

CHAPTER 4: R&D AND THE UNIVERSITY SECTOR

4.1 Universities have traditionally played a major role in research in Australia. Other significant roles of universities include the provision of training and experience for future researchers and the dissemination of learning, ranging from the elementary to “leading edge” international knowledge. Universities thus contribute to innovation by activities which add to the “stock of knowledge”. The diffusion of this knowledge throughout industry helps promote economic growth.

4.2 According to the AVCC, the policy changes being investigated by the Committee have had a variable impact:

*At best, such shifts in public policy have contributed to enhanced R&D collaboration between universities and industry and business. At worst, they have contributed to a serious decline in public funding for research infrastructure and research training and to the undermining of Australia’s long-term basic and strategic research capability through an emphasis on research for short-term commercial gains.*²²⁸

4.3 Before 1987 the tertiary education sector included colleges of advanced education and institutes of technology, which were only funded for undergraduate teaching and postgraduate course work.²²⁹ The implementation of a unified national system in 1987 brought about a major structural change, increasing the number of tertiary institutions with university status.²³⁰ Despite their different status, many of the former institutes had already established a successful research effort via industry linkages – the government hoped a restructure of the sector would build on these links.

4.4 A decade on, the research efforts and outcomes of Australian universities reflect their origins. The July 1996 report by the Australian Research Council (ARC), *Patterns of Research Activity in Australian Universities*, drew attention to the emergence of research niches.²³¹ For example, the former institutes of technology are major players in information and communication technology and are strongly represented in applied sciences and technology – fields where the business sector performs a comparatively more important funding role. The older universities undertake

228 AVCC, submission no. 49, p. 1.

229 Care therefore needs to be taken when looking at research data before 1987.

230 Those eligible to apply for research funding increased from 19 to 38 (includes two non-public universities).

231 ARC/DEETYA, *Patterns of Research Activity in Australian Universities*, July 1996, p. 5 at <http://www.detya.gov.au/highered/research/outcomes/innovat1.htm> (as at 26 July 1999).

basic and applied research in a broad range of areas. The ARC observed that even minor research institutions may be big players in some fields and that this may be obscured by consideration of overall size or performance in research.

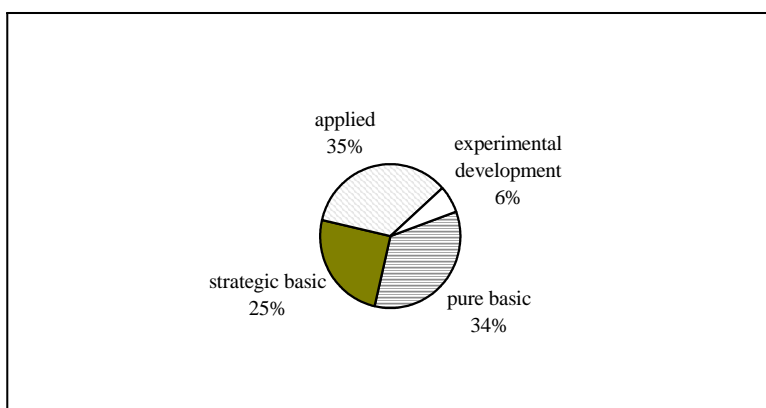
4.5 Issues which arose during the inquiry in relation to research undertaken in the university sector include:

- what research is being done?
 - pure basic, strategic basic, applied research or experimental development; and
 - field of research, which corresponds roughly to academic discipline.
- where is the research being undertaken?
- how is research infrastructure funded?

Categories of research

4.6 Pure basic research and applied research each account for about 35 percent of Australian university research expenditure, while strategic basic research accounts for 25 percent (see Box 8 below). However, 82 percent of all the pure basic research undertaken in Australia, and 44 percent of the strategic basic research, is carried out by universities. Universities account for 26 percent of Australia's applied research – reflecting the greater private sector role in that area.

Box 8: University research by type of activity



Source: ABS, Cat No. 8111.0, 1996, p. 10.

4.7 The major fields of research (that is, what is being researched) based on university disciplines in 1996 included:

- medical and health sciences (\$491 million or 21 percent);
- social sciences (\$446 million or 20 percent);
- biological sciences (\$286 million or 12 percent);
- humanities (\$184 million or eight percent); and
- general engineering (\$163 million or seven percent).²³²

4.8 The AVCC also noted the growing importance of multidisciplinary endeavours.²³³

4.9 Although the Committee found data for the 1990s in relation to higher education R&D was readily available, data prior to this does not appear to have been routinely collected and, where available, is not always comparable with present day data.

Recommendation 11:

4.10 The Committee recommends that the Department of Education, Training and Youth Affairs, the Department of Industry, Science and Resources and the Australian Bureau of Statistics continue to collect and analyse data annually on R&D in the higher education sector in such a way that comparisons over time and with the international arena are facilitated.

