The Parliament of the Commonwealth of Australia

INNOVATION

A Concept to Market

Report by the House of Representatives
Standing Committee on Industry,
Science and Technology
November 1995

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PREFACE

The House of Representatives Standing Committee on Industry, Science and Technology is one of eight general purpose standing committees established pursuant to Standing Order 28B of the House of Representatives. Each of the general purpose standing committees corresponds in its area of interest with a Federal Government department or group of departments. In the case of the Industry, Science and Technology Committee those departments are: Industry, Science and Technology; Small Business, Customs and Construction; Primary Industries and Energy; Resources; Industrial Relations; and Tourism.

Under the Standing Orders the Committee is empowered to inquire into and report on any matters referred to it by either House or a Minister, including any pre-legislation proposal, bill, motion, petition, vote or expenditure, other financial matter, report or paper. In addition, annual reports of government departments and statutory authorities stand referred automatically to the relevant Committee for any inquiry the Committee wishes to make.

On 16 November 1994 the Minister for Industry, Science and Technology, Senator the Hon Peter Cook, requested the Committee to inquire into and provide advice on innovation issues. In particular, the Committee was requested to:

- suggest key measures and policy structures for the Government to develop an innovative culture in Australia; and

- identify options for Government activity, including program design and resources.

The inquiry was advertised on 10 December 1994, and interested organisations were invited to provide submissions to the Committee.

Innovation is recognised as a key determinant of economic growth. It is vitally important that Australia maximise its innovation potential in order to continue to prosper in a world of rapid change.

The difficulty for governments developing programs that act as catalysts for innovation is that innovation is a complex process with many facets. It depends to a significant extent on cultural attitudes and attributes - such as the level of community support for creativity and inventiveness; and the encouragement of entrepreneurial attitudes and behaviour. These cultural characteristics can be fairly deeply embedded and resistant to rapid change. Promoting creativity and entrepreneurial skills are fundamental to promoting innovation. The education system obviously has a key role to play in developing these skills.

Innovation is not just about invention or research. It depends on a number of factors which enable creative discoveries to be successfully developed and commercialised - factors such as the availability of finance; the rapid diffusion of knowledge and technology; the network of linkages within the business community and between the

private and public sectors; the skills of managers and workers alike; and the nature of enterprise and industrial organisation.

Innovation requires considerable resources and it may be many years before profits result. Access to long term patient capital therefore lies at the heart of an enterprise's capacity to undertake innovation. Establishing and promoting linkages in the economy brings together the talents, skills and knowledge of individuals and enterprises enabling the process of continuous beneficial change which is innovation to take root.

The Committee stresses that the changes needed to promote innovation nationally involve changing the culture of our society. Many of the necessary changes will not yield immediate measurable results but will mean substantial benefits in decades to come. Governments must be patient and persistent in their approach to promoting an innovative culture.

There are number of government programs, such as the 150% tax concession for R&D, the *Business Networks Program*, the *Ideas and the Investor* program, the *Key Competencies Program*, the *Enterprise Education Strategy* and many others which either have been in place for a while and are producing results, or are relatively recent but appear well designed. The Committee does not consider that there is a need for a suite of new programs but rather the continued application of the programs already in place, with a strong focus on making those programs operate as efficiently and effectively as possible.

Mr Roger Dench of Dench McClean Associates was invited by the Committee to comment on the content and presentation of the report while it was being drafted. Mr Dench generously provided his services free of charge and I would like to express my own and the Committee's appreciation of his contribution. The Committee was also assisted by the services of Mr Richard Grant, a participant in the Australian National Internship Program, who very capably carried out important background research and drafting for the Committee. I would similarly like to record my and the Committee's appreciation of his input.

The Committee received 123 submissions and 82 exhibits in the course of the inquiry. Three public hearings were held in Melbourne, Sydney and Canberra. Twenty-four witnesses appeared before the Committee, recording over 266 pages of evidence.

I wish to thank all those who gave their time and effort to contribute to the inquiry.

The Hon. Alan Griffiths, MP
Chairman
November 1995

TERMS OF REFERENCE OF THE INQUIRY

On 16 November 1994 the Minister for Industry, Science and Technology, Senator the Hon Peter Cook, wrote to the Committee proposing terms of reference for an inquiry into innovation issues.

The terms of reference for the inquiry direct the Committee to:

- suggest key measures and policy structures for the Government to develop an innovative culture in Australia; and
- identify options for Government activity, including program design and resources.

The central objective of these policy and programs options was to develop an environment supportive of pursuing and maintaining international competitiveness in industry, science and technology.

MEMBERSHIP OF THE COMMITTEE

37TH PARLIAMENT

Chairman (from 10 May 1994):	Hon A G Griffiths MP
Chairman (to 10 May 1994):	Mr A R Bevis MP
Deputy Chairman	Hon N B Reid MP
Members:	Mr R E Charles MP
	Mr P R Cleary MP
	Mr M R Cobb MP
	Mr B T Cunningham MP
	Mrs M Easson MP
	Hon M J Evans MP (from 22 September 1994)
	Mr L D Ferguson MP
	Mr R H Horne MP (to 22 September 1994)
	Hon L S Lieberman MP
	Mr A A Morris MP
	Mr G M O'Connor MP
Secretary:	Mr P McMahon
Research Officer:	Mr J Winton

Other staff who assisted the Committee in the course of the inquiry:

Mr B Egan
Mrs F Wilson

ACRONYMS/ABBREVIATIONS

ABARE	Australian Bureau of Agricultural and Resource Economics
AGPS	Australian Government Publishing Service
AMC	Australian Manufacturing Council
AMTDP	Advanced Manufacturing Technology Development Program
ANSTO	Australian Nuclear Science and Technology Organisation
ARC	Australian Research Council
ASTEC	Australian Science and Technology Council
AusAID	Australian Agency for International Development
AUSTRADE	Australian Trade Commission
BERD	Business Expenditure on Research and Development
BCA	Business Council of Australia
BIE	Bureau of Industry Economics
BMFT	Ministry for Research and Technology (Germany)
BNP	Business Networks Program
CRC	Cooperative Research Centre
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DEET	Department of Employment, Education and Training
DIST	Department of Industry, Science and Technology
DITAC	Department of Industry, Technology and Commerce
DGS	Discretionary Grants Scheme
DPIE	Department of Primary Industries and Energy
EFIC	Export Finance and Insurance Corporation
FASTS	Federation of Australian Scientific and Technological Societies
GERD	Gross Expenditure on Research and Development
GDP	Gross Domestic Product
GTGS	Generic Technology Grants Scheme
IC	Industry Commission
IFTEH	Institute of Future Technology (Japan)
IIP	Industry Innovation Program
IR&D	Industrial Research and Development
MBA	Master of Business Administration
MIC	Management Investment Company
MTIA	Metal Trades Industry Association
NIES	National Industry Extension Service
NISTP	National Institute of Science and Technology Policy (Japan)
NPDP	National Procurement Development Program
NTCS	National Teaching Company Scheme
OCV	Foresight Steering Committee (The Netherlands)
OECD	Organisation for Economic Cooperation and Development
OST	Office of Science and Technology (United Kingdom)
PDF	Pooled Development Fund
R&D	Research and Development
RMIT	Royal Melbourne Institute of Technology
SME	Small to Medium sized Enterprise
STA	Science and Technology Agency (Japan)
TAFE	Technical and Further Education
TFP	Technology Foresight Program (United Kingdom)

QUOTABLE QUOTES

'Innovation is less about "that brilliant idea or breakthrough" and more about an attitude that encourages continuous improvement in products, service delivery and research. Such an attitude is one of the "signs" of high productivity.'

'Innovation is the process of converting an idea for a product, service or process into a successful opportunity, normally measured by a satisfactory commercial result.'

'... innovation means a commitment to best quality and practice, leading edge technology, the continuous improvement and adaptation of technology, the development of new capabilities through research and development and the commercialisation of new ideas.'

'... improving economic and social wellbeing by making things better and making better things.'

'... creativity and new ideas within a company seems to be the key to true innovation: to come up with those ideas and think out of the box.'

'We cannot continue to go in all directions. Our innovative capacity is limited. Choices have to be made.'

'... government thinking in the past has had blind faith that, if you push more money into the bottom of the innovation system, something good comes out the top. It is like pushing string uphill; it does not happen that way.'

'Cultural change is just as important in the capital market as it is on the waterfront and the factory floor.'

'The problem that we have in Australia is the "not if it is invented here" syndrome, that Australian purchasers of technology are far more fascinated by widgets from Germany, the US Japan or somewhere rather than something that is invented in Caulfield.'

'Introducing a more innovative culture into the management of companies is ... perhaps the one single most important thing.'

SUMMARY AND RECOMMENDATIONS

SUMMARY

To reap the benefits and to deal with the challenges presented by technological change and a more competitive world trading environment Australia needs to utilise fully its innovative talent. Australian enterprises will have to be committed to innovation in order to continuously improve their performance and keep up with the world's most competitive enterprises.

Definition

It is unlikely that a single definition of innovation would gain universal acceptance. Innovation is a complex and dynamic process which can involve complex cross linkages and interactions. The Committee, however, considered that the definition used by the Business Council of Australia was a useful starting point in the inquiry.

> '... innovation is something that is new or improved done by an enterprise to create significantly added value either directly for the enterprise or indirectly for its customers.'

Targets/Outcomes

The broad aims of becoming a more innovative culture must be a continually improving quality of life for all Australians with enhanced employment opportunities, sustainable economic growth and a healthy external financial position. One of the key targets is for Australia to gain an increased share of world trade, particularly in high value-added goods and services. Australia must develop more internationally competitive industries and enterprises. The aim should be to become international leaders in management methods, industrial harmony and production efficiency. Australia should also aim to achieve world leadership in educational methods, design, and the development of new products from our scientific prowess.

Australia must aim for an even more highly skilled workforce, better levels of networking and business cooperation within the private sector and between the private and public sectors and for improvements in venture capital availability.

The Government and government agencies also should aim for world best practice - in the provision of public infrastructure and in the management of government programs. Governments at all levels should aim to be leading edge customers to encourage innovation in Australian suppliers.

Australia's innovation performance

There is convincing evidence that Australia needs to greatly improve its performance in innovation. While change is occurring - our economy is becoming more focussed on export markets and more open to international competition domestically - the recent growth in business expenditure on R&D must continue. The research output must be converted through development and commercialisation to export income.

There is a justifiable impression that too much of what is discovered or invented within our shores is left for others to develop and exploit. It is at the crucial development and commercialisation stages of the innovation process that Australian enterprises have found success most elusive.

A number of factors are used as indicators or proxies to assess a nation's innovation performance. These include: the level of R&D expenditure; numbers of patent applications; the rate of uptake of technology; share of scientific publications and citations; and education levels.

R&D expenditure

In 1992/93 gross expenditure on R&D rose 16% over the previous year to $6.3 billion. Business expenditure on R&D rose 17% in that year and rose another 4% in real terms in 1993/94. Despite this rise, Australia's performance relative to it's major trading partners remains poor due to the low base from which it started. The contribution of the public sector in Australia to R&D expenditure compares favourably with that in other OECD countries. The problem of Australia's overall comparatively low performance in R&D spending lies with the low contribution of the business sector. The structure of the economy is changing, but the necessity to move to greater value adding activities and industries will demand greater R&D expenditure by the business sector.

The Australian business sector's R&D expenditure has been concentrated in a relatively small number of firms. In 1988/89 the largest 5% of R&D performers accounted for 63% of total business R&D expenditure. There is evidence that the concentration may be decreasing. More small enterprises are actually performing R&D and medium sized firms have increased their average R&D effort considerably. The increase in R&D activity has been concentrated in industries largely composed of SMEs. Nevertheless, small to medium sized enterprises often lack the resources to acquire the latest technology or to undertake the level of networking necessary to be aware of new technologies.

Australia's R&D effort focuses on the early stages of the innovation process. That focus is accentuated by the strength of public sector expenditure on R&D in comparison with the weakness of the business sector and the fact that the public sector R&D effort is predominantly directed to research rather than development. Australia 'does less experimental development as a proportion of all R&D than many other countries - only one-third as compared with well over a half in the United States, Sweden and Japan.'

The Committee considers that freely operating, well informed competitive markets are the ideal mechanism for deciding the appropriate mix and level of research investment and commercialisation expenditure. However, market barriers may result in a less than adequate commitment of resources to research, especially from the private sector. Where the Government can act to remedy market failure, at a cost which is less than the benefits to be obtained, then it should do so.

The Committee agrees with the Industry Commission that there should not be a 'catch-up target based on some international ratio of BERD to GDP'. The Committee also does not seek to identify an ideal 'mix' of the different types of R&D activity. However, there is clear evidence that the pattern of R&D expenditure in Australia needs to change. This change should not occur by shifting resources away from the research end of the spectrum but by increasing the amount of expenditure on experimental development. It is also clear that this increase in expenditure must be achieved by raising the contribution of business enterprises. There is evidence that business expenditure on R&D is increasing in real terms and that the pattern of R&D spending is shifting accordingly.

The Committee considers that the solution to Australia's R&D problems does not require a suite of new programs but the continued application of programs already in place with a strong focus on making those programs operate as efficiently and effectively as possible.

In order to be able to monitor properly the effect of government R&D policies it is important that there be reliable information concerning the level of expenditure on R&D. The Committee considers that it would be highly desirable if organisations which are required to submit annual reports, in both the public and private sectors, should also be required to include in their annual reports information collected in a consistent manner on their R&D expenditure.

Patents

The number of successful patent applications, both domestically and externally, is often used as one of the comparative indicators of the level of innovation in nations. Australia's ranking in terms of external patent applications improved significantly during the 1980s. Between 1981 and 1991 the number of external patent applications by Australians rose by an average 17% per annum.

Technology Uptake and Diffusion

There is an unsatisfactory level of technology uptake by Australian firms. Poor implementation and failure to integrate new technology with existing operations are 'alarmingly common'. This has been attributed to the difficulties firms experience in obtaining finance, a lack of senior management expertise and poor interaction between firms. The 1994 *Working Nation* document stated that Australian industry lags some three to eight years behind industry in competitor nations in adopting new technologies.

Australian Bureau of Statistics figures show that the proportion of Australian manufacturing establishments using advanced technology increased in the 1988 to 1991 period in all industry sectors, except textiles. Other studies have show an increase in the proportion of manufacturing output which involved innovative products or processes. This is an indication of technology diffusion and structural change in Australian industry but the figures presented are not compared to trends in competing economies.

