Submission to

House of Representatives Standing Committee on Science and Innovation
Inquiry into Business Commitment to Research and Development in Australia

by

Emeritus Professor Murray Gillin A.M.
and
John Yencken
Australian Graduate School of Entrepreneurship
Swinburne University of Technology

Scope

This submission relates to

1. two elements of the Inquiry:
   - The R&D drivers in small and medium business
   - The needs of fast growing companies
2. two of the questions:
   - What are the impediments to business investments in R&D?
   - What steps need to be undertaken to better demonstrate to business the benefits of higher private sector investment in R&D?

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Propositions

1. Australia needs to place more emphasis , in both policy and support systems, on improving Australia's technology absorptive capacity, that is the ability to exploit new knowledge, as opposed to investment solely focused on government R&D investment to generate new knowledge.
2. Technology absorptive capacity is directly related to the proportion of research scientists and engineers employed by business as a proportion of the total number of research scientists and engineers in the country. For Australia, this is very low.
3. Low R&D investment by business, except for the agriculture and mining sectors, is primarily structural rather than attitudinal (Gregory 1983).
4. For existing SMEs, the focus should be on building more and better linkages both between firms to fund research on common problems (as for example the Australian Minerals Industry Research Association) and involving universities and other public research agencies.
5. Most SMEs are basically low-tech enterprises. There is a need for skilled intermediaries to act as *surfactants* with ability to work in the *good oil* of the research provider and the weaker technology literacy of the research user. Mechanisms such as industry associations and the use of E-commerce should be encouraged and supported in this role.
6. The CRC and similar Programs, where there is collaboration between research users and research providers, with the users involved in the project selection process, have resulted in significant increases in both user awareness of R&D investment needs and increased research user R&D investment.

7. The rate of R&D investment per employee in new high tech start-up spin-offs from universities and other public research agencies is significantly higher than in existing SMEs. Such new ventures therefore make a significant contribution to R&D investment and hence to technology absorptive capacity. They should therefore be encouraged and supported.
8. The critical areas of support needed to generate more successful spin-offs and other university derived start-ups include:
    - Adequate internal support by the research provider agency and dedicated funding for this resource
    - Access to government programs such as COMET and particularly pre-seed funding
    - A taxation environment that encourages *first investors* such as business angels (not just venture capitalists) in such ventures

Technology absorptive capacity and business R&D (BERD)

The OECD report on *Benchmarking Industry-Science Relationships* (OECD2002 p.37 Fig. 6) identifies *Size of R&D and Absorptive capacity* as key factors for business enterprises in assessing and benchmarking industry-science relationships. The recent interest in absorptive capacity, that is the ability to exploit new knowledge for commercial opportunities, started from the quantitative analysis of R&D intensity, innovation opportunity and appropriability by Cohen (1995) and Cohen and Levinthal (1989). They suggested that absorptive capacity is *largely a function of the firm's level of prior related knowledge*. Reinhard (2000) more succinctly defines absorptive capacity as *the capability of a business to identify external knowledge, to take it up and to utilise it as learning.* Cohen and Levinthal (1990) commented (p.2) that *...research shows that firms that conduct their own R&D are better able to use externally available information (e.g., Tilton, 1971; Allen, 1977; Mowery, 1983). This implies that absorptive capacity may be created as a by-product of a firm's R&D investment.* Implicitly the ability to absorb and exploit new knowledge is the key factor in the entrepreneurial propensity of new high-tech ventures (Yencken and Gillin 2000a).

There has been not only regular comment that absorptive capacity is primarily determined by internal R&D investment, but quantitative proof that this is so:

- ...firms are found to be more frequently engaged in *(external)* R&D cooperation the more they spend on internal R&D (Veugelers 1997)
- ... in-house R&D positively affects the ability to extract knowledge from R&D cooperation (Cusmano 2000 p.26).

Lankhuisen (1998 p.14) in her econometric analysis of the roles of absorption capacity and human capital for the ability of national economies to "catch up" concluded that the greater the share of total Research Scientists/Engineers (RSEs) human capital involved in business internal R&D, the greater the absorptive capacity of the country.

Table 1 shows OECD comparisons of the ratios of expenditure between government R&D expenditure and business R&D expenditure (BERD) in Gross Domestic Expenditure on R&D (GERD). In 1998, for the countries listed, Australia had the second lowest BERD as a percentage of GERD—at 45.1 per cent of GERD. Only New Zealand was lower.

The business funded R&D base overall is poor, but varies across sectors. Gregory (1993), as quoted earlier, showed that Australia's R&D investment in agriculture and mining was high by world standards. He makes the point that the low level of BERD in other sectors is primarily structural rather than attitudinal and relates to the high

proportion of Australian manufacturing businesses that are subsidiaries of multinationals with a natural tendency to do their R&D closer to home.