4.11 Further to the comments at pages 45 to 48, there is ongoing debate about the appropriate balance between basic research and research with more immediate benefits for economic growth. For example, the Australian National University (ANU) has stated that:

The argument that any additional funding should be directed principally to diffusion and commercialisation initiatives ignores the generative role of basic research...

There is a crucial distinction to be made between strengthening industry links and inducing university researchers to shift their activity towards applied and industry relevant research. The former is mutually beneficial but the latter is damaging in weakening the

232 DEETYA, *Selected Higher Education Research Statistics*, 1996, p. 5. See also comment by the Institute of Marine Engineers, submission no. 13.1.

233 AVCC, submission no. 49, p. 8.

*national competitiveness of and infrastructure for basic research.*²³⁴

4.12 The RMIT, however, argued that "...basic research is underfunded but outcome-driven research is even more so".²³⁵ The RMIT advocated a new scheme for outcome-oriented research, separate from the ARC grants process discussed at pages 79 and 80.²³⁶

4.13 Also, Mr Michael Rice (a Fellow of the Institution of Engineers) submitted that:

*...this country produces only about 2 per cent of the world's basic research. Consequently, the probability of indigenous basic research leading to breakthroughs for Australia is not very high... We need to do a certain amount of basic research to provide us with the skills to keep abreast of and to make use of overseas work. Whether that necessitates the support of basic research at a level that puts us among the world leaders is a moot point.*²³⁷

4.14 The balance between basic and applied research in the university sector needs to be reviewed on a regular basis. Presumably this matter will be raised again in the proceedings for the National Innovation Summit and in debate on the government's Green Paper on higher education research (pages 77 and 78 refer).

R&D funding

4.15 Sources of university revenue are: funds from all levels of government; fees and charges; investment income; donations and bequests; and the higher education contribution scheme (HECS).

4.16 Higher education expenditure on R&D (HERD) has steadily increased since 1988 (see Box 9 on the page opposite).²³⁸ In 1996, \$2.3 billion was spent which equates to 0.46 percent of GDP. Of the \$2.3 billion, 88 percent of universities' research funding was provided by the federal

234 ANU, *The Case For Additional Investment in Basic Research in Australia*, March 1999, p. 11.

235 RMIT, submission no. 24.1.

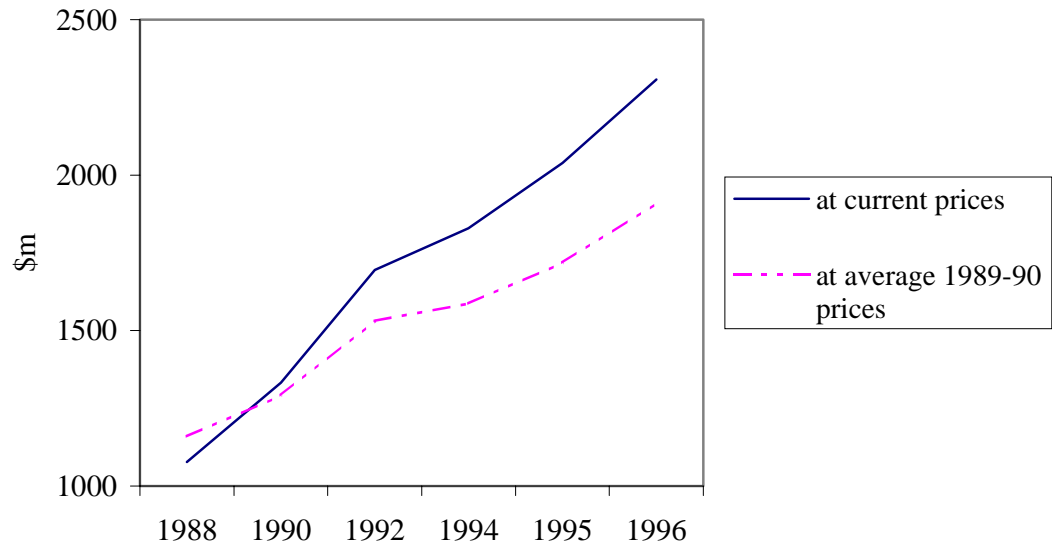
236 RMIT, submission nos. 24 & 24.1. See also Dr Paul van Saarloos, submission no. 23, pp. 1-2.

237 Mr Michael Rice, submission no. 50, p. 3. See also Mr George Poropat, submission no. 17, pp. 4-5.

238 ABS, *Research and Experimental Development, Australia, Higher Education Organisations* (Cat No. 8111.0), 1996, pp. 3 & 4 and The Hon John Moore MP, *Science and Technology Budget Statement 1998-1999*, p. 3.3.

government. Business enterprises provided five percent (\$121 million) and State and local governments provided a further two percent (\$51 million).²³⁹

Box 9: Higher education expenditure on R&D



Source: ABS, Cat No. 8111.0, 1996, p. 4.

