
Research and Development Investment by Australia's Leading Businesses – A Survey of BCA Member Companies

Business
Council of
Australia



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Foreword

The Business Council of Australia (BCA) is an association of Chief Executives of the top 100 companies.

The Council was established in 1983 to provide a forum for Australia's business leadership to contribute directly to public policy debates in order to build a better and more prosperous Australia.

The vision of the BCA is to make Australia the best place in the world to live, learn, work and do business.

Fifty years ago, economies were ranked primarily in terms of raw industrial output and access to financial capital. Today we are part of a global economy which increasingly values knowledge and requires the application of knowledge to ensure innovation and increased productivity.

It is essential to recognise that companies achieve innovation success through a range of strategies including capital investment, process reengineering, and research and development.

There is a need to broaden the debate on innovation. The main focus of the debate should be whether businesses in Australia are able to maximise the potential level of innovation within their companies.

Appropriate judgement on this issue rests not on whether Australian businesses are spending relatively more or less on research and development than businesses from other countries, but rather, on an assessment of the effectiveness of the innovation process.

This survey of BCA Members aims to shed light on the commercial imperatives that guide large companies when they invest in research and development. The survey confirmed the companies undertook research and development to support business growth, that is, to:

- capture or maintain market share;
- benefit from emerging technologies; and
- find new markets through the development of new products and services.

Twenty respondents spent \$768 million on R&D in 2002/03, representing at least 10 per cent of total business expenditure on research and development (BERD).

Respondents, on average, spent most of their funds using in-house expertise, but directed around \$100 million of research and development expenditure to universities and publicly-funded research institutions.

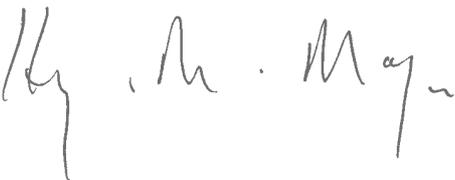
While the survey confirmed the significant research and development efforts of Australia's largest companies, the report also indicated that for many companies their innovation is not through traditional research and development spending.

Increasingly, this innovation is about process adaptation, workplace reorganisation, applications of new technologies or the outcome of capital investment in new plant and equipment.

There is a need to ensure public policy decisions in areas as diverse as workplace relations, the operation of financial markets and business regulation do not inhibit the capacity of business to innovate cost-effectively in line with their business strategy.

Under the next stage of its innovation policy program, the BCA will examine how well business innovation is supported by current public policy frameworks.

Copies of *Research and Development by Australia's Leading Companies* are available at www.bca.com.au.



HUGH MORGAN
President, Business Council of Australia

Executive Summary

Business innovation is a critical contributor to company productivity and competitive advantage.

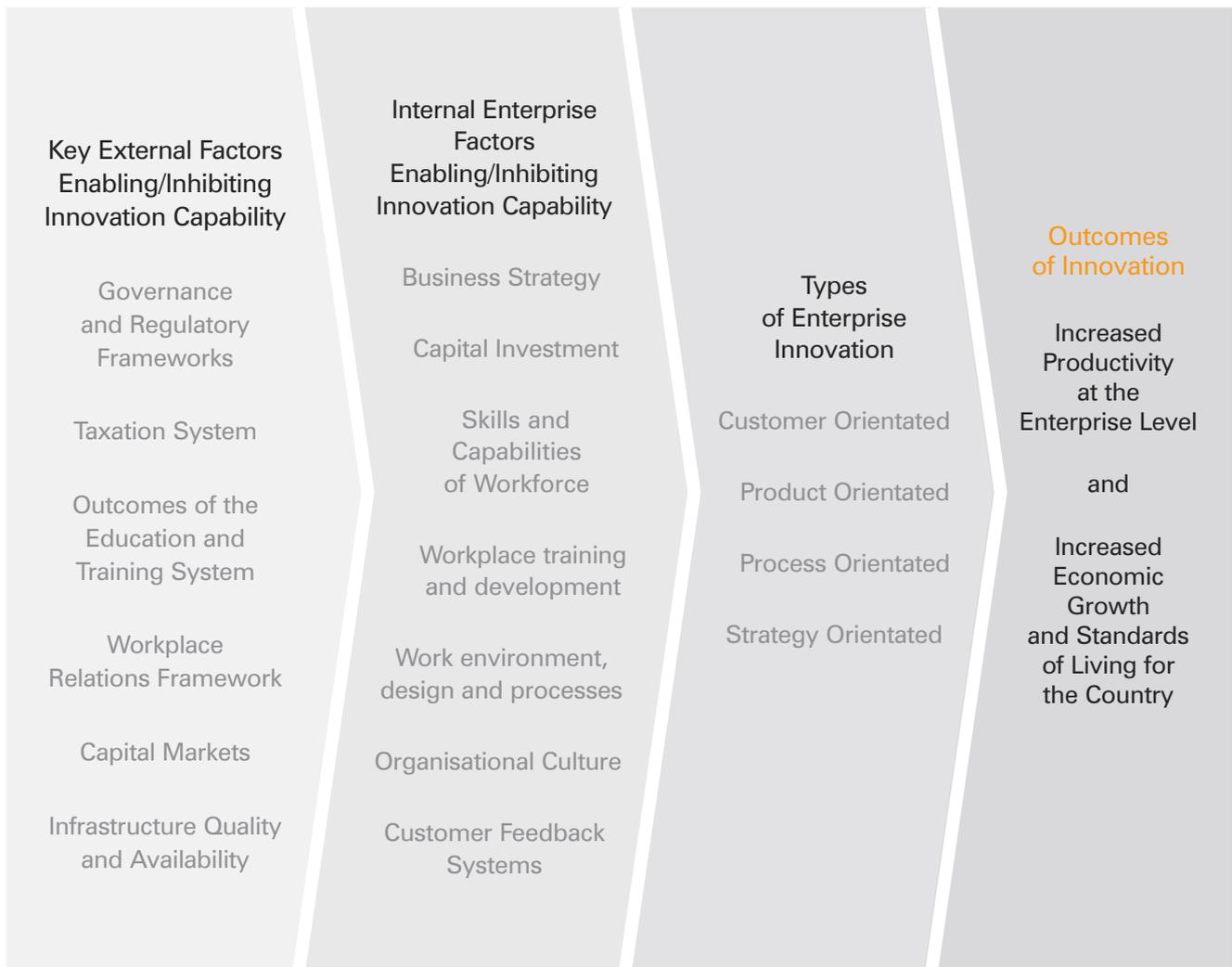
The core of innovation is putting new ideas into practice and achieving commercial success with them. It can include breakthrough ideas that lead to brand new products and services or incremental ideas that contribute to ongoing improvements in any aspect of the business.

Companies can achieve innovation and productivity success through a range of mechanisms such as their business strategy; work organisation; financial systems; management practices; logistics management; capital investment; process reengineering; and research and development. All of these factors are impacted by public policy as indicated in the diagram 'Ensuring Innovation Capability and Productivity Growth' (page 6).

In light of this, there is a need to broaden the debate on innovation and ensure public policy decisions in areas as diverse as workplace relations, the operation of financial markets and business regulation do not inhibit an enterprise's capacity to innovate cost-effectively in line with its business strategy.

The BCA currently has a number of projects underway to consider the factors affecting innovation in member companies. The first stage of work is this survey of BCA Members to shed light on the commercial imperatives that guide large companies to invest in research and development.