Scientific Publications

The Industry Commission report on *R&D* referred to evidence of a decline over the 1980s in Australia's share of global publications of science and in the share of citations of Australian science publications. Possible reasons suggested for this 'decline in international visibility' include: a move away from basic to applied research; a decline in the 'infrastructure capacity for basic science in Australian universities'; and 'the high costs of "big" science'.

Education levels

Australia has apparently been a beneficiary, since 1983/84 at least, of the international 'brain drain' - being a net receiver of academics, scientists and engineers. However, just 10% of 25 to 64 year olds in Australia's population have university or equivalent level education compared to 13% in Japan, 15% in Canada and 23% in the United States.

Education and the Innovation Process

The true source of innovation is the creativity of people. It is the desire of people to explore and understand the unknown, and having gained that knowledge to use it, which leads to innovation. The application of knowledge can involve risk. It is vital to encourage entrepreneurial attitudes and behaviour if innovation is to flourish.

The central role of the creativity, skills and knowledge of people as the prime source of innovation points clearly to the key role of the education and training systems as drivers of innovation. Education and training at all levels must promote creative thinking and entrepreneurial attitudes and behaviour as well as imparting the skills and knowledge the economy needs to be internationally competitive.

Education can play a key role in developing innovation on several levels. It can develop not only the innovative talent of individuals but it can also help change community attitudes - influencing the level of support the community gives innovators.

There is a need to develop a strategy that addresses how to encourage innovation at primary, secondary and tertiary education levels and also in skills training and managerial education courses. This requires long term commitment from the Commonwealth and State Governments.

Creativity

While it may be a skill that comes more easily to some than to others, much can be done to improve the creative abilities of virtually all people. People need to be encouraged in their education and training to explore possibilities outside traditional patterns of thought and procedure.

It is clear to the Committee that, given the essential role of creativity in innovation and that innovation is essential to economic prosperity, the Government must firmly adopt the aim of developing the creative skills of the Australian people. This must be achieved through all levels of the formal education system as well as through the less formal means of education in the community. The emergence of creativity cannot be left to chance. What is envisaged is a major cultural change which may well take a generation to reach full fruition. There must be a long term commitment to this aim.

The Committee believes that whether the education system is adequately teaching students how to think creatively, whether such thinking skills are best taught as part of existing subject curricula, or whether there should be a separate core subject on thinking skills, should be investigated by the relevant education authorities.

Primary and Secondary Education

In recent years the Commonwealth Government, in conjunction with the States and Territories, has identified two key education strategies to enhance the preparation of young people for today's workplace. The first of the initiatives has been the development of the *Key Competencies Program*, a $20 million, 3 year program announced in 1993 to develop, trial and evaluate key competencies. The second initiative is the *Enterprise Education Strategy* to which $3.4 million over 4 years was allocated in the 1995/96 budget.

The Committee strongly supports the principle of using the education system to help develop entrepreneurial skills and to help instil cultural attitudes which recognise the important role of business enterprises in our society. The *Key Competencies Program* and the *Enterprise Education Strategy* are two initiatives which, if adequately supported with resources and effectively executed, could be highly beneficial to the aim of developing a more innovative Australia.

The Committee considers it essential that the education system fully equip students to enter the commercial world. What students learn in classes at school should be enhanced through the practical experience of being placed as part of their training in selected businesses. The education system should interact closely with business and industry, not only through work experience but through work based training. There are some secondary schools which have established work based training programs in conjunction with the business community. The Committee strongly advocates that such initiatives be copied in all secondary schools across Australia. The Committee believes that the principle of internships is equally important at tertiary level education.

Tertiary Education

Management, not government, must shoulder much of the responsibility for creating innovative, competitive and highly successful enterprises. The Government cannot create innovative enterprises by prescription. However, the Government can ensure the infrastructure exists to train world class management.

One of the major objectives of the Government's innovation strategy should be the delivery of appropriate training to the managers of the future. The Committee believes that government support in this area would not require considerable additional resources. The infrastructure for a well structured education program already exists.

The Committee considers that the quality of management education in Australia would be enhanced by a system of accreditation for institutions and educators. This system would provide potential clients with a guide to the institutions that best meet their specific requirements. The Committee believes that improving the flow of information to potential students would lead to greater competition between management training institutions and to an improvement in the quality of management education.

A significant deficiency in Australian management is the level of understanding of technology and its importance to enterprise improvement and innovation. This is a result of the limited number of Australian managers who have qualifications in either science and engineering.

Currently, many scientists and engineers lack training in basic management and business skills. This creates a barrier to the advancement of scientists to management levels in enterprises. In order for Australia to become a more innovative society scientists and engineers need a better understanding of business skills and those in enterprise management need a better understanding of science and technology. The education and training system needs to adopt a more multi-disciplinary approach to achieve this spread of knowledge and skills.

The TAFE system is an important part of vocational education and training. Aside from providing training under the existing system of apprenticeships and traineeships, TAFE also provides vital management training and support, especially for the small and medium size enterprise sector.

The programs offered through the TAFE system have to be enterprise driven so that management skills development is linked to business outcomes. Inevitably, this requires close links between program developers and enterprise representatives. The traditional delivery of programs in a classroom environment is no longer the best way to meet enterprise needs. Traditionally, vocational training in TAFE has emphasised the technical aspects of occupational training. Tradespeople and technicians who are trained in TAFE, often lack the management skills that are necessary for them to move into a management role.

The impact of the vocational education and training sector on innovation would be enhanced by raising the profile of TAFE as an important source of quality

management training, especially for managers of SMEs whose capacity to utilise more formal education processes is limited. TAFE institutions should offer flexible management training courses to cater for individuals employed full time. At the same time TAFE needs to focus more on management skills as part of the training of trades people and other technical professionals.

Interaction between industry and management schools must be constant. A fundamental component of this interaction should be enterprise secondments for students and lecturers as well as placements in tertiary institutions for industry participants.

One way to increase information flows between management/innovation schools and the business sector would be to institute a system of personnel exchanges between these groups. These exchanges would involve:

- enterprise managers participating in teaching either as course facilitators or less formally as advisers to program designers;
- students undertaking placements with small businesses to provide them with a better understanding of the role of management; and
- lecturers with a strong background in the business sector, especially from innovative enterprises, delivering courses from the perspective of an individual with relevant practical experience.

It is equally important that Australian management schools keep pace with overseas trends in teaching management techniques. One way to monitor international standards is to actively engage in exchanges with overseas institutions.

A key to effectively improving management standards through education is to enhance the accessibility of management training. To achieve this Government and training institutions must be aware of the different needs of individual managers. Obviously, training institutions should regularly check through consultation and market research methods that their courses meet the needs of managers and potential managers. The Government should also ensure that the mix of courses offered by institutions as a whole offers the variety in format, duration and content that mangers need.

Australia cannot successfully teach innovation without innovative teaching techniques. Innovative teaching involves using new methods of imparting knowledge and making available new methods by which people of all ages can obtain knowledge by themselves.

This time of rapid change in communications and computing technology offers a golden opportunity to re-think how education and training is best delivered and also to re-think the content of education and training programs. Rapid change both demands and encourages creativity in addressing these issues.

The Government must be committed to an ongoing process which examines, explores and implements the latest technologies and techniques in teaching all forms

of educational material. This process should examine both international and domestic trends. It should also assess new technologies and appraise their possible integration into current educational processes to improve course delivery.

Access to Finance

An insufficient level of long-term or patient capital is seen as one of the more intractable barriers to innovation in Australia. This suggests a deficiency in the financial system and/or a failing in the training of the loans managers in financial institutions.

Linkages/Networking

Innovation is very rarely the result of the guidance and skills of a single individual. Frequently the knowledge and skills that are required are not even found within a single enterprise. Innovation requires interaction between individuals, enterprises and even industries. The multi-disciplinary nature of innovation cuts across traditional demarcation of individual professions. Developing Australia as an innovative culture will depend on the formation of networks in the economy which bring together innovative people and their particular skills.

Linkage mechanisms are also needed to connect all participants in the innovation process with customers and suppliers. This is crucial since demand driven innovation is the most likely to succeed. Linkages are vitally important not only between institutions and individuals within the domestic economy but between Australian institutions and individuals and their counterparts overseas.

Linkages enhance a nation's innovation performance in a number of important ways, mostly to do with improved information exchange. In a recent BIE survey, many of the benefits identified by firms from linkages they had established were 'spin-offs' - that is, they were not the expected benefits which had been the cause of the links being adopted. The most common of these unexpected benefits were: improved 'market knowledge, improved production processes, product development and improved quality'. These are, of course, all of significant importance to innovation.

A number of barriers exist to the formation of business linkages and when links are formed problems may occur. Sometimes these problems are substantial enough to lead to the collapse of the cooperative arrangement. It is important for these barriers and problems to be understood so that they can be taken into account by the Government in the promotion of cooperative arrangements. It is also important to emphasise that the proportion of firms which experience major benefits from linkages is much greater than that which experience major problems.

There is an apparent information shortage, for example about potential linkage partners and opportunities for cooperation, which if properly addressed by government and industry associations could substantially increase the extent of business cooperation.

There is clearly a role for external assistance in promoting the benefits of linkages and their role in the innovation process and to help overcome the information problems which the BIE survey identified. The principal sources of assistance to firms seeking to form cooperative arrangements with other firms are the Government and industry associations. Other sources of external assistance include Chambers of Commerce and Chambers of Manufactures, business advisers, consultants and accountants.

The main Commonwealth Government program specifically promoting firm to firm linkages is the Business Networks Program (BNP) run through AusIndustry. The BNP involves the use of 'network brokers' and financial assistance to help groups of at least 3 firms through the stages of feasibility study, business plan development, formal cooperation agreement and possibly even implementation.

Almost 70% of the firms in the BIE survey 'claimed they had no prior knowledge of appropriate government programs or departments which might help them form cooperative arrangements'; so there is clearly scope for much greater effort by governments in informing the business community of assistance which is available. There would also appear to be the need to improve performance by governments in the following areas, where assistance was rated most poorly:

- 'introducing firms;
- 'identifying market and business opportunities; and
- 'providing training in forming links'.

In marketing the benefits of the Business Networks Programs, the Government should publicise the fact that the network facilitators come from the private sector. This should help overcome an apparent resistance by firms to the idea of the Government providing brokers and facilitators.

The Government must accord a high priority to educating firms about the benefits of business cooperation and about the range of programs which exist to assist firms in establishing cooperative arrangements.

To effectively educate firms concerning the benefits of cooperative arrangements and to promote enterprise involvement, it will be essential for the Government and in particular AusIndustry, to interact closely with other providers of assistance to firms. Industry associations directly assist cooperation through such means as organising focus groups and trade missions as well as helping 'firms find partners or cooperation opportunities'. The relationship between the Government and industry associations is very important. Industry associations can perform the function of facilitators and delivery points of government assistance. They can also play an important role in the design of assistance policies.

Collaboration between government and industry associations will lead to improved delivery and access to assistance. The Committee acknowledges that AusIndustry does work with the private sector but considers that even greater efforts should be made to increase such cooperation to improve community awareness of assistance programs and to improve the effectiveness of the delivery of those programs.

The BIE recommended the creation of an electronic 'cooperation network', much broader than *BizLink*, to provide assistance to agencies and cooperators with a forum to access information on matchmaking, opportunities, case studies, financial assistance, and training issues related to business cooperation. The Committee supports the concept of using an expanded form of the *BizLink* program to increase the level of business cooperation in Australia.

The fairly recent Government initiative, the *Ideas and the Investor* program, should serve as a useful means of promoting firm to firm linkages and of encouraging the commercialisation of innovative ideas. The program is now being extended nationally as part of the Government's Business Equity Information Service, through the Chambers of Commerce. Based on the favourable early outcomes from the *Ideas and the Investor* monthly publication, it is obviously important that it continue to receive strong government support.

There is scope in the Australian economy for large firms to strengthen links with their local suppliers and to promote networks among those suppliers. If more large firms will take the initiative in *supply chain management* then the links which are built could also serve as channels of information concerning the availability of government assistance programs.

Small and Medium sized Enterprises

Small and medium sized innovative firms are likely to encounter particular difficulties because of their size. They are likely to have greater difficulty than larger firms in gaining access to finance; they are less likely to have the resources necessary to undertake sufficient R&D; and they are less likely to have the resources needed to pursue and fully participate in business networks.

In many cases it is neither practical nor possible for SMEs to undertake R&D on their own. The Committee believes that one of the goals of government policy should be to enhance the contact between SMEs and research agencies, especially public R&D agencies.

Few Australian SMEs establish links with other firms. The information necessary to initiate useful collaborative arrangements is not readily accessible to SMEs. The CRC program is one mechanism the Government has established to increase the involvement of SMEs in cooperative arrangements, especially in arrangements focussed toward enterprise innovation. However, the CRC program does not appear to have proved as accessible for small enterprises as it has for larger enterprises.

The Committee is also concerned that SMEs are currently not able to exploit all the opportunities presented by the CRC program and believes there is a need to provide support to SMEs that would facilitate their increased involvement. Resource requirements and the presence of large players within CRCs are the major barriers to increased involvement by SMEs. Some smaller firms apparently feel some reluctance to become involved in the CRC program owing to a fear of being overwhelmed by their larger commercial partners. The Committee believes there is a need to:

- create a second tier of CRCs which are principally for SMEs; and
- allow SMEs to form networks and for those networks to participate in CRCs as a single unit.

Public research agencies are valuable resources Australian industry has available to it and which could be much better utilised. A scheme which enhanced the access of firms to public research agencies with minimal charges would greatly benefit Australia's innovation performance. The Committee considers, however, that it is best left to individual agencies to decide how to allow greater access to firms.

Technology Foresighting

It is important that the scarce resources devoted to enhancing Australia's innovation performance should be effectively used to improve the international competitiveness of industry. There is concern that Australian resources directed toward innovative activities are spread across too many areas and their impact is lessened as a result. The challenge for a small to medium sized economy like Australia is how best to use it's limited resources in both the public and private sectors to maximise the benefits to the economy. Unfortunately, deficiencies such as imperfect information, frequently prevent the ideal result from being achieved by the market alone.

Many governments around the world have instituted technology foresight programs in an attempt to encourage and improve long term planning of technology investment. The Committee considers that the Government should closely study the various foresighting methodologies and the experience of other countries with them. There is a need for Australia to use such studies to help provide better direction to research and development investment both in the private and public sectors. Foresight analysis has the potential to greatly enhance Australia's innovation performance. The information and analysis provided by a foresight program is essential to the decision making process that allocates resources between competing interests.

Foresight programs must be ongoing, as they are in Japan, and not simply one-off exercises which quickly become dated by unanticipated advances in science and technology. They should include projections over a range of time scales from 10 to 30 years and the methodologies used must be frequently reviewed. There must be a considerable level of involvement by industry and researchers.

