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Private sector investment in agricultural research and development in Australia

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Abstract. There is growing recognition that the private sector is playing an increasingly important role in agricultural research and development internationally, and in Australia. There are only very limited data available about the extent of private sector research and development (R&D) investment that is occurring in Australia, and the nature of that investment. This paper reports the results of a survey and data review that was carried out to gain a better understanding of private sector agricultural R&D investment in Australia. The survey, whilst limited, suggests that private sector agricultural R&D investment in Australia is more significant than previously reported, and that private sector investors see public sector investment in this area as complementary, rather than competitive.

Keywords: agriculture, research and development, public sector, private sector.

Introduction

This research was conducted to gain a better understanding of the role of the private sector in agricultural research and development (R&D) in Australia. It was funded by the Australian Farm Institute, in conjunction with the Council of Rural Research and Development Corporations. This paper provides a summary of the main findings of the research.

The two main elements of the research were a review of available literature on the changing roles of the public and the private sector in agricultural R&D both in Australia and globally, and a survey of the private sector in Australia to gain a better understanding of both the scale and nature of private-sector investment in agricultural R&D.

In reviewing available literature and data on private-sector agricultural R&D, it became apparent that despite international agreement of the definition of R&D, reported international and domestic data do not use a standard definition of what constitutes agricultural R&D. This possibly arises because agricultural R&D differs from industrial R&D, in that agricultural R&D is undertaken by participants in a range of different industries (plant breeding, fertiliser manufacturers, pharmaceuticals companies, machinery manufacturers, food processors and retailers, other services providers) with different technology requirements and different market structures. Farm businesses represent only one part of the picture, and are generally not directly involved in R&D activities.

Despite the limitations imposed by inconsistent definitions, it is apparent that in most developed nations the private sector is playing an increasingly important role in agricultural R&D. Estimates vary depending on the definition used (some or all of the farm, food, forestry, fisheries and beverage

sectors are included in different definitions of 'agriculture') but when food and agriculture are included the share of total agricultural R&D investment by the private sector averaged 54% for OECD nations in 2000, up from 44% in 1981. Unfortunately, more recent internationally comparable data is not available.

Drivers of private sector R&D

There has been a range of different factors identified that are believed to have resulted in increased private-sector agricultural R&D investment over recent decades.

The implementation of laws which create and protect ownership of Intellectual Property (IP) rights in plant and animal species is considered to be a key factor.

The size of a firm, and the share that the firm holds of the market have also been found to be related to private-sector R&D investment intensities, with larger firms that hold a greater market share more likely to invest in R&D. Appropriability, or ability to capture the majority of benefits arising from successful R&D is also important, with some areas of agricultural research being such that the benefits of successful R&D investment are not easy to capture.

Foreign Direct Investment (FDI) levels in a national industry have also been observed to be related to levels of private-sector R&D investment. In the case where there are high levels of FDI, it appears that multinational firms are more likely to invest more in R&D in their home markets, and limit the R&D investment by their international subsidiaries to experimental development research specific to that market. This is relevant to Australia, where there is a high level of FDI in some important farm input sectors.

Public-sector agricultural R&D activities are generally believed to be complementary to private-sector agricultural R&D, with a high

level of cooperation observed to occur between the two sectors. While classical R&D theory suggests that the public sector should be involved in more basic research and work on enabling technologies that the private sector can then develop and commercialise, this is not necessarily the model observed in many situations, where a range of different factors determine altered roles for the two sectors.

Agricultural R&D in Australia

There is a range of official statistics published about the level of private-sector agricultural R&D investment in Australia. Unfortunately, the methodology used to collect this data and the different definitions used mean that the available data is questionable, and contradictory.

The Australian Bureau of Statistics (ABS) estimates of annual private-sector agricultural R&D expenditure in Australia range from \$53.8 million to \$412 million (depending on the definition and the categorisation used) although there is no information available to identify how much of this was net expenditure by firms, and how much was expenditure utilising funding from government or other sources.

The range of values arises because R&D investment can be categorised on the basis of:

- the principal activity of the organisation carrying out the research,
- the 'field of science' being used for the research, or
- the anticipated socio-economic outcomes of the research.

ABS survey respondents are required to self-assess and categorise their R&D expenditure, which is also a possible source of error in these statistics.