Ensuring Innovation Capability and Productivity Growth





Executive Summary

Between them, BCA Companies – Australia’s largest companies – employ nearly a million people throughout Australia, have annual total revenues in excess of \$338 billion, account for one-third of Australia’s total export revenue and play a major role in the financing of government and the provision of government services and infrastructure through the payment of taxes and charges.

The survey confirmed the companies undertook research and development to support business growth, that is, to:

- capture or maintain market share;
- benefit from emerging technologies; and
- find new markets through the development of new products and services.

Between them, the respondents to the BCA survey undertaking research and development in 2002-03 accounted for at least 10 per cent of total business expenditure in research and development (BERD). Twenty companies spent in excess of \$768 million during that period including over \$100 million expended in universities and publicly-funded research institutions.

It is also apparent from the historical data provided by 13 of the companies that the level of research and development investment has been increasing, with the median increase in research and development expenditure in these companies from the previous financial year being 8.7 per cent. Modest to substantial increases in research and development spending in the future are anticipated by 64 per cent of respondents.

Results of the survey indicate that research efforts are focused on the core business operations of companies, and are concentrated in information and communication technologies, resources and materials engineering, and manufacturing, mechanical and electrical engineering.





Executive Summary

Furthermore, BCA Member Company expenditure on research and development has a primary emphasis on experimental development, and a proportionally higher level of investment in applied research than is the case for all businesses in the Australian Bureau of Statistics BERD survey.

There are some interesting differences across industry sectors in the survey results suggesting a greater focus on applied research in the mining and manufacturing sectors, and experimental development in the communications services and finance and insurance sectors.

These results suggest that firms in industries where Australia is a global leader in innovation are more likely to undertake original investigation because they have a comparative advantage in undertaking such research, while companies in industries where Australia is not at the technological frontier find it more appropriate to develop new products, services and systems from existing, often imported, knowledge.

The respondents identified relative cost of research to benefit, lack of resource availability, and access to internal finance (given competition from other business investments), as the main inhibitors of investment in research and development.

Responses from some foreign-controlled businesses suggest that the cost of research and development activities in Australia relative to the rest of the world is a major inhibitor, as is access to particular skills, while some foreign-controlled respondents noted that a lack of international awareness of Australia's research capabilities is also a major factor preventing further investment in research in Australia.

Around one-third of respondents undertook some of their research and development activities overseas, however, the level of investment is relatively small. 'Proximity to expertise' is by far the most critical factor when considering international research and development activities. The proximity of research facilities and intellectual property were other factors that were nominated as relatively important by respondents.

The survey highlighted that 28 per cent of respondents have undertaken commercialisation exercises with universities and 20 per cent with publicly-funded research institutions. Sixty-three per cent of these respondents rated this commercialisation experience as 'successful' or 'very successful'.





Executive Summary

While the survey confirmed the significant research and development efforts of Australia's largest companies, the report also indicated that for many companies their innovation is not through traditional research and development spends as measured by BERD.

The main drivers of research and development investment decisions identified by respondents suggest that businesses understand the long-term commercial benefits of investing in research and development activities. The survey shows that businesses allocate their research and development expenditure to activities that provide the greatest innovation benefits.

Where innovation can be achieved through other forms of investment more cost-effectively such investments will be pursued.

Increasingly, innovation is about process adaptation, applications of new technologies or the outcome of capital investment in new plant and equipment.

The challenge is to ensure that public policy frameworks support such approaches to innovation. Under the next stage of its innovation policy program, the BCA will examine how well business innovation is supported by current public policy frameworks.



Summary of Findings

Business innovation should be measured by its effect on company productivity.

BCA Members predominantly invest in research and development to capture or maintain market share; to benefit from emerging technologies; and to find new markets through the development of new products and services.

Twenty respondents spent \$768 million on R&D in 2002/03, representing at least 10 per cent of total business expenditure on research and development (BERD).

Respondents indicated an average spending increase on R&D of 8.7 per cent compared to the previous year.

Business strategy drives the decision to invest, although the Government policy environment remained relevant for more than half of respondents.

Investment decisions are made primarily at the Board or senior management level.

Research and development is concentrated heavily in the information and communication technologies, resources and materials engineering, and manufacturing, mechanical and electrical engineering sectors.

Respondents, on average, spent most of their research and development funds using in-house expertise.

Respondents directed around \$100 million of external research and development expenditure to universities and publicly-funded research institutions.

Access and proximity to research skills and expertise was considered important, in particular for companies with foreign-controlled parent organisations, many of which direct funds overseas if suitable skills cannot be found locally.

Government policies should continue to focus on maintaining a robust, flexible and strongly growing economy which in turn will provide the environment for business investment including research and development investment.

The current arrangements for the R&D tax concessions may need to be reviewed to ensure they target the appropriate stages and types of R&D expense to effectively address cost issues.

Increasingly, innovation is about process adaptation, applications of new technologies or the outcome of capital investment in new plant and equipment, rather than investment in research and development.

Public policy frameworks must support broad approaches to innovation.

Introduction

The Business Council of Australia (BCA) has a strong interest in encouraging innovation in Australia. In a global economy which increasingly values knowledge, the fostering of world-class education, skill development and innovation in Australia is essential for the enhancement of our competitiveness.

Companies can achieve innovation and productivity success through a range of mechanisms such as their business strategy, work organisation, financial systems, management practices, logistics management, capital investment, process reengineering and research and development.

The BCA currently has a number of projects underway to consider the factors affecting innovation in member companies. The first stage of work is this survey of BCA Members to shed light on the commercial imperatives that guide large companies investment in research and development.

In addition to information on the amount and type of research and development (R&D) expenditure being undertaken by BCA Member Companies, this report

attempts to look at issues such as processes around the determination of R&D budgets, drivers and inhibitors of R&D spending, factors surrounding decisions to internationalise R&D activities and the extent of R&D collaboration and commercialisation by Members.

While the survey confirmed the significant research and development efforts of Australia's largest companies, the report also indicated that for many companies their innovation is not through traditional research and development spending as measured by BERD.

The main drivers of research and development investment decisions identified by respondents suggest that businesses understand the long-term commercial benefits of investing in research and development activities. The survey shows that businesses allocate their research and development expenditure to activities that provide the greatest innovation benefits.

Where innovation can be achieved through other forms of investment more cost-effectively, such investment will be pursued.

Overview

2.1

Overview of Business R&D Expenditure in Australia

Business expenditure on R&D (BERD) in Australia was approximately \$6 billion in 2002-03. Over the last twenty years, BERD in Australia has grown strongly as a percentage of GDP from 0.25 per cent in 1981-82 to 0.79 per cent of GDP in 2002-03.¹

Business investment in R&D is heavily focused on the traditional areas of engineering associated with the manufacturing and mining industries (accounting for approximately 40 per cent of BERD in 2002-03). However, since the early 1990s there has been relatively strong growth in BERD in services, particularly in computing and information and communication technology (ICT) services, which now account for approximately 30 per cent of expenditure.

BERD in Australia is also skewed towards expenditure on experimental development (ie. the development of new or improved

products/processes using existing knowledge gained from research or practical experience) as distinct from spending on basic and applied research. In 2002-03 expenditure on experimental development accounted for approximately 68 per cent of total BERD, while businesses spent 7 per cent of their R&D expenditure on basic research.

