



Mpumalanga

Sustainable Agriculture

Market Intelligence

Opportunity Brief 2022



MPUMALANGA
GREEN CLUSTER
AGENCY

Mpumalanga Green Cluster Agency

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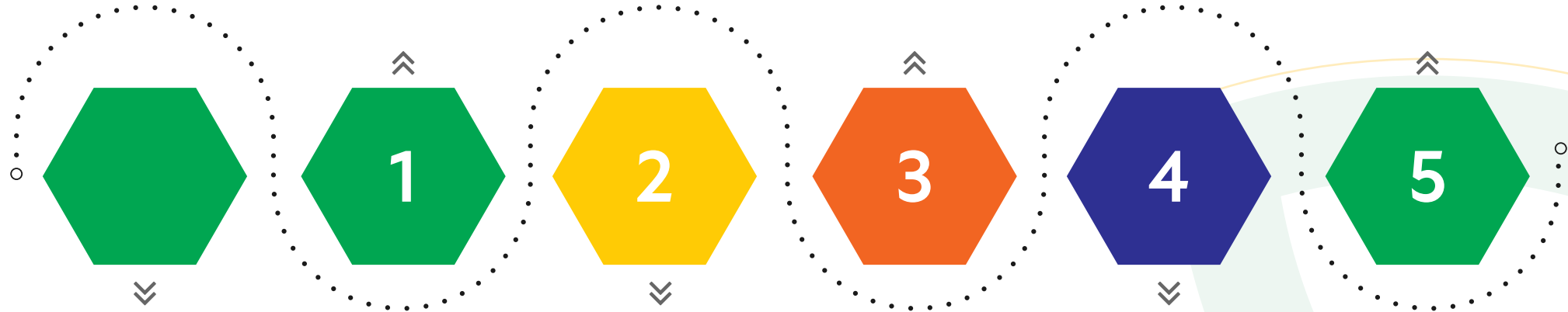
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LIST OF ABBREVIATIONS AND ACRONYMS

Abbreviations & Acronyms	Meaning
AFcFTA	African Continental Free Trade Agreement
AWM	Agricultural waste management
BFAP	Bureau for Food and Agricultural Policy
CA	Conservation agriculture
CEA	Controlled environment agriculture
CGA	Citrus growers association
CSIR	Council for Scientific and Industrial Research
DARDLEA	Department of Agriculture, Rural Development, Land and Environmental Affairs
DFFE	Department of Forestry, Fisheries and the Environment
DMRE	Department of Mineral Resources
EU	European Union
FAO	Food and Agriculture Organisation
GDP	Gross domestic product
GHG	Greenhouse gases
GVA	Gross value added
JT	Just Transition

Abbreviations & Acronyms	Meaning
MEGA	Mpumalanga economic growth agency
NDG	National development goal
NDP	National development plan
PV	Photovoltaic
RA	Regenerative agriculture
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
SADC	Southern African Development community
SAIIA	South African Institute of International Affairs
SMMEs	Small, medium and micro enterprises



EXECUTIVE SUMMARY

This market opportunity brief is part of an annually updated series of reports that highlight investment opportunities in the green economy in Mpumalanga. It is written for investors who want to understand the opportunities for investment and job creation in green economy sectors in the province.

Agriculture contributes significantly to South Africa (SA)'s economy and plays a vital role in sustaining livelihoods and ensuring food security. Mpumalanga contributed 16% to total employment and a GVA of 13% in South Africa's agricultural and value-added activities in 2021. The sector is largely influenced by both internal and external factors which influence its productivity and investment trends. These include climate change, the economy, social and regulatory risks, which often pose numerous risks to an already sensitive sector. As such, this has accelerated agricultural production towards a more resilient, green ecosystem where higher returns can be expected while ensuring economic resilience. Globally, this trend is recognised more because of population growth, scarce natural resources (water and arable land) and international market pressure for environmentally friendly products, technological advancement and growing consumer preferences for healthier products.

The conflict between Ukraine and Russia continues to pose a threat to the South African agriculture sector. In light of these circumstances, there is also a rising potential for increased production which results in greater returns within the value chain. While the ongoing COVID-19 pandemic further demonstrates the susceptibility of the sector to the changing dynamics of the industry. It is also important to highlight that there has been a positive growth of the agriculture sector in South Africa.

Mpumalanga offers numerous opportunities for **investors, agricultural and green technology manufacturers, service providers, distributors, and others in the value chain** to support and enable the transition to a more sustainable agriculture sector. The different opportunities emerging in the province are highlighted in this brief are shown in **Table 1**.

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Table 1: Summary of opportunities in sustainable agriculture in Mpumalanga

Opportunity		Drivers	Barriers	Expected time frame	Market size
Renewable energy applications	Agrivoltaics	<ul style="list-style-type: none"> Ability for dual use of land compared to large land requirements of establishing solar farms. Demonstration of value through on-going feasibility studies on the technology in Mpumalanga. Reduced carbon intensity as required for continued trade including due to the EU's Green Deal (2019). Reduction in water demand for agriculture due to improved water use efficiency. 	<ul style="list-style-type: none"> Primarily applicable for shade-loving crops. Limited space for machinery that can be deployed under the frames. Lack of financial incentives to fully explore this opportunity. 	Medium to long	<ul style="list-style-type: none"> Prospecting mine closures in the country to release land for agricultural production. Estimated R3.67 billion* market for agrivoltaic systems. <p><i>*Est. 93 632ha of which 14% of high potential arable land is being mined (GreenCape, 2021)</i> <i>10% conversion = 1 310.48ha</i> <i>system cost (for infrastructure) = R 2.8 million</i> <i>Market size = R3.67 billion</i></p>
	Solar powered irrigation systems	<ul style="list-style-type: none"> Increased electricity costs. Lack of reliable energy supply due to load shedding. Exponential growth predicted as growers seek cheaper, more reliable energy. 	<ul style="list-style-type: none"> Lack of technical knowledge to efficiently implement the technology. High capital costs in comparison to traditional systems. Incorrect sizing of pump system. 	Medium to long	<ul style="list-style-type: none"> Estimated R16.5* billion market for solar powered irrigation systems. <p><i>*Est. 1 527 942ha under irrigation in MP (Remote sensing, 2021)</i> <i>10% conversion¹ = 15 2794.2</i> <i>System cost = R108 000/ha (Parker 2019)</i> <i>Market size = R 16.5 billion MP</i></p>
Controlled environment agriculture	Aquaponics Hydroponics Greenhouses	<ul style="list-style-type: none"> Erratic rainfall making crop production in open land risky. High potential for exports of high value crops to neighbouring countries (Swaziland and Mozambique). Recent roll-out of R1.2bn in investment for fresh produce infrastructure inception through MEGA Mpumalanga Economic Growth agency. Alternative protein supply (in the case of aquaponics). 	<ul style="list-style-type: none"> High capital cost of infrastructure for CEA. Limited technical skills to implement the technologies. High energy costs. 	Short to medium	<ul style="list-style-type: none"> Market expected to expand at a compound annual growth rate of 20.7% from 2021 to 2028 (MarketsandMarkets, 2022) Estimated current market size of R138.2 million* <p><i>*Potential area for CEA (e.g. aquaponics) = 807ha</i> <i>Cost of infrastructure = R126 312/100 m² (Adeleke et al, 2021)</i> <i>Total running cost = R45 000/ 100 m² (Adeleke et al, 2021)</i> <i>Market size = R138.2 million in MP</i></p>

¹ According to the International Finance Corporation, a 10% conversion is a realistic estimate (IFC 2015)

Opportunity		Drivers	Barriers	Expected time frame	Market size
Smart farming/ precision agriculture	Precision spraying	<ul style="list-style-type: none"> Poor irrigation scheduling, resulting in high water losses. Certifications and regulatory standards that require data collection on farm. Increased interest in supply chain transparency and traceability. 	<ul style="list-style-type: none"> High cost of technologies that improves efficiency. Inconsistent land reform policies and water use allocations leading to unavailability of information on land and water use. Limited access to efficient irrigation systems. Limited land tenure rights- farmers do not want to invest in high cost of infrastructure. 	Immediate	<ul style="list-style-type: none"> Estimated market of R9.9 million*. <p>*10% conversion e.g. Citrus area planted = 19 000ha (MP) Cost = R528/ha (increased from R450/ha) Market size = R9.9 million</p>
	Drones				<ul style="list-style-type: none"> Estimated market of R14.7 billion*. <p>*10% conversion e.g. maize production Area under CA = 259 958ha (MP) (Smith 2021) Infrastructure cost = R568 000/ha Market size = R 14.7 billion</p>
Agri- waste management	Waste to fertilizer	<ul style="list-style-type: none"> Rapid urbanisation and growing food loss and waste along agri-food chain. High demand for high-value crops produced using organic fertiliser. Enables on-farm nutrient cycling to be maximised while reducing pollution and increasing profit. Increased demand for organic fertilizers. Financial benefit for farms by adding value to their waste products, therefore increasing profitability. Chemical fertilizer bans. Increasing cost of landfilling waste. National Waste Management Strategy 2020. 	<ul style="list-style-type: none"> Lack of effective handling, application and storage of agricultural waste. Lack of education and awareness of waste management. Competition for land use for fertiliser production with mines & food production (food security). 	Short to medium	<ul style="list-style-type: none"> 30% local agricultural production in SA is wasted each year. 1.4 million tons of sugarcane produced in 2017 (SA), the bagasse by-product can be used as mulch. 12% of commercial farms use organic fertilisers. Estimated market size of R248 million. * <p>*10% conversion (e.g. sugarcane) Average annual waste = 30% 1.4 MT Cost of beneficiation = R 589/t Market size = R248 million</p>

Opportunity		Drivers	Barriers	Expected time frame	Market size
Regenerative agriculture	Conservation agriculture	<ul style="list-style-type: none"> • A requirement to reduce carbon emissions associated with sector contribution to reduction of carbon emissions to 50% by 2030 according to EU's Green Deal (2019). • The Carbon Tax Act No 15 of 2019 aimed at reduction of GHG. • Opportunity to generate income from agricultural carbon trading. 	<ul style="list-style-type: none"> • Requires new production systems which support low emissions. • It takes time for farmers to realize profits (risk of profit losses). • Recording systems for carbon trading can be onerous for farmers. 	Medium to long	<ul style="list-style-type: none"> • Estimated R245 million* <p><i>*10% conversion Area = 285 ha (maize) Cost of CA infrastructure = R 859000 Market size = R245 million</i></p>
	Bio stimulants	<ul style="list-style-type: none"> • Repurposing of mine land (mine land rehabilitation) which contributes to achieving the priorities of National Development Plan 2030 (2013). • Increased appetite for soil remediation projects for mine land rehabilitation in the province. • Opportunity for increased productivity and profitability due to quality and yield maintenance. • Reduced yield drops associated with the adoption of regenerative agriculture. 	<ul style="list-style-type: none"> • Inconsistent financial information provided by mines and Department of Mineral Resources and Energy (DMRE) for land rehabilitation. • High cost of remediation technologies. • Lack of industry standards in South Africa. • Biostimulants fall under subcategory of fertiliser by definition; therefore, administrative red-tape for certifying products for commercial use. 	Short to medium	<ul style="list-style-type: none"> • Estimated R16.88 million* <p><i>*Sprays within foliar applications at 2-4 L/ha 259 958 ha under CA (MP) Biostimulants = R158/L Market size = R16.8 million</i></p>





**THE MPUMALANGA
GREEN ECONOMY
CLUSTER AGENCY**



The Mpumalanga province of South Africa faces socio-economic and environmental challenges arising from its resource-intensive economic activities that contribute to climate change. Carbon intensive industries like mining, power generation and petro-chemicals are the core economic drivers in the Province. The region is also currently navigating high levels of unemployment, inequality and poverty, even as pressure mounts to transition away from its current coal-based economy.

Under the leadership of the Mpumalanga Department of Economic Development and Tourism work has begun to design a strategic intervention for the green economy in the province to attract investment and create jobs. This strategy identified the concept and theory of cluster development as an effective way to transition to an economy that has the ability to provide labour absorbing capacity through competitive green jobs.

Clusters can create the context to build trust between sector players, and work to unlock new mechanisms to enhance competitiveness and resilience. The Green Economy, in particular, lends itself to collaborative ecosystem building approaches. Set in this system of rapidly changing technology, and the economics surrounding that technology, are commitments to social inclusion, and greater equality.

The Mpumalanga Department of Economic Development and Tourism, working with GreenCape and with support from the international development finance community, has set up the Mpumalanga Green Cluster Agency. This cluster will focus on unlocking and unblocking economic opportunities in the green economy, with the aim of making a contribution to regional economic diversification and job creation efforts.

The Mpumalanga Green Cluster Agency is registered as a not-for-profit organisation in South Africa, with an appointed board of directors. The Cluster uses the triple helix cluster model with representation from government, business and academia as part of its design set up. The Cluster hosted the Mpumalanga Energy Summit in 2022, where it was formally launched by the Mpumalanga Government MEC: Finance, Economic Development and Tourism.

The Cluster has made significant progress to date, in particular to systematically engage with businesses in the province to identify and highlight opportunities and barriers for green economy projects in Mpumalanga. The Cluster has had several hundred engagements with the private sector to understand barriers and opportunities and it has launched several capacity building programs and technical support interventions in Mpumalanga.

Some of these interventions has led to investment declarations and intent to develop some R60bn worth of projects, a primary impact goal for the Cluster. The Cluster has also been accepted to be the second African member of the International Cleantech Network, creating an international eco-system access point for green businesses in the Province for potential growth opportunities.

