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POLICY BRIEF

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Addressing **barriers to innovation by agribusiness to drive growth** in South Africa

Summary

Performance in the agribusiness industry in South Africa has been subdued because of factors such as climate change and rapid technological advances. At the same time, there is growing emphasis on agriculture's role in achieving the sustainable development goals of ensuring food security and eradicating hunger.

The priority is a well-designed, inclusive, sector-specific science, technology and innovation policy framework and set of instruments to promote economic growth and human development. Significant new policy initiatives are in process in South Africa towards these goals. While recent growth has been encouraging, the evidence suggests that levels of technological innovation remain low. More businesses should be encouraged to use research and development (R&D) and technological advances available, to improve yields, productivity, and prevent environmental degradation.

Agribusiness transformation is complex, requiring policy instruments to directly respond to and address barriers to innovation at farming enterprise level. Implementation of the policy vision can be more effective if guided by research evidence on farmers' existing practices and capabilities on the ground. How do agricultural businesses experience the barriers blocking and discouraging them from engaging in technological innovation?

And, how aware are agricultural businesses of public sector policy support, and government incentives to promote innovation on a wider scale?

This policy brief interrogates trends from a survey of commercial agricultural businesses, including farming, forestry and fisheries enterprises, to inform policy implementation insights. The evidence indicates that resource, knowledge and market factors play a key role in creating an enabling environment for innovation in the agribusiness industry. Therefore, policy interventions that target these factors can support pathways to overcome innovation constraints. On this basis, the policy brief makes a call to the government and policy makers at national, provincial, local and regional levels to develop policies that are responsive to key barriers and may improve innovation performance along the agribusiness value chain.

There is a pressing need for innovation-oriented policies to accelerate the propensity to innovate. In practice, these policies should inform the development of innovation-specific funding instruments for agribusiness, government-financed agribusiness R&D, strengthened regional value chains, cooperation, and more effective market linkages. Therefore, this policy brief also offers guidelines to exploit technological innovations on a wider scale, and outlines strategies to benefit from existing science, technology and innovation (STI) knowledge and infrastructure.

The policy brief is based on data from the South African Agricultural Business Innovation Survey (BIS) 2016–2018, conducted by the Centre for Science Technology and Innovation Indicators (CeSTII) at the Human Sciences Research Council (HSRC), on behalf of the Department of Science and Innovation (DSI).

Agribusiness innovation identified as a key policy priority

South Africa's national development policy's vision foregrounds the vital role of science, technology and innovation in programmes to address our complex social and economic challenges, in an increasingly globalised world. Disruptive technological advances, ranging from artificial intelligence to precision agriculture technologies, are already transforming global agricultural production in profound ways. South Africa in particular, is confronted with the challenge of finding ways for innovation policy to drive the adoption of such technological advances towards inclusive and sustainable development outcomes (DST, 2019).

The White Paper on Science, Technology and Innovation 2019 recognises the need for technological modernisation of traditional sectors, to exploit new growth opportunities (DST 2019) and, to this end, agriculture is identified as a key priority area. After lengthy stakeholder engagement, this STI policy vision is now aligned with a consolidated sectoral development framework prepared by the Department of Land Reform, Agriculture and Development. In particular, the Agriculture and Agro-processing Master Plan 2022 emphasises the need to modernise and promote sectoral growth through innovation and technological advancement. Out of this convergence of policy and planning, intensifying agribusiness innovation activities as well as development mechanisms to strengthen innovation processes, such as skills development and training, have emerged as key levers. In this policy context, two specific sectoral policy challenges identified in the Department of Science and Innovation's Decadal Plan (DSI 2022) – low levels of technological innovation and inadequate advisory services – shaped the focus of this policy brief.

Low levels of technological innovation in South African agribusinesses

Evidence shows that some South African agricultural firms do modernise their agricultural activities by using various ICTs and digital tools, such as drones, robotics, precision agriculture, smart plant and animal breeding, crop sensors, air and soil sensors and livestock biometrics (Buchana, et al, 2022). However, despite the multitude of environmental, economic and social challenges in the agricultural sector in South Africa and globally, there is also evidence that many firms do not innovate.

Agribusiness transformation is complex, requiring policy instruments to directly respond to and address barriers to innovation at firm level. Implementation of the policy vision through advisory services or innovation funding and resource incentives can be more effective if guided by research evidence on farmers' existing practices and capabilities on the ground. Such evidence can provide insight for policy actors to overcome prevailing innovation deterrents. How do agricultural businesses experience the barriers blocking and discouraging them from engaging in technological innovation? And, how aware are agricultural businesses of the public sector policy support, and government incentives that are available to promote innovation on a wider scale?

