TRENDS IN PUBLIC RESEARCH EXPENDITURE IN
AUSTRALIAN AGRICULTURE

J D Mullen*, K Lee+ and S Wrigley*


Abstract

Expenditure data for production research in agriculture were collected from the published financial accounts of CSIRO, State Departments of Agriculture and major Universities with interests in agricultural research. In nominal terms expenditure on rural research in Australia rose from $9m in 1953 to $411m in 1988. Research intensity in nominal terms based on agricultural GDP rose by a factor of 7.5 from 0.6 percent in 1953 to 4.4 percent in 1988 after peaking at 4.9 percent in 1986. In real terms however, the increase in public sector research has been much less. In dollar terms expenditure increased from $9m in 1953 to $38m in 1988, a factor of about four. The growth in research intensity was also much lower. Real research intensity increased from 0.6 percent in 1953 to 1.6 percent in 1988 after a peak of 2.1 percent in 1973. This suggests public sector support for rural research, after increasing significantly in the ‘50s and ‘60s, has been drifting down since the early ‘70s.

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2  
Trends in Public Research Expenditure in Australian Agriculture

1. Introduction

The development and adoption of new technology is an important source of economic growth and development. In many economies the public sector has directly provided a large proportion of the research and advisory services available to agriculture. The rationale for public sector involvement has traditionally been based on the expectation that the private sector, consisting of a large number of small farmers, would underinvest in such services because of their 'public good' characteristics. The knowledge generated by research is non-rival in consumption, that is it can be used by many at little additional cost, and it is difficult for those who finance the research to appropriate its benefits and deny them to 'free-riders' who do not contribute to the cost of the research.

Both the role of public sector in agricultural research and the level of investment in research has come under scrutiny. A widely held view, reviewed in Harris and Lloyd (1990), has been that the level of public investment in R&D has been too low. The role of the public sector has been examined by the Industry Commission in 1976 and 1994/1995 and there have been a number of inquiries into the appropriate role of State Departments of Agriculture. The gradual evolvement of the rural industry research and development corporations (RDCs) since the 1950's reflects a growing belief that rural industries should take greater responsibility for the direction and funding of rural research.

There has been little empirical analysis of these issues. Not only has there been no econometric study of the relationship between investment in R&D and increases in productivity leading to an assessment of the rate of return earned by such investment (until a recent study by Mullen and Cox (1995b)), but even descriptive statistics concerning the growth and sources of funding for rural research have been unavailable except for recent years. An important stumbling block has been the lack of an extended series of data on research expenditure in agriculture in either the private or public sectors. Australian research expenditure data bases have, in the past, been based on discontinuous surveys. These surveys were initially undertaken by the Department of Science (Project Score) in 1968/69, 1973/74 and 1976/77 and then later by the Australian Bureau of Statistics in 1978/79, 1981/82, 1984/85, 1985/86 and 1988/89. However, Chavas and Cox (1992), Pardey and Craig (1989) and Huffman and Evenson (1993), in studies of R&D in US agriculture, have found that research expenditure may impact on productivity for 35 years. Hence the ABS data series on research is inadequate for most empirical analyses of the relationship between research and productivity growth.
2. Objective

The objective of this paper is to report a descriptive analysis of rural research expenditure in Australia by State Departments of Agriculture, CSIRO and major universities from 1953 to 1988. The dataset presented here will provide valuable insights into:

- the growth in the provision of research services by the public sector relative to the value of the agricultural sector. A measure of public support for rural research, referred to as research intensity, is loosely defined as the ratio of expenditure on research to the value of agricultural production;

- the relative importance of CSIRO, the State Departments of Agriculture and the Universities as providers of research services to agriculture;

- the growth in producer funding of research through the RDC 

- the relative importance of research, extension and regulatory activities in State Departments of Agriculture;

- and facilitate the economic analysis of the impact of rural research.

This data base was assembled as part of a project funded by the Australian Wool Research and Development Corporation (now part of the International Wool Secretariat) which set out to estimate the rate of return to production research conducted by the public sector in the extensive livestock and cropping industries, referred to as broadacre agriculture, in Australia. Hence a narrower objective has been to estimate expenditure by the public sector on production (as opposed to processing) research in broadacre agriculture in Australia.