The Mpumalanga Green Cluster Agency's mission is to stimulate a vibrant green economy for communities in the Mpumalanga province, underpinned by a collaboration between government, business and academia. The vision is a vibrant, green and sustainable economy in the Mpumalanga province, that leverages the province's rich natural resources and heritage to create a legacy for South Africa low carbon economic growth. Collaboration through clustering on a local scale to build competitiveness on a global scale will support the growth of the green economy in Mpumalanga, and determine the green cluster in Mpumalanga's success.

To become a member of the Mpumalanga Green Cluster Agency, please sign up [here](#).

Green Economy Market Opportunity Briefs

This market opportunity brief is part of an annually updated series of reports that highlight green economy investment opportunities in the green economy in Mpumalanga. It is written for investors who want to understand the opportunities for investment and job creation in green economy sectors the province.

Each brief provides an overview of the market within a sector, including key developments and achievements, the key players, legislation and regulation, market opportunities and challenges, and funding opportunities.

This brief focusses on the green economy investment opportunities in the sustainable agriculture sector.

To access the other sector briefs, please visit: <http://www.mpumalangagreencluster.co.za/>



SECTOR OVERVIEW AND CONTEXT





SA has a market-oriented agricultural economy that is highly diversified. It includes the production of animal products, field crops and horticulture. The latter two include the production of all major grains (excluding rice), oilseeds, deciduous and subtropical fruits, sugar, citrus and vegetables. This section describes the South African agricultural sector and delves deeper in the agricultural production in Mpumalanga province.

2.1.

Agriculture sector in South Africa

SA offers a diverse range of agricultural activities because of its wide range of vegetation types, biodiversity, climates and soil types. It consists of a dual economy with a well-established commercial sector, as well as a small scale and subsistence sector which all contribute to the economic activities of the province. Approximately 80% of the food produced in SA comes from large-scale commercial farms. The farming activities range from intensive crop production in winter rainfall and high summer rainfall areas, to cattle ranching in the bushveld and sheep farming in the more arid areas.

Climate and soil physical and chemical properties leave only 12% of the country's soil as arable for agricultural production, with only 3% considered as fertile land. As such, there has been an increasing trend to transition to a more resilient sustainable agricultural production ecosystem. Some of the technologies focus on the production using the adoption of soil-less farming activities including agricultural production in greenhouses, aquaponics and hydroponic systems. About 69% of the land is suitable for grazing and livestock farming which is by far the largest agricultural sector in the country.

Figure 1 indicates agricultural activities in SA according to provinces, while **Figure 2** illustrates agricultural activities and gross value by commodity in the country in 2019. The gross value of agricultural production was R377 317 million in 2021, and there have been some shifts in the relative contributions of livestock (42.3%), field crops (29%) and horticulture (28%). According to the 2021 Agricultural economy review, the sector contributes 2.3 % of the total GDP with an expected exponential increase despite the devastating COVID-19 pandemic. Although a relatively small contribution compared to other sectors, agriculture remains an important sector in the South African economy.

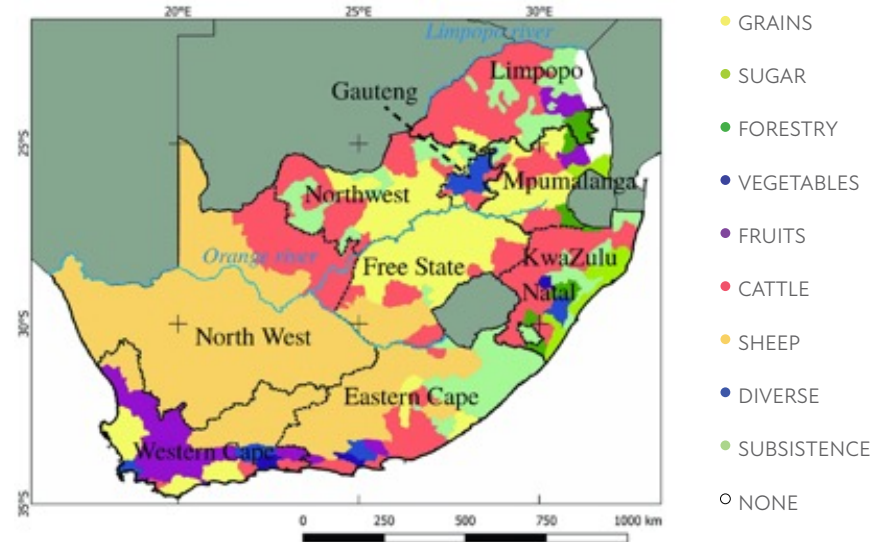


Figure 1. Breakdown of agricultural regions of SA (Source: Weldner et al, 2021)

The goods that drive South African agriculture

Sales of goods in the agriculture and related services industry, 2019

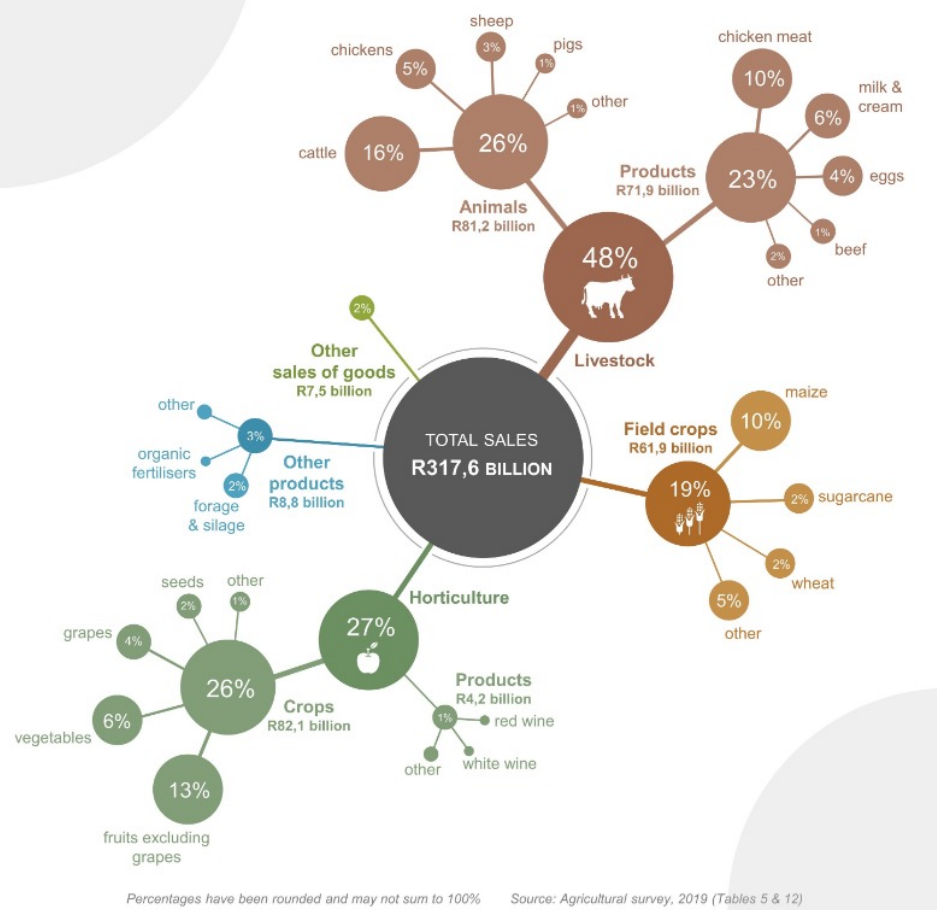


Figure 2. Gross value of South African agricultural production by commodity (Source: StatsSA, 2019)

2.2.

The agricultural economy in South Africa

The value of primary agricultural production in SA increased by 15.9% to R332 953 million in 2020, while its contribution to the GDP was estimated at R81 337 million in 2019. The agricultural sector has shown tremendous growth despite the COVID-19 pandemic and the recent ongoing Ukraine-Russia war, as highlighted by the Bureau for Food and Agricultural Policy (BFAP) in its 2022 report (BFAP brief, 2022).

The gross value production (GPV) of the South African agricultural sector has risen by 3.6% during the first quarter of 2022. The subsectors which are responsible for this positive revenue growth include field crops, horticulture and animal products as shown in **Figure 3**. However, a substantial decrease in the growth of this sector is expected due to rising input costs which are significantly reducing profits.

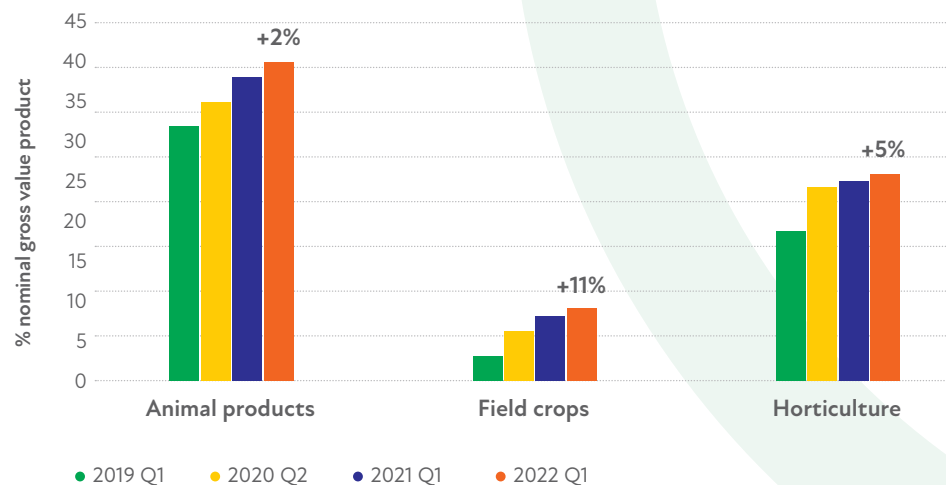


Figure 3. Nominal gross value of production per subsector (Source: BFAP, 2022)

2.3.

Agriculture in Mpumalanga

This section describes the physical geography and climate of Mpumalanga, and provides more details on farming activities of the province.

2.3.1. Climate and soil types

Mpumalanga's climate is defined by its topography resulting in the high-lying grassland savannah of the Highveld escarpment and the subtropical Lowveld plains. Middelburg is at the heart of the Highveld, receiving summer rains with average minimum and maximum temperatures of 8°C and 26°C, respectively. Mbombela lies on the edge of the Lowveld area near the Kruger National Park and enjoys relatively high summer rainfall and mild subtropical conditions.

Growth in the gross value of production for field crops could be attributed to the price gains across most of the sector, resulting from the international market dynamics. Supply constraints and declining stock levels in the international market, which had already pushed prices higher over the past 18 months, were exacerbated by Russia's invasion of Ukraine in February 2022. This recent war has further pushed towards localised agricultural production which creates opportunities for increased production due to higher demand for grain crops within food value chains. Part of the solution to address this need is to increase the economies of scale (EoS) in the farming industry. Increased economies of scale have implications on the performance of the industry, the creation of jobs and the industry's competitiveness in global markets.

Because of the varying climatic conditions of the province, there is high potential for a vast majority of agricultural products and, as such, the value of farming in Mpumalanga is the fourth largest in the country, at about R38bn (TIPS, 2022). **Figure 4** shows the average annual rainfall of Mpumalanga while **Figure 5(a)** indicates 2050 projections of higher annual average temperatures which may adversely affect water and food security.

Evaporation rates will also likely to increase and agricultural outputs may reduce significantly **Figure 5 (b)** (which necessitates the transition to sustainable agricultural production in the province.

The agriculture sector is also experiencing a need to intensify food production predominantly due to:

- Diminishing returns on soil due to unsustainable practices such as monoculture and use of chemical fertilisers.
- Population growth and the growing demand for food.
- Competition from international producers, particularly those with access to more abundant natural resources and government subsidies.

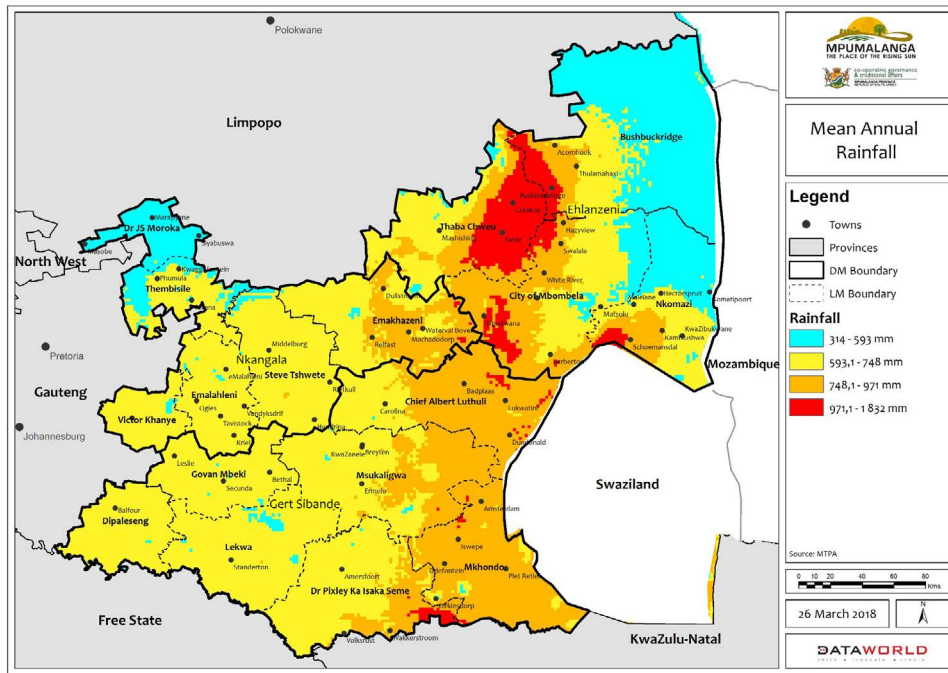


Figure 4. Average annual rainfall in Mpumalanga (Source: MTPA, 2018)

In Mpumalanga, agricultural land is severely degraded as a result of poor soil management and mining activities. Degrading soils decrease land productivity, requiring farms to apply more fertilisers and chemicals for soil improvement. In addition, chemical applications increase soil acidity, causing further degradation of the soil. This impacts the province’s land and water resources as well as the associated value chain activities. For this reason, efforts are required to promote environmentally friendly production and improve natural resource management.