The Innovative Enterprise

The enterprise is the commercial unit that brings together human and other capital to create wealth. It provides the vehicle that turns good ideas into successful innovation.

The importance of management to the innovation culture results from the impact managers have on all aspects of enterprise activity. Enterprises are essentially the product of their managers. Managers are the 'shapers' or 'drivers' of enterprise

change. One of the major objectives of the innovation strategy should be the delivery of appropriate management skills to the managers of the future.

Managers of innovative enterprises must achieve best practice management to ensure their success. The provision of information on management best practice principles and benchmarking are vital to this goal. The Government should take an active role in promoting and disseminating this information.

Working conditions and employer-employee relations can have a major impact on enterprise innovation. Management and employees must take joint responsibility for developing workplace flexibility that is conducive to continual improvement and innovation. Effective enterprise management involves encouraging a cultural shift in the workforce so that employees respond to change positively and play an active role in promoting innovation from below.

It is equally important that unions recognise the important role they have in facilitating innovative activity in the enterprise. A workplace that is responsive to change will be in a better position to adopt innovative practices that improve competitiveness and enhance enterprise performance. This will result in more secure employment and greater opportunities for workers. The Government is obliged to ensure the industrial relations environment does not inhibit the existence of innovative workplaces. If management mistakenly perceives industrial arrangements as inhibiting innovation, they may not attempt to undertake beneficial enterprise change.

RECOMMENDATIONS

The following recommendations have been grouped thematically and are not in the order in which they appear in the body of the report. The paragraphs in which they appear in the report and identified by the numbers in brackets following each recommendation.

Technology Foresighting

Recommendation no. 1

The Committee recommends that the Government make a commitment to introduce technology foresight analysis following the outcome of the ASTEC study, *Matching Science and Technology to Future Needs: 2010* and to adequately fund such analysis on an ongoing basis and to disseminate the findings widely to industry and to research institutions. The technology foresight process adopted should involve a high level of consultation with industry, researchers and community groups. (para 6.164)

Education

Recommendation no. 2

The Committee recommends that the Commonwealth, State and Territory Education Ministers commission an examination of:

- whether creative thinking skills are being adequately taught within the primary, secondary and tertiary education system; and
- whether teacher training programs adequately equip teachers to develop the lateral thinking abilities of their students. (para 4.12)

Recommendation no. 3

The Committee recommends that Commonwealth, State and Territory Education Ministers consider, in conjunction with the business sector, the more widespread introduction of structured work based training for secondary and tertiary students throughout Australia. This would involve the placement of students with businesses for significant periods of time as an important part of their educational experience. (para 4.32)

Recommendation no. 4

The Committee recommends that the Commonwealth Government keep under close review the progress of the Enterprise Education Strategy and be prepared to increase the funding allocation in two years time if necessary to ensure the success of the program. (para 4.34)

Recommendation no. 5

The Committee recommends that the Commonwealth encourage the close involvement of the business community in the development and operation of the Enterprise Education Strategy, including allowing tax deductibility for contributions to the operation of the program. (para 4.35)

Recommendation no. 6

The Committee recommends that the Commonwealth Government ensure that occupational training undertaken in institutions including TAFE should place a strong emphasis on the development of management skills among trades and other technical professionals. (para 4.53)

Recommendation no. 7

The Committee recommends that TAFE and other educational institutions should offer more flexible management training courses to cater for the needs of individuals employed full time and of managers of SMEs. (para 4.54)

Recommendation no. 8

The Committee recommends that the Commonwealth Government support a formal program to improve the relevance of management education. Educational institutions should be encouraged to increase their cooperation with the business community through such means as:

- working more closely with the business sector in the development of courses and in the development of lecture schedules; and
- recruiting lecturers with recent, practical experience as managers in innovative enterprises.

The Committee also recommends that consideration be given to means of encouraging Australian TAFE institutions to increase exchanges of personnel and information with industry and their overseas counterparts. (para 4.62)

Recommendation no. 9

The Committee recommends that the Ministerial Council for Education, Employment, Training and Youth Affairs investigate measures to expand the teaching of:

- innovation, business and entrepreneurial skills in secondary education; and
- innovation studies/programs in tertiary institutions throughout the country. (para 4.69)

Management Skills

Recommendation no 10

The Committee recommends the development of a self help program for Australian management, whereby enterprise managers assist each other with advice. Under the program AusIndustry would develop a database that brings together managers who are seeking assistance and those willing to provide assistance. (6.179)

Linkages

Recommendation no. 11

The Committee recommends that the Government, through AusIndustry, liaise more closely with other major providers of industry assistance, especially industry associations, business organisations and business advisers in promoting and assisting business cooperation. The relationships established between the Government and industry organisations should be used in the design and development of assistance programs to facilitate the spread of cooperation amongst Australian enterprises. (para 5.82)

Recommendation no. 12

The Committee recommends that the Government encourage large firms to introduce *supply chain management* and to use the networks created to increase awareness of the benefits of business linkages and the availability of programs to assist the building of such links. (para 5.89)

SMEs

Recommendation no. 13

The Committee recommends that a second tier of CRCs be created which is reserved for the involvement of SMEs which meet two of the following criteria: they should have less than 50 employees, gross annual revenue of less than $10 million or gross assets of less than $5 million. (para 5.102)

Recommendation no. 14

The Committee recommends that networks of SMEs should be eligible for participation in the CRC program. (para 5.104)

R & D

Recommendation no. 15

The Committee recommends that the 150% R&D tax concession scheme be retained. (para 6.70)

Recommendation no. 16

The Committee recommends that organisations in both the public and private sectors which are required to submit annual reports should also be required to include in their annual reports information on their R&D expenditure. The Committee further recommends that the Government, in conjunction with the Australian Bureau of Statistics and industry, develop an agreed basis according to which such expenditure should be measured. (para 6.124)

Access to Finance

Recommendation no. 17

The Committee concurs with the National Investment Council report *Financing Growth* and recommends that the findings be adopted by Government. (para 5.13)

Recommendation no. 18

The Committee recommends an immediate review of the PDF program. The review should have a particular focus on identifying barriers that have affected the utilisation of the concessionary tax rates offered to investors. The review also needs to consider the impact the PDF program has had on the availability of capital for innovative activity among SMEs. (para 5.17)

CHAPTER 1 - INTRODUCTION

> **'Australians have a tradition of being innovative. But the "folk" concept of innovation will not serve us in the future. Innovation is less about "that brilliant idea or breakthrough" and more about an attitude that encourages continuous improvement in products, service delivery and research. Such an attitude is one of the "signs" of high productivity.'[1]**

WHAT IS INNOVATION?

1.1 The term 'innovation' is interpreted in different ways by different people. According to the Macquarie dictionary, innovation refers to 'something new or different [which is] introduced'. It might refer to the introduction of either new things or new methods. In discussing innovation some are inclined to place the main emphasis on creativity or inventiveness. This can lead to research being thought of as the main driving force of innovation and to less consideration being given to encouraging innovation in the development and commercialisation stages. Others, particularly those involved in industrial or commercial activities, argue that mere invention is not sufficient and that 'true' innovation must carry the implication of successful commercialisation.

1.2 The Australian Graduate School of Engineering Innovation stated in their submission:

> 'We perceive that innovation is a commonly misunderstood concept, with many people subscribing to a narrow concept of innovation, and many confusing the concept with invention. This was confirmed by market research which the School undertook [of its clients comprising representatives of technology-based organisations]...if enterprises which should be intimately concerned with innovation hold a narrow view, then the broader community will have an even poorer appreciation of the nature of innovation.'[2]

1.3 A number of submissions favoured the definition given by the Business Council of Australia in their 1994 study, *Managing the Innovating Enterprise*.

> 'In business, innovation is something that is new or improved done by an enterprise to create significantly added value either directly for the enterprise or indirectly for its customers.'[3]

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1 Business Council of Australia: *Australia 2010: Creating the future Australia (Education Edition)*, Prepared by Ted Hook and Tim Riley for the Business Council of Australia, 1995, p 87

2 Australian Graduate School of Engineering Innovation: Submission no. 43, p 1

3 Business Council of Australia: *Managing the Innovating Enterprise*, p 3

1.4 The Business Council's definition is broad in that it allows for 'innovation' to encompass new or improved products, processes, management methods, supply and distribution systems, et cetera. It does, however, have a distinctly commercial focus and may not be accepted by everyone. While recognising that limitation, the Committee considered that the Business Council's definition was a useful tool for its inquiry.

1.5 It is important to recognise that innovation is a dynamic process which can have complex cross linkages and interactions. New ideas or methods at a research stage can lead to new products being developed and commercialised and the process of development and commercialisation can identify the need for more basic research. Similarly, innovation in one field or industry can stimulate innovation in seemingly unrelated areas. As the submission by BHP stated:

> 'In most of the rest of the world the underlying implied *linear model - research takes place in a laboratory then it* is transferred to industry, to be profitably commercialised - has long been discarded.'[4]

WHY IS INNOVATION IMPORTANT?

1.6 In a presentation to the National Press Club in November 1994, the Minister for Industry, Science and Technology, Senator Peter Cook, outlined why an innovation culture is important for Australia:

> 'A true innovation culture can drive economic growth faster, employ more people in better jobs, and lift the quality of life for all Australians.'
>
> 'In the past we focused on the "reform culture" to improve the business environment, "best practice culture" to build competitive firms and an "export culture" to encourage these firms to take advantage of their competitiveness.'
>
> 'What we need to do is embrace an "innovation culture".'[5]

1.7 It is a cliche to say that we live in a rapidly changing world. Technology is changing at an accelerating rate. The level of world trade is continually expanding and the pattern of that trade has shifted enormously in recent decades as many of the economies of Asia have undergone virtual economic revolutions. Trade barriers are being progressively dismantled forcing all economies, all industries and all enterprises to become more efficient and more competitive.

1.8 Australian producers now face considerably more pressure in the domestic market from foreign competitors. To meet this growing challenge Australian

4 BHP: *Submission no. 84*, p 5

5 Shires, D. and Lewis, S.: *Cooking up a Storm*, Australian Financial Review, April 25 1995, p 13

enterprises will have to be committed to innovation in order to continuously improve their performance and keep up with the world's most competitive enterprises. This is especially important for enterprises which hope to benefit from the emerging opportunities in the rapidly growing economies of east and south-east Asia.

1.9 To deal with these challenges and to reap the benefits of the opportunities presented will require Australia to fully utilise all of its innovative talent.

1.10 The Australian Manufacturing Council's report, *The Wealth of Ideas*, cited five reasons for the increasing importance of innovation for enterprises which intend to survive and prosper:

- **'Consumers expect more**: today's consumers look for products that are specifically designed to meet their individual needs;
- **'Customers have more choice**: with more international competition, customers can afford to pick and choose and have less reason to remain loyal to suppliers. For an emerging exporter they will face even greater competition overseas;
- **'Ideas make up more of the value added**: wealth creation is increasingly about capturing new ideas and applying them commercially;
- **'Product life cycles are getting shorter**: there is now constant pressure to come up with something new or better; and
- **'Niche players need something extra**: in order to sustain sales firms must innovate; however, achieving new growth in serving the next niche depends on developing a better product and service package than anybody else.'[6]

1.11 A report recently prepared for the Business Council of Australia also emphasised the important link between innovation and being 'customer-focussed'.

> 'In part, this means encouraging a focus on the management of outputs rather than inputs. It is a common misunderstanding outside business that innovation is "Research and Development". R&D does not create wealth and jobs in its own right. The practical reality in business is that creating wealth and jobs depends on translating technical development into something that customers will buy at a price that creates value for a business. Becoming much more customer-driven - aiming to meet customer needs in a competitive market - should be a key aim of everyone involved in innovation, especially in our research organisations. Understanding

6 Australian Manufacturing Council and Mc Kinsey & Co: *The Wealth of Ideas - How Linkages Help Sustain Innovation and Growth*, Australian Manufacturing Council, p 3

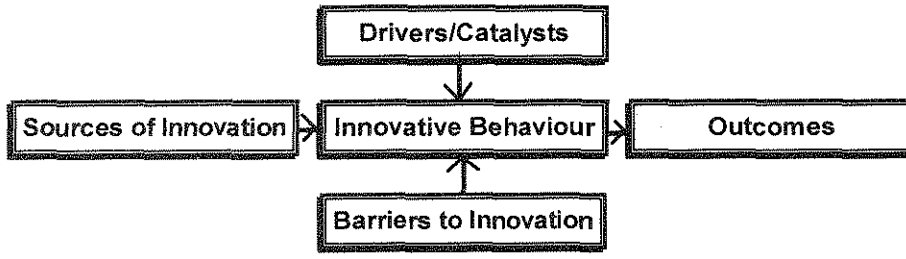
> what is driving those customer needs in the future, and using those insights to drive a forward-looking agenda for improvement (including through R&D) are two other vital disciplines.'[7]

1.12 Leading edge customers expect enterprises to continually improve their performance through new products and improved delivery of services. Consumers not only demand the highest quality and best value for money, but they also expect innovative product developments that meet their specific needs.

1.13 It has become imperative that Australian enterprises become internationally competitive in order to succeed. A key part of this process is a commitment to innovation.

THE INNOVATION PROCESS

1.14 *This report uses the following model to illustrate the process of innovation.*



Sources of Innovation

1.15 It is important to emphasise that the true source of innovation is the creativity of people. It is the desire of people to explore and understand the unknown, and having gained that knowledge to use it, which leads to innovation.

1.16 Creativity and exploration increase the stock of knowledge. The diffusion of knowledge in turn feeds the creative process and facilitates the application of that knowledge. The level of skill and knowledge in the community is therefore a key source of innovation.

1.17 As well as creativity, skill and knowledge there must be a willingness in people to apply the knowledge gained, again using skill and creativity. The application of knowledge can involve risk. Physical and financial resources, and time as well, must be invested to turn knowledge into products, new services or new

7 Business Council of Australia: *Australia 2010: Creating the future Australia (Education Edition)*, Prepared by Ted Hook and Tim Riley for the Business Council of Australia, 1995, p 90

processes. It is vital to encourage entrepreneurial attitudes and behaviour if innovation is to flourish.

1.18 The physical environment in which we live can legitimately be considered as a source of innovation. The geographic isolation of Australia, particularly before fast and reliable means of communication and transport were developed, forced a certain reliance on our own inventiveness and ingenuity. Similarly, the environmental and climatic challenges faced in Australia have often required us to devise novel solutions.