In assembling this data base, the intention was to use publicly available information as much as possible, both to minimise data assembly costs and to maximise the extent to which the database presented here could be replicated by following the procedures described below.

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1 Expenditure on broadacre research was used to explain productivity growth in broadacre agriculture (reported in Mullen and Cox (1995b)). The measure of productivity growth (reported in Mullen and Cox (1995a)) was derived from data from ABARE's AAGIS survey and its precursors including the Australian Sheep Industry Survey.
3. Constraints Encountered in the Data Assembly Process

An immediate constraint in assembly research expenditure data was the paucity of detail in published financial statements. In general it was not possible to identify expenditure on research as distinct from expenditure on extension, regulatory and education functions. Nor was it possible to either identify with any confidence, expenditure by industry or industry group or distinguish operating from capital expenditure.

However of far greater significance were inherent problems of jointness which meant that no amount of detailed financial data was going to allow the desired disaggregation of expenditure without resort to allocation rules which were largely arbitrary in nature. Jointness arises when a production process produces more than one output and fixed inputs have to be shared. There were several dimensions to the jointness problem. Clearly broadacre agriculture is characterised by jointness between a range of cropping and livestock enterprises. There is also jointness in the supply of research, advisory, regulatory and education services by the public sector both at this aggregate functional level and at the level of providing services to a particular industry such as the sheep industry.

The procedures used to estimate expenditure on broadacre research varied between institutions and are discussed in more detail below, but in general they required the application of an allocation rule. Two allocation rules used in assembling this dataset are referred to in the literature as the congruence and precedence rules (Fox, 1987 and Scobie & Jacobsen, 1992). Within Departments of Agriculture expenditure on research was generally estimated as a proportion of total expenditure; where the proportion was derived from management information systems implemented during the '80's to provide information about how resources were being used by function and industry, rather than from published financial statements. The implicit assumption here is that resource allocation in any year is based largely on the allocation of resources in the previous year, in other words resource allocation is largely guided by precedence. Unfortunately the management information series were so short that it was impossible to judge whether there had been any systematic trends in the allocation of resources across functions since the '50's and a constant allocation rule was used (which was different for each State).

To arrive at expenditure on broadacre research the congruence rule was applied. The proportion of the total value of agricultural production accounted for by broadacre industries was estimated through time and applied to total research expenditure to give expenditure on broadacre research.

In theory it would have been useful to maintain a distinction between capital and operating expenditure because the impact of capital expenditure associated with

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2 Jointness in broadacre agriculture prompted a broadening of focus from returns to research in the wool industry to returns to research in broadacre agriculture.

3 A five year moving average was used to smooth the effects of unusual seasonal and price effects.
research on agricultural productivity is likely to be more protracted than that of operating expenditure. This distinction was difficult to maintain and has been ignored here and in Mullen and Cox (1995b) with capital and operating expenditure being added together. The implicit assumption here is that over a long period the rate of annual expenditure on capital items approximates the annual depreciation rate of capital, the more appropriate measure of the use of capital services. This procedure worked well except for the large expenditure associated with the National Animal Health Laboratories at Geelong and this is discussed further in the CSIRO section.

4. Institutions from which Research Expenditure Data were Collected

Expenditure data were collected from the following institutions:

• CSIRO

• Departments of Agriculture/Primary Industry in

  NSW
  Queensland
  Victoria
  South Australia
  Western Australia

• Universities:

  University of Sydney
  University of NSW
  University of New England
  University of Queensland
  University of Melbourne
  Monash University
  LaTrobe University
  Adelaide University (including the WAITE Institute)
  University of Western Australia
  Murdoch University

No doubt some research into broadacre agriculture has been conducted at Agricultural Colleges; Colleges of Advanced Education; Departments of Agriculture in Tasmania and the Northern Territory and other Government Departments such as Lands and Soil Conservation Departments, but the level of activity is likely to have been small. Broadacre research activities in these institutions were also likely to

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4 The distinction was difficult to maintain partly because capital expenditure projects were often undertaken by 'Public Works' Departments rather than by the research institution and their accounts did not identify agricultural research projects; partly because a lot of less significant capital expenditure appears within operating budgets; and partly because of jointness with education and advisory and regulatory functions.
have been small relative to their other activities and hence difficult to identify in any reliable way.