Figure 6 illustrates land use classification in the province as well as production of irrigated, dryland and subsistence cultivation. There is a range of major crops under production in the province under different land use systems including the production of grains and oilseeds dominating the area planted, at 407kha and 204kha, respectively (see **Figure 7**). **Figure 6** further indicates land use applications in the province – 18% of which is used for cultivated commercial and subsistence farming. Agricultural production in Mpumalanga is renowned for citrus and subtropical fruits in the Lowveld, while the Highveld produces summer grains and oilseeds. Plantations of exotic trees and wattles cover much of the escarpment.

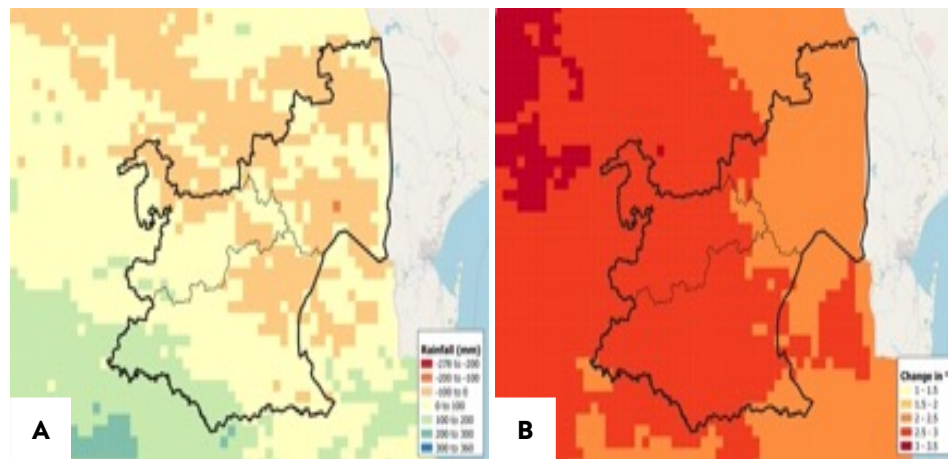


Figure 5. Projected Mpumalanga climate change effects by 2050 (A = rainfall changes; B = temperature changes) (Source: CSIR, 2021)

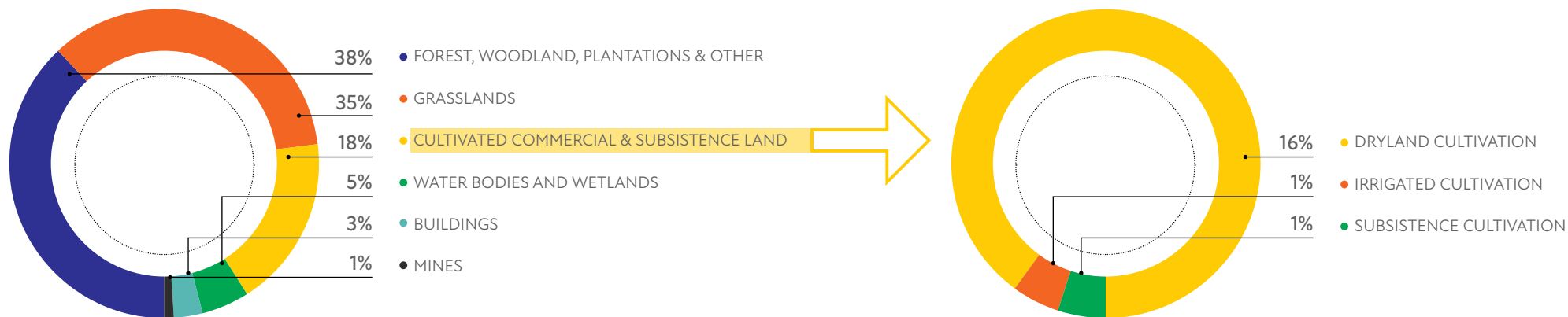


Figure 6. Mpumalanga land use classifications
(Source: DFFE, 2020)

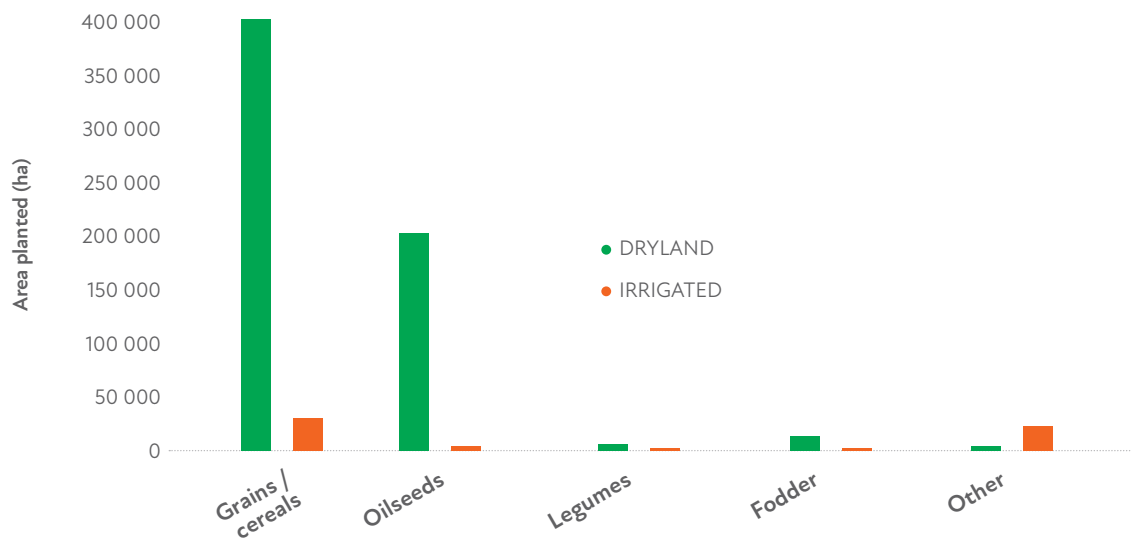


Figure 7: Area planted under field crops in Mpumalanga²
(Source: StatsSA, 2020)

² Note that data related to Mpumalanga production trends and technology trends are all based on data from the 2017 commercial census of agriculture in SA (StatsSA, 2020)

2.3.2. Major agricultural activities in Mpumalanga

The province uses 68% of its land for agricultural production and, as indicated earlier, its wide climatic variation allows for the production of various crops. Mpumalanga produces 44% of SA's soybeans, 21% of its citrus and 67% of the country's banana crop and also exports (Figure 8). Other crops include wheat, maize, sorghum, barley, sunflower seed, soybeans, groundnuts, sugar cane, vegetables, coffee, tea, cotton, tobacco, subtropical and deciduous fruit and citrus. Forestry is extensive around Sabie in the far north of Mpumalanga and Ngodwana is the site of one of South Africa's largest paper mills.

Natural grazing covers about 14% of the province. It is the fourth biggest seller of cattle and has a sizeable poultry industry. Farming activities in the province occur mainly in three regions of Ehlanzeni, Gert Sibande and Nkangala. There is potential for growth through food import replacement investments in areas such as sugar, poultry and maize as well as through the export of citrus, macadamia nuts and marula. Agri-food manufacturing is set to occupy an important position in the agenda for the coming years because of its important contribution to both economic and social welfare. In terms of the GDP, the province contributes about 8% to the South African GDP.

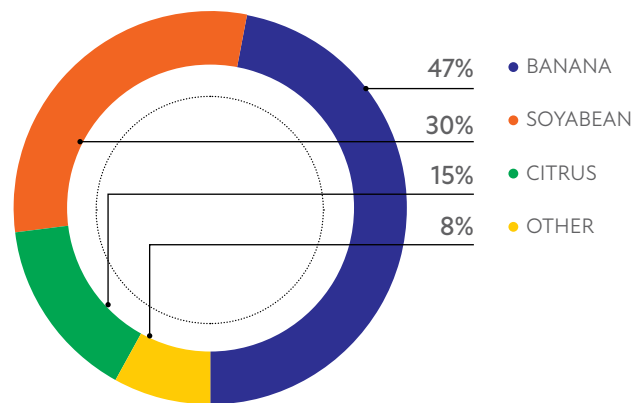
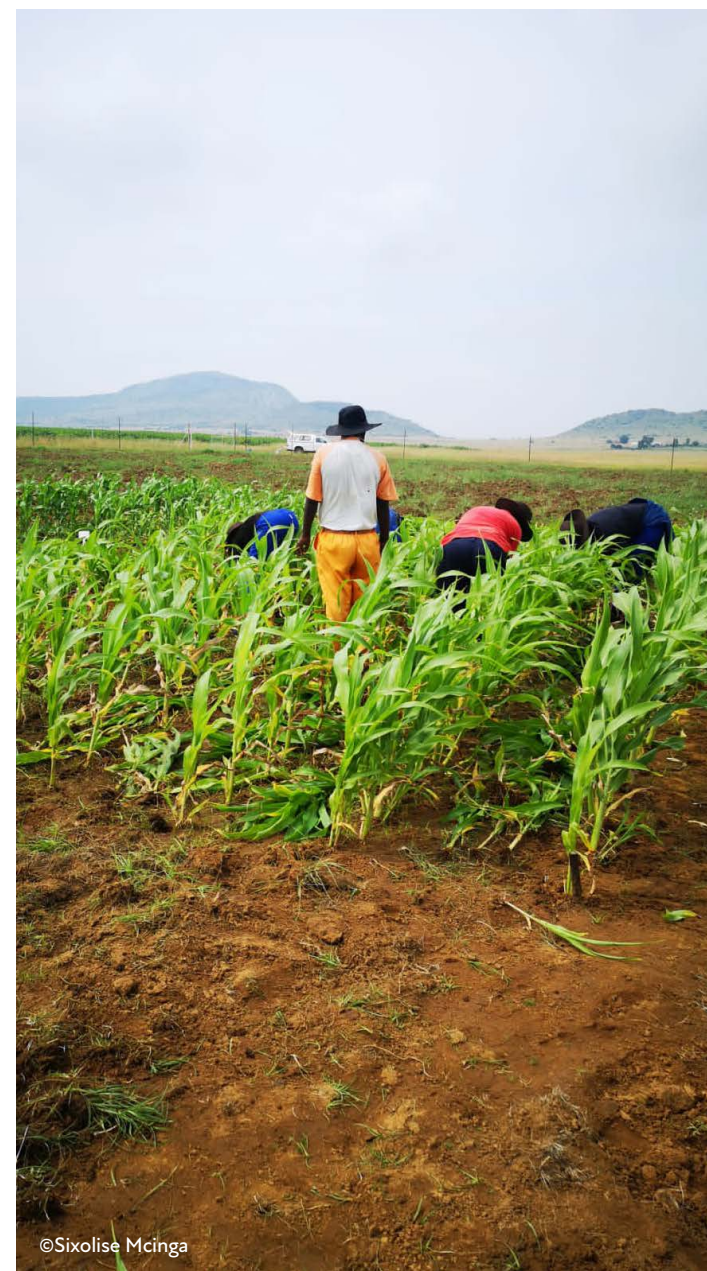


Figure 8: Primary agricultural activities in Mpumalanga province involved in exports (Source: DALRRD, 2021)

2.3.3. Agricultural sector's contribution to farm income and employment

In South Africa, the farmers' cash flow showed an increase of 20.8% and amounted to R136 million in 2021 compared to R105 219 million in 2010 due to higher gross income earned from the agricultural products (BFAP, 2022). In terms of gross farm income, Mpumalanga agricultural production contributed ~12% to total gross farm income in South Africa. Of this, the main contribution to total farm income came from animal products (~6%), field crops (~4%) and horticultural products (~2%), as shown in **Figure 9**.

Mpumalanga has a high unemployment rate of 32.9% with its economically active population of those aged 18 – 65 years (Mahlangu and Sekgobela, 2021). The province has approximately 4 675 commercial farming units which makes it the second smallest in terms of number of farming units compared to other provinces. The province has approximately 101 051 farm workers compared to other provinces like Western Cape which offers employment for less skilled people. This makes job creation in the farming industry important for the rural economy and the improvement for livelihood in the province. It is also described as a province with the highest unemployment rate in South Africa, especially youth.