This policy brief interrogates the barriers to innovation that South African agricultural businesses face – whether small, medium or large, or in agricultural farming, forestry or fisheries sub-sectors. Our goal is to identify policy pathways and interventions to mitigate or overcome these barriers. The perceptions of the most significant barriers reported by agribusinesses provide one set of insights into key constraints, as they are experienced by farmers. Analysis of patterns of existing knowledge flows and sources of innovation can provide insights into alternative kinds of policy initiatives that could create an enabling innovation environment. Disaggregating how barriers are experienced differently based on the types of innovation activity agribusinesses engage in – whether R&D-led, through skills development or related to the acquisition of machinery and ICT – can provide clues for the design of a wider range of innovation support interventions. And finally, tracking the degree of awareness of the currently available government financial support highlights the importance of designing effective advocacy campaigns.

Evidence from South African Agricultural Business Innovation Survey, 2016–2018

HSRC-CeSTII conducts South Africa's national R&D and innovation surveys on behalf of the DSI, to produce national STI indicators. The analysis in this policy brief uses the 2016–2018 Agricultural Business Innovation Survey in a way that can be of value to policy makers, government officials at multiple levels, industry associations and other relevant stakeholders.

Innovations in any form, and with any degree of novelty or success, were reported by almost two thirds (62%) of the sample. Less than 50% of these innovation-active companies reported the introduction of product or process technological innovations. Most of the innovation-active firms tended to introduce non-technological – market or organisational – innovations. A key policy goal in the Decadal Plan (2022) is to grow the rate of technological innovations specifically. Any new policy programmes will need to target the main reasons firms do not innovate, or do not introduce technological innovations.

Agribusinesses' perceptions of the barriers to innovation

The survey investigated agribusinesses' perceptions of the barriers to innovation, whether they are innovation-active or not, with the results summarised in Table 1.

It is useful to categorise the distinct types of factors, as each requires different kinds of interventions that may or may not be under the control of the range of public and private sector policy actors.

- **Resource factors** include access to the basic requirements for agricultural enterprises. They may be addressed by incentive schemes such as finance or the supply of fertilisers, which requires technological expertise. These relate to the nature of the advisory services that can be of value. Likewise, the challenge of community support requires advisory services with skills to manage community participation and networks. Access to water and land requires combined interventions across government departments, to improve water management or land redistribution. Again, the STI dimensions are vital to ensure environmentally sustainable interventions, with environmental factors perceived as highly significant barriers by more than 70% of the innovation-active firms. These constraints could be foregrounded in the deliberations of the Presidential Commission on Climate Change, and debates around the "just transition".
- **Institutional factors** are firmly within the sphere of control of the government. Here, the evidence highlights a negative trend – that a large majority of innovation-active firms perceive agricultural policies and regulations as a constraint to innovation. A lower proportion, just over a quarter of innovation-active firms, and very few non-innovative firms, find government support a barrier to innovation, but that is not to say that it facilitates innovation. A policy and regulatory framework that encourages technological innovation more effectively could be a powerful intervention.
- **Market factors** relating to competition in the sector, are not strongly within the sphere of direct control of government policy actors, but policy can influence the market environment. South Africa has a long history of agricultural marketing boards that have had close relationships with the government, including funding, as a precedent. Private sector intermediaries such as industry and business associations can also shape the market environment, for example, to promote exports. These are not perceived to be highly significant barriers, but a more competitive environment is often a facilitator of technological innovation, which enables an agribusiness to stand out from competitors in the local market or to compete on global markets.

As far as **knowledge factors** are concerned, a lack of skilled labour was reported as a constraint to innovation by half, and access to training by a third, of the innovation-active firms. This trend points to a clear role for advisory services and vocational education and training organisations.

Notably, the innovation-active businesses tended to identify all of the factors as more important constraints than the non-innovation-active ones. It may be that firms that do not innovate are less aware of the potential barriers and constraints. It is significant though, that the barrier identified most strongly by the non-innovators (31%) was finance, a resource factor, followed by a lack of labour and climate change.

