technology globally (GreenCape 2016). However, recent stakeholder interviews indicate that this figure will either be maintained or grow to 10% globally in the next few years (GreenCape 2017a).

The Western Cape market for CEA ranges between R28m – R600m, based on known investments. This could be significantly higher, judging by recent investments of R128m in medium-tech CEA.

According to Global Market Insights (2017), the global vertical farming market size, both indoor and outdoor, is estimated to grow more than 27% from 2013 to 2024, with indoor farming growing at a much faster pace.

As seen in Figure 7, steady growth is predicted for the three main technologies applied in CEA; however, it is anticipated that hydroponics will remain the most popular technology. In 2016, the global market size for vertical farming was more than US$ 2 billion (R28 billion)[39] and is predicted to surpass US$ 13 billion (R186 billion) by 2024. Outdoor vertical farming is estimated to account for less than 30% of the overall market growth, highlighting the shift toward indoor farming.

Farmers using CEA have reported revenue increases of up to 60% owing to higher yields and longer production cycles

Case study: Comparative study illustrates business benefits of undercover tomato production

Haygrove, an internationally recognised company specialising in tunnel structures, recently did a comparative study for a tomato farmer in East London, a city in the Eastern Cape province of SA, to determine the exact benefits of growing produce under cover.
The crops were grown under a series of Haygrove trellis tunnels, designed specifically for trellising crops such as tomatoes. The design allows for ventilation along the full length of the tunnel, ensuring near-perfect environmental conditions for the tomato crop. Over a one-year period, three trial blocks were tested under different conditions:

- one block was grown in open field conditions;
- one block was grown hydroponically in a Haygrove trellis tunnel; and
- one block was grown in soil in a Haygrove trellis tunnel.

All plants received the same irrigation, fertilisation and pest control treatment.

The results summarised in the table above, show that produce farmed in soil using Haygrove trellis tunnels produce 176 tonnes / ha more than open field farming. The produce farmed with hydroponic undercover techniques produced 332 tonnes / ha more than soil-based open field farming. This shows an increase of more than 600% in tonnes produced per hectare.

Not only were the yields higher, the percentage of class one (export quality) crop was 1.5 times higher. Another bonus was the extended season of the crops under cover, which meant produce was available to the market when prices were higher.

Producers often avoid undercover farming due to the initial capital outlay of a structure like the Haygrove trellis tunnel. However, farmers report that the benefits of increased yields and higher income result in a reasonable payback time, typically two years.

Table 11: Results from comparative study between open field and undercover farming for tomato production

	Units	Open Field	Haygrove Trellis Hydroponic	Haygrove Trellis Soil
Total yield (2 crops in tunnels per year)	Tonne / ha	60	392	236
Percentage (%) class one fruit per harvest	%	60%	90%	90%

39 | US$ 1 = ZAR 14.33 average exchange rate for the period January 2017 to January 2018

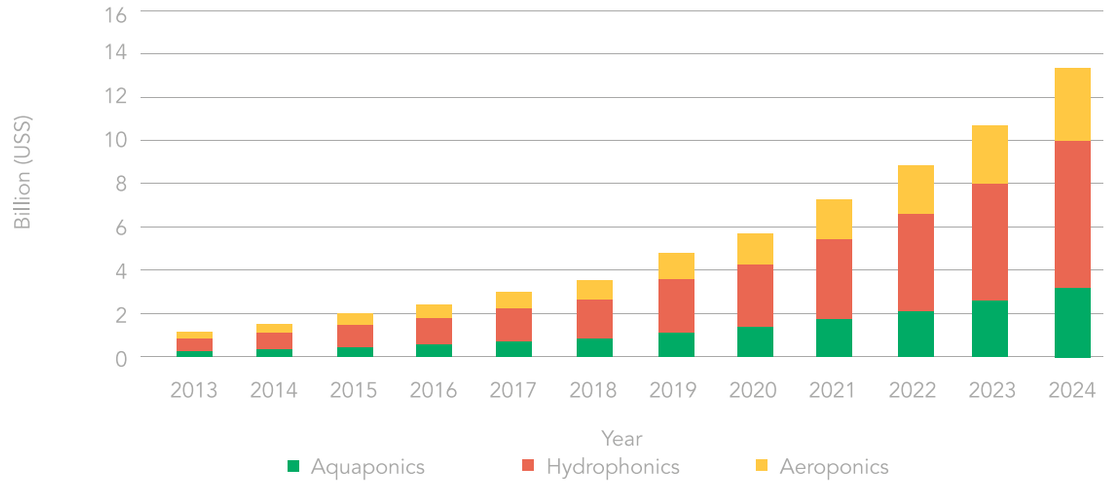


Figure 7: USA vertical farming market size per technology from 2013–24 (US$ billion)

In the WC, the 2017 baseline market estimate is conservatively valued at R28 million (for low-tech CEA) to R600 million (high-tech CEA)[40], with growth of ~15% a year[41]. Two key industry players reported that an additional R128 million (85 ha) of medium-level tech (including automated fertigation systems costing on average R1.5 million/ha) was installed in the past year.

This investment, and recent stakeholder interviews, highlight that the market growth of CEA technology in the WC is potentially greater than 15% per year; however, new or emerging CEA farmers report difficulties in entering certain commodity markets where established conventional farmers have long-standing contracts with retailers.

Most of the investment in the WC to date has been in low- and medium-tech protective material. However, there is an increased shift in investment towards high-tech automated CEA systems as the market becomes more familiar with the concept and its efficiencies. Investments are seen in both soil-based and non-soil-based systems (the latter including hydroponics, aquaponics and aeroponics).

There has also been an increased uptake of CEA by the citrus industry. In the Limpopo province, a citrus producer selling to the export market installed 109 ha of netting over orchards in 2017, with an additional 70 ha planned for 2018 to reduce production losses caused by hailstorms (SAFE news 2017).

Emerging opportunities within the CEA space include:

- affordable high-tech automated systems, specifically for high-value crops
- skills development
- increased affordable finance
- import substitution of components.