Finally, it should be noted that large businesses in Australia undertake most of the BERD. In 2002-03 large business units accounted for approximately 62 per cent of total BERD.² Furthermore, large businesses in Australia have higher R&D intensities than other businesses. In 2000-01 large businesses employed 38.2 per cent of private sector employees and accounted for 50.6 per cent of total industry value added, yet undertook nearly 63 per cent of total BERD.

1 AiG (2004) notes that from 1981 to 2001 the annual average growth rate of BERD in Australia was 9.6 per cent, compared to the OECD average of 4.5 per cent. See *Innovation, R&D and Economic Growth*, AiG, 2004.

2 Large business units being defined as businesses who employ 200 or more employees.

2.2 The State of the R&D Debate in Australia

Debate concerning the appropriateness of business R&D expenditure in Australia has largely focused on the relatively low level of BERD in Australia compared to other OECD countries. In 2000-01, Australia's BERD to GDP ratio was ranked 15th in the OECD (21 countries). This result contrasts with the high ranking of Australia's government sector R&D expenditure to GDP ratio (3rd out of 21 countries). These figures have been used by many commentators to argue that Australian businesses are not pulling their weight when it comes to investment in R&D activities.

However, it is not clear that Australia's low BERD rankings among OECD countries imply suboptimal business investment in R&D activities. In particular, it is not apparent or obvious that Australia is a typical or average OECD economy, and thus it is questionable whether any international comparisons could provide any insight into the appropriateness of BERD levels in Australia.

This point was made clear by a number of submissions to the recent Inquiry into Business Commitment to R&D in Australia by the Standing Committee on Science and Innovation. The submissions noted that the structure of the Australian economy implied that optimal levels of BERD may be lower in Australia compared to other industrialised countries.

For example, the Productivity Commission told the committee that:

'the lower ratios of BERD that we observe in Australia have more to do with Australia's industry structure being rather less-R&D intensive than the industry structures in some other countries. The services sector in this relatively small economy [Australia] looks particularly large and, while the service sector does much innovation, not a lot of that is technological R&D, although services are big users of technology'.³

Similarly, the Australian Business Foundation in their submission to the inquiry noted that low levels of BERD in Australia compared to OECD countries can also be explained by the relative small number of large businesses (the largest spenders on R&D activities) in the Australian economy, due largely to the smallness of domestic markets.⁴

The Australian Government report, *Mapping Australian Science and Innovation*, also commented that Australia's R&D activity is influenced by our industrial structure. The report noted that the relative small size of Australia's manufacturing industry compared to the economy, and the small size of defence and high technology industries within the Australian manufacturing sector, result in lower levels of business R&D expenditure.⁵

3 Mr Gary Banks (Productivity Commission), Transcript, p. 481.

4 Ms Catherine Livingstone (Australian Business Foundations Ltd), Transcript, p. 295.

5 *Mapping Australian Science and Innovation*, Australian Government, 2003, p. 79.

2.2 The State of the R&D Debate in Australia

These considerations led the Commonwealth Department of Industry, Tourism and Resources in its submission to the Inquiry into Business Commitment to R&D in Australia to conclude that structural differences in economies 'make international comparisons of relative expenditure on R&D by business and/or by governments difficult to interpret and of limited value on their own'.⁶

In addition to such arguments, recent research on R&D spending in Australia has found that Australia invests as much in R&D as could be expected given factors such as the structural characteristics of the Australian economy.⁷

The excessive focus on OECD BERD comparisons also confuses R&D expenditure with innovation. R&D is an input into the innovation process, not an outcome. The ultimate outcome of innovation is increased productivity. On this scale Australia's recent performance is impressive, even by international standards.⁸ Parham (2002) notes that labour productivity in Australia grew at an average annual rate of 2.3 per cent over the period 1990 to 2001, while the OECD average was just 1.8 per cent.⁹ Such growth saw the rank of Australia's GDP per capita within the OECD rise from 15th in 1990 to 8th in 2002.

R&D expenditure is but one input into the innovation process. There is evidence to suggest that due to the structure of the Australian economy, businesses will tend to innovate in ways other than through R&D spending. Smith (2004) argues that there is empirical evidence to suggest an inverse relationship between the share of investment expenditures in total innovation expenditures and firm size, while there is a positive relationship between firm size and the share of R&D in total innovation expenditures. The implication being that small firms rely more on the acquisition of capital goods in innovation expenditures, so that knowledge structures in SMEs are more likely to be more heavily dependent on embodied knowledge within capital equipment.¹⁰

This finding is supported by evidence from the Productivity Commission to the Inquiry into Business Commitment to R&D in Australia which argued that:

'Technological R&D is often less valuable as perceived by SMEs than other forms of innovation: organisational innovation, innovation in terms of the relationships with their customers and so on.'

6 Commonwealth Department of Industry, Tourism and Resources, Submission No. 38, pp. 7-8.

7 Brooks, Robert and Davidson, Sinclair (2004) 'How Much R&D Should Australia Undertake?', *Economic Papers*, 23 (1), 165-174.

8 While it could be argued that Australia's recent productivity performance is the result of liberalising reforms from the early 1980s onwards. AiG (2004) argues that the nature of the changes suggests that the impact of policy was to remove constraints to (or diversions from) a more dynamic private sector performance – that is allowing greater innovation by businesses. See *Innovation, R&D and Economic Growth*, AiG, 2004.

9 Parham, Dean (2002) 'Microeconomic reforms and the revival in Australia's growth in productivity and living standards', *Paper presented to the Conference of Economists*.

10 Smith, Keith (2004) 'A Perspective on the Knowledge Economy in the Australian Context', *Innovating Australia*, CEDA.

2.2 The State of the R&D Debate in Australia

Given the prevalence of SMEs in the industrial structure of the Australian economy, this would suggest that much innovation in Australia is going on in ways not reflected by measures of R&D investment. Australia's strong investment in ICT can provide one indicator of how excessive focus on business R&D spending is inappropriate. Scott-Kemmis (2004) notes that Australia has the third highest level of expenditure on ICT (10.5 per cent of GDP) in the OECD.¹¹

These results concur with the recent findings of Jensen and Webster (2004), that there is only a small correlation between R&D spending and innovative activity in Australian firms.¹²

Given these factors, the BCA's survey of Members' R&D programs aims to broaden the debate concerning business R&D spending in Australia by providing further information on factors driving R&D decision-making.

The main focus of the debate should be whether current activities by businesses in Australia are maximising the potential level of innovation within the economy. Appropriate judgement on this issue rests not on whether Australian businesses are spending relatively more or less on R&D than businesses from other countries but rather on an assessment of the effectiveness of the innovation process.

By providing a wide range of information on factors around the determination of R&D spending by businesses in Australia, this survey aims to contribute to a more comprehensive consideration of ways in which the contribution of businesses to innovation in Australia may be enhanced.

11 Scott-Kemmis, Don (2004) 'Innovation Systems in Australia', *Innovating Australia*, CEDA.

12 Jensen, Paul, and Webster, Elizabeth (2004) 'Examining Biases in Measures of Firm Innovation', IPRIA Working Paper No. 05/04.

Results of Survey

3.1

Overall Business R&D Expenditure

Member Companies were asked to provide information on their R&D spending. Twenty Member Companies provided data on their R&D expenditure in the last financial year (approximately 2002-03). These companies spent \$768 million on R&D activities. Given that total BERD in Australia was around \$6 billion, this suggests that these companies are major spenders on R&D activities.