Federal government funding

4.17 Universities receive federal government support for research through:

- operating grants;
- funds administered by the academic research councils (the Australian Research Council and the National Health and Medical Research Council); and
- other programs which provide funds directly or indirectly (government-sponsored industry R&D bodies in agriculture, energy and resources).

4.18 Since the advent of the unified national system, the level of operating grants to universities has dropped; however, universities now receive funding through HECS, while the level of targeted research grants (allocated principally on the advice of the academic research councils) has increased. This mirrors the trend observed in the higher education sectors of OECD countries generally.²⁴⁰

239 ABS, *Research and Experimental Development, Australia, Higher Education Organisations* (Cat No. 8111.0), 1996, pp. 11-13.

240 OECD, *Trends and Time Horizons in Research*, 1998, p. 177.

4.19 It should be noted, however, that in the decade since the implementation of the unified national system, annual new enrolments in higher education have expanded from 394 000 (1987) to 659 000 (1997)²⁴¹ – an increase from 31.7 to 46 people in tertiary education per thousand head of population.²⁴² According to the AVCC, universities are now being asked to do more with less:

Base operating grant funding has declined by 24.7% from 1988 to 1999 per planned equivalent full-time student unit (EFTSU). The HECS Scheme was introduced in 1989. In the same period, total funding for higher education per planned EFTSU, including operating grant funding and targeted research grants, fell by 12.9%.²⁴³

4.20 Sir Gustav Nossal informed the Committee that:

...the atmosphere and morale in universities is low. It is the tremendous pressure that has come from this relentless increase in the student to staff ratio, and the relentless increase in the competitiveness of the granting system occasioned by us essentially having twice as many universities as we had before.²⁴⁴

4.21 The distribution of funding across the sector is set out in Box 10 on the page opposite. Eight universities accounted for 62 percent of the R&D funds for universities in 1996, with the remaining funds spread between 30 other eligible universities.²⁴⁵

241 Mr Roderick West et al, *Learning For Life: Review of Higher Education Financing and Policy*, DEETYA, April 1998, p. 70 at <http://www.detya.gov.au/highered/hereview/toc.htm> (as at 23 July 1999).

242 Industry Commission submission to the West Committee at http://www.detya.gov.au/highered/hereview/submissions/submissions/I/ic_cont.htm (as at 23 July 1999).

243 AVCC, submission no. 49, p. 9.

244 Sir Gustav Nossal, Australian Academy of Science, transcript of evidence, p. 40.

245 DEETYA, *Selected Higher Education Research Statistics*, pp. 8-9. See also RMIT, submission no. 24.1.

Box 10: Distribution of government expenditure across universities

University	Total expenditure on R&D (\$ ' 000)
ANU	270 332
Melbourne	229 116
Queensland	215 661
NSW	193 243
Sydney	186 347
Western Australia	136 294
Monash	116 732
Adelaide	90 766
sub total	1 438 491
other universities	869 087
Total HERD	2 307 578

Source: DEETYA, *Selected Higher Education Research Statistics*, 1996, pp. 8-9.

4.22 As this report was being finalised the government released its Green Paper on higher education research, titled *New Knowledge, New Opportunities*.²⁴⁶ The key features of the Green Paper, as nominated by the government, are:

- an enhanced role for the ARC to provide strategic advice to government, and more flexible ARC programs with an improved focus on interdisciplinary research and, through a new series of program directors, a strengthened capacity to encourage industry links;
- research infrastructure as a component of research grants;
- as a precondition for funding, the preparation by universities of research and research training management plans "...to improve institutional planning and accountability";
- a new university block funding program, the Institutional Grants Scheme, to support research and research training and to encourage institutional diversity (this would absorb funding for the research

246 The Hon Dr David Kemp MP, *New Knowledge, New Opportunities*, DETYA, June 1999 at <http://www.detya.gov.au/highered/index.htm> (as at 23 July 1999). See also The Hon Dr David Kemp MP, "Kemp Announces Proposal to Reform Higher Education Research and Research Training" (media release), 29 June 1999 at http://www.detya.gov.au/ministers/kemp/june99/k5806_290699.htm (as at 23 July 1999). A number of the proposals in the Green Paper follow on from the earlier West Committee report.

quantum, as discussed at paragraph 4.26). Sixty percent of these funds would be allocated on share of student research places; the remaining 40 percent would be allocated on share of total research-related income from all sources, including consultancies and industry income; and

- an Australian Postgraduate Research Student Scheme, based on portable HECS-exempt scholarships for research degree students. A research grant would thereby be attached to a student rather than a university, allowing the student to move with the research funding (after one academic year of study) to another university.²⁴⁷

4.23 According to the Minister for Education, Training and Youth Affairs:

For too long many of Australia's best ideas have gone offshore to be developed by others. The reforms in this paper will help to build an entrepreneurial climate for Australian science and research, increase prospects of cross disciplinary research and develop collaborative links with industry...