Table 1: Agribusinesses' perceptions of barriers to innovation

Barriers to innovation	Innovation-active (%)	Non-innovation-active (%)
Resource factors		
Access to finance	61.8	30.9
Acess to land	38.1	20.6
Access to water	76.0	23.5
Access to community support	26.5	8.8
Access to agro-chemicals, including fertiliser, herbicides, etc	45.0	22.1
Knowledge factors		
Access to training/skillls (farming skills, business skills, ICT skills etc)	35.8	19.1
(Lack of) labour	55.7	25.0
Market factors		
Competition from other farmers and food businesses	35.5	7.4
competition from external players (i.e., non-traditonal agric businesses	26.3	2.9
Institutional factors		
Gorvenment support	27.6	14.7
Agricultural policiees/ regulations	53.6	19.1
Environmental factors		
Weather/ climate change	73.7	25.0

Source: CeSTII-SA Agricultural Business Innovation Survey, 2016–2018

How can an innovation-enabling environment be created?

Innovation requires the creation, use, adoption and/or adaptation of new knowledge and technologies. A lack of effective market linkages and knowledge flows could hinder innovation at firm level. The whole-of-society approach to innovation promoted in the Decadal Plan 2022 prioritises the creation of an enabling innovation environment for knowledge and funding flows over the next 10 years. It may be possible to inform the design of the planned cross-cutting initiatives to address knowledge barriers and strengthen flows in the agricultural system, by analysing the sources of the information for innovation reported by agribusinesses as highly important.

As in most countries, market sources of information were most common, particularly from suppliers of equipment, materials, components and software. A quarter of firms relied on internal sources for innovation, suggesting that these may not have been technology-intensive types of innovation. Institutional sources in the public sector were not widely reported as sources of information. While much policy effort had been invested in promoting linkages between universities and firms, this was not reflected in practice. Agribusinesses were more likely to rely on private research institutes, and sources that were easily available in the public domain, such as conferences, journals and trade publications. This trend suggests a potentially significant role for professional associations, as key partners in promoting innovation in specific sub-sectors. These trends also provide important clues to inform initiatives to create an enabling environment for innovation in the agricultural sector specifically, creating linkages and mechanisms to draw on more of the available knowledge and market resources.

Table 2: Sources of information for innovation rated as highly important by innovation-active businesses

Sources of information	Innovation-active (%)
Internal sources	
Sources within your business/business group	25.4
External - market sources	
Suppliers of equipment, materials, components or software	32.6
Clients or customers	30.9
Competitors or other businesses in your sector	18.4
Consultants, commercial labs or private R&D institutes	22.4
External- institutional sources	
Universities or higher education institutions	15.5
Government and public research institutes	9.2
Private research institutes	19.4
External- other sources	
Conferences, trade fairs, exhibitions	21.4
Scientific journals and trade/technical publications	15.8
Professional and industry associations	14.3

Source:HSRC- CeSTII- SA Agricultural Business Innovation Survey, 2016-2018

Were different types of innovation activity associated with specific barriers?

The policy challenge is to promote more technological innovation in more agribusinesses. It is now widely recognised that not all innovation relies on R&D or the design of new advanced technologies, and that there may be a wide range of innovation activities that policy initiatives will need to support in different ways. Hence, it is useful to drill down to disaggregate the perceptions of barriers, to determine whether agribusinesses reporting different types of innovation activity experienced the barriers to innovation in different ways.

Table 3 reflects the results of a correlation analysis to determine the direction and significance of the relationship between types of innovation activity and barriers. A blank entry means no significant association, while a negative association means that agribusinesses engaged in this type of innovation were significantly less likely to experience this barrier to innovation. A positive association means that agribusinesses engaged in this innovation were significantly more likely to experience this barrier to innovation.

Types of innovation activity that may overcome specific barriers

The results show that businesses engaging in in-house R&D were significantly less likely to experience the resource (lack of access to water), knowledge (lack of access to skilled labour, lack of access to agrochemicals) and environmental barriers (weather and climate change). This may be explained by the fact that, through R&D, businesses can develop and use more effective and efficient water access and preservation methods; crop nourishment, health and protection products; crop varieties and farm animal breeds that can withstand harsh weather and climate change; and less labour-intensive farming methods.

Businesses that designed and acquired computer software innovation activities were less likely to experience the barrier of resource factors relating to lack of access to water. This suggests that design and computer software activities may be needed to be able to generate solutions.

Businesses that engaged in outsourced R&D and acquisition of other external knowledge were significantly less likely to experience the resource (lack of access to community support and water) and market barriers (competition from other farmers and businesses). Both of these activities involve the capacity to seek external knowledge sources and support through linkages and partnerships, illustrating their significance in enabling innovation.