As stated in the 2017 Agriculture MIR, international expertise and advances in countries such as Israel, the Netherlands and France have led to importation of many components, resulting in high capital costs. This opens up opportunities for import substitution, stimulating local manufacturing of components and systems that are applicable to WC conditions[42].

Furthermore, there is a high demand for good quality seedlings in SA, which often results in a long waiting periods. As a result, the use of CEA systems to grow seedlings is being explored.

40 | Baseline estimate of market size for low-tech CEA (e.g. netting) = estimates of 140 ha from two companies x R200 000/ha = R28 million market. Baseline estimate for market size for high-tech CEA (e.g. advanced hydroponic systems) = estimates of 60 ha from two companies x R10 million/ha (technical infrastructure) = R600 million market.
41 | Low-tech CEA is expected to grow faster than high-tech CEA due to the current cost of high-tech CEA technology.
42 | Those with an interest in such manufacturing could consider the Atlantis Special Economic Zone (SEZ) for greentech manufacturing. For more information on the Atlantis SEZ please see the chapter on 'The Western Cape: Africa's Green Economy Hub'.

Recent investments and how they have been financed

SA's limited financial options for CEA farmers and high lending and insurance costs from financial institutions have led to an increase in partnerships, shared funding models and private investment. Limited financial options exist, even though most aspects of production are controlled, which decreases the risk of production losses compared to a conventional open system. This points to a limited understanding of advanced agricultural technology in SA.

Although there are barriers to investment, growth in the CEA market is increasingly evident in SA and Africa. The following developments provide insight into the investment channels explored and partnerships formed to enable successful implementation of CEA in SA and Africa.

Hydroponic flower production with foreign capital: A local hydroponics flower producer formed partnerships with international CEA technology and service providers. Due to high lending costs, the local farmer collaborated with a Netherlands-based company. Through this partnership, the farmer acquired the needed capital at a more favourable rate in the Netherlands. The partnership also enables the producer to obtain continuous operational support from skilled experts abroad.

Tunnel vegetables with local finance: A CEA project is planned in collaboration with a full management team of skilled staff, industry experts, and professionals. The operation will be one quarter of a hectare in size and located in the peri-urban region in Stellenbosch, with another location in Pretoria.

The fully automated system will include four green vegetable production tunnels, one mushroom production tunnel and one aquaculture tunnel. The CEA system will have storage, management and production facilities with off-grid energy solutions. To date the project has secured 50% financing with one of the largest SA agri investment organisations and is in final discussions with a 50% equity investor.

The produce is marketed towards the niche 'health conscious' export market through reduced chemical inputs. The facility will produce on-site fish feed and house a processing and packaging facility. The net present value (NPV) of each project is R25 million and construction cost is R11 million. The projected internal rate of return (IRR) is 25% over a 10-year period. Most of the CEA technology components are to be imported from international suppliers. The engineering, procurement and construction will be managed by Monolith 4D.

Citrus, kiwi and table grapes with equity investment: Equity investors have shifted their focus from growing seedlings for wine grape production to citrus, kiwi and table grape production in CEA systems. They are collaborating with a Dutch company who produces turnkey modular CEA systems. The partnership is looking for a suitable site to further their R&D locally.

Modular container farming with grant and equity funding: Where funding is not obtainable, private investment funds for smaller CEA start-ups. A key target market for start-ups are restaurants and hotels. Modular container farming is practised in Nigeria by a company called Fresh Direct. The company is financed through grant funding, but most of the funding is equity funding. The company has acquired locally sourced containers at lower cost, and it rents vacant inner-city land to reduce distance to market. The key markets are restaurants, retailers, direct delivery at customers and farmer markets. This is a similar scenario to the local leafy greens producer, which started with own investments and targeted niche markets. Due to difficulty in obtaining contracts with retailers, the company has started exploring markets for its technology in other neighbouring countries.

4.2.3. Barriers to investment

With CEA being an emerging market in South Africa, there are many remaining barriers to development and implementation. The 2017 Agriculture MIR highlighted a number of these:

- **Capital costs** for specialised lighting and climate-controlled systems are high.
- **It is difficult to enter into supply contracts** with retailers until quantity and quality can be demonstrated.
- **Producers are legally prohibited to label produce as organic** when grown in non-soil growth mediums; thus they are unable to enter the organic market.

Recent stakeholder engagements highlighted additional barriers:

- **Lack of access to finance** for 'smaller' projects. Most financial institutions only finance CEA projects of R5 million or more. This creates a barrier for start-ups in accessing funding.
- **Lack of public funding for R&D** leads to privately funded R&D, which results in little to no information sharing.
- **Lack of access to hedge funds:** Funding models are designed to take into account risks associated with conventional production systems. They are not tailored to the uniqueness of CEA conditions and have relatively high lending costs.
- **Certification**, e.g. Global GAP certification, is unaffordable for small players in the emerging market, which in turn makes it more difficult to secure supply contracts with retailers.
- **Cold truck delivery requirements** by some retailers increase costs for new CEA farmers.
- **Specialised skills and knowledge** to operate and maintain CEA systems are lacking.
- **Poor feasibility studies, and components and systems that are not suitable for local conditions**, are main causes of failed projects in SA.
- **High-tech CEA projects are energy intensive.** Electricity plays a major role in keeping the system functioning, i.e. cold storage, regulating water temperature in aquaculture. Rising energy prices in South Africa are expected to affect the uptake of high-tech CEA, but there may also be opportunities for taking up small-scale RE generation.

In addition to these, barriers have been identified to implementation of CEA in urban regions of the WC (see 2017 Agriculture MIR).

Hope that CEA-specific labelling will stimulate market demand

Although the inability to label produce as organic has been identified as a barrier for the industry, various associations have been working on CEA-specific labelling. The Association for Vertical Farming is assisting in the development of a labelling standard for vertically farmed produce.