To avoid double counting, the research activities of the RDCs were accounted for in the institutions which conducted the research on their behalf. Research funded by the Department of Primary Industries and Energy was accounted for in the same way. Broadacre research activities of ABARE have not been included partly because of difficulty in accessing public financial statements back to 1953 and partly because of the difficulty in classifying which of their activities had a direct impact on productivity in broadacre agriculture.

Productivity is also likely to be affected by private R&D. Data on agricultural research conducted by the private sector in Australia are only available for the limited period covered by the ABS. In other countries such as America and the UK, private sector research is as large as public sector research but it appears to be much smaller in Australia. The Industries Assistance Commission estimated that private research only amounted to seven percent of total rural research in Australia in 1973/74 (IAC, 1976, p31). No attempt was made to assemble data on private research in this study.

5 CSIRO

The CSIRO is Australia's largest publicly funded research organisation with a total budget in 1988 of $452m. While CSIRO's predominant interests in its early years were in agricultural production research, these interests broadened into the technologies of processing rural products and beyond that into research issues across many sectors of the Australian economy.

5.1 Data sources

Published sources of data for CSIRO research expenditure included CSIRO Annual Reports until 1984/85 and from 1980/81 the Department of Science and Technology's 'Science and Technology Statement'. Unfortunately there were slight inconsistencies between these two sources during the overlapping years and an averaging procedure was used. Expenditures were recorded from recurrent funds (Treasury sourced), from external funds (industry sourced) and capital expenditure (both sources in addition to funds made available from other Departments, eg. Public Works).

As CSIRO is primarily involved in research, problems with jointness of supply across institutional function do not arise. However the frequent changes in CSIRO's divisional structure and its extensive research interests outside production agriculture meant that identifying expenditure on production agriculture in non-agricultural divisions was difficult. Particular problems were that some research which directly affected farm productivity, in the area of resource management for example, was conducted in Divisions such as Soils, Land Management and Wildlife which had a much broader focus than production agriculture. There was also the problem of the allocation of general CSIRO overheads and research services, such as computing and statistical analysis, to production research activities. In these
instances it was necessary to use allocation rules developed in consultation with relevant Divisional or Institute management.\(^5\)

Research expenditure on broadacre industries was estimated by applying broadacre agriculture's proportionate contribution to total agricultural gross value of product for Australia to annual research expenditure figures.

Between 1977/78 and 1983/84 the Australian Government invested over $200m in the National Animal Health Laboratories in Geelong.\(^6\) This marked increase in capital expenditure explains the 'blip' in the graphs of CSIRO and Australian research expenditure in 1977/78 (Figures 1 to 3 and 10 to 13). In these years the implicit assumption that annual capital expenditure is a reasonable approximation of the annual flow of services from the capital stock or the depreciation rate, is clearly breached. In Mullen and Cox (1995b) this capital expenditure was amortised over 20 years and this smoothed the series.

### 5.2 Data trends

CSIRO agricultural production research expenditure has clearly increased over time (Figure 1). Apart from the 'blip' around 1978 (explained in 5.1), Figure 1 depicts exponential growth between 1953 and 1983, but a slower growth in research expenditure is evident in the late 1980s. Figure 1 also shows that expenditure on agricultural production research as a proportion of CSIRO's total budget has declined from around 40% in the 1950s to less than one third in the 1980s.

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\(^5\) This difficulty increased in the late 1980s when research expenditure was classified by the sector that was perceived as benefiting from the research rather than by the sector in which the research was conducted. For example, woolgrowers were seen to be the major beneficiary of most wool processing research.