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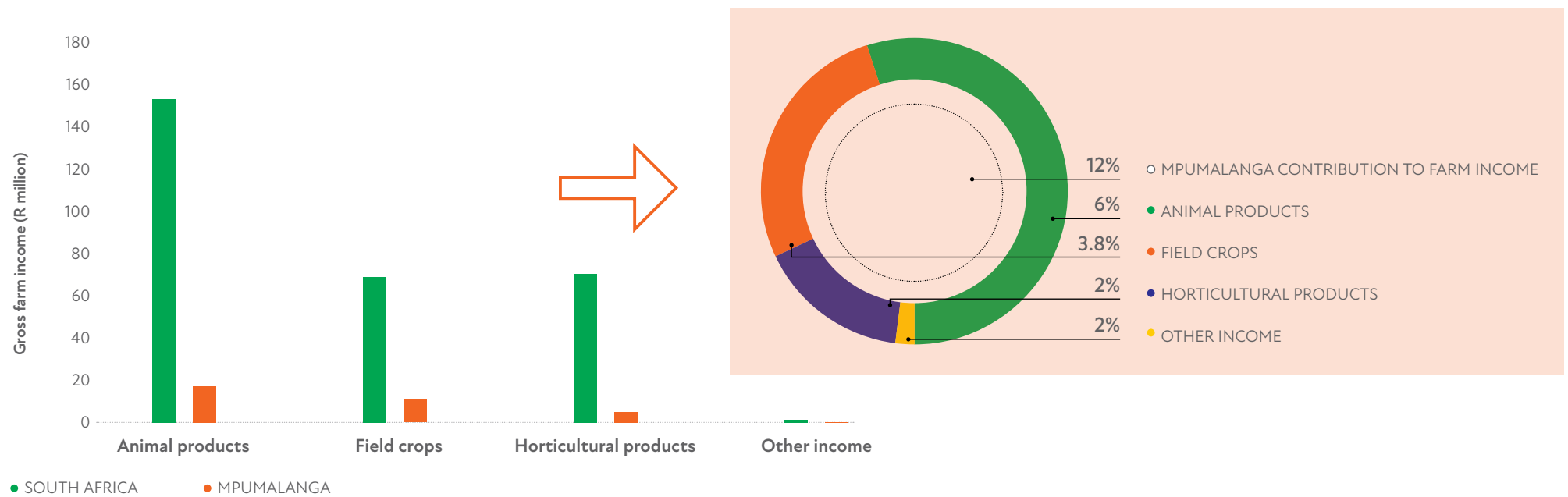


Figure 9. Total gross farm income in SA (left) and percentage contribution of Mpumalanga agricultural products (right in orange block) (Source: StatsSA, 2021)

2.4.

Agricultural trade at national and regional levels

SA is known as a net exporter of agricultural goods, exporting more than 30% of its goods. Mpumalanga contributes about 7% to total agricultural exports (BFAP, 2022). **Figure 10** elaborates the trade performance of agricultural and related products in Mpumalanga since 2010.

Exports in the province have performed well, growing from R884 million in 2010 to more than R7 billion in 2021 (using current prices) and the agricultural trade balance has also improved from R796 million in 2010 to R6 billion in 2021, despite imports of agricultural products also expanding during the same period.

In Mpumalanga, exports are expected to expand to neighbouring countries (Mozambique, Swaziland and Lesotho) as there has been a recent roll-out of R1.2 billion investment to increase the fresh produce market through MEGA³ (Manoko, 2022). The province is currently planning to build a state-of-the-art fresh produce market in Mpumalanga to improve markets for fresh produce. So far, R540 million has been invested in the inception of the project.

³ The Mpumalanga Economic Growth Agency (MEGA) is responsible for funding SMMEs, agro projects and farming for promoting investment in Mpumalanga.

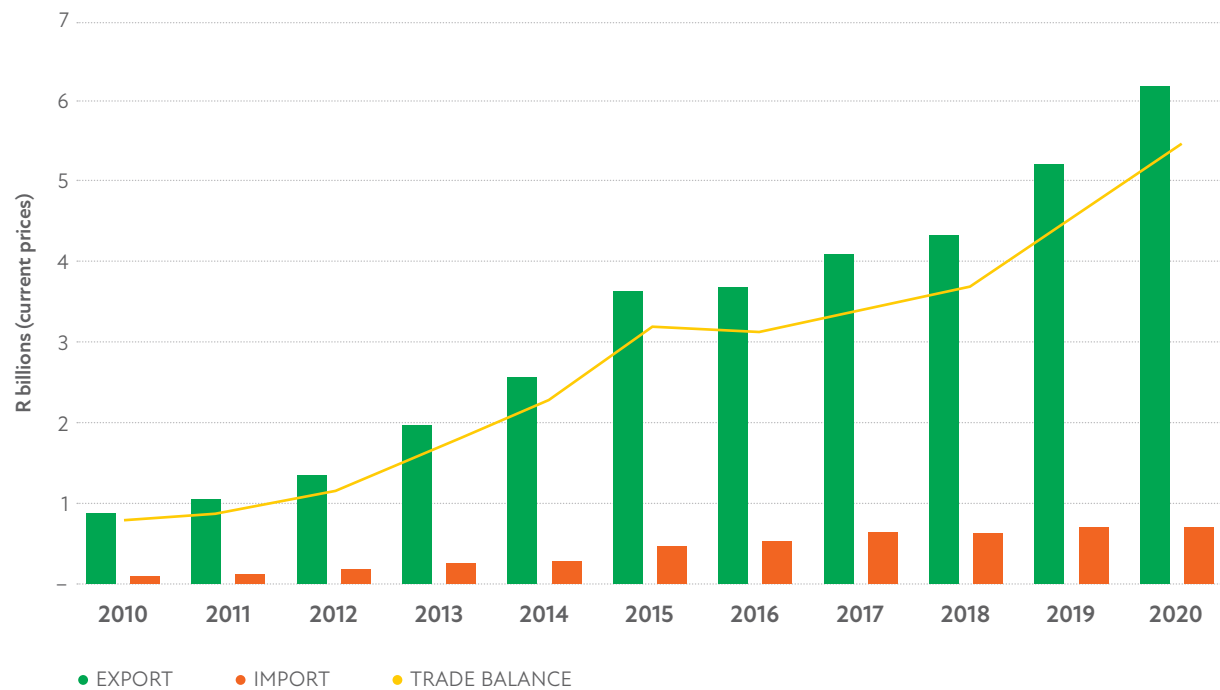


Figure 10. Mpumalanga agricultural exports and imports (2010 – 2020)
(Source: Quantec, 2021)

Mpumalanga exported most of its agricultural products to Asia (43%), followed by Europe (25%) and Africa (21%) in 2020. At the same time, agricultural imports into the province were mainly attained from the continent (90%) and some parts from Asia (5%) and Europe (3%).

In 2021, the revised citrus⁴ protocol between SA and China presented opportunities for increased agricultural trade. As such, there was an increased production of citrus in preparation for exports in 2022.

While SA celebrated its first consignment of lemon exports (100 000 lemons) to China earlier this year, the country experienced a devastating turn of events in the EU market as it struggled to ship its produce as a result of the new European Union rules⁵ due to False Coddling Moth (FCM) phytosanitary regulations.

The EU accounted for 41% of Southern African citrus exports by value in 2021. Locally, in 2021 citrus accounted for 25% of South Africa’s total agriculture exports up from 19% in 2019. The new regulations caused a major blow to South Africa’s citrus industry as they severely disrupted exports.

⁴ A revised protocol to relax the current regulatory requirements for cold treatment of South African lemons exported to China was signed between the South African Department of Agriculture, Land Reform and Rural Development in June 2021. The protocol is anticipated to increase volumes of South African citrus exports to China.
⁵ European Union’s (EU) Standing Committee on Plant, Animal, Food and Feed (SCOPAFF) published drastic, and arguably misinformed, new regulations requiring the cold treatment for oranges heading to the region as a means to address False Coddling Moth (FCM) interceptions from Southern African orange exports.

These regulations make extensive changes to the current applicable phytosanitary requirements for citrus coming from South Africa. They require that imports of citrus fruit must undergo specified mandatory cold treatment processes and precooling steps for specific periods before consignments are shipped.

Although the citrus industry argues that they have been highly effective in protecting the European production from the threat of pests and diseases, the industry remains severely threatened. These new requirements differ significantly from South Africa's existing rigorous FCM Risk Management System, which has been highly effective in protecting European production from the threat of pest or disease, including FCM.

The country's authorities are having numerous discussions with the EU to drop these newly-introduced regulations as it may result in a collapse of the citrus industry in SA. This may put 140 000 jobs that the local industry sustains at risk hence the SA authorities refer to this new regulation as unjust and punitive.

As next steps, SA's citrus industry has identified that standards are essential and has invested in research and technology to keep abreast of changes in phytosanitary standards. This will always result in increased importance of supporting shared capabilities necessary to supply-chain quality, pest and disease free fruit.

Table 2. Top 10 agricultural products in Mpumalanga exported to Africa (Source: Quantec, 2021)

	Export value (R) in 2020
HST10: Cereals	R867 831 660
HST02: Meat and edible meat offal	R563 545 295
HST04: Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included	R202 728 596
HST07: Edible vegetables and certain roots and tubers	R143 612 244
HST15: Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes	R112 939 564
HST22: Beverages, spirits and vinegar	R103 914 433
HST08: Edible fruit and nuts; peel of citrus fruit or melons	R68 263 300
HST19: Preparations of cereals, flour, starch or milk; pastrycooks' products	R59 991 185
HST12: Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medicinal plants; straw and fodder	R53 977 197
HST20: Preparations of vegetables, fruit, nuts or other parts of plants	R51 213 927



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2.5.

Key players in the agricultural value chain

An ecosystem's network of actors within the value chain determines its suitability and productivity. This collaborative approach is embodied in the concept of agricultural innovation systems (highlighted in [Figure 11](#)).

The concept involves a network of organisations, enterprises, and individuals focused on bringing new products, processes, and forms of organisation into economic use, together with the institutions and policies that affect their behaviour and performance. The approach emphasises the need to consider and create interactions throughout the entire value chain, including beyond the farm gate (World Bank, 2020).

As a result, players within Mpumalanga's and broader South Africa's agricultural ecosystem are crucial to promoting sustainable agriculture. The key players in the agriculture sector can be divided into six broad categories: Producers, research/academia, input suppliers, technology suppliers, industry associations, financiers and labour organisations. The key players in Mpumalanga are indicated in [Table 3](#).

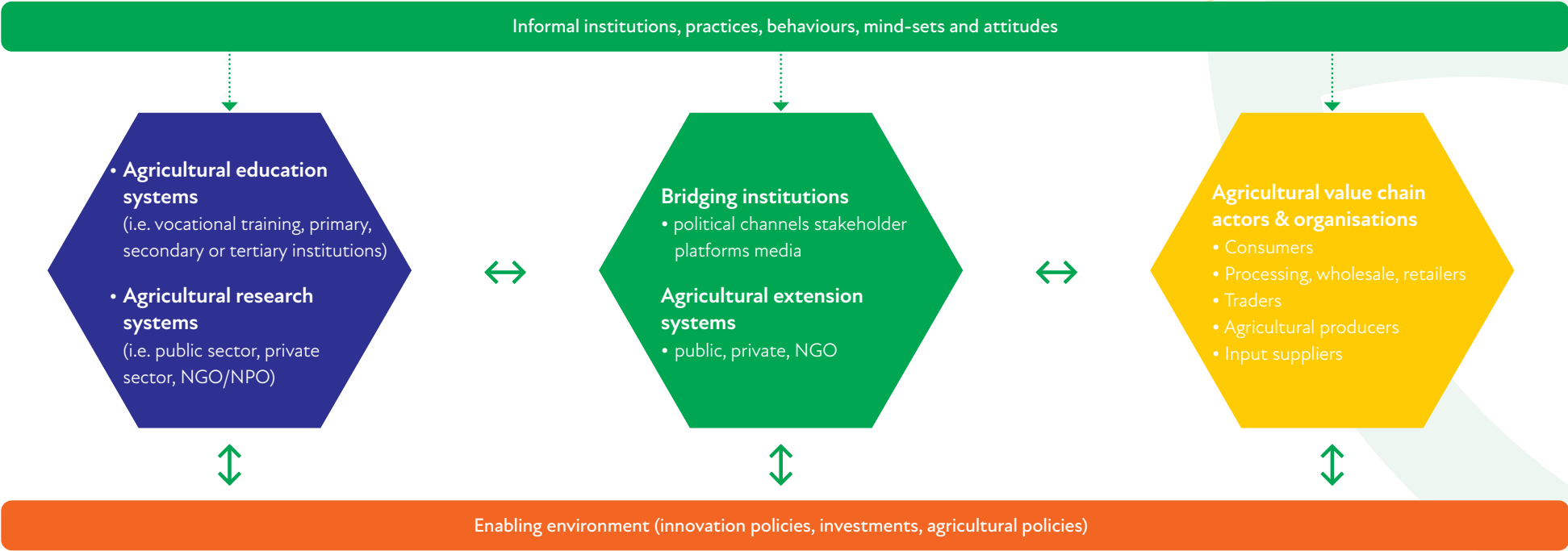


Figure 11. Agricultural innovation system (Source: World Bank, 2020)

Table 3. Key agricultural players in Mpumalanga

Category	Function	Key players in Mpumalanga
Producers/ farmers	Key players in adopting sustainable farming practices and technologies. Produce commodities and in most cases do their own harvesting, storage, and transport.	Range of farmers in the province such as those producing grain crops, horticultural crops and livestock.
Research & training institutions	Key players in adopting sustainable farming practices and technologies. Produce commodities and in most cases do their own harvesting, storage, and transport.	University of Mpumalanga, Agricultural Research Council, Timbali Technology Incubator, Lowveld College of Agriculture, Perdekop Agricultural School, Buhle Farming Academy.
Industry associations	These 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.	Citrus Association, Subtropical Fruit Association, GrainSA, Forestry South Africa, South African Poultry Association; Sugarcane Growers Association, Red Meat Producers Organisation; Agri-Mpumalanga.
Labour organizations	These are organisations that provide support for employees in the agricultural sector by assisting them in attaining the best possible financial and social position in all employment positions along the entire value chain. They also play a key role in strengthening supply chains and minimizing disruptions.	Mpumalanga Farmers Union, Food & Allied Workers Union, Transvaal Agricultural Union.
Technology suppliers	Develop and supply technologies and inputs across the value chain to enable increased food production and local economic development.	Range of suppliers such as TWK Agri, VKB, Picket, Valtra, Equalizer, Ottosdal Landini
Government	Enable policy environment and incentivising business to invest in sustainable agriculture and green economy.	Department of Agriculture, Rural Development, Land and Environmental Affairs; Department of Economic Development and Tourism, Department of Social Development, District municipalities

The South African Institute of International Affairs⁶ (SAIIA) has identified a need to optimise the agricultural value chains in Southern Africa (Matema and Prinsloo, 2022). The contributing factor is largely that COVID-19 has affected global value chains (GVCs) by interrupting transport and logistics, supply and production dynamics and demand and consumption patterns.