*Australia is a small country in the global perspective. We cannot achieve everything across the broad spectrum of research activities. These proposals allow researchers to develop specific areas of strength and allow universities to develop higher profiles as centres of research excellence.*²⁴⁸

Operating grants

4.24 The major part of the federal government's support for university research and research training, approximately \$1.2 billion in 1999-2000, is provided through operating grants.²⁴⁹ These grants are funded as a lump sum under the *Higher Education Funding Act 1988* for a rolling three-year period. Universities have discretion over how they use operating grants to fund teaching, research training, research and infrastructure.

4.25 The level of the grant depends on a combination of each university's number of approved student places and its educational profile of teaching and research activities. This component of funding does not assess research capacity or quality of research – it is an input weighting device which

247 The Hon Dr David Kemp MP, *New Knowledge, New Opportunities* and "Kemp Announces Proposal to Reform Higher Education Research and Research Training"; and "Radical Revamp of Research Proposed", *The Australian*, 30 June 1999.

248 The Hon Dr David Kemp MP, "Kemp Announces Proposal to Reform Higher Education Research and Research Training".

249 For further details see Senator the Hon Nick Minchin, *Science and Technology Budget Statement 1999-2000*, p. 5.17.

recognises the higher costs associated with providing, for example, a science-based course compared to a business studies course.

4.26 Since 1990 the operating grant has included a component known as the “research quantum”. These funds are allocated to institutions on the basis of research performance as measured by the composite index, which is a weighted aggregate of funding-inputs to outputs such as research project publications and higher degree research completions. In 1999-2000 the research quantum will be approximately \$220 million.²⁵⁰

Competitive grants

4.27 Since the 1980s, it has been federal government policy to make research more relevant to Australia’s socioeconomic needs, to target specific research areas and to encourage industry funding of research. As a result, access to funding has become highly competitive.

4.28 The ARC is the main vehicle through which the federal government supports research carried out in universities, with the majority of universities’ targeted research funding allocated on the ARC’s advice. Requests for public health and medical research grants are assessed on a competitive basis by the National Health and Medical Research Council (NHMRC). Some of these grants are expended in universities.

Australian Research Council

4.29 The ARC’s mission is to provide advice on research funding and research policy, and to promote the conduct of research and research training “...of the highest quality for the benefit of the Australian community”. The ARC has special responsibility for research in the higher education sector, basic research and research training.²⁵¹

4.30 The ARC administers a variety of funds including:

- competitive research grants;
- postgraduate research awards;
- research fellowship awards; and
- collaborative grants.

250 For further comment see AVCC, submission no. 49, p. 9.

251 Senator the Hon Nick Minchin, *Science and Technology Budget Statement 1999-2000*, p. 5.19.

4.31 In 1999-2000 the budget for targeted research programs administered by the ARC is approximately \$357 million.²⁵²

4.32 Applications to the ARC are ranked through a process of peer review, with panels of Australian and international researchers assessing proposals. The major selection criterion is the perceived excellence of the proposed research but other criteria which may be taken into consideration are: potential economic or social benefit, training of researchers and contribution to international links.²⁵³

4.33 Some have criticised the ARC for not giving sufficient consideration during its funding deliberations to how research would contribute to Australia's economic performance.²⁵⁴ Another criticism of the system (as distinct from the ARC) is the high applicant failure rate occasioned by limited funding. The ARC was able to fund less than 20 percent of all 1996 grant applications, meaning that a large proportion of worthwhile research projects are not supported. It is neither possible nor desirable to fund every application for research in every field from the public purse. Nor is it desirable to fund a larger number of projects from the same budget for grants. However, the uncertainty created by the high failure rate of applications would appear to be a serious problem for the future of Australian research.²⁵⁵

4.34 In its response to *Priority Matters* and the West Committee report, the federal government reaffirmed the current practice of funding research through a variety of channels:

*... centralising the research effort to a high degree runs the risk of difficulties in balancing, internally, diverse and competing priorities. Rationalisation of administration to achieve efficiencies should be weighed against potential loss of administrative and research responsiveness to user demands. The Government recognises that a degree of competition between research groups and of alternative sources of funding is necessary and effective and supports the present pluralistic nature of its support for science and technology.*²⁵⁶

4.35 Data needs to be collected and outcomes analysed to ensure that the objectives that the government wishes to achieve are not being adversely affected by the diversity of grants.

252 *ibid.*

253 Industry Commission, *Research and Development*, p. 364.

254 See for example RMIT, submission no. 24, p. 5.

255 See AVCC, submission no. 49, p. 9.

256 Government response to *Priority Matters* at <http://www.disr.gov.au/science/cs/stocresp.html> (as at 10 February 1999).