Survey results

A survey of firms that may potentially invest in agricultural R&D was carried out to gain a greater understanding of the scale and nature of private-sector agricultural R&D in Australia. A survey format was developed, and tested in ten face-to-face interviews during April and May, 2010, with research or development managers from major firms supplying farm inputs in Australia. The survey was then mailed to 281 firms in June 2010, which were contacted several times to encourage their participation. Responses were received from approximately 50 organisations, 31 of which were directly involved in agricultural R&D (with agriculture defined as including farm, forestry and fishery activities).

The gross R&D expenditure of all firms surveyed was \$41.5 million, of which \$32.2 million was 'own-company' expenditure, and \$9.4 million was funding sourced externally. The average level of net R&D expenditure reported by firms participating in the survey for 2008–09 was \$1.34 million. In excess of 93% of the R&D being carried out by the companies responding to the survey was classified as either 'applied research' or 'experimental development'.

Survey respondents were allocated to broad groupings based on their main business activities, and the average R&D intensity was calculated. R&D intensity is a measure commonly used in analysis of trends in research and development expenditure at industry and national levels. It is calculated as the ratio of net own-firm R&D expenditure to gross sales revenue. As has been reported in similar international studies, there was a high degree of similarity in R&D intensities for firms within groups (see Table 1).

Survey participants were asked a series of questions about the activities of rural research and development corporations (RDCs). Their responses were generally quite positive, with firms that had previously collaborated with RDCs likely to be more positive towards RDCs than non-collaborating firms. When asked to rank the activities of rural RDCs on a scale ranging from complementary to competitive relative to their own activities, responding firms overwhelmingly saw the activities of the rural RDCs as complementary to their own R&D activities, rather than competitive. Firms that had previously collaborated with RDCs were more likely to see the RDC activities as complementary (see Figure 1).

Survey respondents were asked to score a range of factors that might either encourage or discourage investment by their firm in agricultural R&D in Australia. Figure 2 provides the combined results of that assessment.

The major factors encouraging R&D investment were the uniqueness of Australian agricultural systems (necessitating research under Australian conditions), the high rate of innovation adoption by Australian farmers, and the interaction between the public and private-sector R&D activities. The major factors discouraging private-sector R&D were regulations and costs and uncertainty associated with product registration processes (especially relative to the size of specific markets in Australia).

Based on research intensities for groups of businesses included in the survey, and extrapolating those research intensities for the whole market, it was projected that total

net private-sector agricultural R&D expenditure in Australia in 2008–09 was approximately \$197 million. Utilising that projection in association with other available data enabled a breakdown to be prepared of all the sources of agricultural R&D funding in Australia in 2008–09 (see Table 2).

Table 2 highlights that, depending on the definitions and the categorisation systems used, and whether revenue from compulsory farm R&D levies is counted as private-sector agricultural R&D or not, markedly different estimates arise of the share of total agricultural R&D that is funded by private-sector expenditure. The estimates of the share of private-sector R&D in total national agricultural R&D (35.5% excluding compulsory levy funds or 50.0% including compulsory levy funds) are much closer to OECD averages than previous estimates.

The Productivity Commission (Productivity Commission, 2011) in its recent report on future funding arrangements for rural R&D corporations found that total government funding for rural R&D in Australia in 2010 was \$1,131 million, and as a result that the share of public funding of rural R&D in Australia was higher than indicated in Table 2.

In reaching this conclusion, the Productivity Commission utilised its own unique definition of what constitutes agricultural R&D, and included in its estimates public expenditure on:

- rural extension,
- capital works associated with research facilities, and
- environmental R&D.

in addition to activities that are normally defined as agricultural R&D. None of these additional activities are included in accepted international definitions of what constitutes agricultural R&D (for example as defined in the OECD Frascati Manual), and nor are they included in annual reporting of agricultural R&D expenditure by Australian government agencies, or in Australian reports on R&D funding provided for the OECD. It is unclear why the Productivity Commission used this much wider definition of agricultural R&D, which had the effect of increasing the apparent share of total agricultural R&D investment in Australia that is being funded by the public sector.