These effects have also been felt in the Southern African Development Community (SADC) across agricultural value chains, impacting regional food security, intraregional trade and economic growth.

Although agriculture has been less severely affected by COVID-19 than other sectors, the pandemic has nevertheless exposed challenges in SADC agro value chains and highlighted areas for improvement.

⁶ South African Institute of International Affairs (SAIIA) is an independent public policy think tank advancing a well governed, peaceful, economically sustainable and globally engaged Africa.

2.6.

The key recommendations made by SAIIA include:

1. Agricultural value chains should be geared towards creating opportunities for both small-scale subsistence farming and large-scale, export geared commercial farming.
2. Governments and the business sector should form public-private sector partnerships to develop resilient infrastructure for the agricultural sector, including the adoption of climate smart technologies.
3. Activities in the value chain should be digitalized to ensure more effective interactions between farmers, input suppliers, transport and logistics service providers, financiers and other value chain partners.
4. Priority should be given at a government level to concluding outstanding issues relating to the implementation of the African Continental Free Trade (AfCFTA) which would then constitute the springboard for higher volumes of agricultural trade, thus improving trade revenues, food security and employment in the agricultural sector.

Relevant legislation

The agricultural sector is governed by a range of policies and regulations that influence the trajectory of sustainable agricultural production. This section highlights key regulations at national, provincial and international level impacting the agricultural sector

2.6.1. National legislation and policies

The following section discusses the national policies and legislation governing and driving the agriculture sector in SA to be more sustainable and resource-efficient. **Table 4** provides policies that impact and drive sustainable production, while **Table 5** highlights policies that govern agricultural resource use.



Table 4. List of policies and legislation that govern sustainable agricultural production

Key policy or legislation	Relevance to sustainable agriculture
The National Development Plan 2030 (NDP 2012)	<ul style="list-style-type: none"> • Highlights plans to expand irrigated agriculture and develop new water schemes. • Highlights plans to support local and sectoral efforts to reduce water demand and improve water-use efficiency. • Highlighting the importance of agriculture to the green economy.
The Agriculture Integrated Growth and Development Plan (IGDP 2012)	<ul style="list-style-type: none"> • Plans to develop equitable, productive, competitive, profitable and sustainable agriculture, forestry and fisheries sectors. • Emphasises that the sector needs to benefit all South Africans.
National Bioeconomy Strategy (2013)	<ul style="list-style-type: none"> • Highlights strategic interventions in the agriculture sector and enhance competitiveness. • Plans to unlock value of indigenous crops. • Plans to establish a network of agro-innovation hubs that enhance technology transfer and extension.
The Agricultural Policy Action Plan (APAP 2014)	<ul style="list-style-type: none"> • A programmatic response to key policy documents, including the National Development Plan (NDP) and the New Growth Path (NGP).
Draft Conservation Agriculture Policy (2017)	<ul style="list-style-type: none"> • To promote and establish ecologically and economically sustainable agricultural systems to increase food security. • Recommending government to offer producers with incentives to adopt conservation agriculture measures thereby developing incentive schemes, and that tax rebates are provided to manufacturers of conservation agriculture equipment.
National Climate Change Adaptation Strategy (2019)	<ul style="list-style-type: none"> • Support to farmers to implement more efficient climate-smart and conservation practices. • Promotion of urban agriculture, including community and household food gardens in areas not classified as agricultural land. • Increasing the role of agricultural extension officers in supporting vulnerable farmers. • Promotion and subsidisation of water conservation technologies.
Draft Climate Smart Agriculture Framework Policy (2018)	<ul style="list-style-type: none"> • To provide management of climate change impacts and identify new industrial opportunities in the growth of the green economy. • Enhance adaptive capacity of the country and increase reduce vulnerability from climate change. • Contribute to global efforts to reduce greenhouse gas emissions.
The sugar industry masterplan (2020)	<p>The South African sugar industry has welcomed the virtual signing of the all-important Sugarcane Value Chain Master Plan to 2030 by all stakeholders which aims to:</p> <ul style="list-style-type: none"> • Take urgent action to address the immediate crisis facing the industry in order to prevent an unmanaged decline in the industry, protect and preserve jobs and rural livelihoods as far as humanly possible, and preserve as far as possible those productive assets, businesses and participants that will provide the foundations from which a newly diversified, competitive and dynamic value-chain will emerge in the medium to long term. • Set a bold ambition for the future, aiming to deliver significant new job opportunities along diversified sugarcane-based value chains. • Make the necessary tough choices about focus – to ensure that limited resources are targeted at the key levers that will deliver results. • Develop pragmatic and practical plans, with measurable milestones and outcomes.

Key policy or legislation	Relevance to sustainable agriculture
Poultry masterplan (2021)	<ul style="list-style-type: none"> • Ensures that locally produced product makes up an increasingly larger proportion of consumption over time. • Export cooked and raw product to SADC and other ACFTA countries, the EU, and the middle east. The master plan aims to export at least 3-5% of production by 2023, 7-10% by 2028 and a growing proportion thereafter. • Expand the industry by increasing capacity at all stages of the value chain farming of feed, farming of chickens and processing of poultry product -thereby increasing fixed investment, employment and the value of output. • Increase the level of black participation and particularly ownership across the value chain and increase employment and worker share-ownership in the sector.
Cannabis masterplan (2021)	<ul style="list-style-type: none"> • Increase the volumes and variety of Cannabis products destined for both local and export markets. • Establish and increase the capacity of South African farmers to produce dagga and hemp. • Create opportunities for creation of small and medium size enterprises across the cannabis value chain. • Replace imported cannabis products with locally produced products. • Increase investments in research and technology development to support increased production, productivity and competitiveness of the Cannabis industry. • Establish and increase the manufacturing capacity of the South African cannabis industry. • Development and maintenance of an effective regulatory system by strengthening law enforcement measures to deter the production, manufacturing and sale of cannabis outside the legal framework.
Agriculture and agro processing masterplan (2022)	<p>This masterplan aims to achieve a globally competitive agricultural and agro-processing sectors driving market oriented and inclusive production to develop rural economies, ensure food-security, and create employment and entrepreneurial skills through:</p> <ul style="list-style-type: none"> • Promoting transformation in agriculture and agro-processing sectors; • Increasing food security in South Africa. • Accelerating the opening of markets and better access conditions. • Enhancing competitiveness and entrepreneurial opportunities through technological innovations, infrastructure development and digitalization; • Creating effective farmer support, agro-processing, food wholesale and retail incentives. • Creating decent and inclusive employment, and improve working conditions and decent pay in the sector including in the face of climate change and technology innovations. • Increasing farming community safety and reduce stock theft. • Creating a capable state and enabling policy environment; and • Enhancing resilience to climate change and management of natural resources.

Key policy or legislation	Relevance to sustainable agriculture
Preservation and Development of agricultural land framework bill (2021)	<ul style="list-style-type: none"> • Provide principles for the management of agricultural land. • Provide for agricultural land evaluation and classification. • Provide for the preparation, purpose and content of provincial agricultural sector plans. • Provide for the declaration of protected agricultural areas. • Provide for the general objectives of agro-ecosystem management, agro-ecosystem authorisations. • The listing and delisting of activities or areas within agro-ecosystems and the identification of competent authorities.
Climate Change Bill (2022)	<ul style="list-style-type: none"> • Provide for a coordinated and integrated response by the economy and society to climate change and its impacts in accordance with the principles of cooperative governance. • Provide for the effective management of inevitable climate change impacts by enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to building social, economic and environmental resilience and an adequate national adaptation response in the context of the global climate change response. • Make a fair contribution to the global effort to stabilise greenhouse gas concentrations in the atmosphere at a level that avoids dangerous anthropogenic interference with the climate system. • To ensure a just transition towards a low carbon economy and society considering national circumstances. • Give effect to the Republic's international commitments and obligations in relation to climate change; and protect and preserve the planet for the benefit of present and future generations of humankind.

Table 5. List of policies and legislation that govern agricultural resource use

Key policy or legislation	Relevance to sustainable agriculture
National Water Act, Act No 36 of 1998 (NWA 1998)	<ul style="list-style-type: none"> • Redefines water rights in SA to stimulate inclusive growth. • Section 21 of the National Water Act highlights different water uses that require authorisation from the Department of Water and Sanitation. Applications for water use authorisations for water use activities may take the form of a Water Use License (WUL), or a General Authorization (GA), depending on the nature of the proposed water use and the likely impact the water use will have on water resources. On the 1st of April 2021, the DWS implemented a revised turnaround time to process water use licence applications from 300 to 90 days.
The National Environmental Management Act 107 of 1998 (NEMA 1998)	<p>NEMA is the overarching legislative framework for environmental governance core values are reflected through the following principles:</p> <ul style="list-style-type: none"> • Environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably. • Development must be environmentally, socially and economically sustainable.

Key policy or legislation	Relevance to sustainable agriculture
Carbon Tax Act, No 15 of 2019	<ul style="list-style-type: none"> The carbon tax act was gazetted in May 2019 and came into effect on 01 June 2019. The carbon tax will be applied over two phases: Phase 1 will be from 01 June 2019 to 31 December 2022, and phase 2 will be from 2023 to 2030. The implications of act will become applicable to the agriculture sector from phase 2. The Carbon Offset Administration System (COAS), administered by the Department of Mineral Resources and Energy, was launched 23 July 2020. It serves two main purposes: 1) to define the procedures through which project developers submit eligible projects and list their credits; and 2) to provide a platform through which emitters can surrender carbon credits against their tax obligations. The carbon offset regulations provide opportunities for large-scale carbon sequestration and storage in the agriculture sector. To be eligible to generate credits for use in lieu of the carbon tax, projects must be located in South Africa. Projects in the transport, waste, agriculture, forestry, and land use sectors, which are not covered by the tax, can generate carbon credits.
Draft Expropriation Bill Of 2020	<ul style="list-style-type: none"> The Joint Constitutional Review Committee (JCRC) released its final recommendation, in which it advised that Section 25 of the Constitution of South African should be amended to allow expropriation of land without compensation as a legitimate option for land reform. The Expropriation Bill of 2020 was drafted on 9 October 2020. The bill outlines details on circumstances that permit compensation and non-compensation for the expropriation of property. The bill provides more clarity for potential and current investors of the government's intention with this constitutional amendment. At the same time, the Minister of Agriculture announced that the government is making 896 farms on 700 000 ha of underutilised or vacant state land available for emerging farmers on 30-year leaseholds, with an option to buy. About 40 206ha have been allocated to Mpumalanga.
National Waste Management Strategy (2020)	<p>The strategy outlines government's policy and strategic approach to waste management for SA for the coming years. The set of actions to reach strategic outcomes, include:</p> <ul style="list-style-type: none"> Waste minimisation to prevent and reuse waste. Effective and sustainable waste services. <p>Mainstream waste awareness and a culture of compliance resulting in zero tolerance of pollution, litter and illegal dumping</p>

2.6.2. Provincial legislation and policies

The key policy frameworks in Mpumalanga that intend to drive a green economy growth in the province are the Vision 2030 (2013), Mpumalanga Economic Growth and Development Path (2011), Biodiversity Sector Plan (2014) and the Green Economy Development Plan (2016). The key objectives and relevance of the policies to sustainable agriculture are highlighted in [Table 6](#).

Table 6. List of policies and regulations that govern Mpumalanga sustainable agriculture

Key policy or legislation	Relevance to sustainable agriculture
Vision 2030 (2013)	The Mpumalanga Vision 2030 Strategic Implementation Framework (2013-2030) was established as a direct implementation response to the National Development Plan Vision, 2030. The key objectives include promoting employment and economic growth. Agricultural and forestry development are key drivers highlighted to promote economic growth and social protection.
Mpumalanga Economic Growth and Development Path (2011)	The Mpumalanga Economic Growth and Development Path (MEGDP) is informed by the National Economic Growth Path. The path highlights the green economy and information and communication technology as a key opportunity areas.
Biodiversity Sector Plan (2014)	The Mpumalanga Biodiversity Sector Plan (MBSP) is a guideline which is part of a wider set of national biodiversity planning tools and initiatives that are designed for national legislation and policy. The MBSP incorporates climate change improvements in the province.
Green Economy Development Plan (2016)	The Mpumalanga Green Economy Development Plan aims to change the province's economy from relying on coal-based energy to one boasting biomass-based energy, sustainable agriculture, and tourism and eco-conscious towns by 2030.

2.6.3. International regulations

SA is a major exporter of agricultural products and as such needs to adhere to international environmental regulations and standards.

2.6.3.1. Global climate change regulations

Since the Kyoto Protocol was agreed, the number of climate change laws has increased by over a factor of 20 (Nachmany et al. 2017). In light of the recent COVID-19 pandemic, national governments across the globe are making the transition to a low-carbon economy as part of their economic recovery (Biol 2020; OECD 2020).

The international regulatory developments are discussed below.

- China has pledged to reach peak carbon emissions before 2030 and reduce emissions to zero by 2060.
- The European Commission plans to reduce greenhouse gas emissions by at least 55% by 2030. The European Green Deal Lists a set of policy initiatives to achieve climate neutrality by 2030, among these is the Farm-to-fork strategy which plans to:
 - Avoid or minimise placing products related to deforestation or forest degradation into the European Union (EU) market.
 - Ban imported products into the EU market that do not comply with EU environmental standards.
 - Require trading partners to apply sustainable practices in terms of plant protection and pesticide use.
 - Promote sustainable labelling schemes for food imported into the EU.
- In addition, the EU envisages a Carbon Border Adjustment Mechanism (CBAM), a levy on all carbon-intensive imports (based on the carbon intensity of the country of origin). The CBAM will be introduced transitionally in 2023 and finalised before 2026.