It should be noted that the BERD figures produced by the ABS may not be completely comparable with the results of this survey. In particular, the survey asked members to include R&D expenditure allocated to external collaboration activities with third parties such as other private enterprises and public sector institutions. The ABS, following OECD guidelines set out in the Frascati Manual, reports the R&D expenditure of a sector of an economy as the R&D activity being undertaken in that sector rather than the total R&D that the sector funds. Therefore depending on the form of collaboration with public sector institutions, the ABS may report this business expenditure as R&D spending by the public sector. For example, the contracting of a university by a private enterprise to undertake R&D would be considered

university sector R&D expenditure by ABS classifications, while the business expenditure allocated to a private-sector joint venture with a university would be considered BERD.¹³

However, this does not detract from the fact that respondents to the survey are significant contributors to BERD in Australia. The total funds identified in the survey that are allocated to external collaboration activities with public sector institutions amounts to around \$105 million, suggesting that companies who responded to the survey still account for at least around 10 per cent of total BERD.

More importantly, it could be argued that the ABS classification system of R&D expenditure between sectors of the economy may understate the business sector's contribution to R&D activities in Australia. In 2002-03, the business sector was the largest source of funds for R&D expenditure in Australia, funding 46 per cent of expenditure, while the Commonwealth Government funded around 38 per cent of activity. The business sector in 2002-03 provided funding for \$333 million worth of R&D activity undertaken in other sectors of the economy.

¹³ This figure is likely to be higher as some of the \$105 million allocated to collaborative R&D activities with the public sector are likely to be in a form that is attributed to BERD under ABS classifications.

3.1 Overall Business R&D Expenditure

Thirteen Member Companies also provided historical R&D expenditure data. This data shows that the median increase in R&D expenditure in these companies from the previous financial year was 8.7 per cent, suggesting continued strong growth in R&D spending.

Member Companies were also asked whether they expected to increase or decrease their R&D expenditure over the next five years. The results suggest a positive outlook for R&D expenditure in the future with 64 per cent of respondents noting that they expected modest to substantial increases in R&D spending, 28 per cent of respondents expected no

change in R&D spending, while only 8 per cent expected a modest decrease from current levels. When compared to the results of the *Community of Business* survey undertaken by the BCA in 2001-02, these responses also suggest a recent improvement in expectations concerning future business R&D expenditure growth – in the *Community of Business* survey only 30 per cent of Member Companies expected a modest increase in R&D expenditure in the next three years, while 70 per cent of respondents expected no change in R&D spending.

3.2 Processes for the Determination of R&D Expenditure

Member companies were asked to indicate the management level at which budgets for R&D activities were determined. Charts 1 and 2 show the results from both domestically-controlled and foreign-controlled respondents.

Both charts show that the determination of R&D expenditure by Member Companies is highly concentrated in the top levels of management with Boards and senior management dominating decision-making. This structure has benefits by ensuring that decisions about R&D are generally taken from a whole-of-company perspective. However, it also requires that communication between senior management and lower levels is effective in order for an efficient allocation of funds to be determined.

CHART 1
Management Level of R&D Budget Determination (Per Cent of Domestically-Controlled Respondents)

- CEO/Board of Australian Operations
- Other Senior Management
- Line/Production Managers
- Other

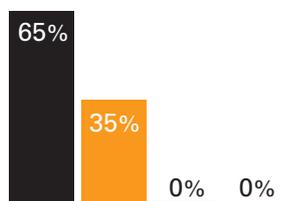
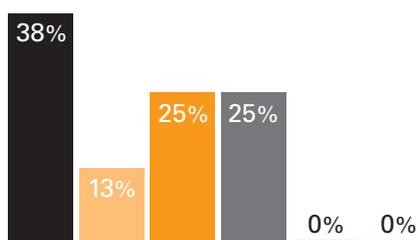


CHART 2
Management Level of R&D Budget Determination (Per Cent of Foreign-Controlled Respondents)

- CEO/Board of Overseas Parent
- CEO/Board of Australian Operations
- Domestic Senior Management
- Overseas Senior Managers
- Line/Production Managers
- Other



3.2

Processes for the Determination of R&D Expenditure

It is also important to note that the responses also suggest that decisions regarding R&D budgets of Australian operations of foreign-controlled firms tend to be determined by foreign management – 63 per cent of foreign controlled respondents noted that determination of R&D budgets were made at the CEO/Board level of the overseas parent or by overseas senior management. This result further highlights the importance of communication between Australian operations and foreign parents in order for appropriate decisions to be made regarding R&D spending by Australian operations.

Those respondents who nominated that their R&D budgets were determined at the CEO/Board level were also asked how this budget was subsequently allocated.

The responses were largely evenly split between the allocation of funds to specific projects or products and the allocation of funds to business units (often to units assigned with the task of developing new or improved products and services).

Finally it should be noted that some respondents (primarily from the financial and business services sectors) commented that the determination of their R&D budgets is largely a secondary result of decisions to undertake certain projects. That is, some firms spent funds on R&D largely as a residual factor in determining to spend funds on other projects that were deemed to be beneficial for the company.

3.3 Main Research Areas of Business R&D Expenditure

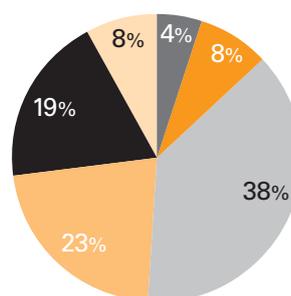
The survey asked Member Companies to nominate the main research area in which their R&D activities was undertaken. As Chart 3 highlights, main research areas are largely concentrated in information and communications technologies, resources and materials engineering, and manufacturing, mechanical and electrical engineering. These results broadly concur with broader trends in Australia and the dominance of business R&D expenditure in traditional areas of engineering and new areas of ICT services seen in the overall BERD figures.

Further analysis also suggests that R&D expenditure by Member Companies is highly specialised towards core business operations. The sector distribution of respondents highlights the point that Member Companies' main research areas are strongly related to their core operations. For example, 80 per cent of respondents who nominated resources and materials engineering as their main research area were from the mining sector, 90 per cent of those who nominated information and communications technologies were from

the communications services, finance and insurance, and property and business services sectors, while manufacturers accounted for 50 per cent of respondents who nominated manufacturing, mechanical and electrical engineering as their main area of research.

CHART 3
Main Research Areas (Per Cent of Respondents)

- Medical and health sciences
- Physical, chemical and earth sciences
- Information and communications technologies
- Manufacturing, mechanical and electrical engineering
- Resources and materials engineering
- Other

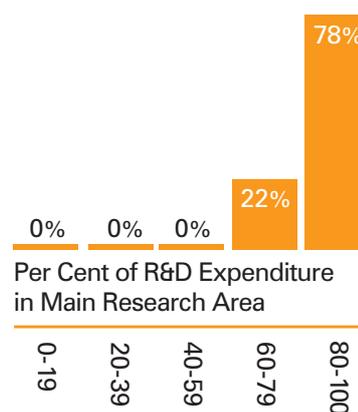


3.3 Main Research Areas of Business R&D Expenditure

Furthermore, Chart 4 shows that R&D expenditure of respondents is highly concentrated in their main research fields. Member Companies were asked to provide a breakdown of their R&D budgets to various research fields, the results show that 65 per cent of respondents undertake all their R&D activities in their main research area, while 78 per cent of respondents undertake over 80 per cent of R&D expenditure in their main field.