1.19 Of course, people operate within a social and economic framework. That framework includes the physical infrastructure; the legal and financial systems; the industrial relations system; the level of interest rates; the taxation system; the natural resource endowment of the nation; and the nature of international trade relations. The operations of government obviously can have a significant effect on this social and economic framework through a whole range of policies such as those which regulate economic behaviour in general or in particular industries; through the nature of the taxation system; industry development policy; monetary and fiscal policy (which impact upon interest rates); trade policy; science policy; education policy; government purchasing policy and in a host of other ways.

1.20 In a broad sense the nature of the social and economic framework could be seen as a source of innovation but it is probably more helpful to consider the individual aspects of that framework as drivers of, or barriers to, innovation.

Drivers or Catalysts of Innovation

1.21 In commenting above on 'why innovation is important', it was noted that markets, both domestically and internationally, have become more competitive and customers have become more demanding - or at least, more able to find alternative sources of supply of products and services because of increased competition. Clearly, one of the main drivers of innovation is market demand.

1.22 Leading edge customers are therefore important catalysts for change and improvement. Enterprises which respond rapidly to the demands of leading edge customers will be those which are most innovative and most successful. One implication of this is that the Government can and should use its purchasing power to encourage innovation in Australian suppliers.

1.23 The central role of the creativity, skills and knowledge of people as the prime source of innovation points clearly to the key role of the education and training systems as drivers of innovation. Education and training at all levels must promote creative thinking and entrepreneurial attitudes and behaviour as well as imparting the skills and knowledge the economy needs to be internationally competitive.

1.24 It follows closely that the mechanisms for spreading or diffusing knowledge are important catalysts for innovation. Among the most important means of knowledge diffusion are the links between suppliers, producers and customers. The role of networks and linkages is discussed in some detail in this report.

1.25 The nation's research and development institutions are clearly vital in driving innovation. Key issues in this context are the extent to which Australia's R&D effort is adequate and the extent to which the focus of R&D should be determined by market demands. Another related issue is the desirability or otherwise of a periodic, national 'technology foresighting' exercise to help identify areas where R&D efforts would be best concentrated.

1.26 Innovation, of course, frequently requires the expenditure of substantial amounts of capital. Finance, either in the form of debt or equity, is an essential driver of innovation. Viewed from a different perspective, an insufficient level of patient or venture capital is seen as one of the more intractable barriers to innovation in Australia.

1.27 The skills and attitudes of management and the workforce generally can be key catalysts for innovation or can act as serious barriers. Similarly, industrial (or enterprise) structure and organisation can facilitate or hinder innovation as can the industrial relations system itself.

1.28 Again, the drivers of innovation exist within a broad social and economic environment. The decisions of governments at all levels are important in influencing this environment. Governments have a vital role to play in ensuring the environment is conducive to innovation.

Barriers to Innovation

1.29 Anything which interferes with one of the drivers or catalysts of innovation is a barrier. A number of actual or potential barriers to innovation were identified in the course of the inquiry. As already mentioned, these include an inadequate supply of capital - particularly for small to medium sized enterprises and for the development of ground-breaking research discoveries.

1.30 It has often been alleged that managers of larger Australian companies and of financial institutions, which might be approached by researchers or inventors for debt or equity finance, have exhibited an attitude of excessive risk-aversion or have been unwilling or unable to understand new scientific discoveries with great commercial potential. This suggests a deficiency in the financial system and/or a failing in the training of managers.

1.31 Another often mentioned, major type of barrier is anything which interferes with the diffusion of knowledge. There is clearly room for much greater cooperation between the public and private sectors in R & D and between enterprises within the private sector. The importance of networks and linkages has already been mentioned and there is clearly scope for much greater cooperation between businesses.

1.32 There are many areas in which the Government can help reduce substantial barriers to innovation in Australia.

Outcomes/Targets

1.33 The outcomes or targets of becoming a more innovative culture flow from the matters identified in the section earlier in this chapter on 'why innovation is important'.

1.34 The broad principal aims must be a continually improving quality of life for all Australians with enhanced employment opportunities, sustainable economic growth and a healthy external financial position.

1.35 Innovation is vital for Australia to be an internationally competitive economy. One of the key targets is for Australia to gain an increased share of world trade, particularly in high value-added goods and services. A related target must be to improve our current account position through an improvement in the balance of trade. The aim should be for an increase both in exports, especially of traded services and elaborately transformed manufactures, and in import substitution.

1.36 In order to achieve these outcomes in international trade we should rely on the development of internationally competitive industries and enterprises. The aim should be to become international leaders in management methods, industrial harmony and production efficiency. Australia should also aim to achieve world leadership in design, the development of new products from our scientific prowess and educational methods.

1.37 Australia must aim for an even more highly skilled workforce, better levels of networking and business cooperation within the private sector and between the private and public sectors and for improvements in venture capital availability.

1.38 The Government and government agencies as well should aim for world best practice in the provision of public infrastructure and in the management of government programs. Governments at all levels should aim to be leading edge customers to encourage innovation in Australian suppliers.

THE ROLE OF THE GOVERNMENT

1.39 There are four important features which should be part of government policy to promote innovation. These are:

- **The Government should ensure an environment conducive to innovation**: This refers to the general macro-economic environment as well as areas such as microeconomic and labour market reform. The performance of the economy will affect the capacity and the willingness of the private sector to undertake innovative projects.

- **The Government should not create unnecessary barriers to the innovation process and should help identify and remedy market failures impeding innovation**: The first step is for the Government to ensure that its policies do not create any avoidable barriers to

innovation. The Government should also try to ensure that failures in the market do not create impediments to the innovation process or, if there are such failures, take steps to correct them. Policy measures must take into account the whole of the innovation process. Policies must be appropriate for, and adjusted to, each of the various stages of the process.

- **Government policies should where possible involve stimulating greater private sector efforts**: It is vital to achieve the maximum possible impact from government program expenditure. Any government assistance to help promote innovation should as far as possible take the form of a catalyst, which stimulates a larger amount of private sector expenditure. In many instances the private sector is keen to commit resources to innovation; however, the perceived risk associated with innovation and the high level of resource requirements create a barrier to greater private sector interest. By sharing part of this risk through relatively small capital injections at crucial stages, or by reducing the risk inherent in innovation, appropriate Government policy can mobilise considerable private sector capital and commitment toward innovation.

- **The Government should adopt a broad spectrum of policies and be flexible**: The Government needs a broad policy agenda that will address the very different needs of the many players in the innovation process. *Tailoring policy to very specific needs will ensure an overall policy* strategy exists which truly promotes an innovative culture.

1.40 If the Government wishes to institute change in Australia's innovation culture it must take a long term perspective, where outcomes are measured over decades, as well as attempting what can be done to achieve improvement as quickly as possible. Periodic program assessment against clearly defined performance measurements will naturally be essential so that programs to make Australia a more innovative society can be adjusted as necessary.

1.41 The Government needs to adopt a broad approach in order to develop appropriate and effective innovation policies. The innovation process is complex and multi-dimensional. To effectively enhance the innovation process, the Government's policies and strategy must be equally diverse, multi-dimensional and multi-disciplinary.

1.42 This report highlights five areas where Government initiatives could have a major impact on Australia's innovation performance and innovation culture. These are:

- education & training;
- foresight planning;
- networking and linkages;

- capital availability; and
- enterprise management and structure.

CHAPTER 2 - TARGETS AND OUTCOMES

2.1 As mentioned in the introductory chapter, the principal reason for promoting innovation in Australia is to ensure we have a society and an economy with a continually improving quality of life for all Australians with enhanced employment opportunities, sustainable economic growth and a healthy external financial position. Innovation is essential for our economy to be internationally competitive so that we can achieve those broad aims.

2.2 There are specific industry and enterprise benefits flowing from greater innovative activity. For the enterprise, innovation means improved competitiveness. The benefits that enterprises might gain from improved competitiveness resulting from innovative activity are:

- expanded market opportunities both internationally and in the domestic market;
- increased opportunities for growth in the scale of the enterprise;
- increased revenue and profits; and
- increased remuneration of employees attracting high quality staff.

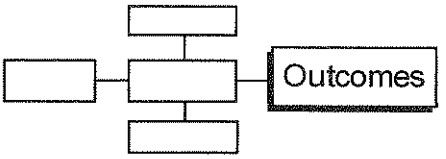
2.3 Some of the beneficial outcomes for an industry or industries from innovation include:

- improved competitiveness compared with similar industries in other countries;
- reduction in the real cost of industry product/service creating increased demand;
- increased exports and share of world demand;
- increased domestic demand for product/service; and
- increased size and revenue of the industry.

2.4 When innovation becomes an embraced culture across many enterprises and industries the benefits will extend to the economy and to the society as a whole. The real value and competitive position of the Australian economy will improve as well as the quality of life experienced by the population. Such changes form the crux of a national objective of reshaping and invigorating Australia's innovation culture.

2.5 The benefits of a broad national commitment to innovation will be felt by all members of society and include:

- reduced reliance on imported technology;
- increased value adding to Australia's abundant natural resources;



- increased levels of trade (increased exports);
- improved terms of trade;
- improved current account position;
- reduced levels of foreign debt;
- improved efficiency in the economy;
- increased growth of the economy;
- increased real incomes;
- greater choice and diversity for consumers;
- increased levels of employment;
- greater and more satisfying employment opportunities; and
- improved quality of life.

CHAPTER 3: AUSTRALIA'S INNOVATION PERFORMANCE

INTRODUCTION

3.1 Australians are not alone in the world in our self-image of being a resourceful and inventive people. Part of what we perceive as our outback heritage is the ability to use what comes to hand in novel ways to turn adversity and necessity to our advantage. There are indeed many inventions and scientific discoveries of world importance which have originated in Australia. However, there is as well a justifiable impression that too much of what is discovered or invented within our shores is left for others to develop and exploit. Examples range from the black box flight recorder to Ralph Sarich's orbital engine and the development of gene shears technology.

3.2 As a nation Australia has to realise that invention or discovery is only the first step in the innovation process - the first step towards realising the full value of an idea. The generation of new ideas must proceed to development and marketing before it will result in commercial success in the marketplace. It is at the crucial development and commercialisation stages of the innovation process that Australian enterprises have found success most elusive.

3.3 It is difficult to measure precisely a nation's performance in innovation because many factors are involved. There are also difficulties resulting from a lack of clarity, or a lack of agreement, about what it is that is being measured. International comparisons may be further complicated by differences in methodology. As a result, a number of factors are used as indicators or proxies to assess a nation's innovation performance.

3.4 In its 1995 report on R&D, the Industry Commission (IC) approached the problem of measuring performance in innovation by looking at inputs to, and outputs from, innovation. On the input side, the IC examined: the level of R&D expenditure; the type of R&D activity; and measures of specific inputs to R&D such as human resources and payments to foreigners for technical knowledge.[1]

3.5 On the output side, the IC referred to: numbers of scientific publications; numbers of patents and patent applications; rates of citation of Australian scientific publications; numbers of degree and diploma completions; net migration rates of academics, scientists and engineers; use of advanced manufacturing technologies; and the proportion of manufacturing output which involves new products or processes. Particular outputs such as the citation rate of publications; education attainments; net migration rates of skilled people; and use of advanced manufacturing technologies were identified as indicators of the diffusion of technology.[2]

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1 Industry Commission: *Research and Development,* Report No. 44, Volume 1, May 1995, pp 103 - 112

2 ibid., pp 113 - 123

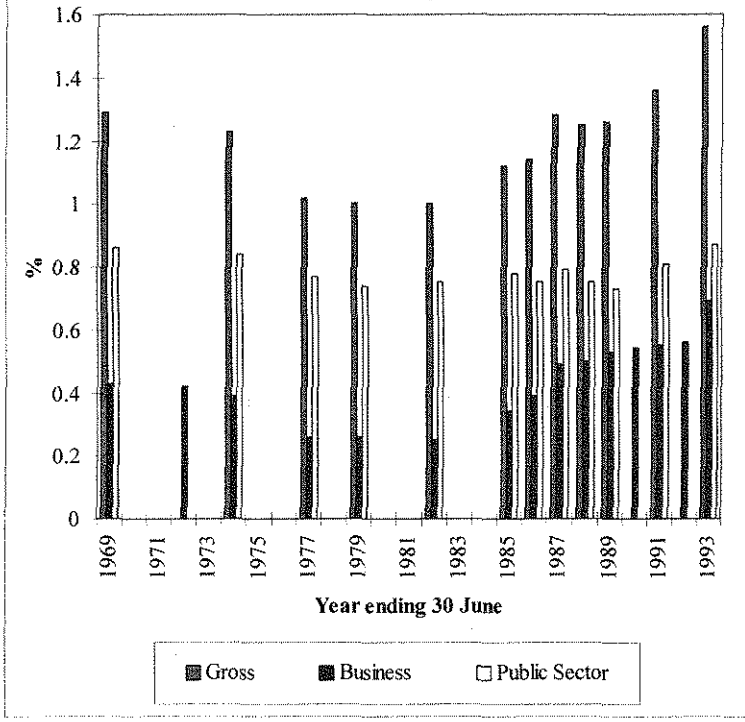
3.6 The following commentary looks at a number of these factors grouped under three headings:

- *R&D,*
- patents, and
- technology uptake and diffusion.

AUSTRALIA'S R&D EXPERIENCE

3.7 Chart 1 shows the changes in Australia's gross R&D expenditure (GERD) as a percentage of GDP over the last two decades and the contribution to that of the business and public sectors. The commitment of national resources to R&D activity fluctuated considerably during this period. There was a significant decline during the 1970s which turned around in the second half of the 1980s. There has subsequently been a very substantial rise in gross R&D expenditure in the early 1990s.

Chart 1: Australian R&D expenditure as a percentage of GDP



Sources: DIST: *Australian Science and Innovation Resources Brief - Measures of Science and Innovation 4*, AGPS, July 1994, Appendix Table A1.3, p. 53
Industry Commission: *Research and Development* Report No. 44, Volume 2, May 1995, p 489
ABARE, *Commodity Statistical Bulletin 1994*, December 1994, Canberra, Table 1, p 1

3.8 From 1981 to 1991 the average annual increase in Australia's gross R&D expenditure as a proportion of GDP (GERD/GDP) was 3%.[3] For the period 1981 to 1992, however, the figure was 4.04% (compared to the OECD average of 2.22%) owing to a 7% growth rate in the years 1990/91 to 1992/93.[4] In 1992/93 gross expenditure on R&D rose 16% over the previous year to $6.3 billion.[5] Business expenditure on R&D rose 17% in that year and rose another 4% in real terms in 1993/94.[6] Despite this rise, Australia's performance relative to it's major trading partners remains poor due to the low base from which it started.