Exports from carbon-intensive sectors such as cement, steel, chemicals and fertilisers will significantly be affected by the CBAM (European Commission, 2019).

- For Mpumalanga and the rest of the country, the EU plays a vital role as a major export destination for agricultural products, so trade-related climate risks equally affect the industry.
- The growing climate ambition targets in major agricultural export markets will likely drive many South African export farmers to adopt sustainable production practices and technologies to remain competitive.





3.

**EMERGING
OPPORTUNITIES,
DRIVERS AND
BARRIERS**



This section provides an overview of the major trends and drivers behind sustainable agriculture and the associated opportunities and barriers that affect sustainable agricultural production and resource use efficiency.

3.1.

Market overview

In South Africa, labour, government, civil society, and businesses have all acknowledged the importance of a Just Transition and prominently featured the implications in, for example, the country's trade union policies on climate change, the National Development Plan 2030 (NDP), national Climate Change policies, supporting documents for South Africa's Nationally Determined Contributions (NDC) and in the more recent Presidential Climate Commission's Framework for a Just Transition in South Africa.

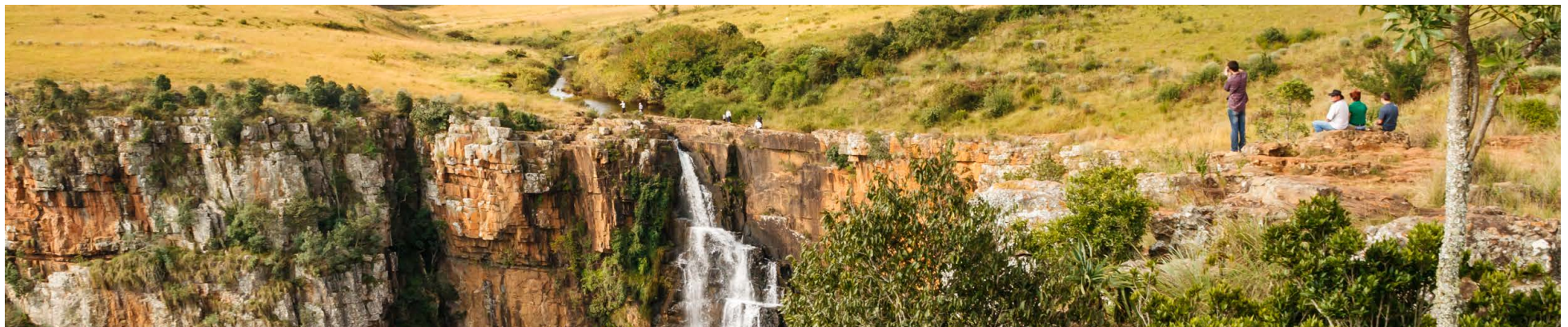
Mpumalanga is the key source of SA's coal supply with over 60% of the province's surface area either being subject to mining and prospecting applications. Transitioning Mpumalanga's coal-heavy economy to higher levels of agricultural output opens new business opportunities and jobs to improve the long-term economic resilience of the province. Investment in new renewable generation capacity (e.g. solar, wind and battery storage) will unlock a range of opportunities in the agricultural sector.

Furthermore, the COVID-19 pandemic has demonstrated the susceptibility of the agriculture sector to the changing dynamics in the industry. The disruptions of the food supply chain due to COVID-19 lockdown restrictions have resulted in new approaches and technologies to the way food is produced, processed, transported and traded.

The Food and Agriculture organisation of the United Nations defines sustainable agriculture as "agriculture that sustainably increases productivity, enhances resilience (adaptation), reduces/removes greenhouse gas (GHGs) (mitigation) where possible, and enhances achievement of national food security and development goals". Sustainable agricultural production can thus be a mechanism that enables job creation, social upliftment and food security.

With Mpumalanga being identified as the province with the highest percentage of arable land, it is important to identify technologies and farming practices that could strengthen production in the province. Water availability and quality for agriculture remains a challenge. However, implementing sustainable practices is expected to increase productivity of agriculture in the province. Some of the key factors that drive the need for sustainable agriculture in Mpumalanga include (further defined in **Figure 13**):

- Population growth and increased food demand.
- Scarce natural resources (water and arable land).
- International market pressure for environmentally friendly products.
- Technological advancement.
- Impact of Covid-19 and Russia-Ukraine conflict.
- Just Transition.



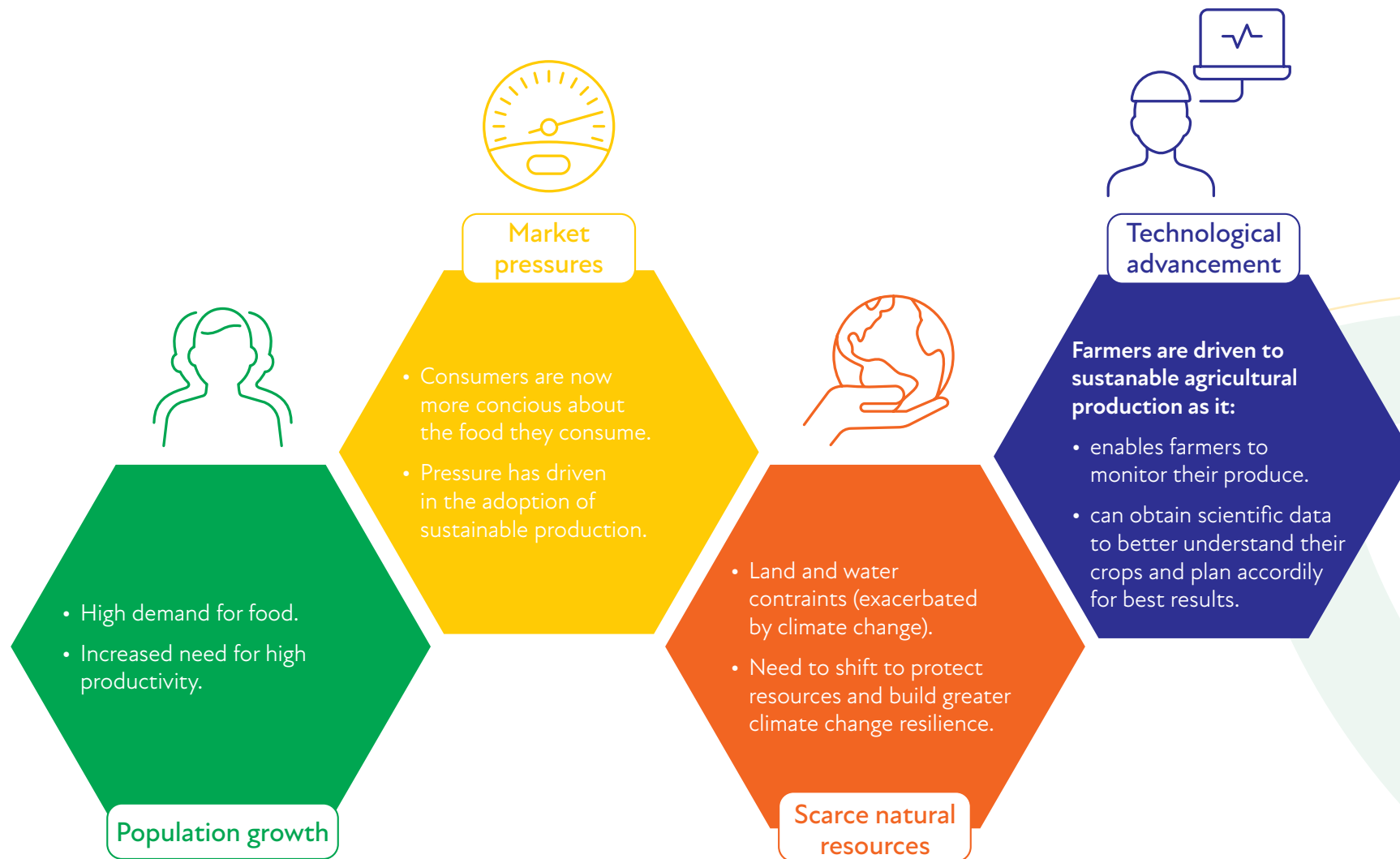


Figure 12. Drivers of sustainable agriculture in Mpumalanga
 (Source: Adapted from GreenCape, 2022)

3.2.

Sustainable agriculture trends

A number of emerging trends in sustainable agriculture are described in the **2021 opportunity brief**. These include opportunities that involve reducing food loss and waste, preventing soil erosion and improving crop productivity using minimum inputs. In line with the drive for a Just Transition, there has been a strong shift to incorporate renewable energy solutions into agricultural production in order to reduce carbon footprint in food production (FAO, 2021). Consumers are increasingly concerned, not only with the quality and safety of products they buy, but with the social and environmental conditions in these products' supply chains.

Increasingly consumers and civil society organisations are putting pressure on producers to comply with standards for organic, fair and ethical (sustainable) agricultural production. With climate risk now being regarded as one of the top risks facing farmers, the importance going forward is to adopt a risk-based view when tackling sustainability, both environmental and financial. Factors such as energy, water, soil health, biodiversity and food waste are all important elements that need to be considered from a risk-based perspective, with appropriate actions and solutions put in place to address the climate risk.

3.3.

Investment opportunities in Mpumalanga

Mpumalanga offers attractive investment prospects due to its diverse agricultural production sector and industrial export base. This market brief discusses the emerging opportunities in five broad categories: **renewable energy applications, regenerative agriculture, controlled environment agriculture, smart farming / precision agriculture and agri-waste management**. These investment opportunities are highlighted in **Table 7** and all fall under the sustainable agriculture sector.

There are a range of opportunities along the agricultural value chain that can transform and reimagine food production to the realities of climate change. These can range from alternative and more sustainable inputs, technologies and services to enable sustainable production, the type of crops produced and a range of value added products. The opportunities highlighted in this brief will be centred on opportunities in the primary production stage of the value chain and cross-cutting opportunities to improve resource use efficiency and recovery.



Table 7. Investment opportunities in sustainable agriculture in Mpumalanga

Opportunity	Drivers	Barriers	Expected time frame	Market size	
Renewable energy applications	Agrivoltaics	<ul style="list-style-type: none"> Ability for dual use of land compared to large land requirements of establishing solar farms. Demonstration of value through on-going feasibility studies on the technology in Mpumalanga. Reduced carbon intensity as required for continued trade including due to the EU's Green Deal (2019). Reduction in water demand for agriculture due to improved water use efficiency. 	<ul style="list-style-type: none"> Primarily applicable for shade-loving crops. Limited space for machinery that can be deployed under the frames. Lack of financial incentives to fully explore this opportunity. 	Medium to long	<ul style="list-style-type: none"> Prospecting mine closures in the country to release land for agricultural production. Estimated R3.67 billion* market for agrivoltaic systems. <p><i>*Est. 93 632ha of which 14% of high potential arable land is being mined (GreenCape, 2021) 10% conversion = 1 310.48ha system cost (for infrastructure) = R 2.8 million Market size = R3.67 billion</i></p>
	Solar powered irrigation systems	<ul style="list-style-type: none"> Increased electricity costs. Lack of reliable energy supply due to load shedding. Exponential growth predicted as growers seek cheaper, more reliable energy. 	<ul style="list-style-type: none"> Lack of technical knowledge to efficiently implement the technology. High capital costs in comparison to traditional systems. Incorrect sizing of pump system. 	Medium to long	<ul style="list-style-type: none"> Estimated R16.5* billion market for solar powered irrigation systems. <p><i>*Est. 1 527 942ha under irrigation in MP (Remote sensing, 2021) 10% conversion⁷ = 15 2794.2 System cost = R108 000/ha (Parker 2019) Market size = R 16.5 billion MP</i></p>
Controlled environment agriculture	Aquaponics Hydroponics Greenhouses	<ul style="list-style-type: none"> Erratic rainfall making crop production in open land risky. High potential for exports of high value crops to neighbouring countries (Swaziland and Mozambique). Recent roll-out of R1.2bn in investment for fresh produce infrastructure inception through MEGA Mpumalanga Economic Growth agency. Alternative protein supply (in the case of aquaponics). 	<ul style="list-style-type: none"> High capital cost of infrastructure for CEA. Limited technical skills to implement the technologies. High energy costs. 	Short to medium	<ul style="list-style-type: none"> Market expected to expand at a compound annual growth rate of 20.7% from 2021 to 2028 (MarketsandMarkets, 2022) Estimated current market size of R138.2 million* <p><i>*Potential area for CEA (e.g. aquaponics) = 807ha Cost of infrastructure = R126 312/100 m² (Adeleke et al, 2021) Total running cost = R45 000/ 100 m² (Adeleke et al, 2021) Market size = R138.2 million in MP</i></p>

⁷ According to the International Finance Corporation, a 10% conversion is a realistic estimate (IFC 2015)

