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policy brief

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Investment in public agricultural research in South Africa: A critical review of the evidence

Summary

Agriculture plays a crucial role in South Africa's economic and social development. Governments in lower and upper-middle income countries[1] such as India, China and Brazil are investing more in research and experimental development (R&D) on food security and agriculture. In this context, how does South Africa fare?

This policy brief concerns an investigation into trends of public-sector investment in agricultural R&D in South Africa. The evidence suggests that, unlike the positive shift in other middle-income countries, public investment in agricultural R&D in South Arica is lagging behind and may even be declining. Strategies to increase investment in order to contribute to and stimulate the scale of R&D so urgently required are therefore proposed.

Introduction

We live in an era where the environmental impact of decades of an extractive carbon-based global economy is raising critical questions for sustainability. Governments in lower and upper-middle income countries such as India, China and Brazil are – for the first time – investing more than high-income countries in R&D on food and agriculture. Significantly, a study conducted by Pardey et al. (2016) showed that in both high- and middle-income countries, the share of agricultural R&D spending by private-sector firms is growing relative to the spend by public universities and government. Similarly, agricultural R&D expenditure by low-income countries (particularly those in sub-Saharan Africa) continued to grow, with 11 of 17 low-income countries increasing their R&D spend from 2000 to 2014 (ASTI 2017).

Such historical shifts undoubtedly impact and shape global food production. In this context, how does South Africa fare?

Agriculture plays a crucial role in South Africa's economic and social development, whether as a direct contribution to GDP (through the creation of employment and livelihoods) or in ensuring food security. The agricultural sector in South Africa has undergone substantial reforms over the past twenty years to address the intertwined objectives and challenges of poverty alleviation and food security

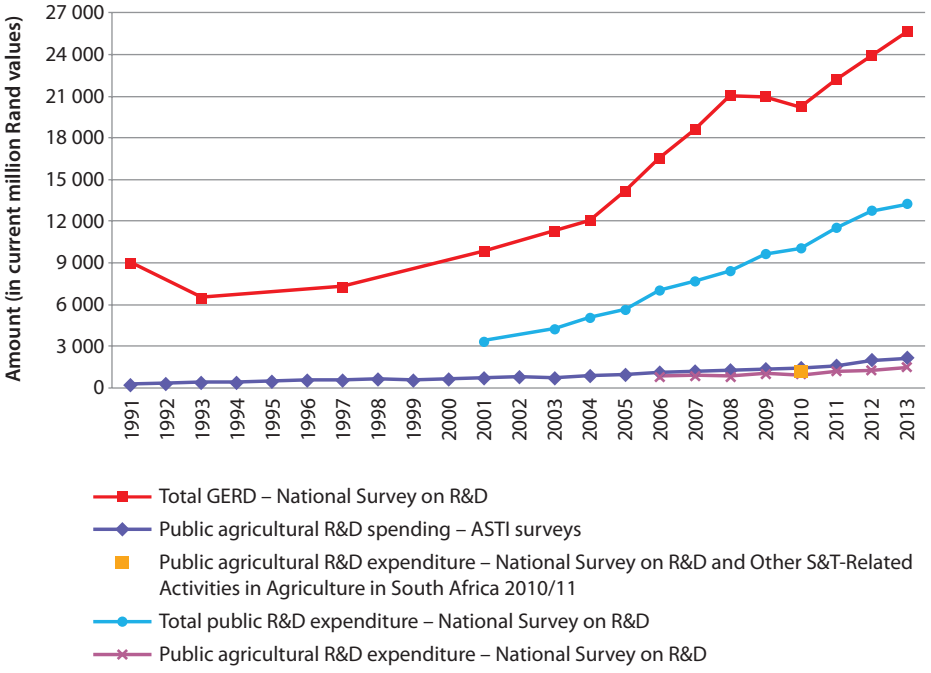
on the one hand and increased competitiveness and profitability on the other hand.