These results suggest R&D programs are highly targeted at areas of core business operations where Member Companies are more likely to have a comparative advantage in research and where benefits from investment in R&D are likely to be the greatest. The lack of R&D expenditure in non-core operations suggests that Member Companies find it more cost-effective to purchase technology in areas where they are unlikely to have direct research expertise.

CHART 4
Amount of R&D Expenditure in Main Research Area
(Per Cent of Respondents)



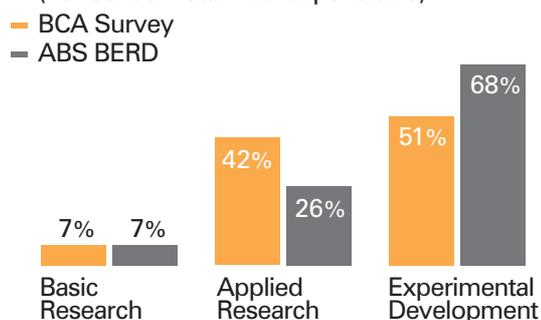
3.4 Allocation of Business R&D Expenditure to R&D Activity

Member Companies were asked to provide information on the allocation of R&D budgets to different R&D activities. In particular, they were asked to show the allocation of their R&D funds to basic research, applied research and experimental development.¹⁴ As Chart 5 shows, the allocation by Member Companies is broadly similar to overall BERD figures, with Member Companies, on average, spending the majority of their R&D budgets on experimental development. However, the chart does indicate that Member Companies, on average, do tend to spend proportionally more on applied research and less on experimental development than the rest of the business community.

Sector analysis of these responses highlights the diversity of outcomes underlying this general result. Respondents from the mining and manufacturing sectors, areas where Australia has traditionally been at the forefront of technological advances, on average have

a much larger percentage of R&D funds allocated to applied research.¹⁵ Respondents from the mining sector allocate 63 per cent of R&D funds to applied research on average, while respondents from the manufacturing sector allocate 61 per cent on average.¹⁶

CHART 5
Average Allocation of R&D Expenditure
by Each Respondent to R&D Activities
(Per Cent of Total R&D Expenditure)



¹⁴ The survey used ABS definitions for these activities. These definitions are as follows:

Basic research: experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundation of phenomena and observable facts, without any particular application or use in view.

Applied research: original investigation undertaken in order to acquire new knowledge, which is directed primarily towards a specific practical aim or objective.

Experimental development: systematic work, drawing on existing knowledge gained from research and/or practical experience, which is directed to producing new materials, products or devices, to installing new processes, systems and services, or to improving substantially those already produced or installed.

¹⁵ One way of determining which areas of research Australia has a comparative advantage is to estimate its *Revealed Technological Advantage* – ie. the ratio of its patents in each technological field over the relative share of patents in that technology for the world as a whole. Australia's Revealed Technological Advantage is strong in areas such as agriculture, miscellaneous manufacturing, primary metals, mining, oil and gas, and industrial machinery. Australia has a relatively weak emphasis on patenting in computers and peripherals, telecommunications, and semiconductors and electronics. See *Inventing Our Future – The Link Between Australian Patenting and Basic Science*, CSIRO (2000), and *Mapping Australian Science and Innovation*, Australian Government (2003).

¹⁶ It should also be noted that, on average, respondents from the manufacturing sector also allocate approximately 20 per cent of their R&D expenditure to basic research.

3.4

Allocation of Business R&D Expenditure to R&D Activity

On the other hand, respondents from the communications services and finance and insurance sectors, who are primarily large spenders of R&D on information and communications technologies, allocate far more of their R&D budgets to experimental development (respondents from the communications services sector allocate 98 per cent of R&D funds to experimental development on average, while respondents from the finance and insurance sector allocate 90 per cent on average). This result may be due to the fact that Australia does not have a comparative advantage in research in ICT services compared to other countries such as the United States.

These results suggest that the current allocation of R&D expenditure by Member Companies reflects comparative advantages and the structure of our economy. This further highlights the risks of simplistic cross-OECD comparisons. Firms in industries where Australia is a global leader in innovation are more likely to undertake original investigation because they have a comparative advantage in undertaking such research, while companies in industries where Australia is not at the technological frontier find it more appropriate to develop new products, services and systems from existing, often imported, knowledge. This result is consistent with the findings of Griffith, Redding and Van Reenen (2000) which concluded that the further a country lies behind the technological frontier, the greater potential for R&D expenditure to increase total factor productivity through technology transfer from more advanced countries.¹⁷

What is clear from the overall results, however, is the relatively small amount of expenditure that is allocated by respondents to basic research. This is not necessarily a sign of inappropriate allocation of R&D spending by businesses (indeed it is reasonable to expect a strong focus by businesses on applied research and experimental development as these activities are more likely to generate a return to investment). However, it does raise an important issue about the current structure of R&D spending in Australia and its effect on the ability of innovation in Australia to produce tangible economic benefits.

Australian public sector R&D expenditure has a strong focus on basic research. In 2002-03, 52 per cent of R&D expenditure by the higher education sector was allocated to basic research, while only 41 per cent and 7 per cent of funds were allocated to applied research and experimental development, respectively. While the concentration of basic research in the public sector and applied research and experimental development in the private sector is not necessarily suboptimal - indeed some specialisation of research may be beneficial - it does increase the importance of communication and research collaboration between firms and public sector institutions, particularly with respect to identifying the commercialisation potential of basic research by public sector institutions (these issues will be raised in a subsequent section of this report).

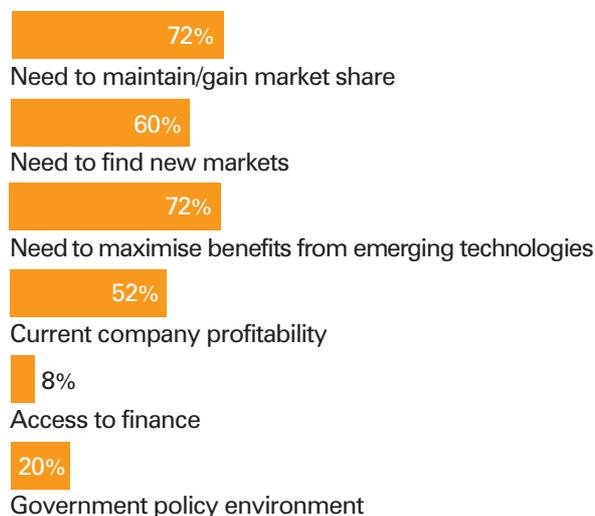
17 Griffith, R., Redding, S., and Van Reenen, J. (2000) 'Mapping the two faces of R&D: productivity growth in a panel of OECD industries', *Centre for Economic Policy Research*, Discussion Paper No. 2457.

3.5 Drivers and Inhibitors of Business R&D Expenditure

The survey also asked Member Companies a number of questions about the drivers and inhibitors of undertaking R&D activities. Firstly, Member Companies were asked to rate on a scale from 'critical' to 'not relevant' a number of factors that may drive the decision to undertake R&D spending. Chart 6 shows the results of responses to this question.

Member Companies were also asked to list, in order of priority, the three main drivers of their R&D expenditure. Chart 7 displays weighted indices of their responses to show the relative importance respondents attached to these factors.¹⁸

CHART 6
Important Drivers of Business R&D Expenditure
(Per Cent of respondents who nominated as 'critical' or 'highly relevant')



Both charts show that the most important drivers behind the decision to undertake R&D expenditure are those associated with commercial rather than regulatory considerations.

