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THE FUTURE OF THE WESTERN CAPE AGRICULTURAL SECTOR IN THE CONTEXT OF THE 4TH INDUSTRIAL REVOLUTION

Annexure A: 4IR Western Cape summary

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1. Western Cape agriculture in perspective

Strategic overview

The Western Cape, with 6.2 million residents, accounts for 11% of South Africa's population and contributes 14% to the country's GDP. In 2014 (latest available data), the real economy (represented by agriculture, mining, manufacturing and construction) made up 22% of The Western Cape's output, with agriculture's contribution at 4% (22% of national agriculture). Although growth in the Western Cape overall has generally been slightly above that of the rest of the country, it also saw decelerating growth from 2011.[1]

The province is currently faced with population growth, declining household sizes, increasing household numbers, high levels of migration, urbanisation and escalating development pressures. These factors have consequently caused changes in land use and land cover and encouraged issues such as urban spread, marginalisation of the poor, limited public access to resources, land degradation and climate change.[2]

The Western Cape Government has identified five Provincial Strategic Goals (PSGs) to deliver on its vision and contribute to the objectives of the NDP. These five PSGs include:
1. Create opportunities for growth and jobs;
2. Improve education outcomes and opportunities for youth development;
3. Increase wellness and safety and tackle social ills;
4. Enable a resilient, sustainable, quality and inclusive living environment; and
5. Embed good governance and integrated service delivery through partnerships and spatial alignment.

Embedded herein, agriculture and agri-processing are strategic sectors in terms of their contribution to economic growth, employment absorption and foreign earnings. Yet, its relative importance for exports from the province creates volatility in the provincial economy, especially given the uncertainty brought about by climatic changes and the water crisis prevailing in the Province.[3] The situation in the Western Cape remains ominous with major long-term impacts due to severe restrictions on the availability of water for irrigation of high-value export industries. Given the continuation of the drought in these areas, grain, livestock, fruit, vegetable and dairy producers are facing severe pressure and the risk of significant production failures.[4]

Based on its vision for a united, responsive and prosperous agricultural sector in balance with nature, the Western Cape Department of Agriculture determined the following seven Departmental Strategic Goals:
1. Support the provincial agricultural sector to at least maintain its export position for the next 5 years by growing its value added from R16.349 billion in 2013.
2. Ensure that at least 70% of all agricultural land reform projects in the Province are successful over the next 5 years.
3. Support the sector (farmers and industries) to increase sustainable agricultural production (primary provincial commodities) by at least 10% over the next 10 years.
4. Optimise the sustainable utilisation of water and land resources to increase climate smart agricultural production.
5. Increase agricultural and related economic opportunities in selected rural areas based on socio-economic needs over a 10-year period and strengthen interface with local authorities.
6. Enhance the agri processing capacity at both primary and secondary level, and to increase this by 10% above baseline by 2019.
7. Facilitate an increase of 20% in relevant skills development at different levels in the Department and sector over the next 10 years.[5]

A 4IR evaluation plan was subsequently formulated by the department to investigate the trends underpinning the expected disruptions, to evaluate the impact of the approaching changes, and to provide a scientific foundation for a response plan to mitigate the negative and maximise the positive impacts. The ensuing discussion aims to contribute to this narrative.

State of agricultural land and its use

The total area of grazing land has declined over time owing to expanding urbanisation and activities such as crop farming, forestry and mining. In addition, ecosystem services in the semi-arid Little Karoo are in decline, and is one of the most degraded areas in the Western Cape, with 52% of the area degraded through overgrazing. Of particular concern is an 18% decline in water-flow regulation and a 44% decline in erosion control; ecosystem services that underpin the region's agricultural economy. Commendable, however, is that the Western Cape is the only province whose citrus exports are allowed into the US due to appropriate sanitary standards, and has become the largest exporter of fresh oranges to the US (almost 50% of US imports).[6]

The map below indicates the six districts that collectively make up the Western Cape, followed by the nature and extent of agricultural land use in the various districts.

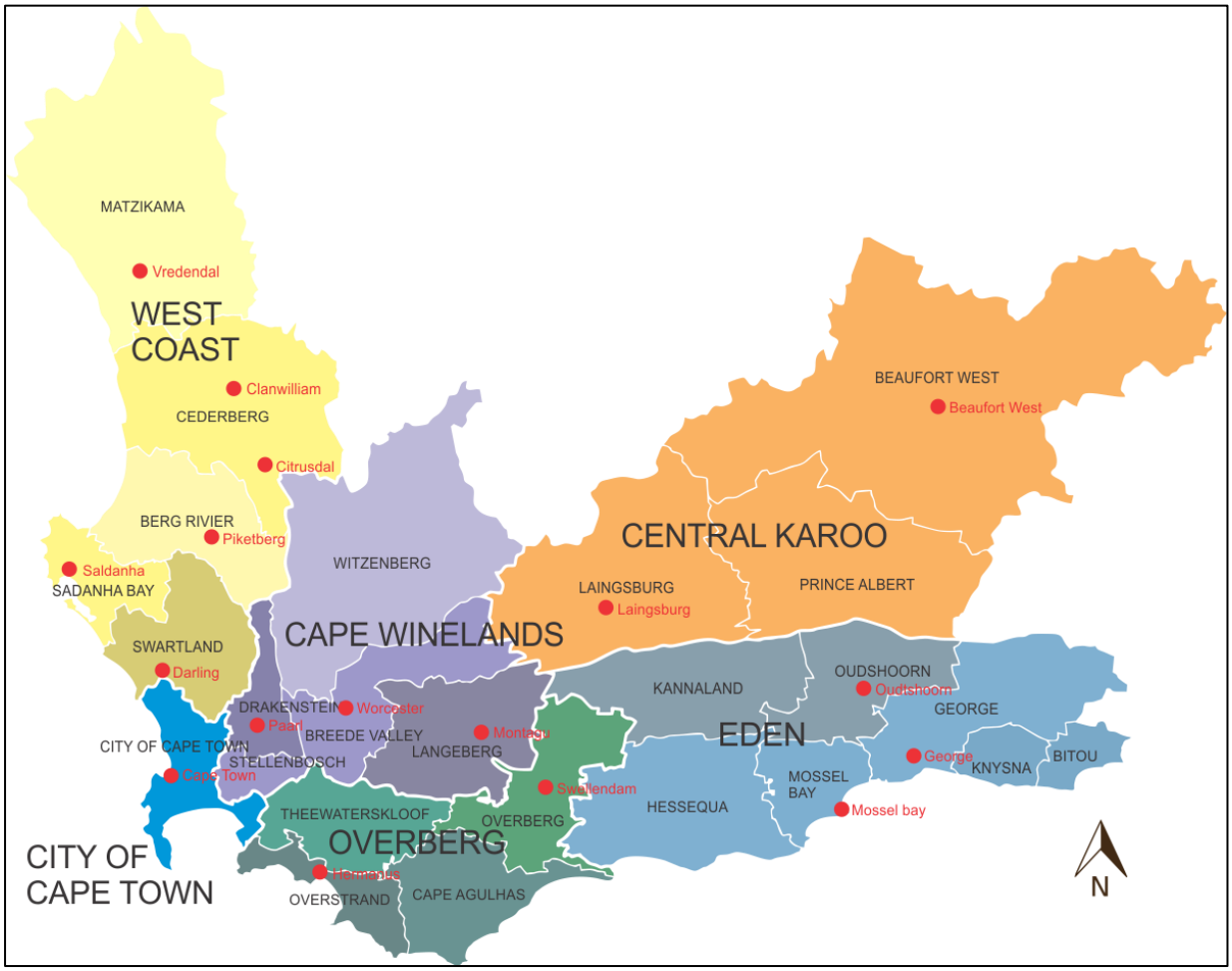

Figure 1: Western Cape districts map[7]