3.9 The 1993 Bureau of Industry Economics report, *R&D, Innovation and Competitiveness*, stated that 'Australia presently ranks sixteenth among 24 OECD countries in terms of GERD/GDP ... [compared] with a ranking of thirteenth in terms of per capita GDP ... .'[7] Australia's GERD/GDP figure of 1.56% in 1992 was still below the OECD average of 1.91%. By comparison the figures for Sweden, the United States, Japan, Switzerland and Germany ranged from 3.11 to 2.5%.[8]

3.10 The contribution of the public sector in Australia to R&D expenditure compares favourably with that in other OECD countries. In 1992/93 Australia was ranked fourth among the OECD countries with the public sector spending the equivalent of 0.87% of GDP on R&D.[9]

> 'About 55% of overall R&D expenditure is by government research agencies and higher education institutions. Over half of the public sector research is conducted within government departments and research agencies.'[10]

3.11 The problem of Australia's overall comparatively low performance in R&D spending lies with the low contribution of the business sector. In part, of course, this reflects the historical structure of the Australian economy and the comparatively smaller role of the manufacturing sector. Also, as the IC has pointed out:

> 'Compared to the industry structure of an "average" OECD country, Australia tends to have below average shares in all "high technology" (that is, high R&D intensive) industries and in most "medium technology" industries.'[11]

3.12 The structure of the economy is changing, but the necessity to move to greater value adding activities and industries will demand greater R&D expenditure by the business sector.

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3 ibid., p 104
4 ibid., pp 104 & 105
5 Shires, D: *Business R&D takes great leap forward at 28pc*, in *Australian Financial Review*, 3 May 1995, p 7
6 Coopers & Lybrand for the Industry Research & Development Board: *Scoreboard '95 Business Expenditure on Research and Development* DIST October 1995, p 2
7 BIE: *R&D, Innovation and Competitiveness*, Research Report 50, AGPS, Canberra, 1993, p 10
8 Industry Commission: op. cit., Table A3.1 p 105
9 Cook, Senator the Honourable Peter: *Science and Technology Budget Statement 1995-96*, AGPS, Canberra, 1995, p 1.3
10 Industry Commission: op. cit., p 211
11 ibid., p 494

3.13 Business R&D expenditure in Australia in 1981 as a percentage of GDP (BERD/GDP) was 0.25% compared to the OECD average of 0.91%. By 1992 BERD/GDP in Australia had increased to 0.69% but the OECD average had also increased - to 1.18%. The figures for Sweden, Japan, the United States, Switzerland and Germany ranged from 2.14% to 1.7%.[12]

3.14 The BIE's report, *R&D, Innovation and Competitiveness*, drew attention to the fact that Australia's R&D effort focuses on the early stages of the innovation process.[13] That focus is accentuated by the strength of public sector expenditure on R&D in comparison with the weakness of the business sector and the fact that the public sector R&D effort is predominantly directed to research rather than development. This helps explain Australia's research strength but poor results in commercialising ideas.

3.15 The study by the IC also commented on the fact that Australia 'does less experimental development as a proportion of all R&D than many other countries - only one-third as compared with well over a half in the United States, Sweden and Japan.'[14]

3.16 Australian business R&D expenditure increased significantly during the 1980s and early 1990s but it still accounts for less than half of Australia's total R&D effort. This is in stark contrast to Japan and Germany where the business sector accounts for over 70% of the nation's total R&D spending. An international comparison of BERD/GDP ratios ranks the Australian business sector eighteenth among a group of 24 OECD and Asian countries.[15]

3.17 International comparisons of human resources devoted to R&D appear to yield fairly confusing results. The IC report noted that 'the fraction of the [Australian] labour force comprising R&D personnel [rose significantly] between 1990/91 and 1992/93'.[16] However, the number of full-time equivalent researchers per 10,000 in the labour force in Australia was well below that in the two top countries, the United States and Japan, substantially above that in Switzerland, 'which has one of the highest GERD/GDP ratios, and well below Ireland ... which has an even lower GERD/GDP ratio than Australia'.[17]

PATENTS

3.18 There are differences between national patent systems which necessitate some caution in making international comparisons. However, the number of successful patent applications, both domestically and externally, is often used as one of the comparative indicators of the level of innovation in nations.

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12 ibid., Table A3.2, p 106
13 *BIE: Research Report 50, p 10*
14 Industry Commission: op. cit., p 109
15 ibid., p 491
16 ibid., p 109
17 ibid., p 110

3.19 The Australian patent system, like that in 47 other countries, has two tiers.[18] In Australia there are standard and petty patents.

3.20 The main two differences between a petty patent and a standard patent are that: a petty patent has a maximum term of only 6 years (as opposed to the maximum term of 20 years for a standard patent); and only three claims (one main and two subsidiary) are allowable under a petty patent application. A petty patent is also not subject to opposition before it is granted, but the extension of the grant beyond one year may be subject to objection.[19] The search concerning inventiveness in relation to a petty patent application is confined to documents published in Australia; however, according to the Advisory Council on Industrial Property, this does not create any real difference from the standard patent system because of the speed of modern communications.[20] 'In general terms, it is quicker, easier and cheaper to obtain a petty patent than a standard patent ... .'[21]

3.21 Part of the reason for having a petty patent system is to promote the development of indigenous inventions by local industry. While there are only about 300 applications per year for petty patents (compared to 20,000 for standard patents) 80% of those come from Australian residents. In contrast, just 10% of the standard patent applications are made by Australian residents.[22] The fact that about 90% of applications for standard patents come from foreign residents to a large extent simply reflects the size of the Australian economy compared to the world as a whole.

3.22 During the 1980s, as the Australian economy took on a more international focus, Australians became much more active in applying for patents overseas. This was made easier with the introduction of international treaties in the early 1980s.[23] Australia's ranking in terms of external patent applications improved significantly during the 1980s. In 1981 Australia was ranked fourteenth among the OECD countries with regard to the number of external patent applications. Between 1981 and 1991 the number of external patent applications by Australians rose by an average 17% per annum. As a result, in 1991 Australia's ranking had increased to ninth among the OECD nations.[24]

3.23 There are a number of problems associated with using the number of patents or patent applications as an indicator of a nation's performance in innovation. Some of the problems identified in the 1987 DIST report, *Measures of Science and Innovation*, are:

- 'patent legislation and domestic patenting activity vary greatly from country to country;

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18 Advisory Council on Industrial Property: *Draft Report of the Review of the Petty Patent System* March 1995 p 1
19 ibid., p 23
20 ibid., pp 5, 21 & 26
21 ibid., p 6
22 ibid., pp 7 & 8
23 Industry Commission: op. cit., p 115
24 ibid., p 115

- 'changes in patent law, procedure and cost in a single country may occur with significant effects on observed trends;
- 'while all patent applications (or grants) are treated equally, not all represent the same commercial value;
- 'not all inventions are patented. In some cases inventors may rely on secrecy or lead time over their competitors, while in other cases the invention may not be patentable under national legislation; and
- 'the propensity to patent varies between industries and with economic conditions.'[25]

3.24 Despite these problems, large differences between countries in patent activity can reflect important trends. For example, the number of patent applications in Japan increased by a massive 254% between 1970 and 1987 compared with declining levels in Europe and marginally increased numbers in the USA over the same period.[26] The disparity in numbers of patent applications reflects the technological development in Japan which has powered the remarkable economic growth of the post-war period.

TECHNOLOGY DIFFUSION AND UPTAKE

3.25 The BIE's 1994 study, *Beyond the Innovator: Spillovers from Australian Industrial R&D*, identified four ways in which the diffusion of innovative technology or ideas occurs.[27] These are:

- **Positive disclosure.** Innovating firms may openly disclose new technology they have developed for such reasons as establishing that particular technology as the industry standard or to establish its reputation as a technical leader. Patenting is one form of positive disclosure which helps to reduce unnecessary duplication of research effort while rewarding the innovative firm with patent rights. Frequently, however, firms prefer to rely on secrecy rather than give competitors the benefit of their discoveries.
- **Inter-personal networks.** Firms often have common customers and suppliers. Those shared customers and suppliers are forms of networks just as industry or professional associations are. Formal and informal networks and collaborative arrangements (for example between firms and research agencies) promote the diffusion of innovation between enterprises.

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25 DITAC: *Measures of Science and Innovation*, November 1987, p 206

26 Nelson, R: *National Innovation Systems: A Comparative Analysis*, Oxford University Press, 1993, p 103

27 BIE: *Beyond the Innovator: Spillovers from Australian Industrial R&D*, Occasional Paper 16, AGPS, Canberra, 1994, p 20

- **Labour mobility.** Labour mobility results in the flow of knowledge between firms as employees move from enterprise to enterprise. This may not be to the advantage of an individual firm which loses some key personnel but the industry as a whole, or other industries, benefit.

- **Product availability/reverse engineering.** Finally, the market provides an avenue for diffusion with competitors being able to purchase products, and imitate the innovative 'ideas and concepts' - subject to the constraints imposed by intellectual property rights laws.[28]

3.26 As the IC has pointed out and which is implicit in the above, new technology may not only be *embodied* in the form of a physical object, but it may be *disembodied* in the form of knowledge, which may be documented (such as in a patent description), or in the form of knowledge and skills carried around in the human brain. Formal and informal training are therefore important means of technology diffusion. Takeovers and mergers may be part of the process of technology diffusion and change in organisational structures may be an essential part of technological change. It is also important to realise that technology diffusion itself feeds the process of innovation.[29]

3.27 The 1994 report by the Department of Industry, Science and Technology, *The Pace of Change,* argued that there is an unsatisfactory level of technology uptake by Australian firms. The report cited work by the Australian Industry and Technology Council which found that poor implementation and failure to integrate new technology with existing operations are 'alarmingly common'. This was attributed to the difficulties firms experience in obtaining finance, a lack of senior management expertise and poor interaction between firms.[30] The 1994 *Working Nation* document stated that Australian industry lags some three to eight years behind industry in competitor nations in adopting new technologies.[31]

3.28 The IC report on *R&D* referred to evidence (a 1994 study by Professor Paul Burke and Ms Linda Butler) of a decline over the 1980s in Australia's share of global publications of science and in the share of citations of Australian science publications. In another study Australia was ranked 9th in a list of 18 industrialised nations in terms of 'mean citations per scientific paper' in the 1981 to 1990 period.[32] The Department of Employment, Education and Training stated that the Burke and Butler study indicated that 'the Australian share of world scholarly [science] publications ... remained relatively stable in the period 1982 to 1991 [but that] the Australian share of world citations began to drop in 1987'. Possible reasons suggested for this 'decline in international visibility' include: a move away from basic to applied research; a decline in the 'infrastructure capacity for basic science in

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28 ibid., pp 20 - 23

29 Industry Commission: op. cit., pp 62 - 63

30 Department of Industry, Science and Technology: *The Pace of Change: Technology uptake and enterprise improvement,* Discussions in Science and Innovation 3, an occasional paper in a series on Australia's research and technology, and their utilisation, AGPS, Canberra, 1994, p 41

31 The Honourable P. J. Keating, MP: *Working Nation: Policies and Programs*, paper presented 4 May 1994, Canberra, AGPS, p 65

32 Industry Commission: op. cit., pp 116 - 118

Australian universities'; and 'the high costs of "big" science'.[33] The Australian Academy of Science has been funded to investigate these findings.

3.29 Australia has apparently been a beneficiary, since 1983/84 at least, of the international 'brain drain' - being a net receiver of academics, scientists and engineers.[34] However, just 10% of 25 to 64 year olds in Australia's population have university or equivalent level education compared to 13% in Japan, 15% in Canada and 23% in the United States.[35]

3.30 The IC report referred to Australian Bureau of Statistics figures which show that the proportion of Australian manufacturing establishments using advanced technology increased in the 1988 to 1991 period in all industry sectors, except textiles.[36] The IC also referred to other studies that show an increase in the proportion of manufacturing output which involved innovative products or processes.[37] This is an indication of technology diffusion and structural change in Australian industry but the figures presented are not compared to trends in competing economies.

3.31 The Australian business sector's R&D expenditure has been concentrated in a relatively small number of firms. 'In 1988/89 the largest 5% of R&D performers (that is, enterprises with R&D expenditure of $2 million or more) accounted for 63% of total business R&D expenditure.' Similarly, 'the largest 6% of firms (with more than 1000 employees) accounted for 37% of business R&D expenditure in 1988/89'. At the other extreme, 'the 34% of firms employing fewer than ten people accounted for 6% of business R&D expenditure'.[38] There is evidence that the concentration may be decreasing.

3.32 From 1984/85 to 1988/89 approximately 75% of the increase in business R&D expenditure occurred in SMEs. In the manufacturing sector, SMEs contributed 85% of the increase in the sector's R&D expenditure, with nearly half occurring in small enterprises alone. This is the result of a number of factors. More small enterprises are actually performing R&D and medium sized firms have increased their average R&D effort considerably. The increase in R&D activity has been concentrated in industries largely composed of SMEs. These industries include computer software, telecommunications, pharmaceutical and veterinary products, fabricated metal products, food beverages and tobacco, and other services.[39] The IC report noted that 'the number of R&D performers ... rose from 1278 in 1981/82 to 2766 in 1992/93'.[40]

3.33 Nevertheless, small to medium sized enterprises often lack the resources to acquire the latest technology or to undertake the level of networking necessary to be aware of new technologies. This has to be a major concern for Australia given the

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33 Department of Employment, Education and Training: *Submission no.* 119, p 6
34 Industry Commission: op. cit., p 120
35 *ibid.*, p 119
36 ibid., p 121
37 ibid., p 122
38 BIE: Research Report 50, pp 15-16
39 ibid., pp 16-17
40 Industry Commission: op. cit., p 122

large number of small firms in this country. Table 1 below shows the number of business units having certain numbers of employees. (The type of business unit, *enterprise group*, is used, which is defined as the 'unit covering all the operations in Australia of one or more Legal Entities under common ownership or control'.[41]) Chart 2 presents this information graphically.