CHART 7
Relative Importance of R&D Drivers Identified by Respondents

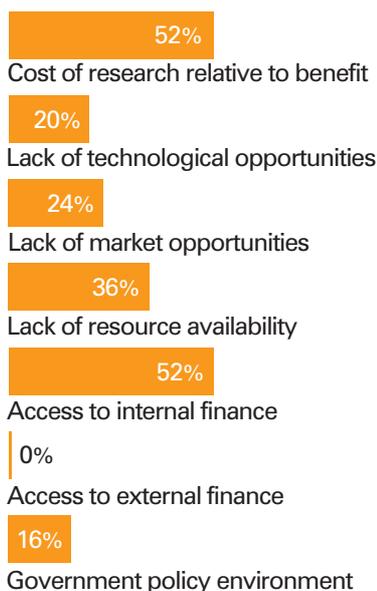


¹⁸ The index in Chart 7 is calculated by giving a weighting of '3', '2' and '1' to factors that were nominated first, second and third most important, respectively. The sum of these weight was then divided by the maximum score possible (ie. the number of respondents multiplied by '3') and indexed to 100. Therefore if all respondents nominated 'gain/maintain market share' as the most important factor, that category would receive a score of 100.

3.5 Drivers and Inhibitors of Business R&D Expenditure

When deciding to undertake R&D expenditure, the primary drivers for Member Companies were the desire to gain or maintain their share of existing markets; the ability to gain benefits from emerging technologies (perhaps because of the ability of these technologies to support innovation, improve efficiency and/or product quality); and the need to find new markets (including through the development of new products and services). Another relatively important driver was the commercial consideration of maintaining current company profitability.

CHART 8
Important Inhibitors of Business R&D Expenditure
(Per Cent of respondents who nominated as 'critical' or 'highly relevant')



The survey also asked Member Companies to rate from 'critical' to 'not relevant' a number of factors that may inhibit the undertaking of R&D expenditure by businesses. Chart 8 shows the responses to this question.

Member Companies were also asked to list, in order of priority, the three main inhibitors of their R&D expenditure. Chart 9 displays weighted indices of their responses to show the relative importance respondents attached to these factors.

CHART 9
Relative Importance of R&D Inhibitors Identified by Respondents



3.5 Drivers and Inhibitors of Business R&D Expenditure

Both charts show that the 'relative cost of research to benefit,' 'lack of resource availability' and 'access to internal finance' were nominated as the three most important inhibitors of R&D activities – 52 per cent of respondents highlighted 'cost of research relative to benefit' and 'access to internal finance' as 'critical' or 'highly relevant' inhibitors of R&D activities, while 36 per cent of respondents nominated 'lack of available resources' as a 'critical' or 'highly relevant' inhibitor.

Overall the results from questions concerning drivers and inhibitors of business R&D expenditure highlight a number of areas which can influence the level of R&D investment.

Appropriately, the main drivers of business R&D expenditure are commercial factors which businesses recognise can be achieved through R&D activities. The leverage of policy in these areas, however, is negligible. Where a role for policy becomes apparent is in a consideration of the major inhibitors to business R&D spending.

Before discussing how policy could aim to reduce major inhibitors to business R&D investment, it is worth discussing what the survey responses suggest for the effectiveness of the current government policy environment surrounding business R&D issues.

Although the government policy environment is not regarded as either a 'critical' driver or inhibitor of business R&D activity, this does not suggest the respondents were not influenced by the current policy structure.

Indeed 48 per cent of respondents nominated current government policy as a 'relevant' inhibitor, while 44 per cent nominated it as a 'relevant' driver of business R&D.

This suggests that government policy is a second-order consideration that is affecting business R&D decision making at the margins.

The cost of research has been highlighted as an important factor preventing further business investment in R&D. A number of comments from respondents who nominated 'relative cost of research to benefit' as a major inhibitor of R&D expenditure suggest that it is the absolute cost of research that is the main inhibitor rather than a lack of potential return from investment.

3.5

Drivers and Inhibitors of Business R&D Expenditure

The principal government initiative to alleviate the cost of R&D to businesses and thus increase the level of business R&D spending in Australia is the R&D tax concession. The results of the survey suggest that while the current R&D tax concession may be effective at marginally reducing the cost of R&D activities by businesses, to noticeably reduce cost as an inhibitor of R&D spending either the tax concession needs to be significantly increased, the coverage of the concession needs to be expanded from its current focus on certain classes of expenditure at particular stages of R&D, or more emphasis needs to be placed on other policies aimed at reducing cost.

In particular, greater weight could be given to policies aimed at reducing the up-front costs to R&D activities that tax concessions are not effective to ameliorating (examples of such policies include grants and seed funds) – an expanded version of the Commercial Ready program, both in terms of size and coverage, could be one option.

As well, more importance could be placed on policies such as co-location of research facilities and collaboration between private companies and public research institutions to help reduce costs for businesses associated with R&D activities by encouraging a greater level of sharing of facilities.

Similarly, the policy response to reduce ‘lack of resource availability’ as a major inhibitor of business R&D activities in Australia further

highlights the importance of focusing on broader R&D policy measures than simply R&D tax concessions. These responses need to focus on improving the skill base of Australian workers and researchers, and ensuring that businesses have access to the equipment and facilities that they require to make R&D activities commercially viable.

The nomination of ‘lack of resource availability’ as a major inhibitor of business R&D spending may also be partly due to a lack of knowledge by businesses of the research resources that are available in Australia. This highlights the need for governments, using information gained from reports such as the *Mapping of Australia’s Science and Innovation System* study, to ensure that businesses are aware of the scope of Australia’s research infrastructure, and the importance of knowledge exchange networks such as Knowledge Commercialisation Australia’s Commercialisation Forum and Fair of Ideas, and the Innovation Exchange.

The importance assigned to ‘access to internal finance’ as an inhibitor of R&D spending by businesses also suggests that effective policies aimed at increasing business R&D investment may not necessarily even lie within the gambit of traditional R&D policy. The ability to access internal finance for R&D activities is strongly related to corporate profitability which itself is related to economic conditions and the broader economic policy framework, hence the cyclical behaviour of R&D spending.

3.5 Drivers and Inhibitors of Business R&D Expenditure

Therefore, significant emphasis should be placed on policies aimed at maintaining a robust and strongly growing economy, that is, a virtuous cycle.

Policies that aim at ensuring effective macroeconomic management and microeconomic reform may, ultimately, be just as successful in supporting effective levels of business R&D spending in Australia as business tax concessions.

The policy responses highlighted above suggest the need for a holistic approach to ensure business R&D investment in Australia. The major inhibitors of business R&D spending nominated in the survey are varied and affect business spending in a number of ways. In order to be effective any policy response needs to address each of these inhibitors at their source. A policy focus on just one type of measure to improve business R&D outcomes is thus inappropriate. Policy measures ranging from traditional R&D tax concessions to education policy to macroeconomic policy all need to be considered and targeted towards reducing the major inhibitors highlighted in this survey.

Before turning to a discussion on the factors surrounding the decision to undertake R&D activities overseas, there are some further points from the survey results concerning the drivers and inhibitors of overall R&D spending

that are noteworthy. Firstly, it is reasonable to conclude that the lack of importance assigned to 'access to external finance' as an inhibitor of business R&D spending is due mainly to most businesses relying on internal sources of finance to undertake R&D, and the venture capital market is rarely considered in R&D decision making.