Opportunity		Drivers	Barriers	Expected time frame	Market size
Smart farming/ precision agriculture	Precision spraying	<ul style="list-style-type: none"> Poor irrigation scheduling, resulting in high water losses. Certifications and regulatory standards that require data collection on farm. Increased interest in supply chain transparency and traceability. 	<ul style="list-style-type: none"> High cost of technologies that improves efficiency. Inconsistent land reform policies and water use allocations leading to unavailability of information on land and water use. Limited access to efficient irrigation systems. Limited land tenure rights- farmers do not want to invest in high cost of infrastructure 	Immediate	<ul style="list-style-type: none"> Estimated market of R9.9 million*. <p><i>*10% conversion e.g. Citrus area planted = 19 000ha (MP) Cost = R528/ha (increased from R450/ha) Market size = R9.9 million</i></p>
	Drones				<ul style="list-style-type: none"> Estimated market of R14.7 billion*. <p><i>*10% conversion e.g. maize production Area under CA = 259 958ha (MP) (Smith 2021) Infrastructure cost = R568 000/ha Market size = R 14.7 billion</i></p>
Agri-waste management	Waste to fertilizer	<ul style="list-style-type: none"> Rapid urbanisation and growing food loss and waste along agri-food chain. High demand for high-value crops produced using organic fertiliser. Enables on-farm nutrient cycling to be maximised while reducing pollution and increasing profit. Increased demand for organic fertilizers. Financial benefit for farms by adding value to their waste products, therefore increasing profitability. Chemical fertilizer bans. Increasing cost of landfilling waste. National Waste Management Strategy 2020. 	<ul style="list-style-type: none"> Lack of effective handling, application and storage of agricultural waste. Lack of education and awareness of waste management. Competition for land use for fertiliser production with mines & food production (food security). 	Short to medium	<ul style="list-style-type: none"> 30% local agricultural production in SA is wasted each year. 1.4 million tons of sugarcane produced in 2017 (SA), the bagasse by-product can be used as mulch. 12% of commercial farms use organic fertilisers. Estimated market size of R248 million.* <p><i>*10% conversion (e.g. sugarcane) Average annual waste = 30% 1.4 MT Cost of beneficiation = R 589/t Market size = R248 million</i></p>

Opportunity	Drivers	Barriers	Expected time frame	Market size	
Regenerative agriculture	Conservation agriculture	<ul style="list-style-type: none"> • A requirement to reduce carbon emissions associated with sector contribution to reduction of carbon emissions to 50% by 2030 according to EU's Green Deal (2019). • The Carbon Tax Act No 15 of 2019 aimed at reduction of GHG. • Opportunity to generate income from agricultural carbon trading. 	<ul style="list-style-type: none"> • Requires new production systems which support low emissions. • It takes time for farmers to realize profits (risk of profit losses). • Recording systems for carbon trading can be onerous for farmers. 	Medium to long	<ul style="list-style-type: none"> • Estimated R245 million* <p><i>*10% conversion Area = 285 ha (maize) Cost of CA infrastructure = R 859000 Market size = R245 million</i></p>
	Bio stimulants	<ul style="list-style-type: none"> • Repurposing of mine land (mine land rehabilitation) which contributes to achieving the priorities of National Development Plan 2030 (2013). • Increased appetite for soil remediation projects for mine land rehabilitation in the province. • Opportunity for increased productivity and profitability due to quality and yield maintenance. • Reduced yield drops associated with the adoption of regenerative agriculture. 	<ul style="list-style-type: none"> • Inconsistent financial information provided by mines and Department of Mineral Resources and Energy (DMRE) for land rehabilitation. • High cost of remediation technologies. • Lack of industry standards in South Africa. • Biostimulants fall under subcategory of fertiliser by definition; therefore, administrative red-tape for certifying products for commercial use. 	Short to medium	<ul style="list-style-type: none"> • Estimated R16.88 million* <p><i>*Sprays within foliar applications at 2-4 L/ha 259 958 ha under CA (MP) Biostimulants = R158/L Market size = R16.8 million</i></p>



3.3.1. Renewable energy applications: Drivers and barriers

3.3.1.1. Agrivoltaics

Solar energy has particularly gained particular attention in Mpumalanga, especially in the context of the Just Transition. Eskom is intending to drive investment in renewable energy capacity to Mpumalanga because it will be more affected by the energy transition from coal (Bega, 2022). In agriculture, particular focus has been around creating a dual land use system for both energy and crop production. For several years, SA has been constrained by an insecure power supply and rising electricity tariffs, placing many businesses at risk. The agriculture sector, like many industries, is highly dependent on secure energy supply for farm productivity. The largest energy usage in the sector is fuel usage from traction (~67%) (i.e. use of farm machinery and equipment) followed by electricity use in activities such as irrigation (~8%), process heating and water heating (~6%) (Switch Africa Green, 2016). The use of diesel generators is often an alternative option that most farms revert to in the absence of reliable electricity supply (e.g. due to load shedding). However, diesel generation is unsustainable as it creates high operating and maintenance costs.

In South Africa, agrivoltaics could be leveraged to address the need for renewable energy and intensive commercial farming including for the rehabilitation of damaged land and polluted water in Mpumalanga, to provide industrial, agricultural and potable water, food, quality jobs and energy for local communities. Agrivoltaics enables small business development and job creation in a way that is greater than solar PV alone. This makes agrivoltaics well positioned as a technology to deploy to support a Just Transition in SA and in the Mpumalanga region. Currently, there are feasibility studies with agrivoltaics internationally focusing on the production of high-value crops such as golden kiwis, blueberries, macadamia nuts, strawberries and leafy vegetables. Agrivoltaics offer an opportunity for cultivation of produce throughout the year thus improving climate resilience. Over 240 000ha mining land in Mpumalanga has been identified as requiring rehabilitation. With respect to mine land rehabilitation, feasibility studies in the province are currently underway to assess crop adaptability on mine-affected land. Agrivoltaics offer the use of land to also produce energy for use in heating, cooling and drying facilities in pack houses as well as irrigation. The surplus energy produced through this system can even be transmitted back into the local grid and sold on to a utility company or to other offtakers.

The installation of agrivoltaics improves water use by plants by significantly reducing transpiration rates. This is important as it reduces water losses during crop production. The barriers for the production under this system include limited space for machinery that can be deployed under the frames and the high capital costs associated with transitioning into this system.

3.3.1.2. Solar powered irrigation systems

Agriculture is one of the high water consuming sectors during primary production and processing of agricultural commodities. In South Africa, a significant amount of land is under irrigation, which accounts for 30% of the total crops in the country (Piliso, 2021). The improved business case for the inception of solar PV as one of the energy supplies in the country improves opportunities for multi-functional use of solar PV, also in agriculture. SA has imported solar PV panels worth nearly R2.2 billion in the first five months of 2022 alone which indicates a high pull of investment in the technology. Although solar PV prices are still significantly high, there is perception that solar PV prices will decrease with time. This directly links to the improvement of multi-faceted use and investment in agriculture.

One opportunity that is increasing in demand is solar powered irrigation systems. Irrigation in SA consumes approximately 28% of the total electricity used in agriculture. Because it is also dominated by commercial farmers (who are the key players in the value chain), there is a market for this opportunity. Driven by high electricity costs and an unreliable supply of electricity due to load shedding, this investment opportunity has a potential to provide electricity supply for irrigation. This is particularly important in the production of high-value crops which have a very small window for failure in production. Barriers include lack of financing options which translates to high capital costs. Furthermore, these technologies often require high technical skills for day-to-day maintenance. This means that there is a need to employ medium-skilled persons to run this operation. This poses a challenge because a lot of people who are within the agricultural value chain are not skilled.

3.3.2. Opportunities in controlled environment agriculture: Drivers and barriers

Controlled environment agriculture (CEA) is a technology-based approach for food production. The aim of CEA is to provide protection from the outdoor elements and maintain optimal growing conditions throughout the development of the crop. Although there is a significantly high number of shade nets in Mpumalanga, particularly for citrus production; these types of new systems introduce a new system of resource efficiency. Production takes place within an enclosed growing structure such as a greenhouse or plant factory. Plants are often grown in a soilless medium in order to supply the proper amounts of water and nutrients to the root zone as well as with supplemental lighting to ensure a sufficient daily light. CEA optimises the use of resources such as water, energy, space, capital and labour (illustrated in Figure 14). Technologies applicable for the Mpumalanga province for CEA include hydroponics, aeroponics, aquaculture, and aquaponics⁸.

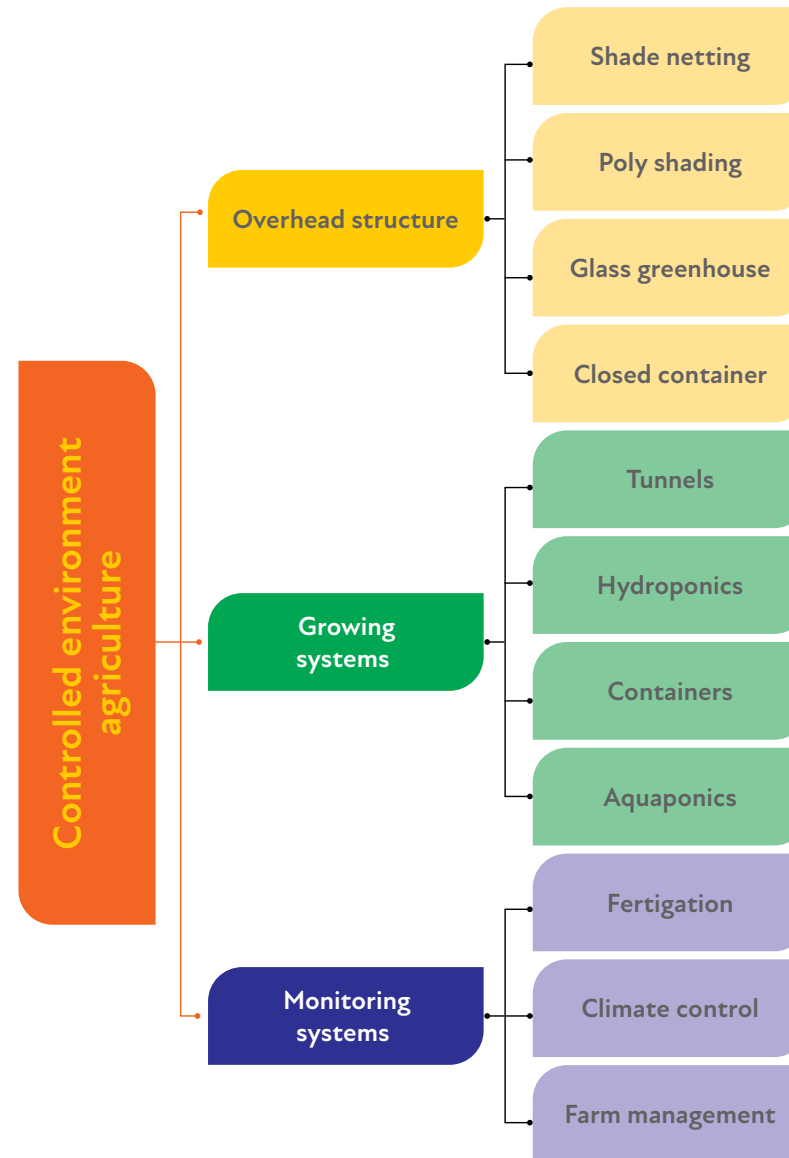


Figure 13. Components of CEA
(Source: GreenCape, 2021)

⁸ Aquaponics are a system of growing plants in a soil-less media, incorporating fish production. e.g. tilapia fingerlings, trout and catfish

One of the drivers for CEA in Mpumalanga is mine closures. CEA ensures continued supply of food even on lands that cannot support primary agriculture is not possible (such as mine lands that cannot be rehabilitated and in industrial areas where space for agricultural production is limited). Furthermore, growing markets are one of the key drivers for CEA in Mpumalanga. For example, in March 2022, the provincial MEC for Finance, Economic development and Tourism in Mpumalanga announced that the province is planning to build a state-of-the-art fresh produce market to move the province out of economic recession. The facility will attract international and large domestic food retailers to Mbombela and open markets for the province's food producers. Another high impact driver for CEA in the province is the recent allocation of R30 million for the commencement of the cannabis project in the provincial budget speech for 2022/23. The project is expected to increase economic activities and create jobs in the province. Cannabis requires high levels of biosecurity and, as a result, indoor farming production is the most suitable growing method for production.

Key barriers for CEA include lack of financing options for the high capital costs of the technology and infrastructure for CEA. Furthermore, CEA requires producers to invest in skills that are not readily available in the agricultural labour force. For example, monitoring growth of crops in a CEA system requires specialised skills such as ICT, electrical engineering, civil engineering. It is therefore important for agricultural institutes for learning and development offer these trainings to better prepare agricultural graduates.

3.3.3. Smart farming / precision agriculture opportunities: Drivers and barriers

Precision agriculture in Mpumalanga is gaining traction because of its profitability and contribution to sustainability. This involves the use of drones and smart technology operations to improve farm productivity. The adoption and use of smart farming allows for the tracking of resources such as labour, capital and inputs on a farm. As consumers have become more consciousness of the food they consume, there is increased pressure to venture into precision agriculture for traceability of product produced. Aspects of smart farming are illustrated in **Figure 14**. Smart agriculture improves climate resilience, especially through the efficient use of water and resources. This is one driver which makes the technology attractive to producers.

Farmers are starting to see the benefit of investing in smart farming technologies, particularly in the face of increasingly unpredictable climate change. In Mpumalanga, the citrus growers association (CGA) has seen benefits to investment in cutting-edge technologies to improve their farm productivity. Other drivers of increased farmer interest have been the clear financial savings technology suppliers have been able to show farmers. As export markets such as the EU implement stipulations around traceability and reduced carbon emissions, it can be expected that farmers will increasingly adopt more smart farming technologies to assist them in managing farm records and implementing climate-smart, money-saving practices.

In 2021, SA has a mobile internet penetration rate of 60.7% (StatsSA 2021), meaning that smart farming technologies that are mobile app-based could miss out on a key segment of agricultural producers. Poor rural connectivity is also a hindrance in smart farming gaining more traction. Furthermore, the technology requires high capital costs and specialized skills to run the operations and there has been a lack of financing options for such technology in agriculture.