Table 1: Business units by employment size (excluding agriculture, forestry, fishing and hunting) August 1992

No. of employees	No. of firms	Percentage
<5	361,950	67.14%
5-9	107,660	19.97%
10-19	40,707	7.55%
20-49	18,768	3.48%
50-99	5,296	0.98%
100-499	3,676	0.68%
500-999	471	0.09%
>1000	537	0.10%
	539,065	100.00%

Source: Australian Bureau of Statistics: *Profiles of Australian Business 1992* Catalogue No. 1322.0 Table 1, p. 14

3.34 Currently, there are approximately 6000 small manufacturing enterprises in Australia with between 20 and 99 employees. The Australian Manufacturing Council and McKinsey & Company report, *Emerging Exporters*, identified 500 of these as being leading edge enterprises. The remaining 5500 firms would benefit greatly from adopting new technologies.[42]

3.35 The problem of low business R&D expenditure is compounded by the fact that industry under-utilises public research facilities. This is the result of poor linkages between industry and public research agencies. The BIE's 1993 report, *R&D, Innovation and Competitiveness*, stated:

> 'Australia's internationally recognised public sector basic research strengths have been seen as a largely untapped resource with potentially significant benefits for economic growth if they can be commercially exploited. While links between the public sector research organisations and agricultural and mining sectors have been good - for example through CSIRO agricultural research and agricultural extension services - links with manufacturing, in general, have been poor.'[43]

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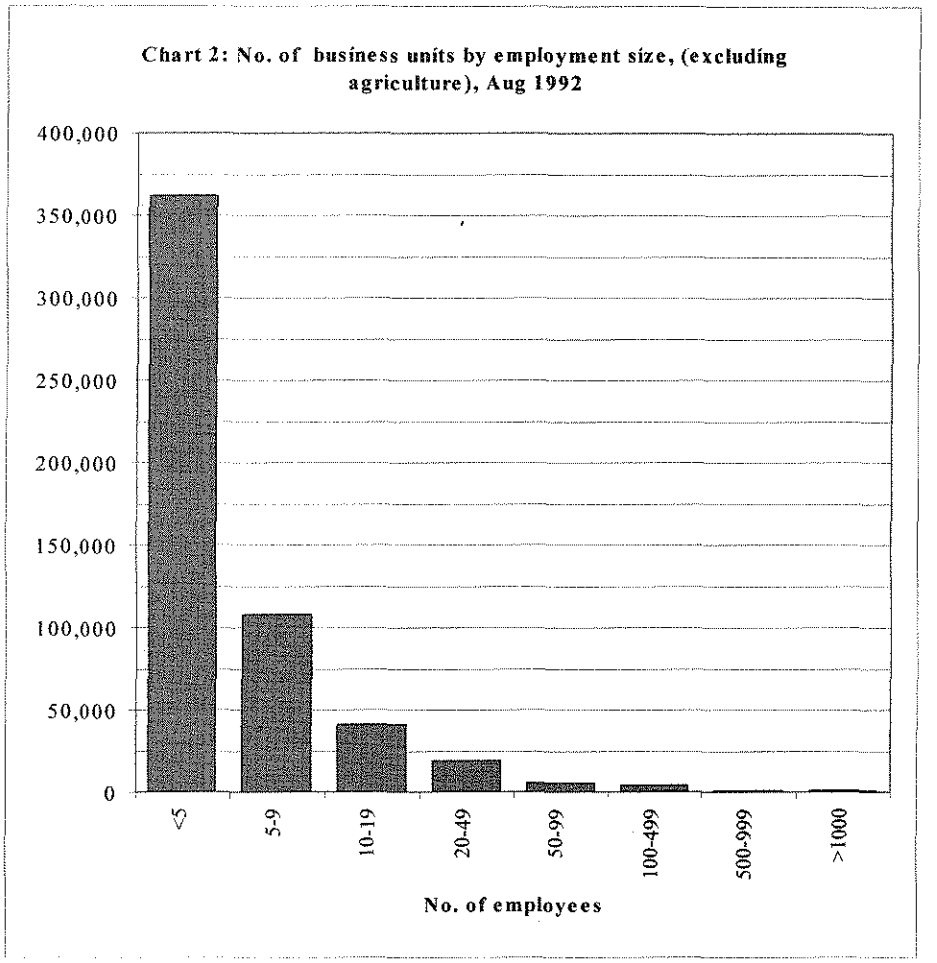
41 Australian Bureau of Statistics: *Profiles of Australian Business 1992* Catalogue No. 1322.0 p 10

42 Department of Industry, Science and Technology: *The Pace of Change: Technology uptake and enterprise improvement*, Discussions in Science and Innovation 3, an occasional paper in a series on Australia's research and technology, and their utilisation, AGPS, Canberra, 1994, p 42

43 BIE: Research Report 50, p 24



3.36 This was identified in the 1983 report of the Espie Committee, *Developing High Technology Enterprises for Australia*, which highlighted the need to improve the poor interaction between high technology enterprises and research institutions to facilitate technology transfer and innovation.[44] The Government has promoted collaborative efforts between industry and public research agencies through programs such as the National Teaching Company Scheme,[45] the Cooperative Research Centres and the setting of external funding targets. Despite these efforts, the Australian Academy of Technological Sciences and Engineering stated in it's submission to the inquiry that industry:

> 'needs to make better use of the nation's public R&D assets and develop better linkage with R&D providers such as CSIRO and Universities. There have been increased industry linkages with CSIRO through the CSIRO requirement to obtain 30% of their funding from

44 Australian Academy of Technological Sciences: *Developing High Technology Enterprises for Australia*, report of the Espie Committee, Victoria, 1983

45 For an overview of this scheme see BIE Program Evaluation Report 10: *The National Teaching Company Scheme*, AGPS, Canberra, 1991

external sources. This has led CSIRO to seek leading-edge customers and joint initiatives with business. Although further interaction, particularly with small and medium sized enterprises is essential, the benefits must be visible to both CSIRO and industry and further culture shifts in both areas need to be encouraged'.[46]

3.37 As the public sector is an important part of Australia's R&D effort, fostering links between research agencies and companies will encourage greater technology diffusion and commercial utilisation of these agencies. It will provide a powerful means of building more competitive enterprises.

CONCLUSION

There is convincing evidence that Australia needs to greatly improve its performance in innovation. While change is occurring - our economy is becoming more focussed on export markets and more open to international competition domestically - the recent growth in business expenditure on R&D must continue. The research output must be converted through development and commercialisation to export income.

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46 Australian Academy of Technological Sciences and Engineering: Submission 58 pp 2-3

CHAPTER 4 - SOURCES OF INNOVATION

4.1 As noted in the introductory chapter, the true source of innovation is the creativity of people. The desire of people to explore and create increases the stock of knowledge. The application of that knowledge produces innovation.

4.2 The level of skill and knowledge in the community and the means of ensuring the diffusion of that knowledge are at the heart of the innovation process.

4.3 It was also noted that the application of knowledge involves the use of physical and financial resources, skill, knowledge and time with the risk of failure and loss. As well as creativity, an entrepreneurial spirit and behaviour is need for innovation to occur.

4.4 It is therefore clearly essential for the formal and informal means of education and training to encourage creativity and entrepreneurial attitudes so that innovation will flourish.

EDUCATION AND THE INNOVATION PROCESS

4.5 A number of the submissions received by the Committee identified education as the most important area for the inquiry to examine. Education can play a key role in developing innovation on several levels. It can develop not only the innovative talent of individuals but it can also help change community attitudes - influencing the level of support the community gives innovators.

4.6 There is a need to develop a strategy that addresses how to encourage innovation at primary, secondary and tertiary education levels and also in skills training and managerial education courses. This would require long term commitment from the Commonwealth and State Governments, but would help create a new generation of Australian entrepreneurs leading competitive and highly successful businesses.

Educating for Creativity

4.7 Creativity involves the ability to perceive the new - whether it be a new product, a new process, a novel use for an existing product or a new solution to an old problem. In the context of innovation, creativity is the ability to look for solutions beyond existing patterns of thought.

4.8 Dr Edward de Bono made the point in his submission that creativity is a logical process and a skill that can be learned.[1] While it may be a skill that comes more easily to some than to others, much can be done to improve the creative abilities of virtually all people. People need to be encouraged in their education and training to explore possibilities outside traditional patterns of thought and procedure.

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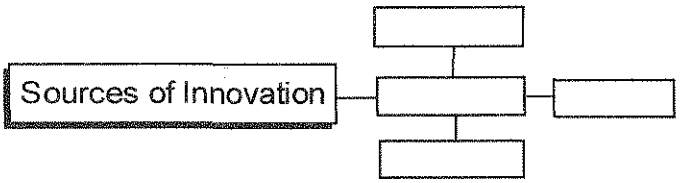
1 de Bono, E: *Attachment to submission no. 48*



4.9 Some submissions argued that 'thinking' should be a core subject in Australian schools.[2] The Committee believes that in many schools in Australia good teachers, across a range of subjects, are aware of the importance of teaching students how to think creatively. The Committee did not receive sufficient evidence in the course of this inquiry to decide to what extent creative thinking skills are being taught within existing curricula or whether a separate course on thinking is required. Nor did the Committee receive evidence concerning the adequacy or otherwise of teacher education programs in imparting the ability to teach students how to think creatively.

4.10 It is clear to the Committee that, given the essential role of creativity in innovation and that innovation is essential to economic prosperity, the Government must firmly adopt the aim of developing the creative skills of the Australian people. This must be achieved through all levels of the formal education system as well as through the less formal means of education in the community. The emergence of creativity cannot be left to chance. What is envisaged is a major cultural change which may well take a generation to reach full fruition. There must be, therefore, a long term commitment to this aim.

4.11 The Committee believes that whether the education system is adequately teaching students how to think creatively, whether such thinking skills are best taught as part of existing subject curricula, or whether there should be a separate core subject on thinking skills, should be investigated by the relevant education authorities.

Recommendation

4.12 The Committee recommends that the Commonwealth, State and Territory Education Ministers commission an examination of:

- **whether creative thinking skills are being adequately taught within the primary, secondary and tertiary education system; and**
- **whether teacher training programs adequately equip teachers to develop the lateral thinking abilities of their students.**

Teaching Innovation

4.13 Not surprisingly, the Commonwealth Department of Employment, Education and Training (DEET) emphasised the importance of education and training in its submission:

2 Hewitt-Gleeson, M: *Submission no. 57*, p 2

> 'To ensure Australia's competitive position in the future, we need to develop and support our young people to become more enterprising and innovative and to provide them with skills and knowledge to work productively in businesses of the future. The foundation of this drive would be the development of enterprising attitudes and enterprising and innovative individuals in our schools. Such developments are best effected at an early age. Strategies developed for later stages of formal and community education would build on those in place at the school level.'[3]

4.14 Entrepreneurs are those who are prepared to use their judgement in a commercial situation and to take calculated risks on the basis of their judgement. The education system must not only teach the skills needed to allow those judgements to be taken in the most informed and rational manner possible, but it must also encourage the preparedness to act on those judgements. Since the encouragement of an attitudinal change is required it is essential for the process to begin at the primary school level.

4.15 Principal responsibility for primary and secondary education in Australia rests with the States and Territories. However, the Commonwealth Government helps fund school education and is involved in 'identifying national priorities for schooling, facilitating cooperative efforts among education authorities and encouraging improved educational quality'.[4]

4.16 DEET's submission pointed out that:

> 'over the last decade an important objective of educational policy has been to develop better linkages between education and training at all levels, a process which has been influenced by the rapid changes taking place in science and technology'.[5]

4.17 In recent years the Commonwealth Government, in conjunction with the States and Territories, has identified two key education strategies to enhance the preparation of young people for today's workplace. Undoubtedly, in achieving this the Government would also enhance Australia's innovation performance. Both the strategies outlined below are in their test stages.

Key Competencies and Enterprise Education

4.18 The first of the initiatives has been the development of the **Key Competencies Program**. The Government announced a $20 million 3 year program in 1993 to develop, trial and evaluate key competencies. The second initiative is the **Enterprise Education Strategy** to which $3.4 million over 4 years has been allocated in the 1995/96 budget. Both these programs are extremely important to the development of

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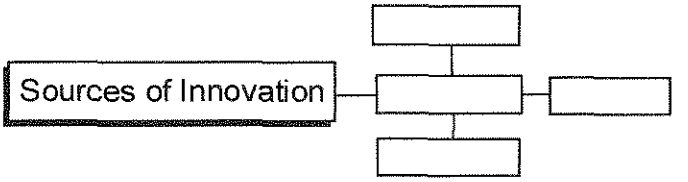
3 Department of Employment, Education and Training: *Submission no. 119*, p 10
4 ibid., p 1
5 ibid., p 1



Australia's innovators, managers and workers of the future and place Australia at the forefront of school based workplace training.

4.19 The Key Competencies Program developed out of recommendations contained in the report of the Australian Education Council Review Committee, *Young People's Participation in Post-Compulsory Education & Training*.[6] The 1991 report concluded there are a number of essential things young people must learn to prepare them for employment. It recommended that all young people should develop these key competencies no matter what education or training pathway they follow. The report stated:

> 'Young people should be able to develop these Key Competencies regardless of the education or training pathway that they follow.'[7]

4.20 Subsequently, a Committee headed by Mr Eric Mayer, the former Chief Executive Officer of National Mutual Ltd, was given the task of developing a means of describing the key competencies so that they could provide a common reference point for curricula and teaching in both the school and training sectors, and could also provide the basis for a consistent approach to assessing and reporting achievement.[8]

4.21 In its report, *Putting General Education to Work: The Key Competencies Report*, the Mayer Committee set down seven key competencies. In 1993 the Ministers for Education and Training agreed to accept the original set of seven key competencies and added an eighth, cultural understandings. The key competencies are:

- collecting, analysing and organising information;
- communicating ideas and information;
- planning and organising activities;
- working with others and in teams;
- using mathematical ideas and techniques;
- solving problems;
- using technology;
- cultural understandings.[9]

4.22 Key competencies are not meant to replace existing subject curricula, nor are they subjects in themselves. The key competencies are broad skill objectives that will overlay the existing education curricula. The aim of the key competencies is to give young people the capacity to apply their knowledge in the workplace. Most work

6 Report of the Australian Education Council Review Committee: *Young People's Participation in Post-Compulsory Education & Training*, AGPS, Canberra, July 1991

7 ibid., p 3

8 Department of Education, Employment and Training: *Key Competencies - For Work Education And Life*, Information Kit, Background Material

9 ibid.

situations require the use of these skills, and this is especially the case in innovative enterprises and projects.

4.23 The development of the Enterprise Education Strategy is at a much earlier stage than the Key Competencies Program. Its first allocation of funding was in the 1995/96 budget. The Enterprise Education initiative was in response to early feedback from the Karpin Committee's review of Australia's managers. The first two recommendations of *Enterprising Nation,*[10] the final report of the Karpin Committee, identified the need to develop an entrepreneurial culture through formal education and training as well as community education.