For these reasons, South Africa needs an effective and sustainable national agricultural research system to respond to broader national challenges. Several policy initiatives, including the National Agricultural Research and Development Systems (NARDS) and the Bio-economy Strategy, have been set in place to promote growth in terms of investment and resources in the agriculture sector. In addition, the National Development Plan emphasises agriculture as it is the primary source of income in rural areas, and highlights several strategies that have to be implemented to ensure growth and sustainability in the sector (National Planning Commission 2011).

Research and experimental development play a very important role in knowledge production through the generation of new ideas and products, often resulting in innovations and contributing to economic growth. As such, promoting and enhancing R&D in agriculture is one of the most effective means to respond to the demands and challenges in the sector. Historically, the public sector has been the main driver of R&D, with the government mandated to implement policies that will lead to change and transformation.

In this context, this policy brief investigates trends of public-sector investment[2] in agricultural R&D in South Africa. The evidence suggests that, unlike the positive shift in other middle-income countries, public investment in agricultural R&D in South Africa is lagging behind and may even be declining. Strategies to increase investment in order to contribute to and stimulate the scale of R&D so urgently required are therefore proposed.

Figure 1: Public expenditure on agricultural R&D relative to total GERD, 1991–2013



Sources: DAFF 2014 (National Survey on Research and Experimental Development 1991/92–2013/14); ASTI 2017 (ASTI surveys 1991–2013)

Methodologically, the analysis draws on and triangulates data from three surveys: (i) the National Survey on Research and Experimental Development and Other Science and Technology-Related Activities in Agriculture in South Africa, 2010/11[3] (Agricultural STI data); (ii) the National Survey on R&D[4] (R&D data); and (iii) the Agricultural Science and Technology Indicators (ASTI) datasets[5] (ASTI data).

A static low level of expenditure

Triangulation of South Africa's agriculture R&D data compares favourably and indicates a high degree of alignment on the state of investment in agricultural science and technology activities. Figure 1 displays the trajectory of agricultural R&D investment in South Africa from 1991 to 2013. The picture presented is that investment in agricultural R&D is very low, and represents a very small portion of the total gross domestic expenditure on R&D (GERD) and R&D performed in the public sector.

To provide further detail from the Agricultural STI dataset: Table 1 shows that in 2010/11, expenditure on agricultural R&D by public institutions was R1.217 billion. The total expenditure represented only 0.074% of the total value added, which is low considering the importance of the sector in the economy and for sustainability.

Similarly, the annual National Survey on R&D datasets reflect low levels of R&D performed in agricultural sciences, in a context in which total GERD grew dramatically since 2000 (a dip in 2009 and 2010 was followed by a recovery from 2011). Expenditure on public agricultural R&D was evidently out of sync with the steady growth in total public expenditure on R&D – a clear reflection of underinvestment in public agricultural R&D.

Table 1: Key indicators for investments in agricultural R&D in 2010/11

Key indicator	Value
Total expenditure on agricultural R&D (public) (billion Rand, excluding VAT)	1.217
Total value added at basic prices (billion Rand)	1 646.664
R&D as a percentage of total value added at basic prices (%)	0.074
Agricultural GDP (billion Rand)	58.664
R&D as a percentage of agricultural GDP*	2.100

Source: DAFF 2014
* Statistics South Africa 2011 (GDP, Quarter 3, includes forestry and fisheries)

Moreover, with a longer time series, the ASTI data suggests that the low level of expenditure has remained static since 1991.

South Africa's agricultural R&D intensity against national and international benchmarks

Another key indicator for measuring agricultural R&D spending in a country and to benchmark expenditure in an international context is to calculate the research intensity ratio. This is a measure of total public agricultural R&D spending as a percentage of agricultural output (agricultural GDP – AgGDP) (Flaherty et al. 2010). Figure 2 shows that agricultural R&D intensity has been erratic since 1991 (based on ASTI survey data) but by 2007, agricultural R&D expenditure as a percentage of AgGDP was declining (see also Beintema et al. 2017). A slight upward recovery that began in 2010 continued up to 2013. More specifically, R&D intensity oscillated between about 2 and 3% during the period from 1991 to 2013, with a decrease from 2.7% in 2006 to 2.0% in 2009, followed by a slight upturn from 2010. The 2010 data point of 2.2% compares well with the corresponding value of 2.1% based on the Agricultural STI data for the period 2010/11 (Table 1).