With the growth of CEA in SA, the association is looking at broadening its reach beyond the USA, EU and Japan into SA. In addition, the Aquaponics Association, established in SA, provides certification labelling for aquaponics produce. It stimulates the growth of the aquaponics market locally and opens up opportunities to access niche markets and obtain premiums.

4.3. Precision agriculture: drone technology in agriculture

Precision agriculture entails the observation and measuring of spatial and temporal characteristics of a number of crop variables. It uses new technologies such as sensors, satellites, drones and Global Positioning Systems (GPS), to rapidly gather data for a specific crop field or farm. Drones are an example of the use of ICT technologies to support precision agriculture as the technology gathers data and communicates information to improve farm management.

Despite being in its infancy, SA's drone market was estimated at R2 billion in 2017 (IT News Africa, 2017). In agriculture, the main opportunity for investors, greentech manufacturers, services providers and other players, is in the supply, servicing, operation, and data management areas in precision agriculture.

With global drone leaders predicting that the drone market will be the largest in the agricultural sector, and with a potential total addressable market of over US$ 127 billion (R1 820 billion) (PwC 2017), the SA agri market for drones is showing significant future potential.

4.3.1. Overview

Precision drones can be used throughout the life cycle of the crop. The uptake of the technology provides evidence of a broader trend in agriculture – an increasingly data-driven approach to on-farm management decisions.

Although there has been a boom in sensor-based and remote-sensing technologies for precision agriculture, and a sharp rise in companies offering

Despite being in its infancy, SA's drone market was estimated at R2 billion in 2017

sensor-based solutions, it does not necessarily mean these technologies and solutions suit farmers' needs. Initially, farmers were overwhelmed by drone technologies' apparent capabilities and applications for precision agriculture, causing them to be hesitant about the technology, or alternatively be disappointed if the technology did not meet their expectations. This sentiment is changing, however, with growing knowledge of drone applications and the technology's ability to use algorithms that make the data increasingly useful (enabled primarily by machine learning)[43].

The major drivers for drone technology uptake in agriculture are:

- **Resource savings:** The technology has proven cost and time savings to farmers. In a highly competitive global market, production efficiencies are key to staying viable, especially with rising input costs (see drone technology case study overleaf).
- **Water scarcity:** SA is a water scarce country and future water allocations for agriculture are set to decrease. Water use efficiency is vital for the survival of farming enterprises and can be achieved through precision agriculture technologies.

43 | Machine learning is an application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. It focuses on the development of computer programmes that can access data and use it to learn by themselves.

Case study: farm savings through drone technology

Pesticides are one of the main input costs to a farming operation. Using precision agriculture to determine the optimal application of chemicals such as pesticides is becoming common practice. It helps reduce water pollution caused by over-application of pesticides. It also helps farmers save money and improve their environmental footprint, with the latter becoming increasingly important for accessing international markets.

The drone and satellite technology company DroneClouds was keen to learn to what extent their technology could help improve the efficiency and effectiveness of agri-chemicals application. They tested their system on a citrus farm of a major exporter located in the Citrusdal valley of the WC.

Any spray programme for this large farm with multiple cultivars requires careful management. Determining where and how much pesticides should be applied takes time and requires large teams of labourers. Furthermore, field visits lead to a measure of variability in observations and miscalculation risks when spraying specific rows and/or trees.

The results of DroneCloud's tests are as follows:

- Coverage: 187 ha were evaluated in one flight;
- Data collection: 17 minutes were required for flight and sensing;
- Data analysis: 48-hour turnaround time;
- Results: identified various areas where chemicals were misapplied; and
- Savings: 6% on agri-chemicals, 85% on time.

4.3.2. Market uptake

The use of drones, or remotely piloted aircraft systems, is forecast to grow exponentially (Navigant Research 2015). However, this technology has not been adopted in SA as fast as in other countries. The global and SA markets are discussed below, along with the key drivers and barriers for uptake in our market.

Global market

A report from RnR Market Research states that the global drone technology market is set to be worth nearly US$ 3.7 billion (R53 billion) by 2022. While private companies and governments are increasingly using drones, related legislation is lacking in most countries.

In 2015, over US$ 350 million (R4 270 million) was invested in 37 drone companies with agricultural applications. These were some of the largest deals across the agritech industry in the course of the year (AgFunder 2015). DroneDeploy, a cloud-based software company operating in over 100 countries, has revealed that agriculture is the largest commercial sector across its ~809 000 ha of worldwide coverage[44].

However, the current growth path shown in Figure 8 also highlights the significance of the infrastructure sector. According to Pricewaterhouse Coopers (PwC 2017) drones have a potential total addressable market of over US$ 127 billion, with agriculture comprising ~25% of the market. However, in the USA, as shown in Figure 9, the current drone market for agriculture only makes up a small percentage (8%) – suggesting potential for growth.

A growing number of businesses are offering farmers drone-related services, such as data generation and analysis.

44 | This aligns with predictions from the Association for Unmanned Vehicle Systems International (AUVSI) that 80% of all drones will be used for agriculture in the near future (AgFunder 2015).