Table 1. OECD comparative BERD and GERD expenditure relationships

Country	*GERD as % of GDP*	*GERD as per capita at current US$*	*Government ERD as % of GDP*	*BERD as % of GERD*
United States	2.65	893	0.84	75.7
Sweden	3.70	774	0.77	74.8
Ireland	1.39	296	0.29	73.1
Switzerland	2.73	685	0.69	70.7
Finland	3.09	707	1.05	69.3
Germany	2.38	563	0.82	68.6
United Kingdom	1.83	396	0.67	65.8
France	2.17	460	0.96	63.1
Canada	1.58	419	0.36	63.0
Netherlands	1.95	471	0.79	54.2
Italy	1.04	231	0.58	53.8
Spain	0.90	164	0.59	51.5
Australia	1.49	361	0.56	45.1
New Zealand	1.13	199	0.57	28.2

Source: Yencken and Gillin 2002a, based on *OECD in Figures . Research and Development. 1998. Table 1.*

Evidence from recent case studies of spin-off companies from public research agencies (Yencken and Gillin 2002b) show such companies to have an ongoing expenditure on R&D per employee very much higher than that of established companies. Encouragement of such spin-off start-up business generation will contribute therefore to national technology absorptive capacity.

The importance of linkages with research providers

> A pilot study comparing Industry/Science Relationships (ISRs) in France and the United Kingdom was undertaken to develop and test a conceptual framework and a methodology for such meaningful and policy relevant benchmarking...One of its important findings is that social networks, as shaped by the education system, exert a strong influence on the national patterns of ISRs (OECD *Benchmarking Industry Science Relationships*).

Improving *the relations developing in a regional context between firms looking for shorter-term problem solving capabilities* relates on the one hand to the capabilities of enough such firms to identify their technological problems and to have the internal technical resources needed to exploit effectively the new knowledge so gained, and on the other hand to increase the interest of academic researchers to build external relationships. Estimates in Australia and Scotland suggest that only about one third to one half of such researchers are so interested. Recent university policies on external consultancies relating to competitive neutrality and to avoid legal liability while organisationally necessary, do not encourage academics to build external relationships.

> A key element of the transformation of the higher education sector in Asia-Pacific Economic Cooperation (APEC) members is recognized to be cooperation between higher education institutions and business enterprises (Turpin et al 1996).

There are interesting differences in the Australian and European experience of enterprise involvement in cooperative linkages, R&D related or innovative. In a recent Australian

innovation survey of SMEs (Yencken et al 2001 p.32), only four per cent of *respondents reporting any type of innovations* reported cooperative linkages that had universities or other research organisations as partners. Cusano's (2000 Figure C5 p.43) analysis of cooperative linkages for realised joint ventures (RJVs) in the European Union (EU), based on analysis of data for 3780 such RJVs in the 3rd and 4th Framework EU Programs, showed that 62 per cent of these linkages involved universities and only 17 per cent were firm-to-firm only.

Attitudes of SMEs

A survey reported in the Yellow Pages ® Special Report Innovation (February 2001 < http://www.sensis.com.au/Internet/small_business/ypbi/smeiypbisr_022.pdf;jsessionid=0YWWQIAAAAK23S0Z2WSSELY>), involving 1800 small and medium sized businesses, showed that :

> Attitudes to innovation were generally positive. However there was a significant relationship between those SMEs saying they *cannot afford the investment needed for innovation* and those saying *they were* not innovative at all (p.6).

In order of importance the top structural or *supply* side factors that encouraged innovation (and relatedly, investment in R&D) were:

1. The skills base of the business
2. Access to technology
3. The extent to which competitors are innovative
4. The extent to which a business's competitors have an advantage over them
5. Ease of access to research organizations.

Three of these factors (1,2,5) relate to technology absorptive capacity.
Demand side factors that encouraged innovation included projected sales (innovations and existing products/services), current profit and sales performance and net assets position. These clearly related to the competitive and financial aspects of the business.

This Special Report found the six key structural factors that discouraged innovation were related to the supply side, in order of declining severity as:

1. taxation system
2. legal system
3. cost of training and hiring trained staff
4. cost of research and innovation
5. cost of technology.

These factors primarily related to the operating environment and were largely out of control of the business itself. This analysis suggests that it is to these areas that government policy initiatives might be directed.

Challenges for Australia to improve its business R&D investment and technology absorptive capacity

1. Increase the rate at which new high-tech small firms are created and survive.
2. Ensure that finance is available at pre-seed and first investor or business angel stage for ongoing technology development by such firms.
3. Develop a taxation system that does not penalize capital and valuation growth for new high-tech, high-growth ventures.
4. Bring the legal system for acquisitions and takeovers into line with overseas standards.
5. Increase the participation of existing businesses to invest in cooperative ventures, such as the CRC program, and in linkages with universities.
6. At State level, support the creation of local SME networks cooperating in technology needs and problem identification, such as the earlier productivity groups or present AMIRA.

7. Facilitate and fund the use of incubator resource people to also act as case managers for technology improvement in existing SME businesses. This done well in Europe.
8. Remove barriers and increase incentives to academic researchers to build relationships with existing companies for new technology and problem solving access.
9. Facilitate and increase the support for university staff and students to set up their own high-tech businesses and encourage entrepreneurial education at school and undergraduate level.

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Diane Walden
Office Secretary
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