3.3.4. Opportunities in agri-waste management: Drivers and barriers

Agricultural waste management (AWM) is a planned system in which all necessary components are installed and managed to control and use by-products of agricultural production in a manner that sustains or enhances the quality of air, water, soil, plant, animal, and energy resources. In the **2021 Sustainable Agriculture Opportunity Brief** it was identified that food losses in SA are estimated at 10.3 million tonnes, with agriculture accounting for 34%, with a financial impact of R74.4 billion per annum. Agricultural food waste results in the loss of natural resources, such as water and energy, along the agricultural value chain. Waste management functions are illustrated in **Figure 15**. This section describes an opportunity in the re-use of agri-waste to produce organic fertilizers. There is an increased demand for organically produced crops globally, and for waste minimisation from an environmental and financial perspective.

The food loss and waste along the agricultural value chain in Mpumalanga is not well documented. However, it may be proportionally higher given that Mpumalanga is the hub for agricultural production in SA. However, various studies have estimated food loss and waste at the national level. In terms of the contribution of food loss and waste, processing (49%), post-harvest handling (19%), and consumption (18%) ranked highest. Based on the method of analysis used, Table 10 highlights the estimations of the food losses at every level along the value chain collated from different studies. These wastes could be converted into a value-added product such as organic fertilizer. Since May 2020, there has been a dramatic 230% increase in fertilizer prices which has had a tremendous effect on food prices globally. Now, driven upward by supply disruptions stemming from the Russia-Ukraine conflict, higher prices are expected. These price hikes are one of the biggest contributors to food price increases. Agri-waste beneficiation to fertilizer is an opportunity to potentially bridge this gap and create (international markets for (organic) fertilizer supply.

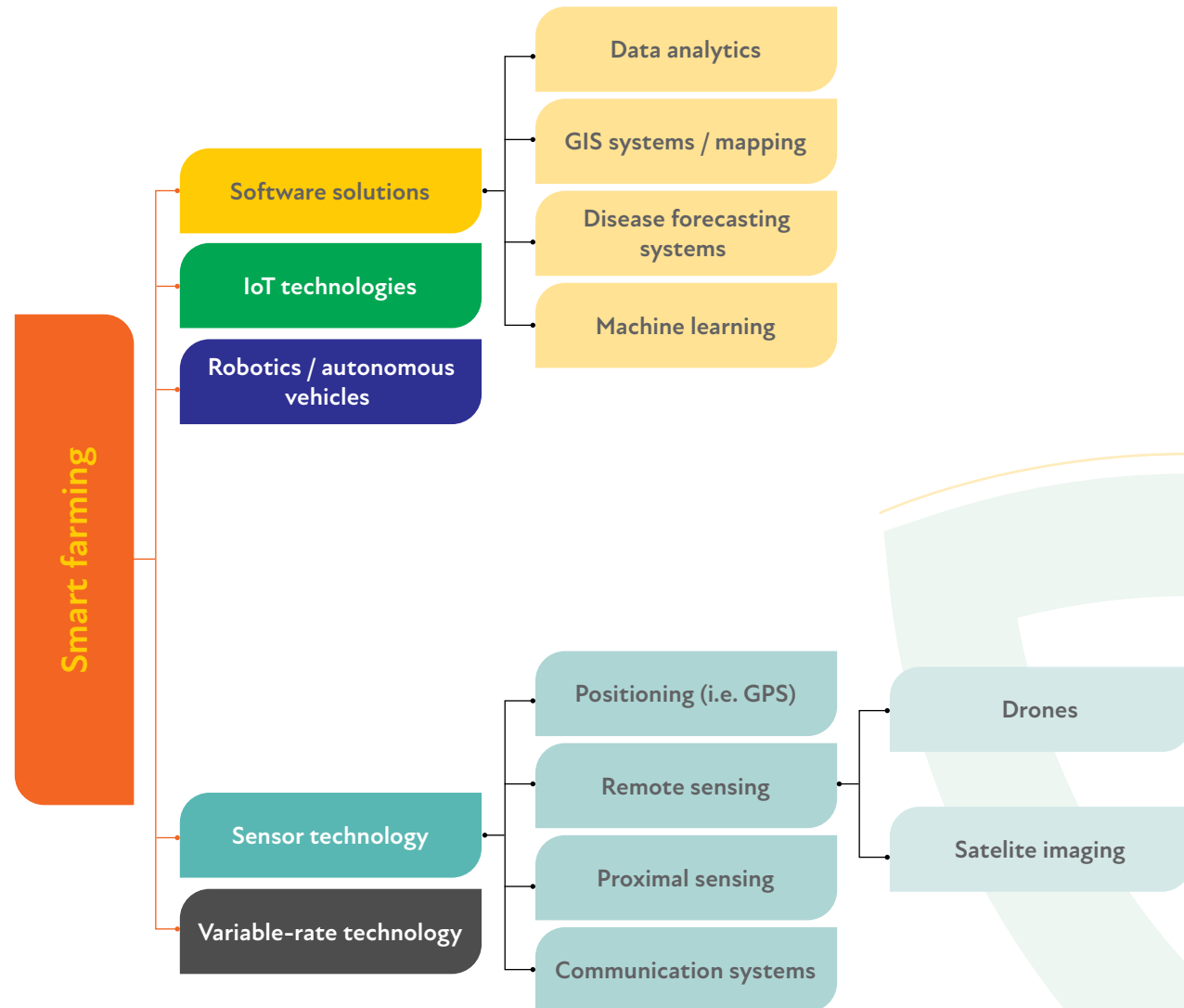
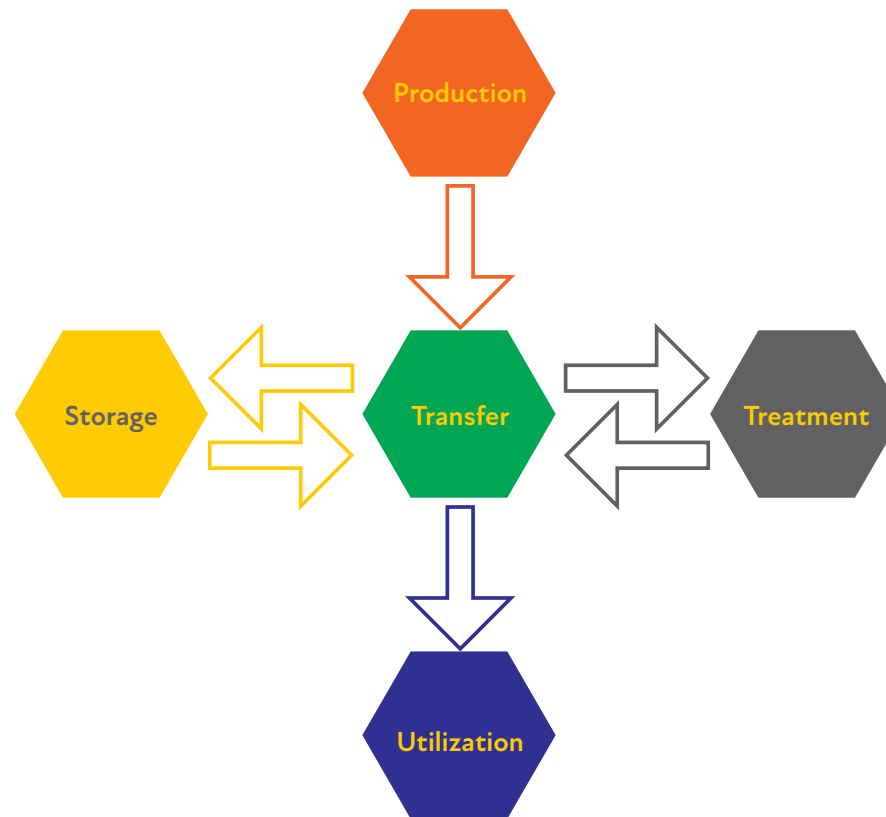


Figure 14. Aspects of smart farming
(Source: GreenCape, 2021)



Production is a function of the amount and nature of agricultural waste generated. Transfer refers to the movement and transportation of the waste throughout the system from the collection to the utilization stage either as a solid, liquid, or slurry. Utilization is the application of the waste for beneficial use and it includes recycling reusable waste products.

Figure 15. Functions of waste management
(Source: AWMF, 2011)

Table 8: Quantities of food waste (in thousand tonnes) at each stage of the value chain of SA
(Source: Oelofse, 2021)

Commodity group	Average annual food production (1000t)	Post-harvesting	Processing and Packaging	Distribution	Consumption	Total
Cereals	103	590	3494	122	864	5 172
Roots and tubers	182	160	133	31	20	526
Oilseed and pulses	3	116	186	74	73	452
Fruit and vegetables	336	621	381	132	463	1 933

Barriers to this opportunity include the lack of effective handling, application and storage of agricultural waste and lack of education and awareness of food-waste management. Although there is a generally high interest in organically produced fruits and vegetables, farmers are still sceptical about using organic fertilizers as soil amendments and fertilizers as they fear significant reductions on their yield and crop productivity (Uhunamire et.al., 2021).

3.3.5. Regenerative agriculture opportunities: Drivers and barriers

Regenerative agriculture involves special techniques to cultivate nutrient-rich soils that also trap greenhouse gases. Often, regenerative and sustainable agriculture are used interchangeably to describe a holistic management framework to restore the environment. Therefore, principles of livestock and pasture management as well as conservation agriculture fall under the umbrella of regenerative agriculture. In regenerative agriculture, the financial benefit comes from saving in inputs in the agricultural production system.

As an example, it is expected that a farmer implementing conservation agriculture (CA) could earn an additional R187/ha/annum of carbon income through reduced CO₂e emissions from the decreased consumption of diesel, lime and nitrogenous fertilisers as well as an increase in soil organic carbon. This is in addition to the R872/ha of savings in input costs for diesel, lime and nitrogenous fertilisers (Credible Carbon, 2021).

The province of Mpumalanga has a land area of 2.5 million ha, of which 48% is grazing land and 38% is arable land. The Highveld region is dominated by summer cereals and legumes (sunflower seed, sorghum, dry beans, soybeans, potatoes, cotton, and maize). Meanwhile, in the Lowveld sub-tropical and citrus fruits as well as sugar are extensively grown.

The province is also known for its intensive and extensive beef production, chickens, eggs, and pork. However, despite the sector's potential, degraded soils caused by poor farming practices and mining activities pose a significant barrier for agricultural productivity and agricultural expansion. It is estimated that ~93 632ha (14%) of the province's high potential arable land is being mined, and 40% is subject to prospecting activities. In addition, rangelands are under threat from overgrazing, invasive plants, land clearing, and uncontrolled fires.

With exposed soils and no vegetation, these rangelands are vulnerable to storms and droughts and cannot store water or carbon effectively. With the closure of many mines in the coming decades, it is envisaged that the land will eventually revert to agricultural developments.

Most recently, Sasol has handed over Secunda farmland to the government to support the development of emerging farmers. With an increasing appetite for feasibility studies in the province for crop production, more investment towards research and development should be targeted to support this transition. The policy and regulatory frameworks for mine closure are currently being updated to enable viable post mining economy to improve societal and environmental benefits. Overall this implies that regenerative agriculture opens a new window for the diversification of economies in Mpumalanga.

The current macro environment is:

- The grain sector in Mpumalanga has adopted conservation agriculture practices in less than 30% of agricultural operations, opening up the possibility of further adoption in various field crops and orchards.
- Mine closure is inevitable in the region. Post-mining land use presents an opportunity for soil remediation and agricultural production.
- The Preservation and Development of Agricultural Bill of 2020 could halt prospective mine applications to protect high potential arable land.

Barriers to entry for RA in SA include a lack of financial incentives to fully adopt regenerative agriculture systems. For example, CA has been identified through research as an emerging opportunity is sustainable agriculture. As such, there has been adoption to some degree, however the cost to transition fully to CA is still significantly high and requires new production technologies which are often too expensive for farmers to adopt.



FUNDING AND INCENTIVES





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

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

General database web page

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

The Green Finance Desk (GFD) primarily acts as a facilitator in the financing of green projects and green business. The GFD works across all sector desks at GreenCape. For more support please contact jack@greencape.co.za

Green Finance Database

GreenCape maintains a database of funding sources and incentives that may be relevant to green economy investors. The database contains information on more than 150 funding opportunities, including an overview of the opportunity and relevant contact details and links. It is ideal for any entity seeking a broad range of funding solutions and financial incentives, with South African institutions being the main source of opportunities. The database is available to view and download online⁹.

Government funding and incentives database

An updated document focused on South African government funding and incentives is available to view and download online¹⁰. These incentives cover local manufacturing, critical infrastructure grants, small enterprise development and a diverse set of sector specific incentives (i.e. Aquaculture Development and Enhancement Programme).

Finfind database

Finfind¹¹ is an innovative online finance solution that brings together SMME finance providers and finance seekers. With a focus on finance readiness, Finfind has more than 200 lenders and over 350 loan products available to SMEs. The database is ideal for South African SMMEs who are seeking funding and/or business advisory services, and those who want to improve their understanding of finance.

AlliedCrowds database

AlliedCrowds¹² is the first complete aggregator and directory of alternative finance providers in the developing world.

Sign-up is free and allows users to access a global database where one can filter for sector (including greentech, agriculture and social impact), type of capital (equity, lending, grant), and type of funding (crowdfunding, angel investing, venture capital, impact investing). In addition:

- Themed databases around the Sustainable Development Goals (SDGs) and the World Green Economy Organisation (WGEO) are available.
- Reports, including a number specifically about African funding sources, can also be downloaded for free.
- Businesses / organisations can also contact Allied Crowds to create a customised funding database. This resource is ideal for any entity seeking a broad range of financial solutions on a global scale.

⁹ <https://www.green-cape.co.za/content/focusarea/green-finance-databases>

¹⁰ <https://www.greencape.co.za/assets/Uploads/Government-Funding-and-Incentive-Booklet.pdf>

¹¹ <https://www.finfindeasy.co.za/>

¹² <https://alliedcrowds.com/>

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