Table1: Western Cape agricultural land use[8]

DISTRICT	TOTAL AGRICULTURAL AREA	ALL FIELDS	CROPPED FIELDS	PLANTED PASTURES*
Cape Winelands	2 099 847	245 351	160 174	52 679
Central Karoo	3 869 904	13 975	1 524	8 026
City of Cape Town	142 068	41 151	24 689	15 062
Eden	2 270 601	346 621	101 785	206 926
Overberg	1 179 823	448 269	229 343	189 269
West Coast	3 067 991	781 919	430 127	216 991
Total	**12 630 234**	**1 877 287**	**947 643**	**688 953**

*Including Lucerne / medics

As the Western Cape is a winter rainfall region, its agriculture sector is unique in South Africa. The diversity of agro-climatic zones in the Western Cape allows for a variety of agricultural commodities as depicted in table 2, which provides an overview of crop and livestock commodities for each agro-climatic zone.[9]

Table 2: Crop/livestock commodities for each agro-climatic zone in the Western Cape

Name	Main crops	Livestock
Bokkeveld	Pome fruit, wheat, stone fruit, onions, potatoes	Cattle
Bo-Langkloof-Outeniqua	Pome fruit, hops, wheat, stone fruit, flowers, honeybush	Cattle, sheep, goats
Breede	Wine and table grapes, wheat, stone fruit, pome fruit, olives, citrus, vegetables, flowers	Broilers, egglaying chickens
Cape Town winelands	Wine and table grapes, wheat, stone fruit, vegetables, olives, canola, citrus, flowers, berries	Broilers, egglaying chickens, pigs
Cederberg	Rooibos, wheat, citrus, wine grapes, stone fruit, vegetables, potatoes, flowers	Cattle
Grabouw-Villiersdorp-Franschhoek	Pome fruit, wine grapes, wheat, barley, stone fruit, flowers, berries	
GrootBrak-Plett	Wheat, barley, vegetables, nuts, berries, flowers, honeybush	Cattle, dairy, egg-laying chickens
Hardeveld/Sandveld-north	Wheat, wine grapes, rooibos, potatoes, vegetables	Cattle, sheep
Hex	Table grapes, citrus	
Knersvlakte	Wheat, wine and table grapes, rooibos	Cattle, goats, sheep
Koup	Olives, vegetables and vegetable seed, stone fruit	Cattle, game, goats, sheep
Little-Karoo	Wheat, vegetables, wine grapes, stone fruit, olives, nuts	Cattle, dairy, goats, ostriches, pigs, sheep
Montagu-Barrydale	Stone fruit, wheat, barley, wine grapes, pome fruit, citrus, olives, flowers, nuts	Sheep
MosselBay-Herbertsdale	Wheat, barley, canola, flowers	Cattle, dairy, ostriches, pigs, sheep
Nelspoort	Olives	Cattle, goats, ostriches, sheep
Olifants irrigation	Citrus, wheat, wine & table grapes, rooibos, tomatoes, potatoes	

Piketberg	Pears, fynbos flowers, stone fruit, wheat, citrus, herbs/ essential oils, wine grapes, Cape rush, rooibos	Cattle, sheep
Rooikaroo-Aurora	Wheat, canola, rooibos, table & wine grapes, potatoes, olives, flowers	Cattle, sheep
Rûens-east	Wheat, barley, canola, citrus, olives, herbs/essential oils, Cape rush, berries, honeybush	Cattle, dairy, ostriches, pigs, sheep
Rûens-west	Wheat, barley, canola, wine grapes, pome fruit, flowers, vegetables, olives, citrus, herbs/essential oils, berries	Cattle, dairy, sheep
Sandveld-south	Wheat, potatoes, rooibos, canola, citrus, flowers	Cattle, sheep
Swartland	Wheat, wine and table grapes, canola, olives, citrus, vegetables, stone fruit, berries, flowers	Cattle, dairy, pigs, sheep
Tankwa-Vanwyksdorp	Wheat, stone fruit, wine & table grapes, vegetables, olives, nuts	Cattle, dairy, game, goats, ostriches, pigs, sheep

Drivers of agricultural land use change

A 2016 study, "Land Use and Land Cover Change in the Western Cape Province: Quantification of Changes & Understanding of Driving Factors", broadly categorised the drivers of land use in the Western Cape as *proximate-* and *underlying* drivers, which is summarised in figure 2 below:

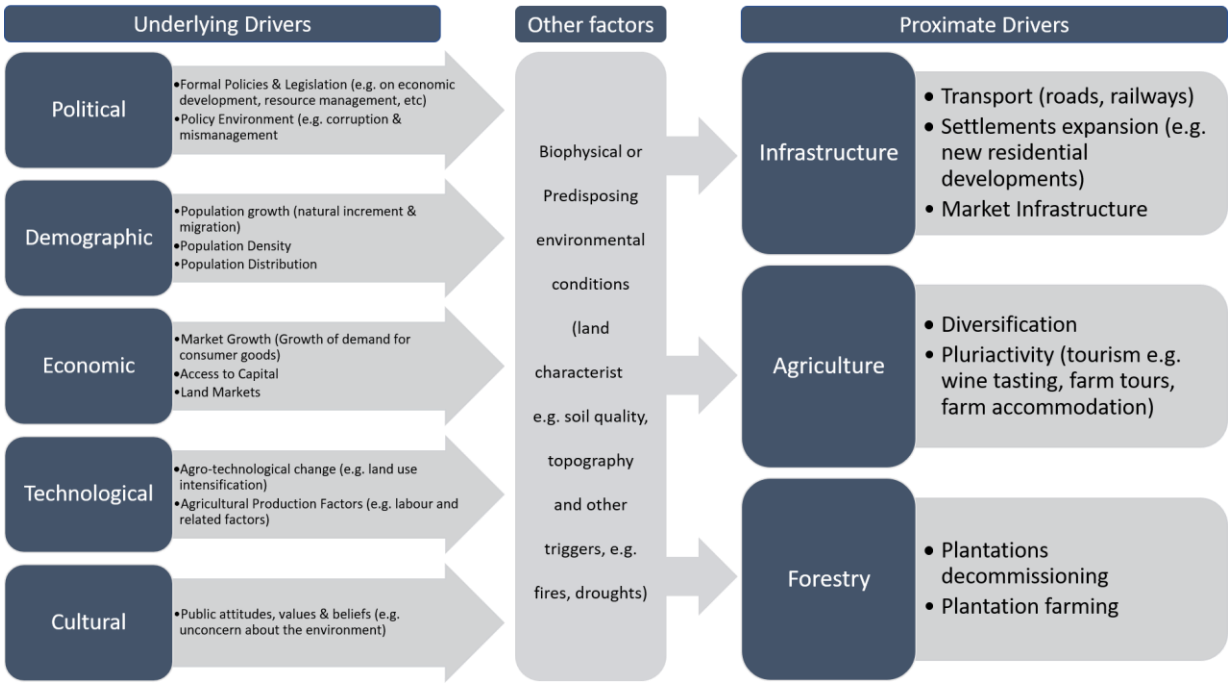

Figure 2: Drivers of land use (Adapted and reconstructed)

Agriculture takes up most of land in the Western Cape (2.5million ha) and past trends indicate a decrease in croplands in the Central Karoo District with a contrasting increase in vineyards in the Western region. The decrease in agriculture is due to land capability and water availability, and the change in state of land use has both positive and negative consequences. Agriculture promotes food security, job creation, economic stability, inputs to other industries amongst other advantages. However, poor farming practices, overgrazing

and land clearance can lead to erosion and land degradation.[2] In fact, inefficient and ineffective practices can have a knock-on effect throughout the agricultural value chain.

Western Cape agricultural value chain

Agricultural production is a highly integrated system as can be seen in the typical agriculture-production value chain in Figure 3.[10] However, agricultural production is undergoing marked changes due to rapid shifts in consumer demands, input costs, and concerns for food safety and environmental impact. In addition, agricultural production systems are comprised of multidimensional components and drivers that interact in complex ways to influence production sustainability.[11]

On the demand side, growing population and economic growth converge to generate the need for increased crop levels and food production. Policies promoting biofuels also add a significant new source of demand to the mix. Apart from such considerations affecting the quantity of demand, there are also drivers affecting its quality as the food chain and consumers increasingly consider the environmental and social dimensions of food production. On the supply side, there is apprehension about declining levels of yield gain, whether due to the laws of diminishing returns or the effects of water shortages and global warming. Agriculture's complex value chain extends input companies, farmers, agents, food companies and retailers, all who must ultimately satisfy the changing demands of the consumer in a sustainable manner. The sector encompasses significant diversity and variety at each stage, from R&D-based input companies to generic manufacturers, subsistence farmers to high tech agroholdings, biotech boutiques and SMEs to multinational corporations.[12]

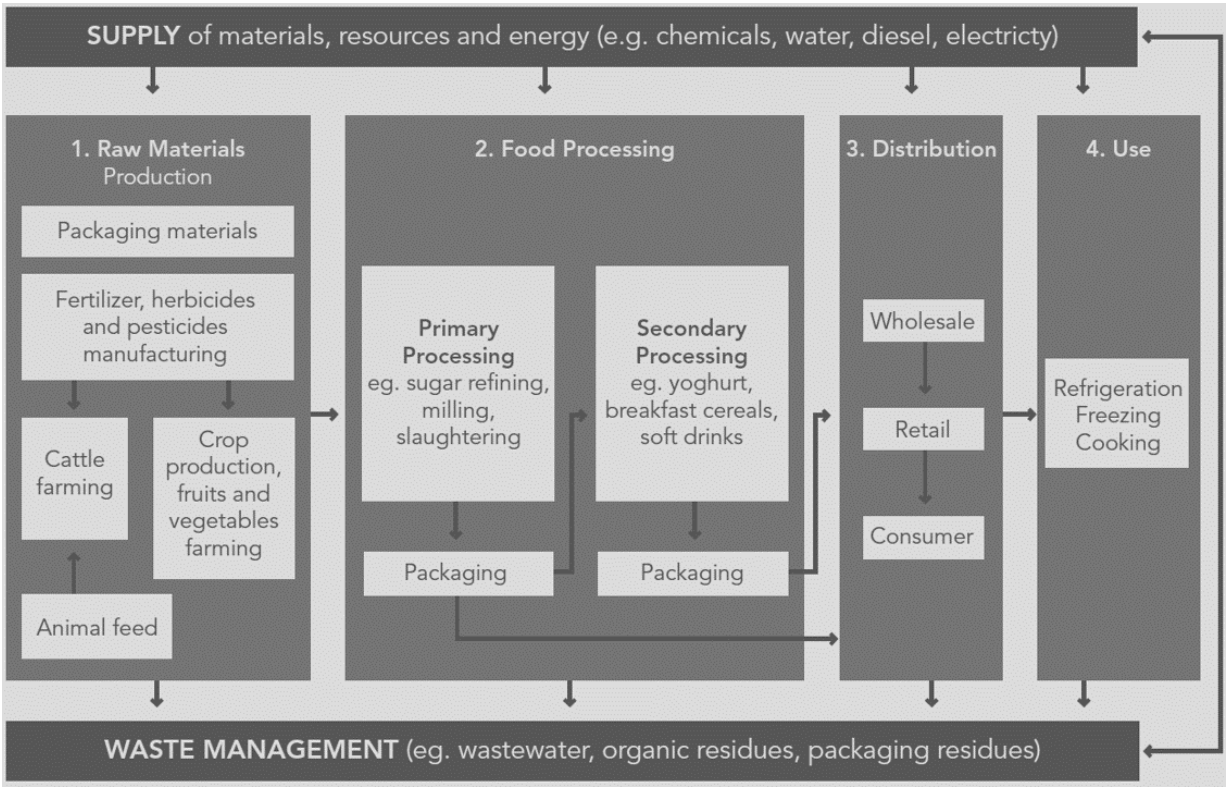

Figure 3: The agricultural production value chain

The emphasis in this essay is on primary agriculture production, highlighting opportunities and challenges related to technologies and practices that increase production efficiency. The intent being to produce more with less inputs, while simultaneously benefitting the environment by conserving resources and reducing negative impacts such as pollution.