Irrespective of the levels of rural R&D funding in Australia contributed by the public and the private sector, it is likely that the private sector will become a more significant contributor in this area in the future, based on overseas trends. It is therefore in Australia's interests to consider how best to

encourage increased private sector investment in agricultural R&D in the future.

Conclusions

A conclusion from the research is that there is a range of initiatives that could assist in either better understanding the scale and nature of private-sector investment in agricultural R&D, or in encouraging increased private-sector R&D expenditure.

There is a need to implement a simple R&D data collection system that could be routinely utilised by public (and possibly private sector) organisations involved in agricultural R&D activities, and which could provide robust and useful information for policy-makers and others in order to better understand agricultural R&D investment trends in Australia.

There is also a need to ensure that public-sector research organisations and RDCs have adequate expertise in R&D commercialisation and IP management. This would enhance cooperation between the public and private sectors, and provide an added incentive for private-sector R&D investment in Australia.

Arising from the survey and the review of literature, it is apparent that there are a number of initiatives that could provide further incentives to increase private-sector agricultural R&D investment in Australia. These include:

- improvements in laws protecting the ownership of IP
- the removal of restrictions on the development of GM crops and the rationalisation of GM crop R&D approval processes
- the continuing availability of the Australian R&D tax concession
- continuing and increasing investment by rural R&D corporations in agricultural R&D
- streamlining of chemical registration and approval processes to create greater certainty of outcomes and to ensure registration requirements are commensurate to risk.

References

Productivity Commission, 2011, 'Rural Research and Development Corporations', Report No. 52, February 2011, Productivity Commission, Canberra.

Note: The Australian Farm Institute research report referred to in the above paper can be downloaded at www.farminstitute.org.au

Appendix

Table 1: R&D investment intensity by broad grouping

Grouping	Total R&D investment intensity	Own-funds R&D investment intensity
Corporate farm businesses	1.76%	1.76%
Agricultural chemicals	1.98%	1.95%
Fertilisers	0.38%	0.14%
Forestry	4.59%	4.33%
High technology (animal/plant breeding and genetic technologies, computer and electronics)	15.6%	15.2%

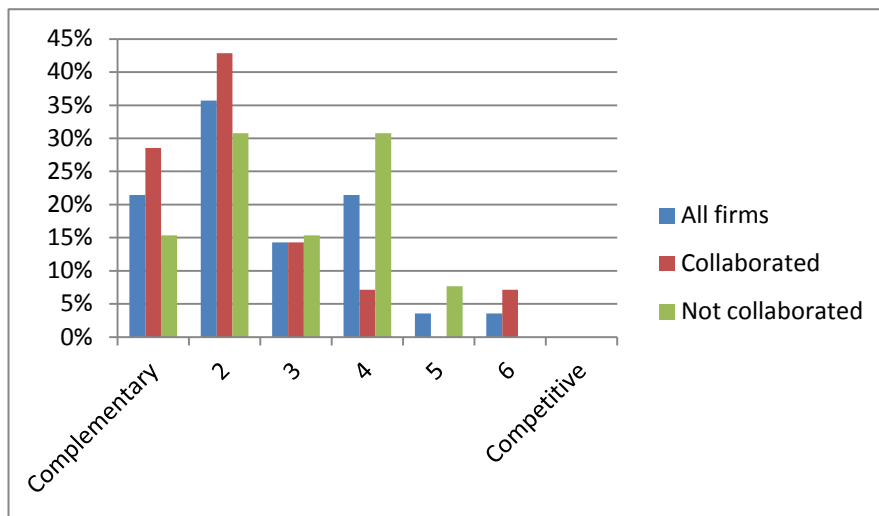
Source: AFI Survey 2010.

Table 2. Source and amount of funding for Australian food and agriculture R&D, 2008–09