However, the national policy target of 3.0% (AgGDP) was achieved for the first time in 2013 – in line with international benchmarks (Department of Agriculture 2008) – when South Africa reported a result of 3.1%. South Africa's agricultural R&D intensity in 2010 and 2013 was relatively high in relation to other African countries such as Kenya (1.0% and 0.8%), Senegal (0.8% and 0.9%) and Tanzania (0.4% and 0.3%) (ASTI 2017).

Interestingly, South Africa's agricultural R&D intensity also exceeded that of its BRICS counterparts: China recorded 0.6% in both 2010 and 2013, India recorded 0.3% in the same years, and Brazil recorded 2.1% in 2010 and 1.8% in 2013. This is in line with an observation made in the research literature that although agricultural R&D spending has increased in the last 10 years in countries with large agricultural sectors (such as India, Brazil and China), their share of AgGDP remained more or less static and in some cases declined.

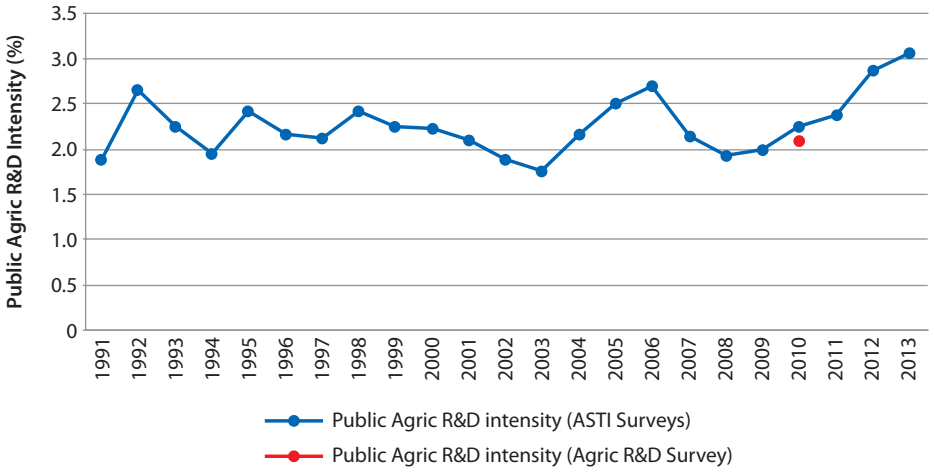
In recent years, South Africa has experienced increased investment in agricultural research (especially biotechnology platforms). However, when comparing the investment in agricultural R&D with the total GERD, the diminished proportion devoted to agricultural R&D becomes more apparent. The high R&D intensity in South Africa suggests that both agricultural R&D and AgGDP are not growing sufficiently.

Indeed, experts monitoring agricultural R&D have expressed concerns and advised that caution should be applied when interpreting conventional intensity ratios. Intensity ratios do not always reflect increased agricultural R&D spending, since the indicator does not take into account the policy and institutional environment where the agricultural research takes place. Due to its limitations, the use of the indicator as a sole measure of agricultural R&D or to set targets is discouraged (Beintema et al. 2012; Nin-Pratt 2016).

Is the balance between private and public funding sources shifting?