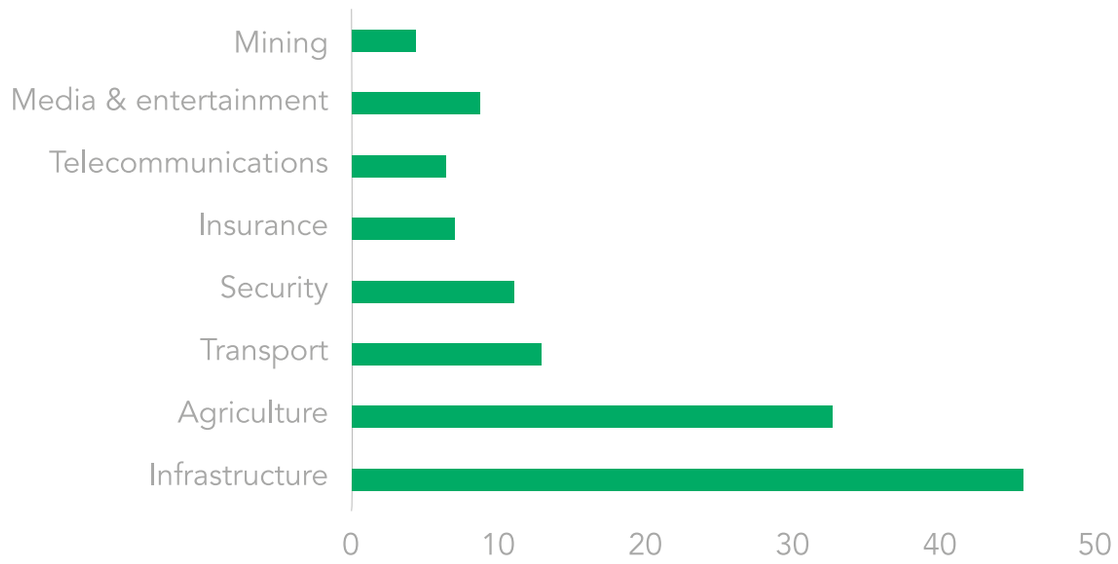


Figure 8: Forecast of worldwide drone opportunities
Source: PwC 2017

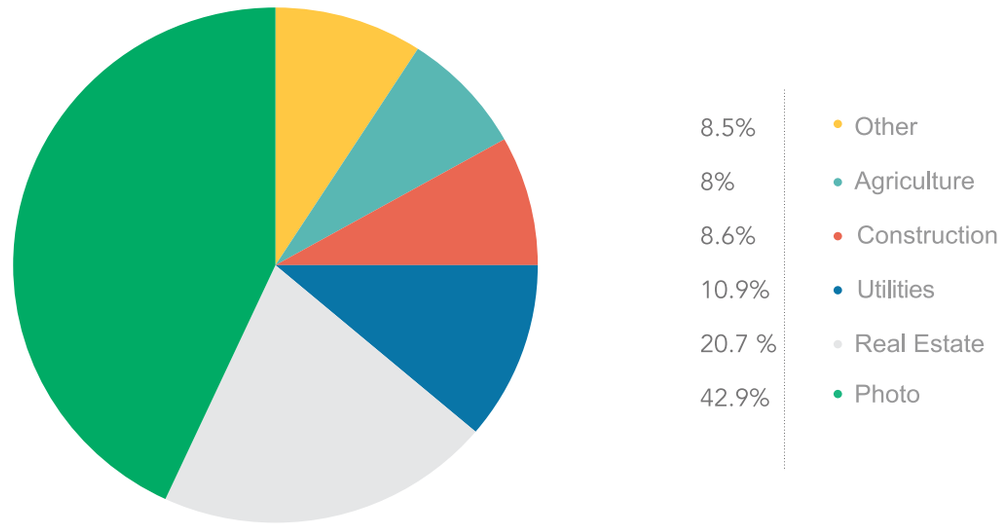


Figure 9: Drone use in industries in the USA[45]
Source: Stuart (2017)

45 Information provided by Stuart (2017). This information is based on the proportion of total exemptions under Section 333 of the Federal Aviation Administration Modernization and Reform Act of 2012. The Section 333 exemption process provides operators who wish to pursue safe and legal entry into the National Airspace System (NAS) a competitive advantage in the Unmanned Aircraft Systems (UAS) marketplace, thus discouraging illegal operations and improving safety.

Importantly, a growing number of businesses are trying to offer farmers more value without actually selling unmanned aerial vehicles (UAVs). Often this value add is in the form of providing services, particularly with respect to data generation and analysis, e.g. DroneDeploy's software service that processes and analyses drone imagery.

South African market

According to the latest research, the SA drone industry is set to generate R2 billion in 2017 (IT News Africa, 2017)[46]. The research also indicates that the industry has the potential to create 30 830 informal jobs and 3 600 formal jobs. An estimated 600 drone pilots are being trained per year in SA and there are approximately 60 000 drones in the country. The earliest corporate SA adopter of drone technology was the mining industry.

Data on drone application for SA agriculture is limited. However, should the prediction that 80% of all drones will be used for agriculture hold, drone technology for agriculture is set to be a multibillion rand industry – especially given the significance of agriculture in the country.

4.3.3. Barriers to investment

The major SA-specific barriers to the uptake of drone technology include:

- **Licensing and regulation**[47]: The drone industry's response to SA's initial UAV regulations was unenthusiastic. Other countries have less onerous and complex legislation.
- **Lack of awareness/disbelief of technology accuracy** by consumers, although this is changing.
- **Cost:** Although technology prices are falling, drones are still seen as expensive in the agriculture sector, especially when incorporating additional technology such as infrared light.
- **Limited funding** is available for start-up companies that want to offer agriculture ICT solutions.
- **Digital illiteracy** and **limited technical sophistication** compared to other countries, particularly in the agricultural sector.

The last two barriers highlight the need for international partnerships in drone technology. Successful drone-based agricultural services will need to acquire the knowledge and local agricultural expertise of a variety of professions, such as agronomists, and Geographic Information Systems (GIS) and Information Technology (IT) professionals. Agronomists will, for example, be able to provide accurate data for relevant production seasons, including critical growth times for certain crops in certain areas. This is important as after the critical physiological stages[48], fly-over data is of little value to farmers.

The case study below highlights the importance of partnerships for ICT applications, such as drones in agriculture.

Case study: partnership opportunities in the provision of drone services

There are various components involved in creating an ICT solution for farmers, mainly divided into R&D, verification and operational aspects. This gives rise to the need for diverse and multidisciplinary partnerships. For example, start-up company DroneClouds, based in Cape Town, helps farmers discover crop issues sooner by using drones, satellites and smart agri experts. The company was formed through a partnership between Afrolabs, a software development company, and IntegriSense, a remote sensing company.

Various other partners, both national and international, are involved in the development of this technology to support precision agriculture. They include:

- Local agriculture consultants and research institutions such as the Agriculture Research Council (ARC) and Stellenbosch University, with the latter providing agrology expertise, e.g. physiological stages of plants.
- International companies such as Airbus and other machine learning partners that support technical improvements.
- Local agriculture industry associations, such as the South African Sugar and Citrus Growers Association, which provide implementation support and feedback.