2. 4IR drivers and impact on Western Cape agriculture

Drivers and megatrends set to disrupt Western Cape agriculture

Albeit that 4IR is characterised by extreme automation and connectivity, disruption does not originate from technology alone, but is also influenced by demographic shifts, globalisation, macroeconomic trends and the like. Western Cape agriculture does not function in isolation, nor do technological developments take place separately; it always interacts with developments in the global, national and local economy, society and politics. In addition, the food systems of the country and province are intertwined in numerous ways, from the trade in raw materials to final products. A large part of the economic value-add of food in the Western Cape is at the farms but also in food processing and in retail, and at the end of the food chain is the consumer, whose needs and demands also influence the production and supply of food. On the other hand, companies in the food chain can exert considerable political and social influence, effecting consumer demand. It is therefore a highly complex system and to investigate its future requires many different factors and a large degree of uncertainty must be considered.**Error! Bookmark not defined.**

A recent report by Deloitte, "From Agriculture to AgTech", presents two overarching disruption drivers, i.e., (1) ten global megatrends that impact agriculture and intensifying transformation (see figure 4), and (2) three agri-specific change accelerators that are amplifying the speed of disruption (See figure 5).**Error! Bookmark not defined.**

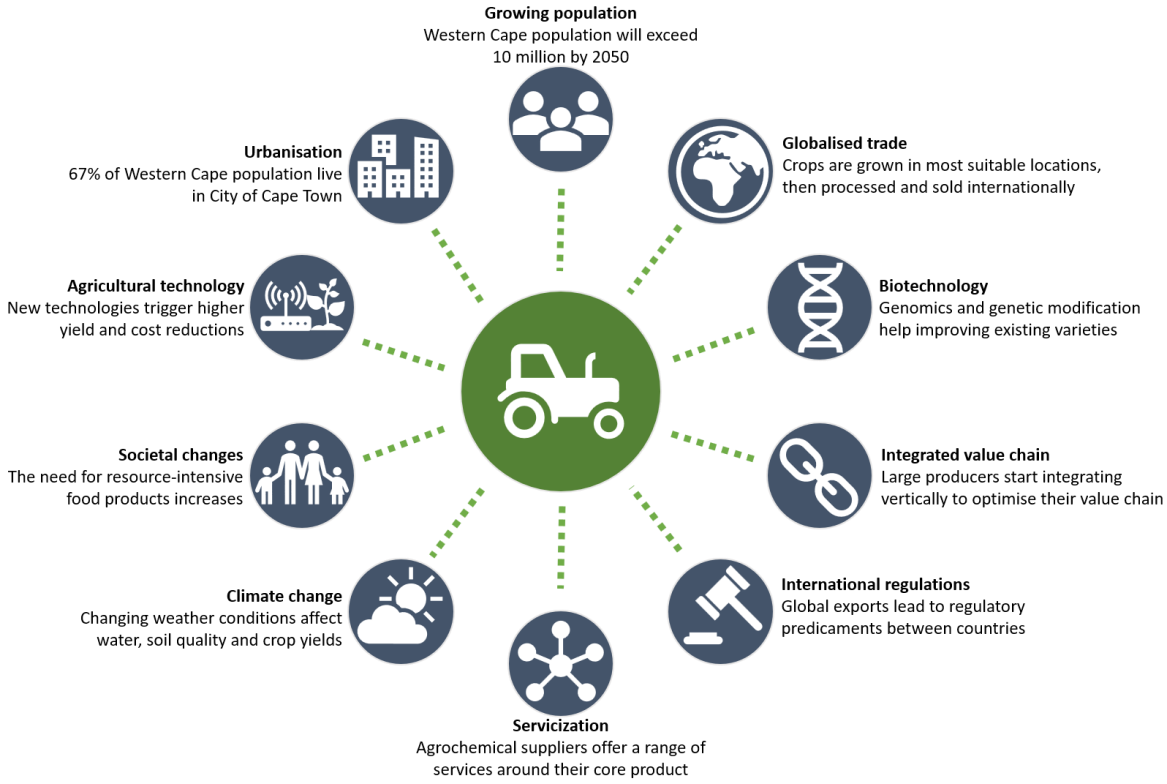

Figure 4: Ten impactful megatrends creating the foundation for transforming agriculture

According to the report, the ten global megatrends will lead to a disruptive transition in the next 5-10 years, in interplay with more industry-specific change accelerators.

The three agri-specific change accelerators from the Deloitte report that are amplifying the speed of disruption are presented below.

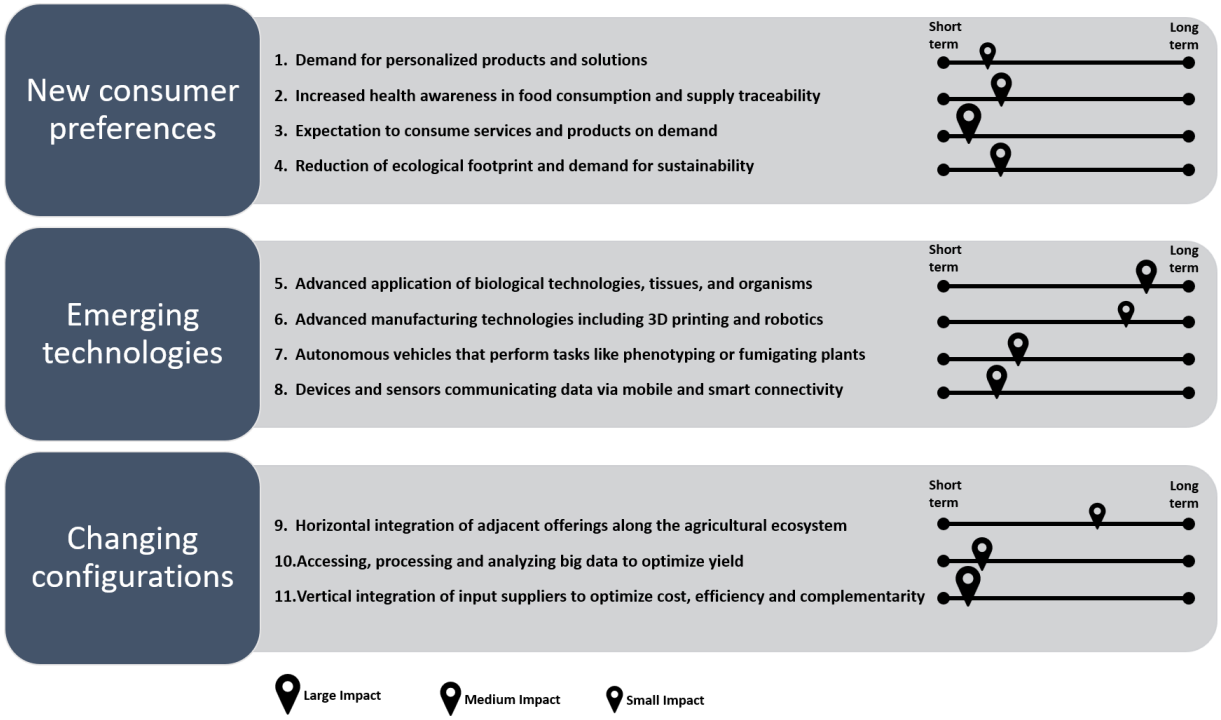

Figure 5: Agri-specific change accelerators that will amplify the intensity of the transformation

The agricultural disruption will be accelerated by new consumer preferences, emerging technologies and changing producer and value chain configurations, leading to new challenges for agricultural players. While the intensity of the impact varies, most change accelerators will happen in the short- to medium-term.