\(^6\) Budget allocations for the Laboratories for the years 1977/78 to 1983/84 were $83m, $0, $20m, $35m, $35m, $35m and $9m.
Research intensity i.e. CSIRO spending on agricultural production research as a proportion of the value of Australian agricultural production, has increased from 0.22% in 1953 to a peak of 1.90% in 1983 (ignoring the ‘blip’ of 2.34% in 1978), then declined slightly to 1.56% in 1988 (Figure 2). This is consistent with the slow down in research expenditure shown in Figure 1 but nevertheless suggests increasing support for agricultural research over the period.
While CSIRO funding has been sourced predominantly from consolidated revenue, rural industry research funding, especially from woolgrower sources, has been important. Changes in the financial reporting procedures of CSIRO from 1984 meant that it was not possible to easily identify industry funding of production research as distinct from processing research. However funding by the RDCs as a proportion of total expenditure appears to have declined in the production research area from around 30% in the 1950s to 10% in the early 1980s (Figure 3).
6. State Departments of Agriculture

As a group the State Departments of Agriculture undertook more rural research than did CSIRO.

6.1 Data sources

Total expenditure by each department was collected from financial statements published as part of annual reports or from statements prepared for budget papers tabled in Parliament. In most cases financial reports were structured similarly for each State and consisted of three accounts:

- Expenditure from Consolidated Revenue which accounted for almost all the Departments' operating expenditure;
- The Loan Fund Account which accounted for capital expenditure most often in the form of new buildings;
- Trust Fund accounts which recorded expenditure by the Department on activities financed externally such as research activities funded by the RDCs and industry funded disease control programs.

Management accounting or program budgeting was introduced to all departments except QLD DPI, from the late 1970s or early 1980s. In most cases such accounts enabled the apportioning of departmental resources between research, extension, regulatory and administrative functions.

6.2. Approach

The three accounts described above provided a reliable estimate of total expenditure by the Department. However all Departments undertook activities which had little direct impact on farm productivity. These activities included business enterprises such as abattoirs and cool stores; Agricultural Colleges; rural finance and adjustment activities; forestry and fisheries activities; and general community activities such as animal welfare and botanic gardens. Expenditure on these extraneous activities were generally identifiable as line items in the Consolidated Revenue Accounts and were deducted to arrive at a reliable estimate of total expenditure associated with research, advisory and regulatory functions in production agriculture.\(^7\)

It was not possible to isolate expenditure by industry or by function from the published financial accounts. To estimate expenditure on research, the share of

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\(^7\) Some regulatory expenditure financed through Trust Funds or Special Deposits accounts was not included in this database as such expenditure was financed largely through producer levies. Contributions made to regulatory and disease control trust funds from consolidated revenue were included in regulatory expenditure estimates.
total expenditure attributed to research from management accounting information was applied to the estimate of total expenditure for each State Department. The estimates of shares of total expenditure attributable to research, extension and regulatory functions for each Department are presented in Table 1. As already noted these budget share estimates only became available in recent years. For all departments there was no reliable trend in budget shares and hence average budget shares were applied to the whole period from 1953 to 1988. The departments in Western Australia, New South Wales and South Australia seem to have devoted about half their budget to research activities while the Department in Victoria has had a much stronger regulatory focus. Note that overhead expenditure was allocated across the three functions according to their shares of expenditure.

Table 1: State Departments of Agriculture Allocation of Funding

<table>
<thead>
<tr>
<th></th>
<th>Research %</th>
<th>Advisory %</th>
<th>Regulatory %</th>
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<tbody>
<tr>
<td>NSW</td>
<td>47</td>
<td>32</td>
<td>22</td>
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<tr>
<td>Vic</td>
<td>33</td>
<td>15</td>
<td>52</td>
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<tr>
<td>Qld</td>
<td>38</td>
<td>(62)</td>
<td></td>
</tr>
<tr>
<td>SA</td>
<td>44</td>
<td>21</td>
<td>35</td>
</tr>
<tr>
<td>WA</td>
<td>52</td>
<td>26</td>
<td>22</td>
</tr>
</tbody>
</table>

Expenditure on broadacre research was estimated by applying broadacre agriculture's share of the total value of agricultural production for each State as already described.