National Health and Medical Research Council

4.36 The NHMRC provides essentially the same function as the ARC with respect to grants for public health and medical research. This type of research is funded through a separate body because such research is undertaken in a number of institutions other than universities, it has independent importance and the objectives differ significantly from those of the ARC.²⁵⁷ Approximately a quarter of Australia's total expenditure in this field is funded by the federal government.²⁵⁸

4.37 As noted in Chapter 3, public policy changes such as outsourcing have caused some difficulties for NHMRC-funded research in hospitals. The Committee has made a recommendation on this matter at page 70.

Funding of university research infrastructure

4.38 The government funds research infrastructure through the Research Infrastructure Program. A significant but not readily quantifiable amount is also provided by the private sector; this is particularly the case with the CRC program. The Research Infrastructure Program includes two elements – Research Infrastructure Block Grants and the Research Infrastructure Equipment and Facilities (RIEF) program. The RIEF funds are allocated on the advice of the ARC, and support:

*...relatively large scale initiatives which develop major research infrastructure on a cooperative basis across groups of institutions and with organisations outside the higher education sector.*²⁵⁹

4.39 The state of infrastructure and its funding were the subject of considerable evidence to the inquiry, as they have been over the last few years to other reviews. The following concerns have been raised:

- reduced funding for universities, together with unfunded salary increases, have led to funds previously earmarked for research infrastructure being required for salary supplementation;²⁶⁰

257 Industry Commission, *Research and Development*, p. 461.

258 An increase in the NHMRC's funding of \$614 million over the next six years was announced in the 1999-2000 federal budget. Forty-seven percent of the funding will go to universities in grants.

259 Senator the Hon Nick Minchin, *Science and Technology Budget Statement 1999-2000*, p. 5.22. See also AVCC, submission no. 49, p. 8.

260 NHMRC, submission no. 36, p. 3. The AVCC submitted that there is no evidence that universities have chosen to divert infrastructure funds to salary increases, and that in any case "...it would be a 'Sophie's choice' at best, given the erosion of federal funding to universities". AVCC, submission no. 49, p. 9.

- the quality of infrastructure is declining to the point where it is affecting the international competitiveness of Australian universities;²⁶¹
- the processes for allocating funding for infrastructure are not optimal – there is an imbalance between direct funding of research and funding for infrastructure;²⁶²
- funding available for research infrastructure is out of step with the level of research activity currently undertaken;²⁶³ and
- the crisis with infrastructure is making it difficult to attract high quality students.²⁶⁴

4.40 According to the AVCC:

*Total research infrastructure funding (including the Research Quantum) in 1999 has decreased by 4% compared to 1998, and will reduce a further 5% in 2000 and in 2001 compared to 1999, and by 6% in 2002 compared to 2001 – even after the inclusion of the \$93.3 million Coalition election commitment which has been confirmed in the 1999 Federal Budget...*²⁶⁵

4.41 In relation to the policy changes being investigated by the Committee, the University of NSW commented on the effect on infrastructure of shorter timeframes for the research required by privatised or corporatised utilities:

*Shorter time frames for the realisation of benefits in corporatised or privatised industries and an unwillingness to make long-term investments in research infrastructure and equipment has impoverished the facilities of leading research groups. This may well have long-term detrimental effects on the national research and development outcomes.*²⁶⁶

4.42 The Industry Commission's 1995 report on R&D canvassed options for infrastructure funding: the status quo, with institutions continuing to fund infrastructure from other income; or part of each ARC grant being quarantined to fund certain types of infrastructure (page 77 also refers).

261 See for example ANU, pp. 12-13. The ANU cites evidence that some research fields in which Australia had been internationally competitive have been abandoned due to lack of funding for research infrastructure.

262 Mr Roderick West et al.

263 *ibid.*

264 Professor Peter Cullen, FASTS, transcript of evidence, p. 69.

265 AVCC, submission no. 49, p. 8.

266 UNSW, submission no. 33, p. 2.

4.43 The West Committee report also raised higher education infrastructure funding as an urgent issue. It recommended an injection of funds not only to maintain funding at current levels but also to bring infrastructure to internationally competitive levels over three years.²⁶⁷

4.44 The Committee recognises that the funding of infrastructure is an urgent issue and that the best method of funding is difficult to determine. An audit to determine the state of university infrastructure and the level of its usage would be beneficial.

Recommendation 12:

4.45 The Committee recommends that the Department of Education, Training and Youth Affairs, further to its study of infrastructure funding under the Research Evaluation Program, undertake an audit to determine the state and level of usage of higher education research infrastructure.

Recommendation 13:

4.46 The Committee recommends that the Minister for Education, Training and Youth Affairs discuss with the Australian Vice Chancellors Committee the most appropriate methods of funding higher education research infrastructure.

Recommendation 14:

4.47 The Committee recommends that the government ensure that funding of higher education research infrastructure is discussed at the National Innovation Summit.