If public expenditure on R&D in general is growing while expenditure on agricultural R&D stays static, there may

Figure 2: Public agricultural R&D intensity, 1991–2013



Sources: DAFF 2014; ASTI 2017 (ASTI surveys 1991–2013)

Table 2: Sources of funds for agricultural R&D in 2010/11

Key indicator	Value
Own funds (billion Rand, excluding VAT)	0.349
Contracts from within South Africa (billion Rand, excluding VAT)	0.535
Grants from within South Africa (billion Rand, excluding VAT)	0.308
Contracts and grants from abroad (billion Rand, excluding VAT)	0.024
Percentage of national R&D expenditure (%) funded by:	
Government	70.900
Science councils	3.600
HE institutions	7.300

Source: DAFF 2014

not be sufficient *public expenditure* on agricultural R&D. Evidence from the 2010/11 Agricultural STI dataset enables us to investigate the main sources of funding (Table 2). This shows that the bulk of expenditure is sourced from contracts at the national level, followed by own funds and then grants at the national level – a total of 98% from local sources. International funding sources are minimal, at 2% of the total.

The lion's share of agricultural R&D expenditure (70.9%) was funded by the government, followed by science councils (3.6%) and the largely publically-funded higher education (HE) institutions (7.3%).

The stasis in agricultural R&D expenditure thus stems from a lack of private-sector investment and a level of public-sector investment that is too low.

The national trajectory is thus unlike comparator middle-income economies. Taken together, these longitudinal trends indicate that South Africa is not following the pattern of its BRICS middle-income cohort to increase its expenditure on agricultural R&D and play a growing role in global research. Nor is there growth in investment from the private sector relative to public-sector sources in South Africa.

Recommendations

The African-owned and -led Science Agenda for Agriculture in Africa (SA3) provides a framework for promoting the science, technology, extension, innovation, policy and social learning Africa needs to implement in order to meet its agricultural and indeed its overall development goals (FARA 2014).

Increasing the level of agricultural R&D investment would be an indication of the sector's commitment to create and adapt new technologies to improve agricultural yields and food security in the context of climate change; growing scarcity of land, water and energy; and population growth. This is important in addressing South Africa's socioeconomic challenges of unemployment and poverty alleviation, particularly for those living in marginalised rural areas.

The National Agricultural Research and Development Strategy (Department of Agriculture 2008) promotes growth in terms of investment and resources. However, in contrast with global trends, analysis of R&D investment shows stagnation. The dwindling levels of investment expose an urgent need to increase private- and public-sector investment in agricultural R&D in order to meet policy directives.

Generally, public agricultural R&D is funded by the government, foreign donors and revenue generated through the sale of agricultural products. The government, as the main source of funding, should ensure that increased investment remains relatively stable to safeguard stability and promote growth in the sector.

Increased investment and human resources are important cogs to drive improvements in agricultural R&D. The government should therefore ensure that allocated funds are also focused on stimulating growth in the human resources devoted to the agricultural sector. Skilled research personnel are able to focus on developing and improving agricultural technologies, ultimately leading to new innovations and contributing to economic growth.

Endnotes

1. Classification of lower and upper-middle income countries: http://micconference.org/mic/list-of-mics/.
2. Public-sector investment/expenditure includes the government, science councils and the HE sector. The HE sector comprises public institutions and private and independent universities. The inclusion of private universities in the HE sector is in line with the institutional classification of sectors as per the Frascati Manual (OECD 2015).
3. This survey was conducted by the Centre for Science, Technology and Innovation Indicators (CeSTII) on behalf of the Department of Agriculture, Forestry and Fisheries (DAFF) in South Africa, and is the most recent and comprehensive set of indicators. For the survey's report, go to http://www.hsrc.ac.za/uploads/pageContent/9523/NATIONAL%20SURVEY%20AGRICULTURAL%20R&D%20201011.pdf.

4. The R&D surveys have been conducted in South Africa by CeSTII since 2001 and provide selected indicators on agricultural R&D activities (DST 2016).
5. The ASTI surveys are conducted by the International Food Policy Research Institute (IFPRI) to gather data across developing countries on a range of indicators. The data for South Africa was gathered by IFPRI, the South African Agricultural Research Council and the University of Pretoria.

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