The above, is argued, will lead to a major disruption and foretells the visionary shift from family farms to smart "food factories."**Error! Bookmark not defined.** The next section attempts to unpack these drivers and megatrends into an integrative, Western Cape specific overview.

Drivers and megatrends integrative Western Cape perspective

Drawing on a previously discussed review of the general megatrends highlighting twelve commonly-cited megatrends across four dimensions[13], the table below indicates the drivers and associated megatrends bound to impact on agriculture in the Western Cape. The examples applicable to Western Cape agriculture is by no means complete, but serves as foundation from where further factors regarding the future of agriculture in the province could be identified.

Well-functioning markets, increased incomes for smallholder farmers, equal access to technology and land, and additional investments all play a role in creating a vibrant and productive agricultural sector that builds food security.[14]

Table 3: Drivers and megatrends impacting on Western Cape agriculture

Driver	Megatrend	Description	Examples applicable to WC agriculture
Technology	Disruptive technology developments	Multiple technology megatrends cited by numerous trend observers, e.g.: – Ubiquitous connectivity, Internet of Things – Materials (e.g. smart, nano, bio etc.) – Customisation, personalisation, localisation – Data-driven technologies – Information security and data protection – Virtual world – Artificial intelligence and Robotics – Genomics – Personalised medicine – etc.	• Farm management software • Precision agriculture and predictive data analytics • Sensors that help farmers to collect data and monitor crop health, weather and soil quality • Software and hardware aimed at better understanding livestock, from breeding patterns to genomics • Robotics and drones • Smart irrigation • Technological platforms that connect farmers directly to suppliers or consumers without any middlemen • New technologies trigger higher yield and cost reductions
Energy and Environment	Changing energy mix	New energy mixes to address growing demand, dwindling non-renewables, energy security, higher costs (e.g. shale, nuclear, coal, renewables etc.)	• Imperative that energy security is environmentally and socially sustainable • Renewable energy (wind and solar) • Photovoltaic (PV) energy and durable warmth production • Biomass • Waves
	Shortage of resources	Shortages of water, food, rare earths, key commodities, including impact of environmental damage	• 6.2 million residents in Western Cape facing water shortage • Water is needed to generate energy with different uses along the energy value chain, while energy is needed to convey and treat water across the water value chain • Catchment areas depleting, adversely affecting distribution of water; longer and more frequent dry seasons • Of water withdrawn for human uses, allocation for agriculture represent 30%

			• 70% increase in food is needed by 2050 to meet population growth demand • Agriculture is a leading cause of loss of global biodiversity due to conversion of natural habitats, such as forests and wetlands, into farmland • Diminishing soil nutrition and erosion
	Climate change	Prevention, adaptation and mitigation to address climate change	• Higher average annual temperature • Higher maximum temperatures • More hot days and more heat waves • Higher minimum temperatures • Fewer cold days and frost days • Reduced average rainfall, particularly in the western parts of Western Cape. • Increase in the frequency and intensity of extreme weather events, including floods, droughts, and storm surges[15]
Economics and Politics	Knowledge and information society	Prevalence of knowledge as basis for economic value, ubiquitous information, growing personalised education, increasing automation requiring highly skilled workforces	In South Africa: • Internet users 52% penetration • Active social media users 27% penetration • Mobile subscribers 145% of population • Active mobile social users 24% penetration • Mobile's share of web traffic 78% • Average time spent on mobile Internet daily 3.03 hours • Mobile broadband 73% penetration[16] • Access to the Internet highest among households in the Western Cape (21.1%)[17]
	Economic shifts	Economic power of emerging market economies overtaking developed markets, increasing middle class and growing wealth	• Chronic poverty is lowest in the Western Cape and Gauteng[18] • Western Cape agri-sector globally competitive • Tableview one of SAs faster growing middle-class suburbs[19] • Paarl, Franschhoek and Stellenbosch are the areas

			with the fastest growing numbers of millionaires in SA[20]
	Globalisation	Increasingly connected global economy and economic integration	• Decline in the costs of cross-border trade in farm and other products • Reductions in governmental distortions to agricultural production, consumption and trade • Farm productivity growth continues to outpace demand growth • Diets in emerging economies move towards livestock and horticultural products at the expense of staples[21]
	New normal	Lower interest rates, greater public policy interventions, greater public debt, bigger defence budgets	• Overall, global growth remains bound by the norms of the post financial crisis era. • Low inflation, absence of significant imbalances and supportive monetary policies suggest that recession risk remains low. • Upside growth potential is held back by high indebtedness (private and/or public), subdued household and corporate confidence, weak credit formation, trivial global trade growth and weakening productivity gains.[22]
	Multi-Polar	Diffusion of power, rising nationalism, shift to networks and coalitions in a multipolar world.	• Increased complexity of the international system • Less stable international order • Increased likelihood of destabilisation and crisis • New architecture of global finance • Increased ability for non-state actors to impact global events • Conflicting ideologies / blurring of ideologies[23]
Social and Health	Demographic shift	Population growth, youth, aging societies	• LSM % distribution: 1 = 0 | 2 = 0.3 | 3 = 0.9 | 4 = 2.5 | 5 = 5.4 | 6 = 14.2 | 7 = 19.0 | 8 = 19.8 | 9 = 21.0 | 10 = 16.6[24] • 76% in LSM 7-10 supergroup • Youth unemployment rate (15-34 years) 29.9% (2015)[25] – higher than national average.

			• Population ageing to become a significant social transformation.
	Urbanisation and mobility	Growth of mega-cities, smart-cities, need for investment in critical infrastructure for safe, fast, ecologically sound mobility	• City of Cape Town population = 4 million (expected to reach 4.2 million in 2023)[26] • By 2030 Western Cape population will exceed 8 million (own calculation using linear regression – R^2 = 0,9981) • By 2050, 70% of the world population will live in urban areas[27] → Equates to 10.5 million for City of Cape Town • As the world continues to urbanise, sustainable development challenges will be increasingly concentrated in cities[28] • Increasing pressure on agriculture and food production to serve urban expansions
	Health and wellness demands	Growing expectations for health and wellness, increasing risks of pandemics, burden of aging populations	• Changing consumer behaviours spurred in part by demographics, evolving healthcare policies and the digital revolution[29] • Progressive health and wellness consumers are increasingly influential in redefining food culture • Health, wellness and sustainability are starting to converge at food retail and food service outlets

