

# Strategic Analysis Paper

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## Declining Research and Development Investment: A Risk for Australian Agricultural Productivity

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### Key Points

- Australia is facing an “investment gap” in agricultural research and development; current levels of investment are insufficient to address the challenges faced by the agricultural sector.
- Agricultural research and development intensity has progressively declined since the 1980s, despite strong links between research and productivity.
- This decline can be attributed to the gradual privatisation of Australian agricultural research and development investment.
- Under-investment in agricultural R&D threatens the food security of future generations. It also leaves Australia open to the threats posed by climate change and volatile global food prices.
- To comprehensively address this issue, Australia needs to develop an integrated investment plan, involving both the public and private sectors.

### Summary

Social and economic returns on agricultural research and development (R&D) investment are consistently high and correlate closely with increased productivity and low food prices. Despite this, agricultural R&D levels have declined, both globally and in Australia, over

recent decades. Since the 1980s, the developed world has experienced a gradual shift in the international agricultural market, from centrally-organised rural industries to privatisation. In Australia, huge increases in private investment are evident in the agricultural research industry. While private investment is positive for the industry, it has come at the cost of a reduction in public investment.

The lag time between investment in research and tangible productivity gains, means that a long-term investment approach is required. The current slowdown in public investment will influence productivity for several decades, at a time when populations are increasing globally and the costs associated with climate change are becoming more apparent. Private investment tends to be short-sighted and commodity focussed. Guidance from a long-term public R&D plan is essential, if private investment is to be effective in the long run. Australia needs to develop a system-wide, integrated investment plan, involving both public and private interests, if we hope to maintain food security for future generations.

## Analysis

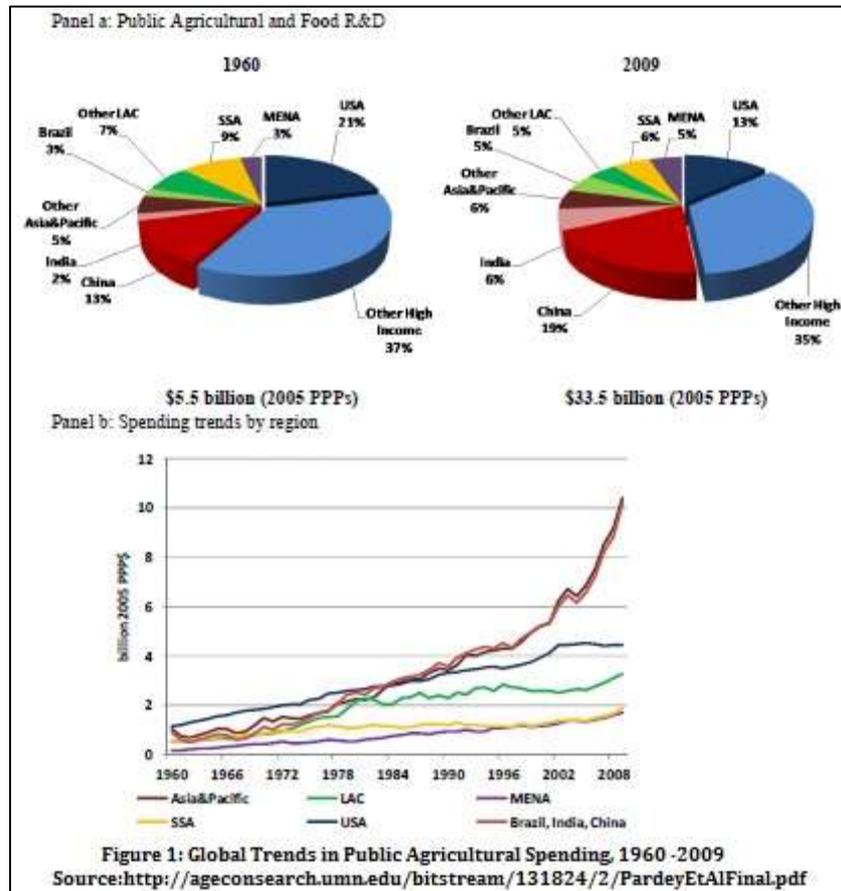
### ***International Trends in Agricultural R&D Investment***

Since the 1960s, agricultural R&D has changed substantially worldwide. Concerns about global food shortages in the early part of this period, triggered a surge in public and private investment in agricultural R&D, particularly in wealthier countries. The investment aimed to support the development of new agricultural technologies, to boost productivity and enhance international food security.