4.24 The Karpin Committee argued that there is a need to move people on from the negative perception of entrepreneurs which resulted from the national experience in the 1980s. The report stated:

> 'The Task Force is of the view that this generally ambivalent to negative attitude toward business enterprise in Australia is culturally-based. It has concluded, for example, that the lack of enterprise and entrepreneurial studies at school, in vocational education and training and in higher education, forms part of the reason why there is not a strong small business culture in Australia. Enterprise education is the main arena whereby enterprise and entrepreneurship can be encouraged across an entire society and the range of business organisations.'[11]

4.25 The Government has described the Enterprise Education initiative, which is a school based strategy, in the following terms:

> 'Enterprise Education is about inculcating in individuals, through the education process, the necessary mindset and skills to recognise opportunity, to manage risk, and to mobilise and manage resources for a social or economic purpose. Generally, it means developing the qualities needed to be an enterprising person such as the ability to tackle problems, take initiative, persevere, be flexible and work in teams. Specifically, it means taking part in projects, usually small-scale business and community enterprise projects, designed to develop these qualities. It is highly interdisciplinary and experientially based.'[12]

4.26 The Curriculum Corporation will be given the tasks of:

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10 Report of the Industry Task Force on Leadership and Management Skills: *Enterprising Nation: Renewing Australia's Managers to Meet the Challenges of the Asia-Pacific Century - Report*, AGPS, Canberra, April 1995

11 ibid., p 15

12 Department of Employment Education and Training and Department of Industry Science and Technology: *Toward a More Enterprising Australia - A School Focus*, p 5

- developing curriculum materials 'to support the development of enterprise and business education in schools';
- devising and providing 'professional development to teachers'; and
- devising 'strategies to encourage a closer liaison between schools and business' so that business career advice is improved.[13]

4.27 Commonwealth, State and Territory industry departments, with support from education departments, have been given responsibility for establishing and promoting a

> 'program of community awareness of the value of enterprise and of the contribution small business makes to Australia and [for determining] what role schools can/should play in this process of developing an enterprise culture in the community'.[14]

4.28 The following targets have been set to be achieved by June 1999:

- 'curriculum support materials which encourage the development of an enterprising culture will be available for use by teachers in all schools, including primary schools;
- 'professional development materials in enterprise education will be available in all schools;
- 'all staff with responsibility for career education ... in all schools will have had specific professional development in enterprise education and will have been provided with materials to assist them to encourage advice to students about career options in small business.'[15]

4.29 Some $200,000 is to be spent in the first year on research and in establishing the sort of program needed to achieve the objective of developing an enterprise culture in schools and in the community.[16] A progress report is due to be made in two years.

4.30 The Committee strongly supports the principle of using the education system to help develop entrepreneurial skills and to help instil cultural attitudes which recognise the important role of business enterprises in our society. The Key Competencies Program and the Enterprise Education Strategy are two initiatives which, if adequately supported with resources and effectively executed, could be highly beneficial to the aim of developing a more innovative Australia.

13 *Agreement of the Ministerial Committee for Education, Employment and Youth Affairs*, May 1995
14 ibid.
15 ibid.
16 Correspondence dated 5 June 1995 from Department of Employment, Education and Training to the secretariat of the House of Representatives Standing Committee on Industry, Science and Technology

4.31 The Committee considers it essential that the education system fully equip students to enter the commercial world. What students learn in classes at school should be enhanced through the practical experience of being placed as part of their training in selected businesses. The education system should interact closely with business and industry, not only through work experience but through work based training. There are some secondary schools which have established work based training programs in conjunction with the business community. The Committee strongly advocates that such initiatives be copied in all secondary schools across Australia. The Committee believes that the principle of internships is equally important at tertiary level education.

Recommendation

4.32 **The Committee recommends that Commonwealth, State and Territory Education Ministers consider, in conjunction with the business sector, the more widespread introduction of structured work based training for secondary and tertiary students throughout Australia. This would involve the placement of students with businesses for significant periods of time as an important part of their educational experience.**

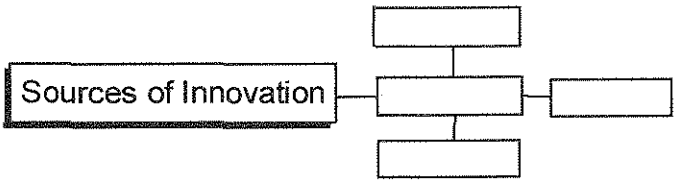
4.33 The Committee considers that the Enterprise Education Strategy should be pursued as a long term initiative and that it be used as an opportunity to improve the links between the business community and the education system. The Enterprise Education Strategy has only just been allocated funding so it is too soon to judge whether the amount allocated ($3.4 million for the next four years) will be adequate to achieve its ambitious and highly important aims.

Recommendation

4.34 **The Committee recommends that the Commonwealth Government keep under close review the progress of the Enterprise Education Strategy and be prepared to increase the funding allocation in two years time if necessary to ensure the success of the program.**

Recommendation

4.35 **The Committee recommends that the Commonwealth encourage the close involvement of the business community in the development and operation of the Enterprise Education Strategy, including allowing tax deductibility for contributions to the operation of the program.**



Tertiary Level Education

4.36 The Commonwealth has particular responsibility for funding research and education at the tertiary level. The number of research students in universities in Australia has increased significantly in recent years - from 12,080 in 1990 to 19,940 in 1994 (of which 9,600 were in the sciences).[17] This is an increase of 65%. In 1993 values the level of Commonwealth competitive funding through the Australian Research Council (ARC) and DEET increased from $54m in 1987 to $125m in 1993. The value of other Commonwealth higher education funding increased in the same period from $83m to $156m. Not all of these funds are specifically for education but it must be recognised that the basic research carried out in tertiary institutions is itself an extremely important means of training new researchers who will often carry their skills and knowledge into industry.

4.37 There are a number of Commonwealth Government programs which foster university-industry cooperation and the diffusion of knowledge and skills. Examples are the:

- Collaborative Research Grants Scheme (which particularly assists small to medium sized enterprises);
- Australian Postgraduate Awards (Industry);
- Key Centres of Teaching and Research Program; and the
- Advanced Engineering Centres Program.[18]

4.38 A number of other programs, such as the:

- Overseas Postgraduate Research Scholarships;
- University Mobility in Asia Pacific scheme;
- Targeted Institutional Links; and the
- Research and Development Internships in Asia program.[19]

help the diffusion of knowledge and skills across international boundaries.

Vocational Education and Training

4.39 The Commonwealth also has particular responsibility for promoting vocational educational and training. The Commonwealth's employment and industry policies in recent years have involved a special emphasis on re-training for the unemployed (in particular the long-term unemployed) and on training for those most effected by micro-economic reform and structural adjustment of the economy.

17 Department of Employment, Education and Training: *Submission no. 119*, p 2
18 ibid., p 4
19 ibid., p 5

4.40 DEET pointed out that 'Commonwealth expenditure on vocational education and training has more than doubled since 1991'. More than $1.1 billion will be provided by the Commonwealth in the 1993 to 1996 period

> '... as a result of the agreement with the States and Territories to establish the Australian National Training Authority ... Much of this funding will go to TAFE to support its changing role in providing a wider range of vocational training in close partnership with industry'. [20]

4.41 Other recent initiatives are the Australian Vocational Training System, which will subsume the 'existing system of apprenticeships and traineeships' and the Australian Qualifications Framework, which 'aims to provide a comprehensive nationally consistent yet flexible framework for all qualifications in post compulsory education and training'.[21]

4.42 The training of managers, engineers, scientists, researchers, accountants, financiers, entrepreneurs and tradespeople is an essential part of the innovation process. Recognition of the importance of teaching creativity and other innovation skills to people in industry is occurring within some educational institutions and there is a growing recognition amongst employers that the intellectual quality of the human capital of an enterprise is fundamental to its performance.

4.43 There are some tertiary institutions in Australia which successfully teach innovation using a multi-disciplinary approach. For example, the School of Innovation and Entrepreneurship at Swinburne University of Technology has developed an inter-faculty course which combines engineering and business studies. The School aims to develop among its students an understanding of the importance of keeping pace with change:

> '...the *real* world is full of discontinuities; it is not predictable; people skills are of fundamental importance; luck can be more important than logic. So, hard as it is, the School must place more emphasis on *right brain* skills, such as: leadership and people skills; lateral thinking, the development of intuition and the subconscious; learning, seeing and communicating free of *filters*; and luck, flexibility and opportunism.'[22]

4.44 The National Key Centre for Design at RMIT has developed a methodology to encourage creativity in companies:

> 'A lot of work that we have been doing has been to look at methods by which we can generate creativity and new ideas within a company and that, to me, seems to be the key to true

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20 ibid., p 11
21 ibid., p 11
22 Swinburne University of Technology: *Submission no. 32*, p 10

> innovation: to come up with those ideas and think out of the box.'[23]

4.45 Mr Thomas Forgan, Project Director of the Australian Technology Park in Sydney, informed the Committee that the Park has a 'special emphasis on education' and that it is intended that the Park have a *School of the Future* consisting of four high-tech class rooms available to schools throughout New South Wales. The Park managers are also looking at a 'TAFE higher skills training centre'.[24]

4.46 The TAFE system is an important part of vocational education and training. Aside from providing training under the existing system of apprenticeships and traineeships, TAFE also provides vital management training and support, especially for the small and medium size enterprise sector. The Karpin Task Force on Leadership and Management Skills examined the role of TAFE and the improvement of management skills in small business. TAFE should aim to provide:

> '... a means of allowing individuals to "create their own futures" by using their management, business and creative flair to create and develop new ventures which employ themselves and provide new jobs for others.'[25]

4.47 Management and business skills training in the TAFE system should look toward the development of best practice management, especially in managers of SMEs. The teaching of business skills in the TAFE environment is one way to improve Australia's level of innovation. All successful innovation relies upon astute enterprise skills that can recognise and act upon business opportunities. The Karpin Task Force highlighted three steps toward improving the TAFE system so that it caters better for the needs of business. These key reforms are:

- enterprise driven programs;
- improving the management content of vocational programs; and
- improving staff skills in the TAFE system.[26]

4.48 The programs offered through the TAFE system have to be enterprise driven so that management skills development is linked to business outcomes. Inevitably, this requires close links between program developers and enterprise representatives. The traditional delivery of programs in a classroom environment is no longer the best way to meet enterprise needs. Research of the Karpin Task Force revealed that

23 Okraglik, H., Associate Director of the National Key Centre for Design at RMIT: *Transcript of evidence*, p 17
24 Forgan, T: *Transcript of evidence*, pp 151 & 152
25 Industry Task Force on Leadership and Management Skills: op. cit., p 211
26 ibid., p 211

owner/managers, especially of SMEs, demand experimental learning approaches based on case studies.[27]

4.49 Traditionally, vocational training in TAFE has emphasised the technical aspects of occupational training. Tradespeople and technicians who are trained in TAFE, often lack the management skills that are necessary for them to move into a management role.

4.50 Many technical people are highly creative; however, their ability to turn good ideas into successful innovation may be limited by their skill as managers. The absence of these skills may be a contributing factor to their possible failure either as business managers or innovators.[28]

4.51 To deliver programs effectively TAFE institutions must have highly proficient educators. The Karpin Task Force identified the need to re-train management development staff and recruit high quality management staff from the public and private sectors. Understandably, TAFE institutions may face resource constraints that restrict their capacity to attract high quality staff. As a result:

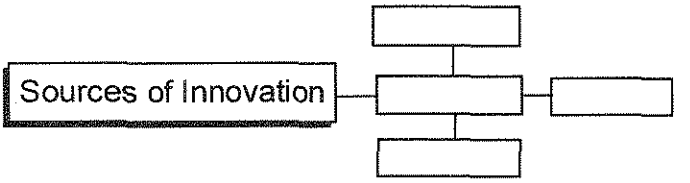
> 'The success of any national effort to strengthen the skills of frontline managers is particularly dependent on the effective re-training of existing or prospective management staff presently employed within TAFE...
>
> 'Strategies for re-training and recruitment of management teachers and consultants that ensure the required number and quality are available to the vocational education and training sector need to be identified and implemented.'[29]

4.52 The impact of the vocational education and training sector on innovation would be enhanced by raising the profile of TAFE as an important source of quality management training, especially for managers of SMEs whose capacity to utilise more formal education processes is limited. TAFE institutions should offer flexible management training courses to cater for individuals employed full time. At the same time TAFE needs to focus more on management skills as part of the training of trades people and other technical professionals.

Recommendation

4.53 The Committee recommends that the Commonwealth Government ensure that occupational training undertaken in institutions including TAFE should place a strong emphasis on the development of management skills among trades and other technical professionals.

27 ibid., p 212
28 ibid., p 212
29 ibid., p 213



Recommendation

4.54 The Committee recommends that TAFE and other educational institutions should offer more flexible management training courses to cater for the needs of individuals employed full time and of managers of SMEs.

4.55 There have also been attempts to increase the appreciation of design in the innovation process at the secondary school level. Professor Trevor Cole, Executive Director of the Warren Centre for Advanced Engineering at Sydney University, stated that there had been a program commenced in the late 1980s in New South Wales to address the inclusion of design concepts and technology in the core curriculum. He said, however, that he did not think the teachers had been properly supported in implementing the program.[30]

Meeting the Market's Needs

4.56 An important feature of any education system is its capacity to evolve and meet the changing needs of its clients. An education system that is able to respond to these needs will be based upon close interaction between educational institutions and their clients. Nowhere is this more important than in the training of innovators and entrepreneurs.

4.57 The importance of maintaining strong links between management schools and the business sector has already been mentioned and was identified in the Karpin Task Force report.[31] The Karpin Task Force reported that:

> 'Consultations with industry and universities indicate that, whilst business and management schools both appear on the surface to pay considerable attention to this issue, in many cases a real commitment is lacking from both parties. Whilst management advisory bodies are almost universally in place, these generally meet infrequently and exert little influence over the management schools either in overall policy terms or at a more micro level such as course design and content.'[32]

30 Cole, T: *Transcript of evidence*, pp 149 & 150
31 Industry Task Force on Leadership and Management Skills: op. cit., p 325
32 ibid., p 325

4.58 The Committee considers that the level of interaction between educational institutions and business groups has to be encouraged more actively by the institutions, the business sector and governments.

4.59 One way to increase information flows between management/innovation schools and the business sector would be to institute a system of personnel exchanges between these groups. These exchanges would involve:

- enterprise managers participating in teaching either as course facilitators or less formally as advisers to program designers;
- students undertaking placements with small businesses to provide them with a better understanding of the role of management; and
- lecturers with a strong background in the business sector, especially from innovative enterprises, could deliver courses from the perspective of an individual with relevant practical experience.

4.60 Management and innovation schools have to prepare Australian entrepreneurs for a highly competitive environment. Australian enterprises are now firmly part of the world economy, so they face considerable competition from overseas as well as domestic firms. Success in this environment relies upon highly proficient and innovative management. Educational standards in Australia must meet world best practice in order to meet the business community's requirements.