46 The methods used to determine his findings include distributing sample surveys among CUAASA members, estimating and concluding results and determining the average multiplier effects on the sector, as well as comparing results with South Africa/European Union and South Africa/US GDP ratios.
47 Find relevant legislation under "Knowledge base" at www.cuaasa.org, website of the Commercial Unmanned Aircraft Association of Southern Africa (CUAASA).
48 Physiological stages such as germination, flowering and transpiration are important to factor in for irrigation requirements.

4.4. Emerging trends

This section discusses other emerging trends in Information and Communication Technology (ICT), particularly:

- the use of mobile phones and tablets in agriculture; and
- the application of ICT to provide cost-effective smallholder index-based insurance solutions.

ICT is a broad term that refers to software and hardware aspects (e.g. mobile phones, tablets and personal computers), data ownership, data handling, data interpretation, and internet and email use.

ICT is widely used in agriculture, generally to reduce transaction costs and improve transparency for market players, and to improve on-farm resource efficiency.

Agriculture is one of the least digitised sectors, according to McKinsey's Global Institute Digitization Index (2015)[49] shown in Figure 10 below. The lack of IT infrastructure could provide an opportunity to create new systems, without the need for extensive overhaul of legacy infrastructure as may be the case elsewhere. This could help drive innovation in the sector and improve SA's competitiveness, particularly given the sound local enabling environment for the development of ICT[50].

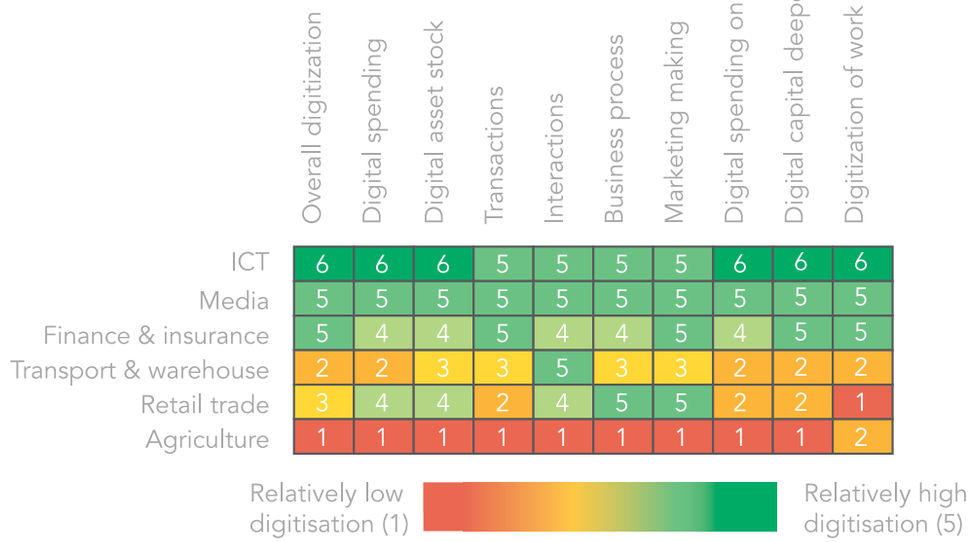


Figure 10: McKinsey Global Institute Industry Digitization Index 2015

49 The original figure features 21 industries and can be found at https://goo.gl/2qX5ZY
50 The WC offers various accelerator programmes and innovation hubs to assist entrepreneurs in the ICT space. A list of these can be found at: https://goo.gl/9hQA1H

4.4.1. Mobile applications in agriculture

A mobile application, most commonly referred to as an 'app', is a type of application software designed to run on a mobile device, such as a smartphone or tablet. In agriculture, they vary widely and can communicate any information of use to producers, e.g. weather, pests, diseases, price, suppliers and buyers.

In general, there has been a decline in the use of desktop computers, laptops and tablets, while mobile phone use continues to increase.

Global market

Between 2010 and 2015 there was a 400% increase in mobile apps for agriculture, from 300 000 to 1.5 million (Agbiz Grain 2016).

Increased productivity from mobile technologies is significant in countries where farming comprises a larger percentage of the labour force. While developed regions still have the highest rates of mobile phone users as a percentage of the population, analysts say Sub-Saharan Africa will experience 10% growth between 2014 and 2020 (see Figure 11).

The number of mobile users in the agriculture industry is increasing, especially in field-related cases. This is important for emerging markets particularly, where mobile is the primary computer – CB Insights

More and more people, including low-income smallholder farmers, have mobile phones at their disposal (as opposed to a laptop or PC, for example), making it a powerful communication tool in smallholder farming solutions. Smallholder farmers manage 80% of farmland in sub-Saharan Africa (FAO 2012). An example of applying mobile applications in smallholder farming is discussed in Section 4.4.2 below.

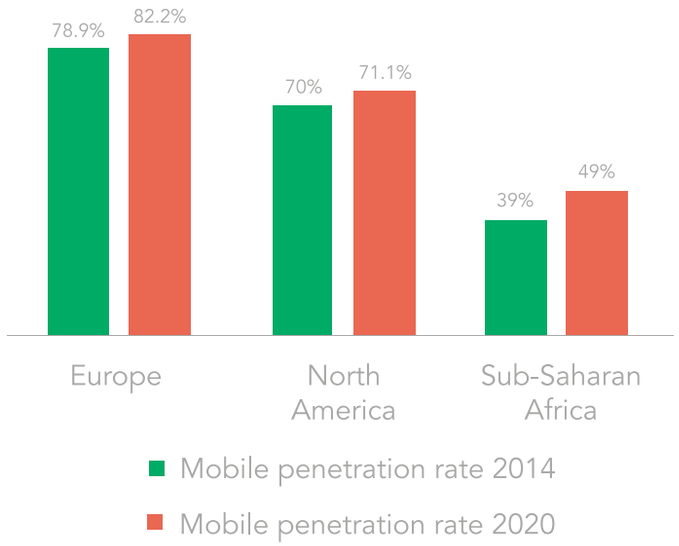


Figure 11: Mobile phone users per global region
Source: GSMA (2015)

South African market

A research study for the South African Journal of Agricultural Extension has found that mobile technology is the preferred technology for internet access, while 79% of the farmers have indicated that they use the internet to source information. This supports the proposition that agricultural organisations should actively use the internet as a medium for information transfer. The preference for and high prevalence of mobile phone use suggest that the South African market is ready to uptake functional apps for agriculture. In addition, the GreenCape and WCDoA GreenAgri[51] website usage statistics show that the number of mobile users has increased by 5% between 2016 (11%) and 2017 (16%).