Businesses that acquired machinery and equipment were less likely to experience the barriers linked to resource factors (lack of access to finance and lack of access to water). This implies that the acquisition of such costly assets, and the changes they require to production and processes, are of value in mitigating key barriers.

Types of innovation activity that are less likely to mitigate specific barriers

In contrast, businesses that leased or rented machinery, or tried to innovate by acquiring land, were more likely to experience a range of barriers: resource factors (lack of access to land; lack of access to agrochemicals; lack of access to community support), knowledge factors (lack of access to labour) and market factors (competition from other farmers and businesses; and competition from non-agricultural businesses). This suggests that types of innovation that are less knowledge intensive are associated more strongly with experiences of fundamental barriers to production. Innovation in such agribusinesses is likely hindered by a lack of the required finances to purchase these costly assets.

Table 3. Relationship between types of innovation activity and barriers to innovation

		Barriers to innovation											
		Lack of access to finance	Lack of access to land	Lack of access to water	Lack of access to community support	Lack of access to training	Lack of access to agrochem-icals	Lack of access to labour	Weather/ Climate change	Lack of government support	Agric policies & regulations	Competition from other agribusiness	Competition from non-agric businesses
Innovation activities	In-house R&D	-	-	*Negative*	-	-	*Negative*	-	*Negative*	-	-	-	-
	Outsourced R&D	-	-	-	*Negative*	-	-	-	-	-	-	*Negative*	-
	Acquisition of agric land	-	*Positive*	-	-	-	-	-	-	-	-	-	-
	Acquisition of machinery & equipment	*Negative*	-	*Negative*	-	-	-	-	-	-	-	-	-
	Acquisition of buildings	-	-	-	-	-	-	-	-	-	-	-	-
	Acquisition of other external knowledge	-	-	*Negative*	*Negative*	-	-	-	-	-	-	*Negative*	-
	Training	-	-	*Negative.*	-	-	-	-	-	-	-	-	-
	Market introduction of inno-vations	-	-	-	-	-	-	-	-	-	-	-	-
	Other activities	-	-	-	-	-	-	-	-	*Positive*	-	-	-
	Lease of machinery, equip-ment and other capital goods	-	*Positive*	-	*Positive*	-	*Positive*	*Positive*	-	-	-	*Positive*	*Positive*
	Acquisition of computer hardware	-	-	-	-	-	-	-	-	-	-	-	-
	Acquisition of computer software	-	-	*Negative*	-	-	-	-	-	-	-	-	-
	Design	-	-	*Negative*	-	-	-	-	-	-	-	-	-
	Engineering activities	-	-	-	-	-	-	-	-	-	-	-	-
Government support	Aware of government financial support for innovation	-	-	-	-	-	-	-	-	-	-	-	-

Note:

Neg. assoc. - Negatively associated (Significant): Businesses that engaged in this innovation activity and aware of government support for innovation were significantly less likely to experience this barrier to innovation.

Pos. assoc. - Positively associated (Significant): Businesses that engaged in this innovation activity and aware of government support for innovation were significantly more likely to experience this barrier to innovation.

- - Blank entry - Not associated (Not significant)

The analysis shows that more or less knowledge-intensive types of innovation activity are hindered by different factors at firm level. Such evidence provides policy makers and stakeholders with insights on the conditions that facilitate and strengthen innovation, to identify pathways and intervention strategies towards growth and sustainability.

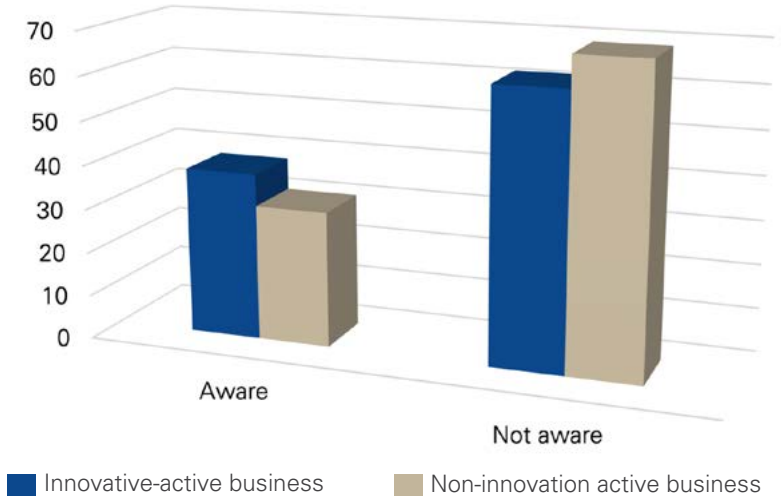
Did agribusinesses know about government support?