Funds for research financed by the RDCs were generally accounted for in Trust Fund accounts which were clearly identifiable. However, a number of trust funds whose primary function was regulatory were also involved in research and extension, for example the Swine Compensation and Banana Industry Funds. It was not possible to identify this research expenditure reliably and it has been ignored here. The extent of underestimation of research expenditure is expected to be small.

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8 Errors arising from the use of management accounting data include potential estimation error by staff members at departments in apportioning their workload and expenditure. Errors would also arise in using MIS research, extension and regulatory function proportions estimated in the 1980s back into the 1950s, 60s and 70s.

9 The budget shares for the Queensland DPI were provided by A. Wiesman (pers. com.) who assisted in a review of research by DPI.
6.3. Data trends

Figure 4 shows the growth in total expenditure and research expenditure by State Departments was particularly strong in the late 1970s and early 1980s.

Average research intensity for the State Departments (agricultural research expenditure as a percentage of State Agricultural GVP) increased from 0.23% in 1953 to 1.45% in 1988 (Figure 5). Rapid growth in research intensity is evident in the late 1960s and early 1970s. The increase in research intensity has been less spectacular since then but research intensity in nominal terms has increased by a factor of about 6.
Research intensity has increased in all State Departments over the period studied. Departments of Agriculture in South Australia and Western Australia exhibit the highest research intensities in 1988 of 1.63% and 1.72%, NSW's research intensity was 1.34% and Qld 1.54%, while Victoria tabled the lowest intensity of 1.02% in 1988. In NSW, Victoria and Qld research intensity has been fairly stable since the mid 1970s, but research intensities in SA and WA have continued to increase (Figure 6).

Funding from RDCs was sometimes difficult to identify from the published financial reports. In particular it was not possible to get a complete series of RDC funding for the Qld DPI. Hence estimates of RDC funding are perhaps less reliable than estimates of total expenditure from all sources. Nevertheless it would seem research funding from industry sources became increasingly important through the 1970s, although their contribution relative to Consolidated Revenue sources for all functions has declined in all departments in the 1980s (Figure 7). Both WA and SA depend more heavily on research funding from industry sources than do the eastern states.
Figure 6: State Departments Research Intensity
Research Expenditure as a % of GVP
7. Universities

7.1 Data sources

Research expenditure estimates were made from universities with agricultural and veterinary science faculties as well as those universities with applied science faculties which received significant RDC funds. These universities were listed in section 4. The primary function of universities is education, hence it was not possible to identify from published university accounts an estimate of total university expenditure on rural research. However for all universities it was possible to identify both internal and external grants for research in production agriculture. Generally such grants only covered expenditure specific to the project in the form of research assistance, travel funds and specific operating expenses and did not extend to the salary component of the project supervisor or to non-specific operating and capital expenditure borne by the universities. The general procedure followed here was to recognise the university contribution to research by doubling the sum of internal and external grants for production research although for some institutions such as the Waite, more detailed financial data were available and were used.

A major difficulty was that some research in what appeared to be traditional agricultural departments did not relate to agricultural production technologies and some agricultural production research was conducted in non-agricultural departments. In the former situation, it was assumed that all grants were related to production agriculture unless individual non-agricultural grants could be readily identified. In the latter case, only RDC grants were recognised as being relevant to production agriculture.

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10 Qld DPI not included in data as Trust Funds not distinguishable from Consolidated Revenue.
Estimation of broadacre agriculture research expenditure was directly achieved by deducting grants that clearly related to dairying or intensive agriculture.

7.2. Data trends

Research expenditure in Australian universities followed an increasing trend over the period studied, with rapid growth in the 1970s and 80s (Figure 8).