Strong evidence supports the notion that research and development in agriculture stimulates productivity growth. In [response to global increases in investment](#), the value of agricultural output per capita increased from \$242.4 per person in 1961, to \$331.0 in 2009. The most pronounced growth was observed in today's upper-middle income countries. By the 1980s, growth in food supply surpassed global population growth. A food surplus occurred, contributing to substantial declines in global food insecurity. Furthermore, new technologies, developed in wealthier countries, 'spilled over' to poorer countries, indicating that public research and development has been an important factor in poverty alleviation globally.

Global anxiety over food security has resurfaced, however. Many commentators suspect that we are facing the end of the era of agricultural abundance. While upper-middle income countries are still seeing productivity increases, developing countries, particularly in sub-Saharan Africa, are experiencing widespread food shortages, while their populations continue to grow. Public agricultural R&D levels in high-income countries have declined over the past decade, leading to a slowdown in productivity growth. Increases in food prices, long-term projections about climate change and other environmental issues - such as soil degradation and the decline in water supplies for irrigation - have the potential to cause food insecurity. These are real causes for concern.

Agricultural R&D across the globe has become heavily reliant on private investment, particularly in developed nations. Figure 1 shows that the growth in public agricultural R&D spending has transitioned: from an extended increase, to a plateau and even to negative growth in some regions. Enduring investment in R&D needs to come from the public sector, as private investors cannot be relied upon in the long-term. The lack of public investment is especially concerning in the world’s poorest countries. As developed countries reduce public investment in agricultural R&D, developing countries have decreasing scope to capture the technological spill-over benefits on which they have relied in the past.



### Trends in Australian Agricultural R&D Investment

Australia has followed the trend set by the world’s wealthier countries, reducing public investment in agricultural research and development in favour of private investment. Strong evidence supports the conclusion that productivity returns on publicly funded R&D are very high. [Analyses](#) show that despite the effects of seasonal changes, total factor productivity (TFP) in agriculture increases greatly in response to investment in R&D.

Public investment in Australian agriculture grew from \$140 million in 1952-53 to over \$800 million in the late 1970s. Since then, however, expenditure growth has been minimal – reaching only \$830 million in 2006-07.

Growth in agricultural research intensity (a measurement of agricultural R&D as a percentage of GDP) has also declined in Australia. Between 1978 and 1986, research

intensity grew by approximately 5.0 per cent per annum. [This has slowed](#) to approximately 3.0 per cent per annum in recent years. Recent data suggests that productivity growth in Australian agriculture has also slowed. From 1998 to 2007, [productivity fell](#) at the rate of 1.4 per cent per annum. Data from 2012 suggests TFP growth is well under one per cent. Declining public investment in R&D is likely to have contributed to this. Reversing this trend will require a comprehensive, long-term government plan for development in this area.

### *An Overview of the Australian Agricultural R&D System*

The Australian rural research and development system is complex and diverse. National institutionalised R&D began in 1916, with the establishment of the Advisory Council of Science and Industry, the precursor to the Commonwealth Scientific and Industrial Research Organisation (CSIRO). A multitude of public bodies now invest in agricultural research programs. These include the Department of Agriculture, Fisheries and Forestry (DAFF) and the Australian Centre for International Agricultural Research (ACIAR) - a key provider of rural R&D for developing countries in the Asia Pacific.

Industry-run research centres, supported by private investment, also play a key role. Rural Research and Development Corporations (RDCs) enable cooperation in R&D between industry and government. In many ways, the Australian agricultural research and development system is strengthened by its diversity; however, a recent report from the Rural Research and Development Council [stated](#) that “its complexity and fragmentation make cohesive responses to emerging opportunities and risks challenging”. Where such diverse and numerous interests are involved, far-sighted and comprehensive policy is difficult to implement.

### **Factors Reducing Investment**

The Australian private sector is gradually taking over rural research and development, allowing governments to scale back public funding. New laws that create or protect intellectual property rights in plant and animal species have been a major influencing factor in privatisation. The growth of agricultural firms has also led to increased privatisation, as larger firms with greater market share are more likely to invest in R&D. This has increased the influence of private companies over research, resulting in a shift in the control of research direction to private sector investors.