One trend flags a simple but potentially significant policy insight – that the lack of government support for innovation was not associated significantly with any of the barriers.

This reinforces a general trend observed, that only 38.1% of innovation-active businesses and slightly fewer, 30.9% of the non-innovation-active businesses, were aware of the available government support for innovation.

These trends highlight an important space for policy intervention. Quite simply, if there is insufficient advocacy to ensure that many more agribusinesses know about the opportunities, new policy interventions, however well intended or well targeted, are unlikely to alleviate any of the barriers.

Figure 1. Awareness of government support for innovation



Firm-level evidence to inform innovation policy in the agricultural sector

Addressing perceived barriers to innovation, and designing potential solutions to mitigate these barriers, are critical considerations for policy actors and industry associations.

Firm-level evidence shows that resource and environmental barriers were more commonly experienced, and affected the propensity for innovation more than other barriers. Access to labour, and government regulatory frameworks were also experienced as significant barriers. Agribusinesses with innovation activities that were knowledge and resource intensive were less likely to experience key resource and financial barriers, and the converse applied – those with less knowledge and resource-intensive activities were more likely to experience these barriers.

Innovation-active firms tended to rely on market and freely available, indirect sources of information for their innovation, rather than knowledge sources in the public sector. And, there was a general lack of awareness of the available government innovation policy support instruments.

The empirical evidence thus points to a set of differentiated policy recommendations to create an enabling environment for the agricultural sector.

Expand financial support for innovation activities by public, private and 'blended' investors
To address resource, environmental and knowledge factors requires greater financial support at firm level. Government departments related to STI and agriculture may increase public financial instruments, such as innovation incentive grants, R&D tax incentives or subsidies, technology transfer grants or grants to ensure technological capability building from the acquisition of machinery, equipment and digital tools. To improve innovation efforts, these will need to be coordinated across multiple public and private funding sources, programmes and investment streams, for example from banks or private equity. Blended finance practice, bringing public and private finance together, should also be explored in strategic areas for scaling.

Widen awareness of existing support across the agribusiness innovation system Lack of awareness about government support for innovation, protracted access procedures and limited targeting of the current policy instruments remain major obstacles to effective implementation of existing policy instruments. Targeted and coordinated awareness campaigns must include multiple information flows and strategies.. For example, awareness of instruments to address barriers of access to water could be strengthened by advocacy amongst agribusinesses, as could awareness of new technologies for water use designed by science councils or universities. Use of longstanding trade publications in the sector could be a quick win, to this end. The need for training and access to skilled labour should be a key task to focus the work of advisory services, which in turn, need to be well publicised. Raising awareness requires partnerships between the government, industry and sectoral associations, advisory services and other sectoral stakeholders.

Strengthen knowledge flows and promote market linkages and cooperation along value chains The evidence suggests that stronger innovation and production systems can be facilitated by knowledge flows and stronger linkages and cooperation along value chains. Market barriers were strongly experienced, and market sources of information are critical for innovation. Firms that engaged in extra-mural R&D and the acquisition of other external knowledge were less likely to experience competition as a barrier to innovation. Targetted policy instruments can be designed to promote flows of knowledge across and between multiple actors in the system of innovation, not only to incentivise linkages with universities and science councils. The learning of THRIPS could be adapted in programme design. Support to strengthen linkages with other firms in a sector, or the availability and uptake of indirect sources of information can mitigate critical barriers, to enhance the technological innovation capabilities of more agribusinesses.

Consulted or Recommended Sources

- Centre for Science, Technology and Innovation Indicators (CeSTII)- SA Agricultural Business Innovation Survey, 2016-2018. https://sabizinnovationsurvey.blog/2021/05/04/results-of-sa-agricultural-business-innovation-survey-2016-2018/
- Department of Agriculture, Land Reform and Rural Development. 2022. AGRICULTURE AND AGRO-PROCESSING MASTER PLAN "SOCIAL COMPACT". Pretoria, South Africa.
- Department of Science and Technology. 2019. White Paper on Science, Technology and Innovation: Science, technology and innovation enabling inclusive and sustainable South African development in a changing world. Department of Science and Technology (DST), South Africa. https://www.gov.za/documents/ white-paper-science-technology-and-innovation-1-mar-2019-0000.
- Department of Science and Technology. 2022. Science, Technology and Innovation Decadal Plan. Pretoria, South Africa.