Figure 8: Universities Agricultural Research Expenditure

Research intensity (university research expenditure as a proportion of Australian agricultural GVP) increased steadily over the period, from 0.02% in 1953 to a peak of 0.50% in 1986 (Figure 9).
8. Summary of all Research Institutions

The trends in research expenditure across all research institutions are summarised in Figure 10 and Table 2. Total expenditure on agricultural research rose from $9.0m in 1953 to $410.9m in 1988. Expenditure on research has increased in all institutions with rate of growth accelerating from about 1972. From about 1965 the State Departments as a group invested more in rural research than did CSIRO. The 'blip' in the graphs between 1977 and 1980 (Figures 10,11 and 12) is due to the Australian Government's investment in the CSIRO National Animal Health Laboratories in Geelong.
So far expenditure on research has been discussed in terms of nominal dollars. Two measures have been used to gain some appreciation of whether there has been a real increase in the resources devoted to agricultural research. The first of these, research intensity relates nominal expenditure on research to the gross value of agricultural production also expressed in nominal terms. The trend in research intensity for all rural research institutions covered here is summarised in Figure 12 and Table 3. It has grown from 0.4 percent in 1953 to 2.5 percent in 1988 and was as high as 2.7 percent in 1983 suggesting that public sector support for research has risen by a factor of about six relative to the size of agriculture.

Research intensity has been defined to date relative to the gross value of agricultural production. Normally it is defined in terms of agricultural gross domestic product (Alston, Chalfant and Pardey, 1993 p.14). The main difference between these two is that the value of purchased inputs is deducted from the former to give the latter which is a measure of the value added by land family labour and management. We did not have agricultural GDP at a State level. For Australia as a whole, research intensity based on agricultural GDP rose from 0.6 percent in 1953 to 4.4 percent in 1988. Alston, Chalfant and Pardey (1993, p14) note that of OECD countries, Australia is second only to Canada in the level of its research intensity. It is not clear whether research intensity should be expressed in terms of gross value of production or GDP as a significant proportion of public research expenditure is related to technologies based on purchased inputs. It seems likely that more purchased inputs have been used in Australian agriculture, hence the growth in GDP has been less than in gross value of production and consequently research intensity measured in terms of GDP has grown more than research intensity measured in terms of gross value of production.
Another obvious measure of the real increase in rural research resources is to deflate nominal expenditure to a measure of real expenditure, although this measure does not relate the size of the research industry to the size of the agricultural sector. The appropriate deflator would have been one based on movements in the prices and quantities of inputs used in the public research sector. Such an index has only been available from the ABS since 1977–78. As an alternative, an index of salaries from 1953 was constructed for a research officer in CSIRO of 'average' experience and qualifications (what is now referred to as an ES 3M) but this series did not explain changes in the more recent ABS state and commonwealth research indices as well as a price index of total expenditure on goods and services by public authorities, hence the choice of the latter as the appropriate deflator (detailed in Table 4).

Real expenditure (constant $1953) increased fourfold from $9m in 1953 to $38m in 1988. It grew linearly until about 1970 but since then the rate of growth of expenditure has been slow (Figure 11 and Table 2).

Figure 11: Real Agriculture Research Expenditure
<table>
<thead>
<tr>
<th>Year</th>
<th>Departments of Agriculture Nominal $</th>
<th>Universities Nominal $</th>
<th>CSIRO Nominal $</th>
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<th>Total Expenditure Real $</th>
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10. Explaining the Increase in Research Intensity

Hence these measures suggest that not only has there been a significant increase in the real resources used in rural research but that the size of the rural research industry has risen at an even greater rate relative to the size of the agricultural sector as a whole. This applies to State Departments as a whole not just to their research function. In this section an attempt is made first, to judge whether the apparent increase in research intensity accurately represents a real increase in support for rural research relative to the size of the agricultural sector, and second to suggest reasons for this increased support.

Up to this point research intensity has been measured in nominal terms as has been the practice in the literature. Applying a common deflator to research expenditure and to the value of production would not change the measure of research intensity. However to get a measure of the real resources associated with each sector, a deflator appropriate to each sector should be used. If these deflators have not increased at the same rate since 1953, then nominal and real research intensities are likely to have diverged. Pardey and Roseboom (1989 p.23) refer to this problem in the context of international comparisons of research intensity.

The largest input in the Australian public research sector is labour. The price of labour has had little correlation with the value of agricultural production. An estimate of the real research intensity was derived as the ratio of real research expenditure, as defined above, to agricultural GDP deflated by an ABARE index of prices received by farmers. The index of prices received by farmers has grown at a much slower rate than the price index of expenditure by the public sector (Table 4) and hence the estimate of the growth in real research intensity is much lower than that of nominal research intensity.