Because the affordability of food mainly relates to income, ensuring access to food remains one of the key pillars of food security and the wider anti-poverty agenda. Agriculture's centrality in the food-water-energy nexus is also of significance. A growing Western Cape population with increasing urbanisation and a deteriorating natural resource base implies more people to feed with less water, farmland and rural labour. Satisfying expected increases in water, energy and food needs requires a shift to more sustainable consumption and production approaches, with agriculture and food systems in the Western Cape made more efficient and sustainable.[30]

3. 4IR opportunities and challenges for Western Cape agriculture

Western Cape agriculture in 4IR challenge-opportunity mix

The goal for the Western Cape agricultural sector is no longer simply to maximise productivity, but to optimise across a far more complex landscape of production, rural development, environmental, social justice and food consumption outcomes. However, there remain significant challenges to developing provincial, national and international policies that support the wide emergence of more sustainable forms of land use and efficient agricultural production. The lack of information flow between scientists, practitioners and policy makers is known to exacerbate the difficulties, despite increased emphasis upon evidence-based policy.[31]

When considering the performance of the Western Cape agro and food sector in the complex local and global food system, the degree of uncertainty increases with a wide range of sectors and disciplines being involved. In terms of technological developments, these may be influenced by entrepreneurs, researchers and policy-makers but also by other developments. In turn technological developments influence other developments, e.g. in food and health, but also in society. That being said, numerous opportunities exist in terms of the application of technology in pursuit of improving efficiencies in Western Cape agricultural production – technology in this context implying the systematic application of scientific knowledge for practical purposes. Examples of technologies holding promise for the future of Western Cape agriculture include:[25]

3D printing
4D printing
Smart materials
Robotics
Autonomous microrobots
Sensor technology
Information technology and IT infrastructures
Bioinformatics
Smart farming
Renewable energy
Biorefinery and biofuels
Genetics
Synthetic biology
Protein transition
Food design
Aquaculture
Vertical agriculture
Conservation technology
Transport technology
Weather modification

Western Cape agriculture is, however, highly dependent on agricultural equipment, infrastructure and workforce. Agricultural equipment consists of mobile and stationary machinery and equipment used for both indoor and outdoor agricultural operations. Modern agricultural equipment provides a range of different options for collecting and analysing process data, but not everyone has digital agricultural equipment, is aware of its benefits, or trusts it sufficiently to use it. Nevertheless, the potentials of digitisation and using data for agriculture are generally recognised. Today, digital technologies can help Western Cape farmers to meet these requirements and optimise their processes at the same time. But there are many obstacles to overcome before these opportunities can be exploited, i.e.:

- Most of agricultural equipment currently in use is analogue, i.e. not equipped with digital technology and not networked.
- Farmers wanting to use new technologies need to extend their tech-competence.
- Telecommunications infrastructures are inadequate in rural areas.
- Data protection and data sovereignty must be ensured.
- Once collected, data must be organised and analysed as “big data”.
- Standalone solutions should be avoided.

Conversely, technological solutions to overcome these challenges already exist, such as Bluetooth "beacons", GPS and RFID systems combined with software, standardisation and interoperability mean legacy machinery can now be digitised. Known as partial digitisation, this is a realistic potential way into Agriculture 4.0 for many Western Cape farmers.[32] The belief that 'bigger is better' that has come to dominate farming and rendering small-scale operations impractical, is busy changing dramatically with advances in technology expected to disrupt current agribusiness models.[33]

Agri impact roadmap and potential of digital opportunity

The agri-sector impact roadmap (Figure 6) below, highlights the relative pace of disruption that is accelerating and how it will affect the sector on a timeline of 5 to 10 years. Given a view of when digital technologies and disruptive activities have emerged, and are forecast to emerge, it is possible to plot the agri-sector along a timeline to forecast when the most disruptive changes might be felt in terms of driving transformational change.[34]

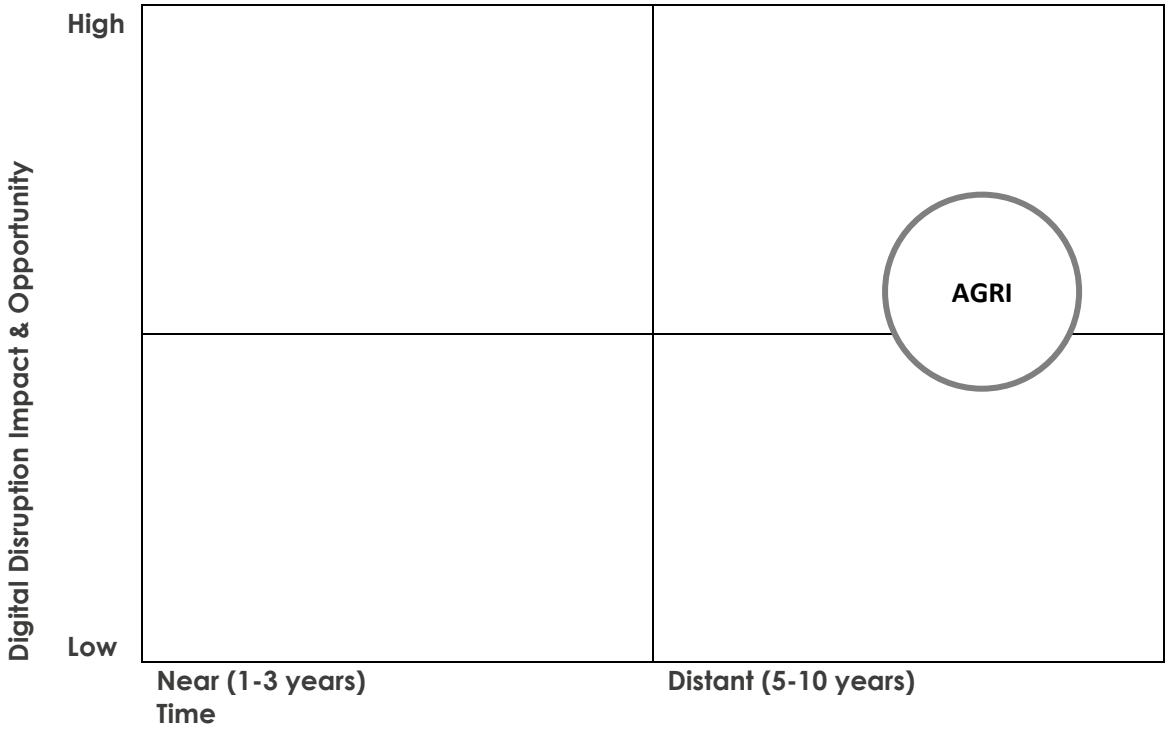

Figure 6: Agri-sector impact roadmap

High impact implies that every aspect of agri-business will be transformed by digital capabilities; aspects being, core competencies and resources, value propositions, distribution channels, customer segmentation and engagement, product design and pricing, revenue and cost bases, and operating models. From the above it is evident that impact is moderate, just above the mid-range between high and low, which nevertheless, still implies significant transformation.