Source of funding	\$ millions	Data source
Australian Government	\$515	Australian Government Department of Innovation, Industry, Science and Research. Budget Papers 2009–10. Table 5. Australian Government support by socio-economic objectives 2008–09 – 'Agricultural production and technology' – defined according to the OECD <i>Frascati manual</i> using the Australian Standard Research Classification system. Includes funding for RDCs, CSIRO, Universities and Cooperative Research centres. *
State governments	\$254	Australian Government Department of Agriculture, Forestry and Fisheries annual data compilation for the OECD. Includes all state/territory governments recurrent expenditure on agricultural R&D (excluding expenditure on rural extension), and capital expenditure on R&D-related infrastructure.
Compulsory farm sector R&D levies paid by farmers	\$227	The Australian Government's 2008–09 Science, research and innovation budget tables, 2008–09.
Private-sector R&D expenditure	\$197	AFI Survey data. Data includes agri-chemicals, fertilisers, seed, fisheries and forestry and corporate farm businesses. Does not include food sector R&D.
Food processing and manufacturing R&D expenditure (private-sector)	\$345	ABS 07/08 (8104.0) data for food processors and manufacturers business expenditures on R&D.
Total (including food sector)	\$1538	Calculated from above data
Total (excluding food sector)	\$1193	
Ratio of private-sector food and agricultural R&D expenditure to total R&D expenditure	35%	Calculated from above data. Funding from compulsory farm R&D levies not included as 'private-sector expenditure'.
Ratio of private-sector food and agricultural R&D expenditure to total R&D expenditure	50%	Calculated from above data, including funding from compulsory farm R&D levies as part of private-sector expenditure.
Ratio of private-sector agricultural R&D expenditure to total agricultural R&D expenditure	16.5%	Calculated from above data (excludes food sector R&D expenditure, and excludes farm sector R&D levies).
Ratio of private-sector agricultural R&D expenditure to total R&D expenditure	35.5%	Calculated from above data (excludes food sector R&D expenditure, and includes farm sector R&D levies).

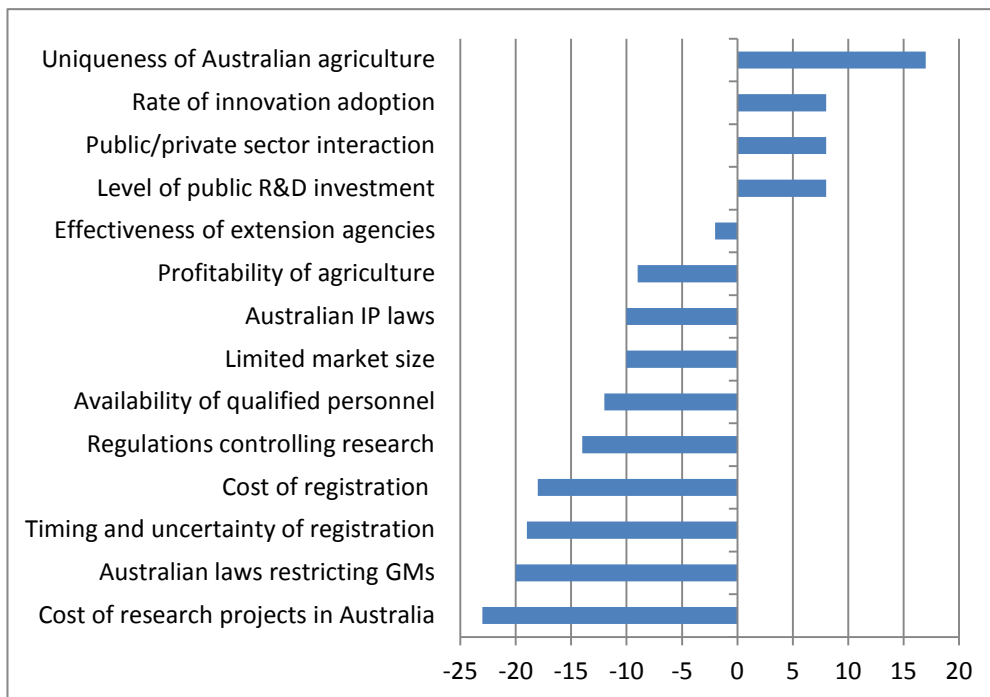
*This amount does not include agricultural R&D funded by universities from general university funds. In total, this was estimated to be \$1242 million in 2008–09. If some of this amount was allocated to agriculture in proportion with the number of agricultural students in total university student enrolments (1.5%), it would add \$18.6 million to total public-sector expenditure.

Figure 1. Attitude of firms towards rural R&D corporations



Source: AFI Survey 2010.

Figure 2. Rating of factors encouraging or discouraging investment in agricultural R&D by private firms in Australia



Source: AFI Survey 2010.