Furthermore, the responses from a number of foreign-controlled Member Companies concerning the drivers and inhibitors of their R&D activities also suggest that their R&D spending in Australia is strongly influenced by considerations of Australia's relative research attractiveness compared to other countries. For example, some foreign-controlled Members noted that the absolute cost of R&D activities in Australia relative to the rest of the world was a major inhibitor. It was also mentioned by a number of foreign-controlled Member Companies that a lack of local skills was a major issue. Finally, some foreign-controlled respondents noted that a lack of international awareness of Australia's R&D abilities was a major factor prohibiting further R&D in Australia. These results are hardly surprising as global companies will find it easier than other companies to reallocate resources to R&D internationally if R&D operations in Australia are not internationally competitive.

3.6 International Business R&D Activities

The survey asked Member Companies to show their allocation of R&D expenditure to activities being undertaken in Australia and overseas. Chart 10 shows that around one-third of respondents undertook some of their R&D activities overseas.

However, Chart 11 shows that the average proportion of R&D spending being allocated to overseas R&D activities is relatively small (around 7 per cent). Indeed, 92 per cent of respondents direct over 80 per cent of their R&D expenditure to R&D activities in Australia.

Member Companies who nominated that they undertook R&D activities overseas were also asked to nominate, on a scale from 'critical' to 'not relevant', a number of factors that may be important to the decision to undertake R&D activities overseas. Chart 12 (page 30) shows the results of these responses.

CHART 10
Per Cent of Respondents Undertaking R&D Overseas

- Firms undertaking R&D overseas
- Firms with 100% R&D in Australia

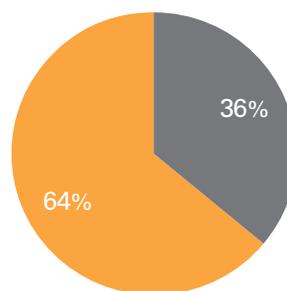
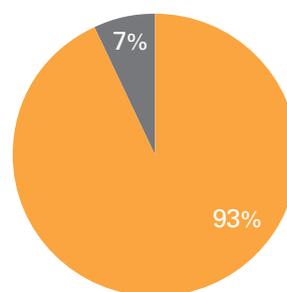


CHART 11
Average Allocation of R&D Expenditure by Each Respondent to Overseas R&D Activities (Per Cent of total R&D expenditure)

- R&D undertaken in Australia
- R&D undertaken overseas



3.6 International Business R&D Activities

Member Companies were also asked to nominate, in order of priority, the three main factors that influence the decision to undertake R&D activities overseas. Chart 13 displays weighted indices of their responses to show the relative importance respondents attached to these factors.

Both charts show that 'proximity to expertise' is by far the most critical factor when considering R&D activities overseas (78 per cent of respondents nominated it as 'critical' or 'highly relevant' to the decision to undertake R&D activities overseas). In particular, respondents

from mining-related industries were heavily represented in this group with 57 per cent of respondents who nominated 'proximity to expertise' as a 'critical' or 'highly relevant' factor belonging to such industries.

The proximity of research facilities and intellectual property were other factors that were nominated as relatively important factors by respondents. Importantly, Australian and foreign government policy surrounding R&D were not nominated as overly critical to the decision to undertake R&D activities overseas.

CHART 12

Important Factors Behind the Decision to Undertake to Overseas R&D Activities
(Per Cent of respondents who nominated as 'critical' or 'highly relevant')

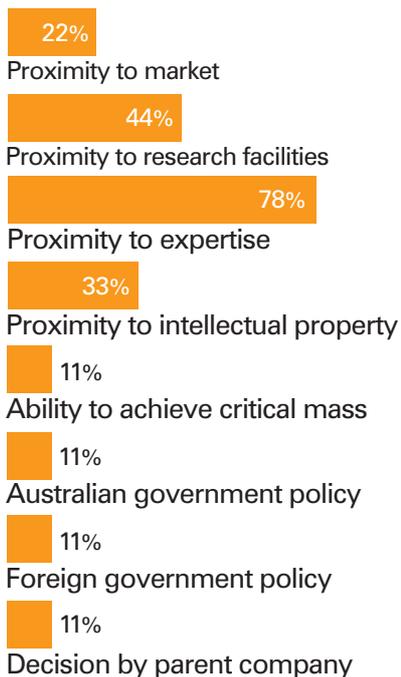


CHART 13

Relative Importance of Factors Identified by Respondents that Influence the Decision to Undertake R&D Activities Overseas



3.6 International Business R&D Activities

As with the responses to the drivers and inhibitors of R&D spending, many respondents did note that government policy environments were a second-order issue when considering where to locate R&D activities (44 per cent of respondents nominated Australian and foreign government policy environments as 'relevant' to the decision to undertake R&D overseas). This suggests that government policies such as R&D tax concessions may have a marginal effect on the level of R&D activities being undertaken in Australia.

These results reaffirm the importance of policy measures aimed at improving research skills and facilities in Australia. Not only are such policies important in addressing inhibitors to R&D spending by businesses in Australia, but they may also be effective in retaining R&D activities in Australia. These results also further highlight the relative importance of these policies compared to efforts to improve the competitiveness of more traditional business R&D policy instruments such as the R&D tax concession.

Not only could such policies help to retain domestic R&D activities they could also attract further overseas R&D investment in Australia. In 2002-03, 5.4 per cent of BERD was financed from overseas sources. While the proportion of overseas financing of BERD varies widely in different countries, international comparisons suggest that there may be some room for improvement in promoting Australia as a destination of international investment when Canada and the UK have 21 per cent and 27 per cent of their BERD founded from overseas sources, respectively.¹⁹

¹⁹ While it could be argued that such high ratios from Canada and the UK are the result of their proximity to large investment markets - the US and the EU, respectively - the low ratio for Germany (2.4 per cent) suggests that country-specific characteristics such as available skills and facilities are also important.

3.7 Business R&D Collaboration and Commercialisation

Member Companies were asked to indicate how much of their R&D expenditures were directed to R&D activities conducted in-house or externally with other agencies (such as universities, publicly-funded research institutions, or other companies). Chart 14 shows that the number of Member Companies undertaking external R&D activities is high, with 80 per cent of respondents undertaking some form of external R&D.

While the industry spread of respondents who undertook external R&D activities was diverse, 86 per cent of respondents who nominated that they undertook all of their R&D activities in-house were from business-services related sectors.

Although the incidence of businesses undertaking external R&D activities is significant, Chart 15 shows that the amount of R&D funds allocated to such activities is relatively small. Respondents allocated only 29 per cent of R&D expenditure to external R&D activities, on average. The median for this allocation is even more demonstrative of this with only 10 per cent of R&D expenditure being allocated to external R&D activities.

Respondents who conducted external R&D activities were also asked to indicate how much of the spending on these activities was allocated to research being undertaken with other private enterprises, universities or publicly-funded research institutions. Chart 16 (page 33) shows that respondents, on average, allocated roughly half their expenditure on external R&D activities to research conducted with other businesses and half to research with universities and publicly-funded research institutions.