Figure 7 below depicts the agri-sector potential of digital opportunity map.

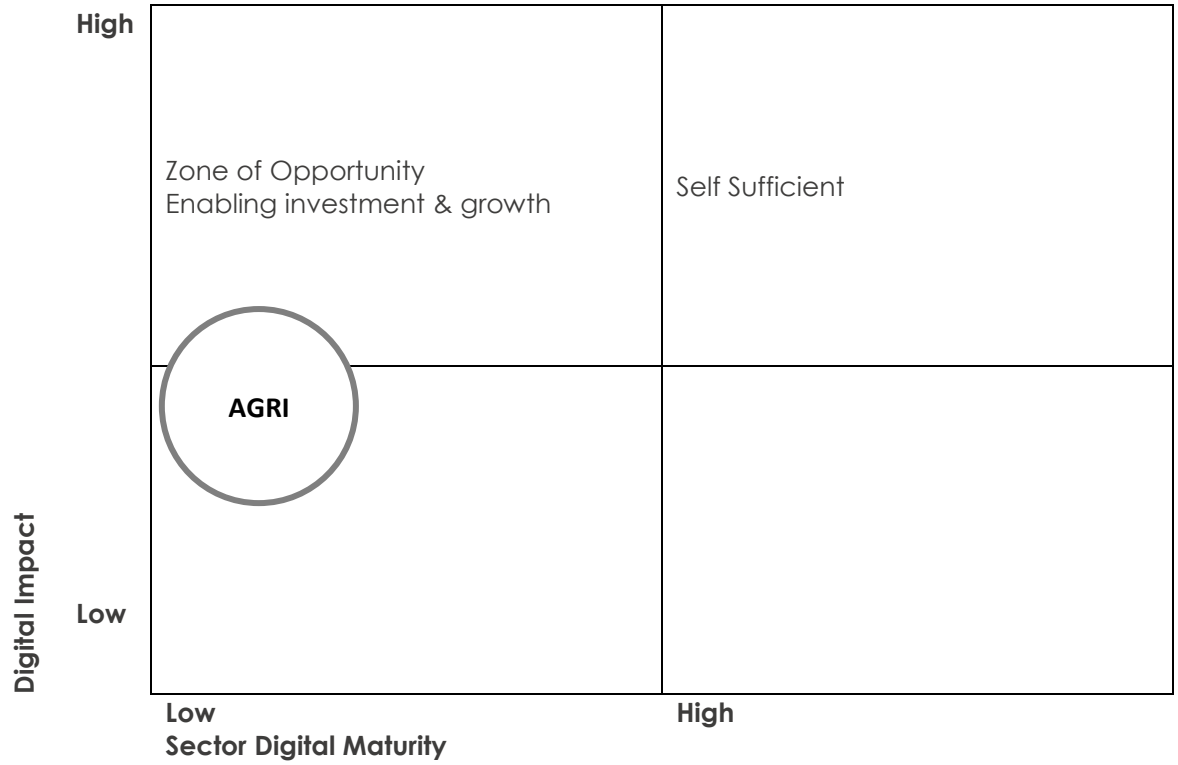

Figure 7: Agri-sector potential of digital opportunity map

The Western Cape agri-sector is moderately transforming in terms of digital impact, i.e., digital transformation is starting to evolve the back offices, technology platforms, operating processes, product innovation and customer experience which impacts multiple strategic challenges. Noticeably, however, is the sector's low positioning in terms of digital maturity, i.e., digital capabilities are progressing in pockets but not yet drawing significant investments; no clear digital leadership; lack of awareness and skills; reliance on outsourcing for digital capabilities; lack of adequacy of support through sector policies; and substandard view of cyber risks and partial availability of cyber security tools.[34]

4. Future of Western Cape Agriculture

Three alternative scenarios

Drawing on the literature consulted, three alternative scenarios for Western Cape agriculture was conceptualised. The point of departure was the creation of a baseline scenario which considered what the future could be like if the drivers and trends continued its current trajectory. Alternative scenarios were then extrapolated from the baseline, given specific changes in the drivers and trends, which resulted in three scenarios, with two mid-way alternatives, as set out in Figure 8 below:

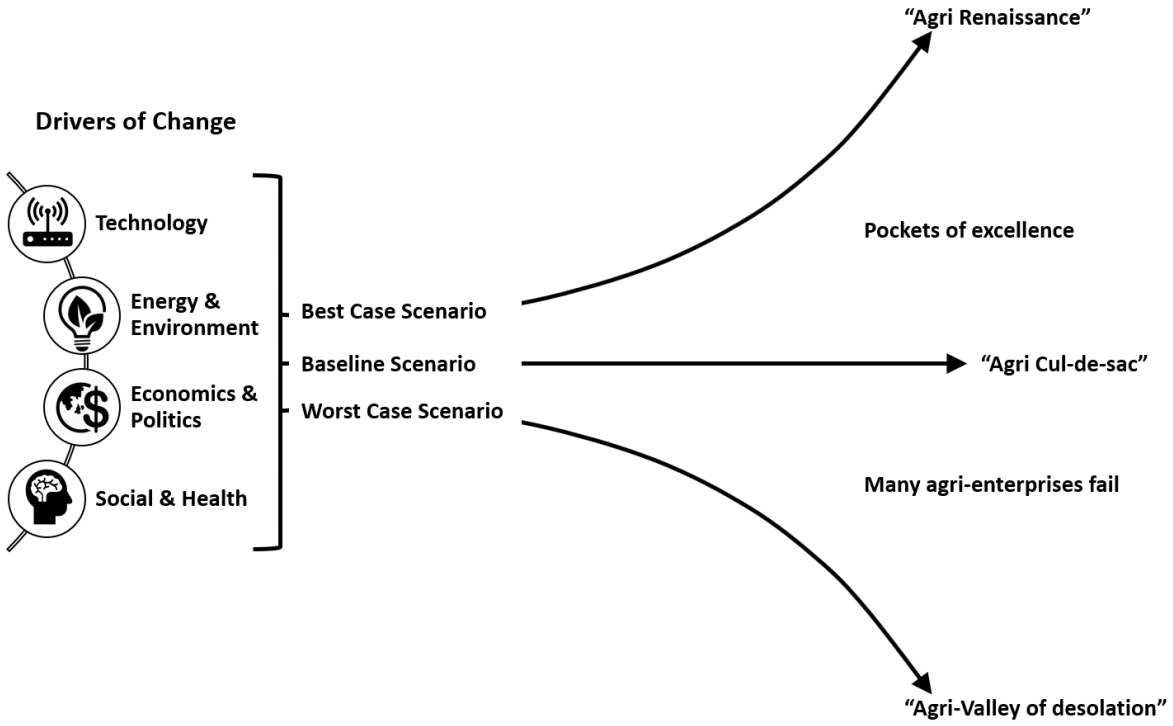

Figure 8: Future of Western Cape agriculture

Scenario 1: Baseline Scenario
"Agri Cul-de-sac"
In the baseline scenario – "Cul-de-sac" – disruptive technology developments persist at an exponential rate while the Western Cape agri-sector advances at a linear, incremental rate. New energy mixes to address the growing demand are not receiving the sense of urgency it requires, with shortage of water, dry and arid climatic conditions, and environmental degradation continuing unabated. Knowledge as basis for economic value, supported by democratisation of information and increasing personalised choices is affecting the nature and extent of the growing middle class' buying behaviour and patterns. Conflicting ideologies and social pressures on South African society continue relentlessly, and failure to reach political consensus and cooperation result in an ever-weakening economy, unable to deliver on the social expectations of citizens, and exasperating the financial pressure on the agricultural community. Amidst an increasingly connected global economy and economic integration, and while the adoption of technology offers new and efficient ways for farming and agriculture, the stifling effects of the local economy mean that agri-producers are evolving too slowly, and face waning returns from the shrinking buying-power of the local market. Population growth of, and migration to, the Western Cape continues to further burden infrastructure, and increasing pressure is exerted on agriculture and food production to serve the urban expansion. The increase in unemployed youth further aggravates degradation of the social fibre in the Western Cape.

Scenario 2: Best Case Scenario

"Agri Renaissance"
In the best-case scenario – "Agri Renaissance" – Western Cape agriculture embraces technology developments through the adoption of, amongst others, farm management software, precision agriculture and predictive data analytics to monitor crop health, weather and soil quality, robotics and drones, production value chain platforms, and smart irrigation – resulting in higher yields and significant cost reductions. The accelerated adoption of technology offers new and efficient ways of farming and agriculture, leading to increased

competition amongst agri-producers in a new agtech-enabled normal. Commercially viable renewable energy alternatives via wind, solar, biomass and waves are achieved, whilst innovative applications to water usage and management become commonplace. Initiatives in relation to the prevention, adaptation and mitigation of climate change and soil erosion results in positive knock-on effects throughout the agricultural production value chain. Dissemination of relevant knowledge by the agri-sector is aligned with buying behaviour and patterns of the growing middle class. Amidst increasing automation, vocational education has adapted to meet the demands of new skills requirements in the Western Cape. Ideological and social pressures on South African society are relieved through inclusivity and concerted efforts toward collaboration by all stakeholders. The achievement of political harmony and cooperation results in economic expansion, able to meet the social expectations of citizens, and within which the agri-community thrives. This shift implies that agri-producers can evolve at a rate aligned with change in the larger business environment, and enjoy profitable returns from an expanding local and global market. While the zeitgeist is disruptive, agri-producers manage to invest in mitigation strategies to cope, and by positioning themselves as partners in inclusive sustainable development, agri-producers in the Western Cape enhance their social contract among citizens and societal stakeholders. Due to the opportunities presented by expanding markets and conducive conditions, new AgTech entrants see the Western Cape as highly favourable, resulting in a series of mergers and acquisitions which stimulate a strong tech-enabled agri-environment that pose significant challenges to the value proposition of local producers.

or "Pockets of Excellence"

As a sub-scenario of the best case, "Pockets of Excellence" is a scenario in which only some agri-producers can make the social, financial, technological and business model transition to navigate the immediate future. Consequently, these isolated producers maintain a competitive position, while their peers are overwhelmed by the external changes in the environment.

Scenario 3: Worst Case Scenario

"Agri-Valley of desolation"

In the worst-case scenario – "Agri-Valley of desolation" – the drivers of change converge in a destructive, reinforcing cycle of decline. Agri-producers in the Western Cape are unable / unwilling to respond to technology advancements and developments in agtech. Others adopt technology as an attractive production increase and cost reduction mechanism, leading to dilution of the commitment to quality and consumer centricity as many agri-producers drift increasingly towards a survivalist attitude. Energy security has become so under pressure that affordable uninterrupted availability of energy sources is taking severe strain, whilst water shortage, soil deterioration and related climate extremities lead to many agri-producers in the Western Cape shutting down their operations. As ideological and political conflict worsens, the economy stalls, followed by further ratings downgrades and a series if divestments by significant players in the Western Cape agri production value chain. Social pressures rise, further eroding the social fabric characterised by power struggles and increasing non-political actors impacting provincial events. Youth unemployment reaches unprecedented levels, further escalating social ills, crime and violence. There is an inability for infrastructure to deal with demographic shifts and urbanisation, which further cause immeasurable pressure on agriculture and food production to serve the growing population and urban expansion. In this scenario agriculture in the Western Cape becomes a desolate sector.

or "Some Agri-Producers Fail"

As a sub-scenario of the worst case – "Some Agri-Producers Fail" – is a scenario in which the economic conditions do worsen, but established agri-players with strong market penetration are able to survive while some are unable to make the transitions required, and fail.

5. Closing comments

The agriculture sector within the Western Cape is globally competitive and known for its production stability, supported by well-developed infrastructure for input supply and output processing (3.7% contributor to Western Cape GDPR). This could also be attributed in part to the fact that it has always been a good adopter of the new technologies that are being used in global markets as they become available. These technologies are, however, generally imported and adopted into the local market, and it is these international digital solutions and innovations that are impacting the agri-sector locally. Similarly, because most of agri-production in the Western Cape (wine and fruit especially) is exported (17% of the province's exports), changing customer expectations are driven by preferences and demands originating abroad. It is therefore important to understand the trends and areas of transformation that are globally affecting the sector.

The Western Cape agri-sector holds significant potential for growth and development, with agri-processing already a large contributor to the economy and the potential to scale. However, the large absorption of unskilled labour which contributes to economic and social growth pose challenges considering the impact of automation set to replace certain types of agri-labour. Examples such as:

- Auto-steering tractors, robotic milking, autonomous spraying drones, data-mapping drones and robotic weeding implements.
- Manned robotic harvesting implements, robotic feed pushing and autonomous robotic weeding technologies.
- Autonomous robotic scouts, autonomous robotic harvesting and robotic fresh fruit picking technologies.[34]

In addition, wide-scale use of digital capabilities is still a challenge and not accessible to most farmers in the Western Cape. The reality is that because the sector is made up of so many players of different sizes, the majority being small, these transformations are slow to be adopted. Small-scale farmers and other participants within the agricultural value chain are starting to adopt and benefit from greater access to information to inform their operations and improve output and so, transformation is starting. But the take-up of digital technologies and capabilities has yet to penetrate all aspects of business models in the Western Cape agri-sector.[34]

Western Cape agriculture's response to 4IR should therefore be integrated and comprehensive, involving the agri- and public sectors in the Western Cape, as well as academia and civil society to adapt, shape and harness the potential of agricultural disruption.

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