Non-government sources of funding

4.48 Industry funds universities' research to gain access to their specialised skills and equipment. This is essentially outsourcing by industry caused, in part, by the high cost of infrastructure and a lack of resident expertise, which the Committee was told is evident in some of the former publicly-owned enterprises.²⁶⁸

4.49 Industry funded five percent of university research (\$121 million) in 1996, which is consistent with the levels experienced in half the OECD countries.²⁶⁹ Research funded by industry is undertaken predominantly in the

267 Mr Roderick West et al, p. 163.

268 Professor Peter Cullen, FASTS, transcript of evidence, p. 66.

269 As reported in OECD, *Trends and Time Horizons in Research*, p. 175.

following fields: medical and health sciences, general engineering and biological, earth and chemical sciences.²⁷⁰

4.50 Many of the newer and smaller institutions are more heavily reliant on industry for their research funding than are the older universities. Before the implementation of the unified national system, the technology institutions did not receive federal government funding for research – they had developed networks with local industry which resulted in arrangements for research funding. This principle has in some cases been extended to alliancing arrangements with other universities. Where the alliances are with the larger and better funded institutions, one of the spin-off benefits is access to funding and research work through the larger institutions' national industrial contacts.

4.51 As discussed earlier, corporatisation and privatisation of former public sector utilities has presented difficulties for universities seeking funding for longer term research. Individual firms are unlikely to fund pure basic research, as it is very difficult for them to capture the benefits of that research. Utility industry associations do fund a limited amount of research, but there is no "open cheque book" and it is more likely to be pre-competitive research. Universities stated this "short-termism" creates difficulties in terms of their ability to offer continuing employment and therefore retain quality staff, and to train researchers.

Relationship between industry and universities

4.52 As noted earlier, access to ARC grants is competitive, with some 80 percent of projects rejected for funding. Universities are becoming increasingly dependent on other funding sources. Many universities have "commercial arms" to foster links with industry and the community – over 100 such entities now manage activities such as customer-driven courses, secondments and placements, invitations to serve on policy committees, the provision of support and assistance to projects, and assistance to academics with the commercialisation of new technologies.²⁷¹

4.53 In the context of the more competitive market in which utilities now operate, the ESAA stated that universities have often not been able to respond in a flexible manner, which has caused industry to seek out other organisations to provide a solution:

Traditionally a high proportion of R&D was carried out by universities with other organisations playing a lesser role. The rate at which projects need to be completed has altered that situation. In many cases it is no longer acceptable to wait for a PhD student to complete a project. Alternative

270 ABS, Cat No. 8111.0, pp. 14–15.

271 See for example Professors Trevor Cairney and Jane Marceau, UWS, transcript of evidence, pp. 111-119.

*organisations can bring together the necessary skills and generally deliver the required product much more quickly than universities.*²⁷²

4.54 This was acknowledged by the President of the Australian Academy of Science, Professor Brian Anderson:

*I think it is often the case that short-term issues can be drivers in the commercial world. Universities by their nature tend to look at longer-term research problems rather than short-term research problems so I am not surprised that if there is a short-term problem facing the industry it may have some difficulty getting a university to handle it.*²⁷³

4.55 The AVCC cautioned that:

While it is agreed that both universities and industry would benefit from a more conscious and strategic approach to cooperative activities and cross-fertilisation, it needs to be stressed that the agendas of universities and industry do not necessarily, nor should they, coincide.

*Government supported programs and initiatives ... are designed to maximise the benefit of these differences. These schemes have, on the one hand, pushed university researchers to think about the commercial potential of their work, and on the other hand, encouraged industry to pursue innovation that at times requires considerable technical risk and often longer time frames.*²⁷⁴

4.56 When research is undertaken by a university on behalf of a private client, the results may not come into the public domain. This is particularly the case where a corporatised or privatised utility is expected to appropriate fully the research results to position itself better in the market. There may also be uncertainty as to who owns the intellectual property – the university or the customer.²⁷⁵

4.57 There are two very different organisational cultures operating in this R&D environment. While it may be reasonable for universities to adopt a more commercial approach to managing contract research, such matters should be negotiated early between the parties.

272 ESAA, submission no. 40, p. 3.

273 Professor Brian Anderson, Australian Academy of Science, transcript of evidence, p. 202.

274 AVCC, submission no. 49, p. 10.

275 See for example The Water Corporation of Western Australia, submission no. 47, p. 3 and Mr Keith Orchison, ESAA, transcript of evidence, p. 162 & p. 164.

4.58 Links between universities, government research bodies and industry are taking place in the context of considerable economic change:

*In the 1990s the justification for R&D spending moved away from strategic planning into the area of immediate cost savings. [The] advent of the competitive market has almost eliminated cooperative R&D funding, stranding the university research groups which had been nourished by it.*²⁷⁶

*It is always relatively easy to criticise university research as being too fundamental and remote from the needs of industry. Whilst public policy reform has forced on university researchers an increasing recognition of the needs of corporatised and privatised industries that were formerly in the public sector, there is now a very real dearth of public sector support for research of the type that will lead to long term solutions to major problems.*²⁷⁷

Formal linkage programs

4.59 Increased university-industry-government collaboration has in recent years been a priority of federal governments. Major programs of the 1980s and 1990s which have encouraged a collaborative research culture include the CRC program, discussed in Chapter 2, and the Strategic Partnerships with Industry Research and Training (SPIRT) scheme.²⁷⁸ These schemes are similar, in that they focus on enhancing research capacity and linking university research with industry. However, the latter scheme is more project-specific.