Anecdotal evidence suggests that farmers favour mobile applications, as they operate outdoors and are constantly moving around. Accessing information through mobile phones comes in particularly handy where infrastructure for other means of access to the internet is limited.

4.4.2. ICT for smallholder farmers: improving risk profiles for credit and access to insurance

ICT applications can help develop smallholder farming in SA and other developing countries through creating cost-effective solutions to key barriers, such as:

- **Lack of access to markets and market information**, which increases transaction costs. Mobile applications communicating timeous information and connecting market players are helping to overcome this barrier.
- **Access to credit** is a large barrier to smallholder investment in machinery and infrastructure. Mobile applications are providing a record-keeping platform that allows farmers to record input and output, which is needed to apply for credit.
- **Access to cost-effective insurance**, which will be discussed further in this section by looking at index-based insurance (IBI) application through ICT.

Index based insurance (IBI) protects policy holders against shared risk, rather than individual risk. It includes risks associated with weather fluctuations, disease outbreaks and price loss. It is unlike traditional insurance, which assesses losses on a case-by-case basis and makes payouts based on an individual client's realised losses. IBI offers policy holders a payout based on the external indicator, which triggers a payment to all insured clients within a geographically defined space. This decreases transaction costs significantly. It is an attractive, cost-effective insurance solution for smallholder farmers who are particularly vulnerable to weather fluctuations, and low-end crop farmers who cannot afford standard insurance. Using ICT, particularly mobile applications for insurance transactions and communication, further reduces transaction costs.

IBI presents an opportunity in SA, as:

- the government is interested in innovative harvest insurance solutions for both commercial and small-scale farmers, since current premiums are not affordable; and
- there are only three private institutions left in SA that provide harvest insurance.

51 | See Section 2.5 for more information on the website.

Mobile app-driven insurance for low-income crop farmers.
Smallholder farmers typically cannot afford standard insurance in SA. Mobisurance is a start-up company that will be using IBI to provide insurance to smallholder farmers in SA[52]. They are not operational yet, but plan to use satellite monitoring and algorithms to determine thresholds for payouts, communicated through mobile applications. Mobisurance's proposed offering is an excellent example of the role ICT can play in providing accessible insurance.

The creation of IBI solutions for smallholder farmers will require multi-stakeholder partnerships to reach farmers and to build cost-effective business models. For example, this may require bringing together the insurance industry with climate change and agricultural researchers to address the following barriers to IBI:

- Non-uniform farming practices, production inputs and harvests.
- A very risk averse insurance sector, with climate change playing a major role in causing uncertainties.

SA is lagging behind other developing countries in applying IBI. Developing countries such as Kenya, Ethiopia, Senegal and India have demonstrated that formally insuring smallholder farmers against extreme weather events is effective as these farmers are most vulnerable to climate change, especially droughts and floods.

The following statistics indicate the potential market growth for IBI (CGIAR 2017):

- The number of farmers globally covered by weather index based insurance has more than doubled over the past two years.
- In Kenya and Rwanda, more than 185 000 farmers have already bought other forms of insurance through their mobile phones, or accepted loan offers for seed purchases.
- In Mongolia, over 15 000 pastoralists have been insured against harsh winters.
- One in 4 farmers in India are covered by IBI linked to agricultural credit.
- Nigeria is working with the Consultative Group for International Research (CGIAR) to help the government understand how IBI can help the country reach its goal of providing 15 million farmers with agricultural insurance cover by 2017.

More about ICT funding and incentives can be found in Section 5.2.

52 | Mobisurance aims to adopt mobile and satellite technology to provide insurance to low-end crop farmers in rural areas where standard insurance is inaccessible. More information can be found at https://goo.gl/ecE7YC

5 – Funding and incentives

A range of sector-specific and general funding solutions and incentives are available to investors, manufacturers and service companies in the green economy. These comprise of development finance institutions (DFIs), local public and private sector financiers and investors, and a considerable range of tax incentives.

5.1. Agriculture funding and incentives

The 2017 Agriculture MIR identified a range of agriculture-specific funding solutions and incentives. The GreenAgri Funding and Incentives webpage[53] also provides links to finance options available to the agriculture sector.

The table below lists additional sources of funding and incentives relevant to agriculture, which were identified in the course of 2017.

Table 13: Funding and incentives for agriculture

Funding / incentive	Description	Link to source
Old Mutual – UFF	UFF is the exclusive agri-investment partner to the Old Mutual Investment Group.	See the UFF webpage[54]
World Bank / Land Bank	The Land Bank's Financial Intermediation Project funds emerging farmers, supported by a R1.3 billion line of credit with a government guarantee.	See the article here[55]
Department of Trade and Industry (dti): Agro-Processing Support Scheme (APSS)	The APSS offers a 20% to 30% cost-sharing grant to a maximum of R20 million over a two-year investment period.	Visit the GreenAgri website[56]
dti Aquaculture Development and Enhancement Programme (ADEP	An incentive programme that provides grants for new projects, or for upgrading or expanding of aquaculture projects.	Visit the dti[57]
Land Bank and European Investment Bank (EIB) loan fund	The fund is targeted to climate adaptation and mitigation projects, including improving natural resource management, energy and water use reduction in food processing, and improving exiting carbon pools.	Visit the GreenAgri website[58]