Rather than looking at R&D holistically, private firms tend to concentrate on commodities and short-term profit margins. Overall, this is driving a reduction in investment, as non-commodity areas - such as soil research - are largely ignored by the private sector.

Furthermore, the food surpluses and efficiency developments that were experienced in the period following the 1960s, have allowed the rural population to develop other areas of the economy. A significant proportion of the Australian rural population has moved away from agriculture and into other sectors, including mining and food processing, triggering a shift in private rural investment away from agriculture.

The time lag between investment in R&D and its observable impact on productivity makes the direct benefits of investment difficult to gauge in the short-term. Private parties are

more likely to channel their capital towards more immediately profitable sectors. Though the private sector has a greater share in agricultural R&D than ever before, total domestic private investment is declining.

The privatisation of investment has also created a disparity between universities and industry. The US employs a Land Grant Model, whereby taxpayer dollars are used to fund research programmes at selected universities. In Australia, there is insufficient support for university-led research programmes in agricultural science and little incentive offered to students to compete for places. The consequence is an ageing research workforce and present – and likely future - shortfall of qualified researchers. Australia currently has a comparative advantage in the production of many high value agricultural products, but must keep up with a constantly fluctuating global demand. There may already be insufficient capacity in the rural sector to develop and adopt innovations at the desired rate.

### ***The Importance of R&D Investment in Australia***

#### *Risks Associated with Under-Investment*

Declines in the rate of increases in agricultural productivity are evident in Australia, as in the rest of the developed world. This suggests that the assumption held by policymakers - that the private sector would sufficiently fill the investment gap - has proven to be over-optimistic.

Under-investment in research and development is linked to decreased agricultural efficiency and productivity. This risks the food security of future generations, by impacting Australia's ability to produce sufficient safe and affordable food domestically. Decreased productivity also creates economic risks for rural communities that are dependent on agriculture.

Declining productivity growth affects Australia's ability to influence global food prices. This is important, as Australia is a significant exporter of food commodities and currently maintains some influence over the global prices of wheat, beef and dairy products. Although Australia's current production levels can only support a population of 60 million out of 7 billion, we currently enjoy a secure food export surplus and it is in the national interest to maintain this.

Global food demand is also expected to increase significantly between now and 2050. The FAO asserts that expanding populations and changing eating habits means that global food production will need to double in the next thirty years. Australia does not have the production capacity to be the food basket of the world, or even of Asia, but goals of increasing production efficiency could help us become a bigger player on the food security stage, as well as securing domestic food security.

#### *Research and Sustainability*

Climate change, population growth and increases in global food demand will all pose challenges to Australia's agricultural industry. Agriculture, Fisheries and Forestry use the most water of all of Australia's economic sectors; they are also significant contributors to total greenhouse gas emissions. These industries need to reduce their environmental

impact, while simultaneously increasing production, to provide sufficient food for future consumption.

Recent [ABARES research](#) has identified five enablers of productivity growth for Australian agriculture: development of new knowledge and technology; facilitating innovation by improving the incentives for, and capability of, industry to adopt new knowledge; removal of regulations or other impediments that stifle innovation; improvements to market access; and enabling expansion while minimising the use, and any degradation, of natural resources. Increasing rural R&D would simultaneously assist in mitigating the effects of climate change, maintain Australia's food security and create opportunities for Australia to move into new export markets.

Currently, mainstream focus is on increasing yields to feed growing populations. Food producers see market opportunities as global demand increases, but their focus tends to be short-sighted. Soil health, land degradation and diminishing water supplies, mean that Australia is constrained in the amount of food it can produce and export. Research should instead prioritise improving the quality of the food produced. This would allow farmers to get more value from their produce, opening up niche domestic and export markets and improving the nutritional security of all customers.

Australia enjoys an export surplus, but soil degradation lessens the nutritional quality of our primary produce. If Australia is to remain competitive in the international food market, efforts to increase yield should be secondary to improving water efficiency, breeding better crop varieties and improving the long-term fertility of our soils. Generating more food at the expense of nutritional quality and our natural productive soils is counter-productive.

Increasing R&D could also enhance Australia's leadership in agricultural sustainability. By pioneering sustainable agricultural management systems, Australia could increase its role in global food and water security.