Strategic Partnerships with Industry Research and Training

4.60 The SPIRT scheme was established in 1998, incorporating the former Collaborative Research Grants and other schemes. SPIRT supports research collaboration between universities and industry, with the government providing funds on a dollar-for-dollar basis with industry collaborators.

276 ESAA, submission no. 40, p. 3.

277 UNSW, submission no. 33, p. 2.

278 Discussion on other sources of funding which support linkages may be found elsewhere in this report. One program not mentioned elsewhere is the Technology Diffusion Program (TDP), which “supports activities aimed at building international science and technology links, domestic science and industry alliances, and initiatives in technology diffusion”. See Senator the Hon Nick Minchin, *Science and Technology Budget Statement 1999-2000*, pp. 2.6-2.7, p. 5.43 & p. 5.47.

4.61 Industry partners are expected to provide over \$38.8 million in cash and kind for SPIRT projects commencing in 1999. Commonwealth funding will be approximately \$57.3 million in 1999-2000 and will increase by \$58.1 million over the next three financial years.²⁷⁹

Research Centres

4.62 A total of \$20.5 million is being provided to Research Centres in 1999-2000. Two types of centres are supported:

- *Special Research Centres* are established on the basis of research excellence “and their potential to contribute to the economic, social and cultural development of Australia”. The Centres are funded as recognised sources of expertise that promote co-operative links with government, industry and relevant communities. Funding of \$14.7 million is being provided to 19 Special Research Centres in 1999.
- *Key Centres of Teaching and Research*, as the name implies, give equal weight to teaching and research. They are based in existing university departments and “aim to boost expertise in areas relevant to national development and to promote co-operation between the higher education sector and industry”.

Key Centres receive an average grant of \$360 000 a year, but most obtain additional funding from other sources. Funding of \$5.5 million is being provided to 16 Key Centres in 1999.²⁸⁰

279 *ibid*, pp. 5.19-5.20; the Hon Dr David Kemp MP, *Higher Education Report for the 1999 to 2001 Triennium*, DETYA, March 1999, p. 145 at http://www.detya.gov.au/highered/otherpub/he_report/1999_2001.htm (as at 26 July 1999) and “\$93.3 Million for Higher Education Research” (media release), 11 May 1999 at http://www.detya.gov.au/ministers/kemp/may99/kB14_110599.htm (as at 26 July 1999); and AVCC, submission no. 49, pp. 9-10.

280 Senator the Hon Nick Minchin, *Science and Technology Budget Statement 1999-2000*, p. 5.21.

Employment

4.63 The major output of universities is educated graduates, trained researchers and specialised technical and professional personnel. In terms of course completions, the numbers have grown as shown below.

Box 11: University course completions by level - 1987 to 1996

Year	Undergraduates		Postgraduates	
		% increase		% increase
1987	62 089	-	18 168	-
1988	66 097	6.5	20 762	14.3
1989	69 169	4.6	21 313	2.7
1990	72 368	4.6	22 097	3.7
1991	80 416	11.1	27 145	22.8
1992	90 019	11.9	30 567	12.6
1993	98 079	9.0	34 781	13.8
1994	102 022	4.0	36 932	6.2
1995	102 233	0.2	38 713	4.8
1996	101 707	-0.5	43 626	12.7

Source: DEETYA Annual Reports for 1996–97/1997–98.

4.64 Within four months of completing their degrees in 1996, 79 percent of first degree graduates were in full time employment.²⁸¹ There are, however, marked differences between different fields of study in both the post-course full time employment rate and the proportion of students continuing with further study. More than 90 percent of available graduates from the health-related disciplines were in full time employment, compared to 72 percent of science graduates and 86 percent of engineering graduates. Only six percent of graduates from health-related disciplines continued with postgraduate study compared to 40 percent of science graduates and nine percent of engineering graduates²⁸² (this last figure refers to engineering

281 Graduate Careers Council of Australia, "Graduate Employment" (media release), 16 June 1998 at <http://www.gradlink.edu.au/gcca/mediafrm.htm> (as at 26 July 1999). Percentage applies to Australian residents available for full time employment.