Using this measure, real research intensity has increased from 0.6 percent to 1.6 percent in 1988. It grew most strongly in the period up to 1972 and has since gradually drifted down again. The nominal and real measures of research intensity
are presented in Table 3 and Figure 12. The deflation procedure used here has a marked impact on the estimate of the size of the research sector relative to the size of the agricultural sector as a whole. While there may be some debate about which are the appropriate deflators, the issue of what is a measure of real research intensity needs to be considered further. Perhaps research intensity in Australia is not as high relative to other countries as suggested by Alston, Pardey and Chalfant (1993).

While real research intensity has not increased as much as nominal research intensity, there still appears to have been an increase in support for rural research at least during the '50s and 60's. It is not easy to explain why this growth has occurred. While the RDCs have been an important source of funds to the Departments, there has not been sufficient growth in RDC funding to explain the growth in the Departments (Table 4 and Figure 13). RDC funding as a percentage of total expenditure on research may have been about twenty five percent around 1970 but has since declined.

Nor does it seem likely that the growth in the size of government relative to the Australian economy can explain this phenomenon. From Table 4, public sector outlays as a percentage of GDP in Australia rose from 29 percent in 1952/53 to almost 43 percent in 1985/86 before declining to 39 percent in 1987/88. Hence the growth in the Departments of Agriculture and CSIRO relative to the agricultural sector has been larger than the growth in the government sector as a whole.

Figure 13: Australian Agricultural Research, Source of Funding

It is perhaps tempting to see the growth in the Departments and CSIRO as an example of successful rent seeking by the agricultural sector. However few programs administered by State Departments had the political profiles of rural
adjustment and finance schemes; statutory marketing issues; and inputs subsidy schemes, presumably because their impact of farm profitability was less direct.

Perhaps some of the growth can be attributed to a widely held view that investments in agricultural research and extension made highly profitable contributions to productivity growth in Australian agriculture. Allied with this must have been less restrictive view of what constitutes an appropriate role for the government sector in agriculture than is the case now.
Table 3: Research Intensity in Australian Agriculture

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11. Conclusions

Expenditure data for production research in agriculture were collected from the published financial accounts of CSIRO, State Departments of Agriculture and major Universities with interests in agricultural research. While it was possible to obtain reliable estimates of total expenditure, jointness both in production agriculture at the farm level and in the supply of research, extension, regulatory and education services by public authorities meant that it was not possible to identify expenditure by function, such as research in broadacre agriculture without resorting to arbitrary allocation rules based on congruence and precedence.

CSIRO is the largest single agricultural research body in Australia. As a group the State Departments of Agriculture account for the largest share of expenditure on agricultural research. Universities make a relatively small contribution to agricultural research and rely heavily on external grants for funding.

In nominal terms expenditure on rural research in Australia rose from $9m in 1953 to $411m in 1988. Research intensity in nominal terms based on agricultural GDP rose by a factor of 7.5 from 0.6 percent in 1953 to 4.4 percent in 1988 after peaking at 4.9 percent in 1986. This suggests a very large increase in support for public sector research in agriculture in Australia.

In real terms however, the increase in public sector research has been much less. In dollar terms expenditure increased from $9m in 1953 to $38m in 1988, a factor of about four. The growth in research intensity was also much lower using an estimate of real research intensity derived in this paper. Real research intensity increased from 0.6 percent in 1953 to 1.6 percent in 1988 after a peak of 2.1 percent in 1973. This suggests pubic sector support for rural research, after increasing significantly during the '50s and '60's, has been drifting down since the early '70s when a long period of inflation commenced.

Despite this gradual decline in support, real research intensity has increased by a factor of nearly three since 1953. This increase cannot be explained either by the increased support from RDCs or by a general increase in the size of government in the economy. Perhaps it reflects successful rent seeking by the rural sector in the '50s and '60's. More likely it reflects a widespread perception that agricultural research was a good investment at a time when a broader role for the public sector in the economy was accepted.
REFERENCES