Australia has the capacity to support developing economies through food aid and technological and industrial support. Both China and India are facing huge challenges in feeding their future populations, which opens up new opportunities for Australia to assist in international agricultural development. China, in particular, is investing large amounts of capital into sustainability research, to tackle widespread water and soil pollution. Australia's domestic innovation and productivity gains could translate into promoting regional food security, through the sale of technology to Asia. Improving food security, particularly in Asia, could also assist in stabilising other issues of regional security, such as political stability and mass migration.

### ***Key Institutions***

Both the public and private sectors are essential sources of Australia's rural R&D investment. Australia should avoid total de-regulation of the industry. The biggest challenges facing Australian agriculture, such as climate change and biosecurity, are not commodity-specific, so they need to be addressed by a long-term government plan. Executive Director of the Australian Farm Institute - Mick Keogh - [argues](#) that private sector investors see public sector

investment in this area as complementary, rather than competitive to themselves. The best approach would be for government to co-invest with industry-owned R&D institutions, to create an integrated research and extension framework.

### *The Private Sector*

The private sector has contributed a huge amount of capital to Australian agricultural R&D. The Australian Bureau of Statistics (ABS) estimates that annual private sector agricultural R&D expenditure amounts to approximately \$412 million. More private-sector research investment should be encouraged, but must be supported by long-term initiatives established by the public sector. Several incentives could be introduced to encourage private investment from agricultural firms. These include improving laws protecting IP ownership, maintaining the Australian R&D tax concession and increasing investment by rural corporations in agricultural R&D.

### *The Public Sector*

Government resources are better allocated to developing long-term strategies for enhancing the productivity and diversity of the agricultural sector. Thus, the Federal Government should focus on establishing a comprehensive investment plan and developing international collaborative agreements.

State and Territory Agricultural departments should be encouraged to play a key supportive role. State governments can target industry actors. They can encourage private firms to take an independent role in their specific fields of interest, through state-supported sector-wide planning. Meanwhile, public investment should also focus on ensuring that rural industries partner more closely with universities. Industries should be encouraged, through government incentives, to invest in university programs that guarantee R&D services, which would ensure that skilled professionals continue to be trained

### *Government Policy*

The Australian government recently addressed the need for a national, integrated R&D framework. In July 2012, the Department of Agriculture, Fisheries and Forestry released a Rural Research and Development Policy Statement, outlining investment goals involving both government and industry at local, national and international levels. The policy statement encourages better coordination, communication and reporting within the rural research and development system. Specifically, it recommends developing public agencies that: employ integrated research and extension staff; support R&D programs in their industries; and ensure the maintenance of knowledge and skills over time.

The Statement is a good start, but whether it will have the influence to redirect resources is yet to be seen. At this stage, it lacks a statutory mandate to administer national coordination and strategic direction of the industry. As a result of the statement, three bills<sup>1</sup> to amend rural research and development legislation have been introduced in the House of

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<sup>1</sup> *Rural Research and Development Legislation Amendment Bill 2013; Primary industries (Excise) Levies Amendment Bill 2013; Primary Industries (Customs) Charges Amendment Bill 2013*

Representatives, but so far none of these have proceeded. It may be years before comprehensive legislative reform takes place to address these issues.

### **Conclusion**

A lack of investment in agricultural research and development threatens the food security of Australia's future generations. Like many other developed countries, Australia has slowly allowed its private sector investors to redirect agricultural R&D to suit their respective industries. Privatisation has come as a result of increased food security and a refocus of investment on other areas of the economy. Consequently, public R&D investment intensity has suffered.

Declines in the rates of agricultural productivity in Australia, highlight the fact that reductions in public funding in this area were short-sighted. Private investment alone is insufficient to keep Australia at the cutting edge of global agricultural technology; private actors tend to make short-term investments in specific commodities, but miss the big picture. The time lag associated with investment in R&D, means that productivity gains are not evident in the short-term.

The assumption held by policy makers that the private sector would fill the investment gap was over-optimistic. To ensure continued food security, both domestically and internationally, the investment gap needs to be addressed. Increased technological and research development could lead to future market opportunities and cement Australia's role as a world leader in agricultural sustainability. Policymakers must work towards developing an integrated research and extension system, which encourages the private sector to invest responsibly, while also setting long-term goals for the whole agricultural sector.

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*Any opinions or views expressed in this paper are those of the individual author, unless stated to be those of Future Directions International.*