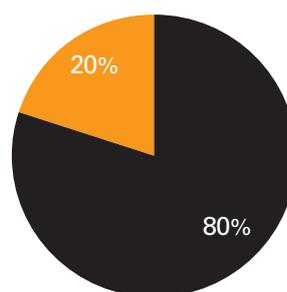


CHART 14
Per Cent of Respondents Undertaking External R&D Activities

- Firms undertaking external R&D
- Firms with 100% in-house R&D

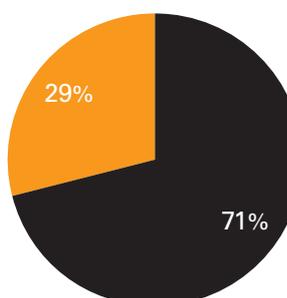


CHART 15
Average Allocation of R&D Expenditure by Each Respondent to External R&D Activities (Per Cent of total R&D expenditure)

- R&D undertaken in-house
- R&D undertaken externally

3.7 Business R&D Collaboration and Commercialisation

Furthermore, respondents undertaking external R&D activities were also asked to nominate in what form most of these activities were undertaken. Chart 17 shows that the vast majority of external R&D activities were undertaken by contracting.

Member Companies were also asked whether they had been involved in efforts in Australia to commercialise R&D outcomes developed under contract or in partnership with Australian universities or publicly-funded research organisations. The results suggest that such commercialisation is not a widespread practice with 28 per cent of respondents undertaking commercialisation with universities and only 20 per cent undertaking commercialisation with publicly-funded research institutions.

Interestingly, when respondents were asked to rate these commercialisation experiences, 63 per cent noted that they were either 'successful' or 'very successful.' This result suggests that business involvement in commercialisation of research by universities and publicly-funded research institutions only occurs where businesses are confident of a successful outcome, but that a number of factors are discouraging them from undertaking such activities.

Respondents were asked to nominate the main factor that could improve these commercialisation experiences. Their responses were wide and varied and provide an insight into the factors that may be preventing more business/public sector research collaboration and commercialisation.

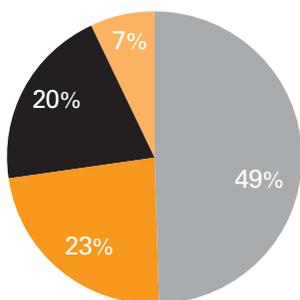


CHART 16
Average Allocation of R&D Expenditure by each Respondent on External R&D Activities (Per Cent of total R&D Expenditure)

- Other private enterprises
- Australian publicly funded research organisations
- Australian universities
- Other

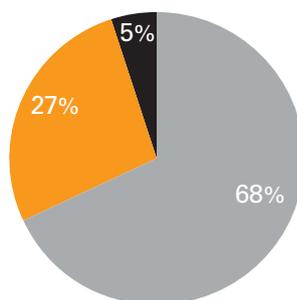


CHART 17
Form of External R&D Activities (Per Cent of Respondents who nominated as main form of external R&D Activities)

- Contracting
- Joint Ventures
- Other

3.7 Business R&D Collaboration and Commercialisation

The main factors that respondents felt could improve the attractiveness of commercialising research with universities and publicly-funded research institutions included:

- Improved incentives around manufacturing and marketing.
- Recognition by universities and publicly-funded research institutions of the global nature of business.
- The need for universities and publicly-funded research institutions to aim for repeat, rather than one-off business.
- The need to collaborate at all stages of development.
- Increased incentives for universities and publicly-funded research institutions to seek a commercialisation outcome.
- The requirement of R&D conducted by universities and publicly-funded research institutions to have a commercial mentor or sponsor.
- The refocusing of government R&D support to development rather than research.
- Encouraging the movement of technical staff between universities, publicly-funded research institutions and businesses.
- The need for greater understanding of the commercial application of intellectual property earlier in the R&D process.
- Greater understanding by universities and publicly-funded research institutions of the requirements for successful commercialisation.

Conclusion

The core of innovation is putting new ideas into practice and achieving commercial success with them. It can include breakthrough ideas that lead to brand new products and services or incremental ideas that contribute to ongoing improvements in any aspect of the business.

There is a need to broaden the debate on innovation and ensure public policy decisions in areas as diverse as workplace relations, the operation of financial markets and business regulation do not inhibit an enterprises' capacity to innovate cost effectively in line with their business strategy.

The aim of this survey is to provide a wide range of information concerning the determination of R&D spending by businesses in order to better understand the factors that may enhance the level of innovation in Australia. In doing so, the survey attempts to broaden the current scope of debate in Australia surrounding business R&D spending, which is currently heavily focused on the level of R&D investment and especially Australia's expenditure relative to other economies.

The survey confirmed that companies undertook research and development to support business growth, that is, to:

- capture or maintain market share;
- benefit from emerging technologies; and
- find new markets through the development of new products and services

Results of the survey indicate that research efforts of Australia's largest companies are focused on the core business operations of companies, and concentrated in information and communication technologies, resources and materials engineering, and manufacturing, mechanical and electrical engineering.

The main drivers of research and development investment decisions identified by respondents suggest that businesses understand the long-term commercial benefits of investing in research and development activities. The survey shows that businesses allocate their research and development expenditure to activities that provide the greatest innovation benefits.

Conclusion

The survey, however, also highlights potential areas where business input into the R&D aspects of the innovation process can be enhanced. The results suggest that there are a number of inhibitors to business R&D spending associated with research costs, the availability of research resources and accessibility to internal funds which excessively reduce the level of investment in R&D activities. Also the results from the survey suggest ways in which to enhance commercialisation of research between businesses and public institutions.

The results further suggest that policy solutions to these issues are varied.

They range from policies aimed at enhancing the research skills and facilities of Australia, encouraging the co-location and sharing of such facilities, ensuring the continued strong growth of the Australian economy, and aiding the commercialisation of research between businesses and public institutions, as well as more traditional R&D policy measures such as adjustments to the R&D concession.

A holistic policy approach to increasing the level and enhancing the effectiveness of business R&D spending in Australia is required.

Whilst the survey confirmed the significant research and development efforts of Australia's largest companies, the report also indicated that for many companies their innovation is not through traditional research and development spends as measured by BERD.

Where innovation can be achieved through other forms of investment more cost effectively such investment will be pursued.

Increasingly innovation is about process adaptation, applications or new technologies or the outcome of capital investment in new plant and equipment.

The challenge is to ensure that the public policy frameworks support such approaches to innovation.

Survey Methodology

The survey of R&D programs was sent to BCA Member Companies.

The BCA Membership represents leading Australian corporations with a combined national work force of almost one million people. The Member Companies of the BCA include most the largest companies in Australia.

The survey asked companies for quantitative and qualitative information on their R&D programs. In particular the survey focused on:

- the amount of R&D expenditure undertaken by BCA Member Companies;
- processes involved in the determination and allocation of R&D budgets;
- the allocation of spending to various research areas and stages of the R&D process;
- factors and inhibitors influencing the decision to undertake R&D activities;
- the level of R&D spending being undertaken overseas by BCA Member Companies and the factors behind the decision to offshore R&D activities;

- the allocation of spending between in-house and external R&D and the form of external R&D activities; and
- the amount of commercialisation of R&D outcomes being undertaken by BCA Member Companies with public-sector institutions and factors influencing its success.

Thirty-three Members responded to the survey. Of these, 25 Members provided full responses to the survey questionnaire. Of the remaining 8 respondents, 5 Members replied that they did not undertake any R&D activities, while the remaining 3 Members were global companies who noted that they undertook R&D only at the global level with costs being apportioned throughout the entire company. Unless otherwise specified, the results of the analysis are provided by the 25 full responses to the survey questionnaire.

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