282 DEETYA, *Annual Report 1997–98* at http://www.deetya.gov.au/publications/annual_reports/9798/09_Higher_Education.htm#HigherEducation (as at 10 February 1999).

graduates who proceed *immediately* to post-graduate study; approximately 30 percent of engineering graduates now complete postgraduate studies in engineering at some time).²⁸³

Science and engineering

4.65 The bulk of evidence available to the Committee related to science and engineering graduates, most of whose jobs are not in R&D. In the 1998 DEETYA study, *Supply and Demand for Scientists and Engineers*, it was found that although there is some evidence of oversupply of graduates with training in certain scientific disciplines, overall a major imbalance between supply and demand did not exist (a finding disputed in evidence to the inquiry).²⁸⁴

4.66 Reasons for the higher proportion of scientists continuing on to further study include: the necessity to acquire more knowledge and skills in order to obtain employment in their chosen field, decreased job opportunities or the availability of places for postgraduate study. Further study may merely result in moving prospective unemployment to those with higher degrees. The University of NSW stated:

*Students completing a first degree in Australia's universities would not now see opportunities to arise from further study at the postgraduate level in a range of important scientific and technological areas.*²⁸⁵

4.67 The Academy of Technological Sciences and Engineering believed one of the major reasons for funding university research to be the provision of a training ground for the more commercially oriented research carried out in industry.²⁸⁶ Mr Laver of the Academy stated:

The problem is that we are still training the researchers, but the number of jobs that are available in the community for researchers is certainly not expanding at any great rate.

283 Mr Michael Rice, submission no. 50, p. 3.

284 S. Borthwick and T. Murphy, *Supply and Demand for Scientists and Engineers*, DEETYA, Analysis and Evaluation Series 98/4, p. 3. Mr Michael Rice submitted that "...the conclusion does not seem to be justified in terms of the number of science graduates in the labour market as against the number of persons employed in scientific occupations... At least another 50,000 natural science graduates will be added to the labour force over the next 5 years, while the scientific work force will not increase proportionately". Mr Michael Rice, submission no. 50, p. 4.

285 UNSW, submission no. 33, p. 3.

286 Mr Peter Laver, Academy of Technological Sciences and Engineering, transcript of evidence, p. 14. This view was questioned by Mr Michael Rice, submission no. 50, p. 3. See also discussion of research training in the Hon Dr David Kemp MP, *New Knowledge, New Opportunities*.

*This will act as a deterrent to other people wanting to take that route.*²⁸⁷

4.68 The University of NSW and the Royal Australian Chemical Institute expressed concerns about the effect on national capacity of a reduction in the number of those training as researchers:

*UNSW is finding that fewer students are presenting themselves for training in research in scientific and technological areas. Job opportunities are now seen to be reduced and students are choosing alternative career paths that do not include research. This is to the national detriment.*²⁸⁸

*In some areas – often involving the “hardest subjects” e.g. mathematics, physics and chemistry, we are facing a “loss of capacity” which would be very costly and time consuming to address.*²⁸⁹

4.69 The Committee was often told that an impact of public policy changes over the last four or five years has been a scientific and technological deskilling of utilities. The DEETYA study on scientists and engineers found that the reduction of:

*...employment opportunities in the public sector [has] meant the loss of some training opportunities, since recent graduates in engineering frequently worked for three to five years in the public sector before moving to the private sector.*²⁹⁰

4.70 As noted in Chapter 2, the research community is concerned about the implications of the sale of utilities overseas for employment opportunities for researchers and the ability to develop solutions to problems unique to Australia. Also, many research projects have shorter time frames or receive funding for short periods before a further application is necessary. FASTS stated that this had affected the nature of jobs offered in research:

Careers in research have been curtailed by a number of factors operating within the university sector. When new positions arise in research organisations they are

287 Mr Peter Laver, Academy of Technological Sciences and Engineering, transcript of evidence, p. 14.

288 UNSW, submission no. 33, p. 3.

289 Royal Australian Chemical Institute, submission no. 34, p. 4.

290 S. Borthwick and T. Murphy, p. 11. The reduced employment opportunities reflect reduced employment generally in the entities affected by the policy changes being investigated by the inquiry. See Productivity Commission, *Inquiry into the Impact of Competition Policy Reforms on Rural and Regional Australia*, Draft Report, pp. 107-108, pp. 126-7, p. 144 & p. 165.

*frequently offered on a casual or short-term contract basis, reflecting the short-term nature of industry's commitment to research.*²⁹¹

4.71 The Committee agrees with the AVCC that data should be collected on changes in employment patterns resulting from public policy changes.²⁹² The Committee commends this to governments, further to Recommendation 9 (on the need for governments to retain in-house expertise; see page 69).

4.72 In summary, the major forces which have changed the pattern of research activity in Australian universities include the restructure of the higher education sector in 1987, the increased take-up rate of higher education, and the growth of competition and commercialisation within the sector. The amount of funding for research and its associated infrastructure, the method of assessing grants and distribution of funding across the sector all need to be carefully considered to ensure that national objectives are being achieved.

4.73 Although there is evidence that public policy changes (such as the corporatisation and privatisation of public utilities) have affected the amount and type of research undertaken in universities, it is difficult to separate this from other factors.

291 FASTS, submission no. 26, p. 3.

292 AVCC, submission no. 49, p. 11.