53 | http://www.greenagri.org.za/tips-and-tools/funding-and-incentives/
54 | http://uff.co.za/
55 | https://goo.gl/yeXQJD
56 | http://www.greenagri.org.za/tips-and-tools/funding-and-incentives/
57 | https://goo.gl/9SHK65
58 | https://goo.gl/4XRscP

5.2. ICT funding incentives

Two national government programmes provide specific funding for ICT:

- The dti offers a Strategic Partnership Programme (SPP)[59]. It develops and supports programmes / interventions that enhance suppliers' capacity to provide manufacturing and services in strategic supply chains, industries or sectors,
- The Technology Innovation Agency (TIA)[60] is a national public entity that serves as the key institutional intervention to bridge the innovation chasm between research and development from higher education institutions, science councils, public entities, the private sector, and commerce. Their strategic technology areas include ICT and they provide funding of up to R50 million.

The Western Cape offers excellent support for start-up companies in ICT through incubators, accelerators and innovation hubs. Support is typically given through access to:

- networks and matchmaking events;
- workspace; and
- technology, particularly software programmes.

A complete list of this kind of support can be found on The Western Cape Entrepreneurial Project[61].

5.3. Financing for climate-smart agriculture

There are various global financing opportunities for climate-smart agriculture available through the United Nations Framework Convention on Climate Change (UNFCCC)[62]. The international Green Climate Fund (GCF) is financing projects aimed at responding to climate change; funds can be accessed in SA through the South African National Biodiversity Institute (SANBI)[63].

5.4. General funding opportunities

5.4.1. Green Finance Database

The GreenCape Green Finance Desk, in conjunction with the South African National Energy Development Institute (SANEDI), maintains a database of funding sources and primarily dti-driven incentives that may be relevant to green economy investors.

The database, which is available to view and download[64], provides:

- information on nearly 100 funding opportunities, including an overview of the opportunity with contact details and links;
- a broad range of funding solutions and financial incentives, with South African institutions being the main source of opportunities.

5.4.2. Other databases

Finfind Database

The Finfind database[65] is an innovative, online finance solution that brings together SME finance providers and those seeking finance. The database:

- focuses on finance readiness and has over 200 lenders and over 350 loan products available to SMEs;
- is ideal for South African SMEs who are seeking funding and/or business advisory services or those who aim to improve their understanding of finance matters.

AlliedCrowds Database

AlliedCrowds is the first complete aggregator and directory of alternative finance providers in the developing world.

59 | https://goo.gl/85S5RT
60 | http://www.tia.org.za/about-us
61 | http://www.wcer.co.za/
62 | https://goo.gl/Kpc5KJ
63 | https://www.sanbi.org/node/14496
64 | https://www.greencape.co.za/assets/Uploads/GreenCape-Finance-Database-v4.xlsx
65 | https://www.finfindeasy.co.za/

Further funding sources
Two more South African funding directories can be downloaded in PDF format from the GreenCape Green Finance Database webpage[66].

5.4.3. Funding gaps of note

While excellent work has been done to fund large-scale projects, such as the utility scale Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), there are a number of funding gaps, particularly for SMEs. This is primarily a result of the relatively smaller pool of domestic funding and the capital-intensive nature of the cleantech industry. Key challenges are highlighted below:

- **The amount of money available for pilot projects is limited.** Part of this reason is that clean technologies (hardware) must compete at any given stage of development against software technologies, which can be 10 times cheaper to fund.
- **Small-scale project finance (up to R50 million) is difficult to acquire** as funders of projects are looking for projects worth at least R50 million (usually R100 million) to make their involvement profitable. Rand Merchant Bank's FIRST initiative has begun to address this issue in the renewable energy space.

66 | Specifically "South African institutions providing funding for entrepreneurs" and the "South African Business Funding Directory 2016/17" – available at https://www.greencape.co.za/content/focusarea/green-finance-databases

5.4.4. Assistance available

Funders often experience a shortage of in-house technical expertise to understand the business case and models of cleantech ventures. In addition, SME founders, particularly on the start-up side, lack the appropriate financial skills to demonstrate the feasibility of their cleantech.

The promotion of financial literacy and fluency by initiatives such as Finfind has gone a long way in encouraging businesses to recognise the importance of financial skills. Furthermore, the GreenCape Green Finance Desk (GFD) can assist investors and primarily acts as data source. The GFD works across all sector desks at GreenCape and its objectives are to:

- develop a network of financial institutions (private and public) with green finance interests;
- develop an understanding of the main green projects requiring investment / financing;
- break down any barriers that exist between green finance and green projects;
- facilitate the implementation / adoption of innovative financing solutions for green economy business models; and
- provide ad hoc support to programmes and initiatives requiring a financial / investment viewpoint.

5.5. Manufacturing incentives

A proposal has been submitted for the Atlantis Industrial Area to be declared a Greentech Special Economic Zone (SEZ). The dti's SEZ programme aims to increase industrialisation, economic development and job creation around the country. The dti has proposed a number of incentives to attract investors to the proposed SEZs, which include:

- **Reduced corporate income tax rate:** qualifying companies will receive a reduced corporate tax of 15%, instead of the current 28% headline rate.
- **Employment tax incentive (ETI):** aimed at encouraging employers to hire young and less-experienced work seekers. It will reduce the cost to employers of hiring young people through a cost-sharing mechanism with government.
- **Building allowance:** qualifying companies will be eligible for an accelerated depreciation allowance on capital structures (buildings). This rate will equal 10% per year over 10 years.
- **VAT and customs relief:** companies located within a customs-controlled area (CCA) will be eligible for VAT and customs relief as per the relevant legislation (dti 2015).

Other incentives available to investments in a designated SEZ will include:

- Section 12I Tax Allowance Incentive;
- SEZ fund for infrastructure development within the designated area.

In Atlantis, the City of Cape Town has made vast tracts of land available at low cost for lease by greentech companies through an accelerated land disposal process. GreenCape's Atlantis SEZ team and the InvestSA One Stop Shop can assist with information and facilitate access to permits, licences, planning and development approvals, incentives and finance. It is also worth noting that the dti has been willing to assure investors that investing prior to SEZ designation will not disqualify them from receiving benefits once the zone is designated.

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. Cape Town has been 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 proposed Atlantis Greentech Special Economic Zone (SEZ).

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 to support precision farming & resource efficiency (SA)

Solar energy for agriculture
Minimum markets of R120m (WC) & R420m (SA) for solar PV in agri & agri-processing

Controlled environment agriculture
R128m invested in 2017 (WC); R600m potential market (WC), 15% growth p.a. (WC)

Energy services (SA-wide)

Solar PV systems & components
500MWp installed capacity; R1.2bn additional investment in 2018 (R7.2bn 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; ~R80m market by 2023

Utility scale renewable energy (SA-wide)

Independent power production
Ministerial determination for 6.3 GWp more RE generation capacity: 1.1 GW (670 MW wind, 450 MW solar) p.a.

Rest of Africa
RE deployment in the rest of Africa, some programmes mirroring REIPPPP

Local manufacturing
Through REIPPPP local content requirements

Waste

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

Organic waste treatment
Providers planning capacity growth from 381 000 t/a to 1 million t/a

Alternative waste treatment
R421/t landfill cost in CT (highest in SA); organic waste landfill ban by 2027 (5 year 50% diversion target by 2022)

Water

Metering & monitoring
30-50% smart metering sales growth (Q1 2018 compared to Q1 2017)

Water efficiency & reuse
R900m p.a. potential market for new commercial and residential developments (WC)

Alternative water
R5.8bn potential residential market (WC); 14%-18% returns on large-scale desalination investments

Bioeconomy & resource efficiency

Food value retention
R600m value through improved cold chain management & waste reduction (WC)

Solar thermal
R33m already installed (WC), R135m (SA); R3.7bn potential agri-processing market

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

Atlantis Greentech Special Economic Zone (SEZ): investment incentives

The City of Cape Town established a greentech manufacturing hub in Atlantis in 2011 in response to the government's focus on localisation of manufacturing as part of the Department of Energy's Renewable Energy Independent Power Producer Programme (REIPPPP).

The City has made tracts of land available at low cost for lease by greentech companies through an accelerated land disposal process. A number of other financial and non-financial incentives are also on offer, including discounted electricity and rapid turnaround on development applications.

An application has now been submitted by the Western Cape Provincial Government for the Atlantis Industrial area to be declared a Greentech SEZ, a decision on which is expected in 2018. GreenCape's Atlantis SEZ team can assist with information, and facilitate access to permits, licenses, planning and development approvals, incentives and finance.

7 – GreenCape's support to businesses and investors

GreenCape is a non-profit organisation that drives the widespread adoption of economically viable green economy solutions from the Western Cape. Our vision is for South Africa to be the green economic hub of Africa.

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 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 over 27 200 tonnes of waste from landfill.

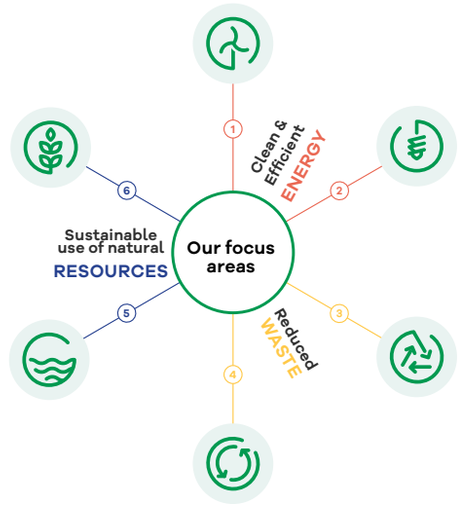
We have facilitated and supported R17bn of investments in renewable energy projects and manufacturing. From these investments, more than 10 000 jobs have been created. Through our WISP (industrial symbiosis) programme, by connecting businesses with waste / under-used resources, we have to date diverted over 4360 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 12 overleaf shows the different focus areas within each of our programmes.

Benefits of becoming a GreenCape member

We currently have over 1 100 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, electric vehicles & alternative basic electrification

2 Energy Services

Commercial, industrial & agricultural energy efficiency & embedded generation; 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).

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.

6 Sustainable Agriculture

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

Figure 12: GreenCape's focus areas

Cross-border matchmaking 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).

For investors looking for opportunities in South Africa, GreenCape's Cross-border Matchmaking Facility offers a business matchmaking facility for green firms and entrepreneurs.

The matchmaking team helps international inbound firms and entrepreneurs looking for South African partners in the green economy. The team assists with contacts, introductions and matches to South African businesses.

They also offer matchmaking activities for trade offices, missions and other inbound interests. These services can be accessed via the ICN passport or directly with GreenCape.

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

Appendix A: Key role players

The 2017 Agriculture MIR identified key companies and role players from government, industry and academia in the opportunity areas.

The table below provides additional role players identified in 2017.

Table 14: Key role players within the report's focus areas

Companies within the MIR focus area	
Conservation agriculture	Equalizer
	Monosem
	Piketberg Implements
	Rovic Leers
	Valtrac
Controlled environment agriculture	Haygrove
	GreenZone
	Advanced Hydroponic Systems
	Anima Trading
	San Light
	NFT Hydro
	Monolith Aquaponics
	Dynatech
	Association for Vertical Farming
Precision agriculture	Aerobotics
	Aerovision
	Agri-Solutions
	Agrista
	Crosscape Precision
	DFM Software Solutions
	Effective Farming Solutions
	EnviroMon
	IrriCheck
	MySmartFarm
	Monolith Aquaponics
	Dynatech
	Association for Vertical Farming

More role players can be found in the 2016/17 Agri Handbook for SA[67].

67 | https://goo.gl/gvkQq3

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The writing of this MIR was made possible with the generous support of the Department of Agriculture, Western Cape.