4.61 To keep pace with international best practice and emerging trends Australian institutions should develop closer links with their international counterparts. These linkages should be based on both the exchange of information and personnel. Lecturers and students should be part of this exchange program.

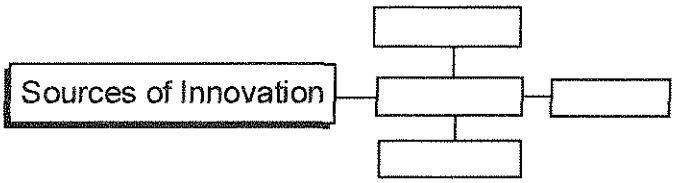
Recommendation

4.62 The Committee recommends that the Commonwealth Government support a formal program to improve the relevance of management education.

Educational institutions should be encouraged to increase their cooperation with the business community through such means as:

- **working more closely with the business sector in the development of courses and in the development of lecture schedules; and**
- ***recruiting lecturers with recent, practical experience as managers in* innovative enterprises.**

The Committee also recommends that consideration be given to means of encouraging Australian TAFE institutions to increase exchanges of personnel and information with industry and their overseas counterparts.



Innovative Teaching

4.63 Australia cannot successfully teach innovation without innovative teaching techniques. Innovative teaching involves using new methods of imparting knowledge and making available new methods by which people of all ages can obtain knowledge by themselves.

4.64 The Commonwealth Government is working with the States and Territories to exploit the potential of innovative educational technology. Developments in computer and communications technology provide tremendous opportunities for more flexibility in the delivery of open learning and distance education as well as more exciting ways of learning in the traditional classroom setting.

4.65 The use of interactive technology and multimedia is being explored by DEET, the Open Learning Technology Corporation and the Curriculum Corporation. DEET has a Cooperative Multimedia Centres program to help promote linkages between industry, 'the creative community' and the education and training sector in the development and use of interactive multimedia. DEET is developing OPEN NET, an open learning electronic support service and is examining options for providing greater access to electronic services to deliver education and training regardless of geographic location. The Open Learning Technology Corporation has been asked by Australian education Ministers to develop a framework for the collaborative use of a broadband service network for education and training. The Curriculum Corporation is developing guidelines 'for the use of interactive multimedia in schools.'[33]

4.66 This time of rapid change in communications and computing technology offers a golden opportunity to re-think how education and training is best delivered and also to re-think the content of education and training programs. Rapid change both demands and encourages creativity in addressing these issues.

4.67 The Government must be committed to an ongoing process which examines, explores and implements the latest technologies and techniques in teaching all forms of educational material. This process should examine both international and domestic trends. It should also assess new technologies and appraise their possible integration into current educational processes to improve course delivery.

4.68 **The Committee considers that there is a strong need to improve the community's understanding of innovation and its importance to national prosperity. What is required is a program that permeates all levels of the education system and which has the active support not only of the Commonwealth Government but also all State Governments.**

33 Department of Employment, Education and Training: *Submission no. 119*, pp 8 & 9

Recommendation

4.69 The Committee recommends that the Ministerial Council for Education, Employment, Training and Youth Affairs investigate measures to expand the teaching of:

- **innovation, business and entrepreneurial skills in secondary education; and**
- **innovation studies/programs in tertiary institutions throughout the country.**

Informal Education

4.70 In addition to the formal education system there has also been some recognition of the importance of providing people with the opportunity to use their natural curiosity and imagination to learn informally about science and engineering - as demonstrated by the activities of bodies such as the National Science and Technology Centre, 'Questacon', in Canberra.

4.71 Questacon and similar science centres have an important role to play in demonstrating to society the significance of creativity and in providing people the opportunity to learn through using their creativity in problem solving. In its submission to the inquiry, Questacon described itself as contributing to the innovation culture by:

> '...increasing public understanding of, and interest in, science and technology and its relevance to our everyday life; and
>
> '...encouraging the spirit of *inquiry*, exploration and innovation by exposing people to scientific concepts and processes using hands-on, minds-on challenges'.[34]

4.72 This is equally true of other science centres throughout the country which both challenge and educate the public. These centres play an important role not only in stimulating an interest in science among children, but also in stimulating adults who are no longer part of the formal education system. The Committee supports such centres taking exhibitions 'on tour' through regional areas to maximise their accessibility to the public.

34 Questacon: *Submission no. 81*, p 2

CHAPTER 5 - BARRIERS TO INNOVATION

5.1 The barriers to innovation are potentially even more numerous than the many factors that act as drivers or catalysts to the innovation process. In this chapter three factors which are often said to impede the innovation process are examined. These are: the problem of access to finance; the level of management skills; and insufficient linkages within the economy between businesses and between the private and public sectors. For small to medium sized enterprises these barriers present particularly difficult hurdles to overcome. The difficulties of SMEs are examined in this context.

ACCESS TO CAPITAL

5.2 Access to capital for enterprises is a complex issue that goes beyond the scope of this report. However, as the issue was raised during the course of the Committee's hearings a number of comments should be made.

5.3 The issue of access to, and price of, capital is a key one for all enterprises, large or small. Whether by way of debt or equity financing, the issue is of relatively greater concern for small and medium sized companies, particularly those producing 'innovative' goods or services, and particularly during the start up or growth cycle of the company.

5.4 Australia does not appear to have a shortage of capital per se. Rather, the issue is how to address impediments to capital formation for those companies who require it.

5.5 As the report of the National Investment Council noted, the typical (usually low growth) SME is 'financed by retained earnings, supplier credit and bank lending'.[1]

5.6 For most SMEs the problems of capital (access to or price of) are related to the provision of debt finance. The overwhelming majority of SMEs do not seek or require equity investment.

5.7 Indeed, there appears to be a strong desire in many instances and at potential cost to the future of the enterprise, to avoid trading equity for opportunity.

5.8 The NIC report makes the useful comparison between typical low growth SMEs and high growth SMEs, the latter having capital demands that outstrip their access to funds through retained earnings and borrowings. This high growth SME category is relatively small but their capital constraint problems are significant.

5.9 In addition to a reluctance to seek equity investments they often share the characteristic of not being 'investor ready'.

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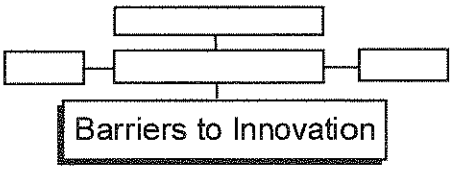
1 Marsden Jacob Associates & The National Investment Council: *Financing Growth* Aug 1995, p 9



5.10 These issues are canvassed in some detail by the NIC report.

5.11 The following is extracted from the summary of the National Investment Council report, *Financing Growth*.

'Small and medium sized enterprises (SMEs) generate around 40 percent of Australia's private sector output and account for about half of private employment. In recent years, they have contributed to more than half of Australia's employment growth. Furthermore, the SME sector is a seed bed for innovation and the development of niche markets based on service and value.

> '*[Potentially] the major growth in employment for the future will be in the services provided by small and medium size businesses, particularly through dynamic entrepreneurial business and emerging exporters.*'

'SMEs have more difficulty than their larger counterparts in obtaining finance, either debt or equity capital. There is well established evidence of gaps in SME finance both in Australia and overseas.(2) Difficulties in obtaining equity capital are particularly apparent for businesses with high growth potential. These capital constraints slow and cap SME growth, restricting their contribution to growth and employment in Australia.

'[The NIC] report focuses on the capital needs of SMEs aspiring to significant growth and whose equity is not listed on the main board of the Australian Stock Exchange (ASX). These high growth unlisted SMEs offer a substantial opportunity to add value to the economy in terms of jobs and output.

'The purpose of [the] report is to:

- understand better the costs, risks and impediments affecting the choice and flow of finance for Australian SMEs;
- assess the prima facie causes of market failures affecting SME finance, particularly for those firms with the potential to achieve high growth; and
- evaluate whether further analysis of SME capital needs and availability is warranted.

'Interviews with more than sixty industry participants were used to identify issues and gain insights into the operation of the SME capital market. These insights were set within the framework of economic and public policy and leading overseas and Australian research on SMEs and their finance. By looking at both the demand and supply sides of the SME finance equation, the study identifies significant impediments to the effective flow of funds to SMEs, particularly growth firms.

'The key findings and recommendations of the report are:

- Only around 10 percent of SMEs aspire to significant growth and only about 30 percent of these are willing to take external equity. ...

- Most growth firms seeking equity are not 'investment ready'. That is, they fail to meet fundamental requirements to be attractive to external investors. For instance, they have not separated their business and personal affairs; they depend on one key individual; and/or they have not established a sustainable market niche. Many growth SMEs are not aware of what is required to be investment ready, resulting in important failings on the demand side for finance. ...

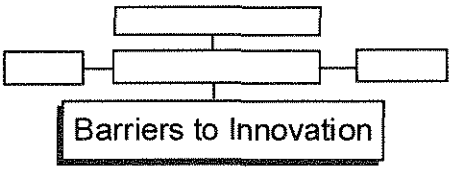
- Despite the difficulties SMEs have in obtaining investment capital, there is no shortage of capital in Australia. The annual flow of domestic and foreign savings available is around 20 percent of GDP, roughly $80 billion per annum. However, major difficulties lie in the efficiency of the market's allocation processes and the ability to deal with the risk, uncertainty, high cost and regulatory impediments incurred when investing in SMEs. ...

- The principal players and intermediaries are the direct private investors in SMEs (the 'business angels'), institutional investors and the specialist intermediaries in SME based investments (the venture/development capital funds). The business angels and the formal funds (including the venture/development capital funds) occupy distinctly different niches. Both face the same generic risks and costs and the same regulatory impediments in identifying and managing suitable investments, but are forced to deal with them quite differently.

  'The formal funds are dealing with other people's money and are therefore subject to fiduciary responsibilities, due diligence requirements and, in the case of the major institutional investors, prudential supervision by the Insurance and Superannuation Commission. In contrast, the angels are dealing with their own money. As a result angels tend to rely on their own judgement and are willing to invest in earlier stage SMEs and smaller investment opportunities. However, the venture/development capital funds are forced by their higher cost structures to seek investments in excess of $1-2 million and have moved increasingly toward later stage investments which carry lower risk and uncertainty.

- These high search, information and transaction costs and risks and uncertainty, are inherent characteristics of the SME capital market which constrain the flow of capital to SMEs. Essentially the same factors constraining SME capital availability in other developed overseas markets including North America and Europe. The challenges posed by these constraints to the relatively few SMEs aspiring to and achieving high growth are acute. ...

- The Corporations Law prospectus requirements and other regulations (that are principally designed to protect investors) act as major



constraints and impediments in the already difficult search process that the growth SMEs must undertake in order to obtain equity. There is a need to reduce regulatory impediments on small businesses seeking finance and to ensure that the potential impact on SMEs is considered in developing future regulations so that unintended adverse consequences might be avoided. ...

...

- There is virtually no information on the current and potential role of Australian private investors in SMEs, that is, business angels. Available international estimates suggest that business angels provide substantially greater funding to SMEs than venture/development capital funds. However, the angels market is characterised by a paucity of information for both the seekers and providers of capital. Substantial unsatisfied demand exists for both private investors and investee companies.

'Research is needed to understand the role and importance of private investors in Australia, and what impediments exist to their investments in SMEs. This is especially importance since Yellow Pages Australia's research indicates that 97 percent of small businesses seeking finance require less than $500,000, which is the territory within which angels operate. It is also important to explore the efficiency of the newly established matching services and the viability of alternative low-cost matching and networking schemes. ...

...

- Australian venture/development capital funds depend increasingly on the superannuation funds which currently allocate very small proportions, if any, to SME-based investments. To overcome information failure and encourage a greater allocation of superannuation and other institutional funds to SME-based investments, trustees and their advisers need a better understanding of the nature and role of those investments in their portfolio.

...

'To achieve this, consistent definitions should be established and performance measurement across venture/development capital funds undertaken. This additional information will enable risk/reward profiles to be established to encourage portfolio investors to view SME investments as a viable investment category. ...

- A gap exists in the supply of equity finance for amounts approximately between $0.5 and $2 million. This is above the typical upper threshold of most potential business angels and below the typical minimum investment threshold of many venture/development capital funds. Little is known about the magnitude and significance of this gap in Australia. ...

...

'These recommendations deal directly with the impediments to the structure and operation of the markets for SME capital in Australia. The impediments and the gains from our recommendations are depicted in Figure 1, with a detailed outline of the recommendations following. Successful implementation of these recommendations will increase significantly the flow of capital to growth SMEs with consequential increases in output, exports and employment.

'Some recommendations can be implemented almost immediately, particularly those relating to increasing the number of investment ready firms, and reviewing regulatory impediments in the search process.

'The greatest and immediate challenge is to increase the proportion of firms which are investment ready.

....

'Detailed Recommendations

'RECOMMENDATION ONE:

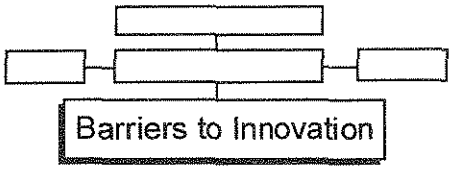
'To assist growth SMEs to be investment ready, the content and focus of government programs be quickly reviewed and priority given to ensuring that growth firms know what is required to be investment ready. The possibility of achieving this goal through private sector delivery should also be considered.

'RECOMMENDATION TWO:

'Remove Regulatory Impediments. In particular the applicability of the Corporations Law's prospectus requirements to SMEs should be urgently reviewed. Specifically,

- the current anomalies in the prospectus requirements and in the exclusions in Corporations Law should be removed;
- the current threshold of $500,000 in Section 66 (3) (a) should be reviewed against the option of lowering the threshold to, say, $250,000;
- the option of continuing the current application of the Corporations Law prospectus requirements to small private offers by unlisted private companies (i.e. SMEs should be assessed against the option of applying a more guided and cost effective, two-tier approach backed by the provisions of the Trade Practices Act (or equivalent).

'Subject to protection for relevant investors through other provisions being appropriate, the regulatory block imposed by Policy Statement 151 to the formation of alternative, second tier markets in Australia should be modified.



'RECOMMENDATION THREE:

'To lift the blindfolds in the searches for/by business angels:

- undertake serious and urgent research to identify the prevalence, roles, potential contribution, obstacles and needs;
- facilitate and sustain collective support for newly established introduction and matching services;
- explore alternatives to matching of proposals, in particular, explore and assess matching based on personality, expertise and trust; and
- encourage and facilitate the involvement and support of accountants, banks and others for introduction and matching services.

'RECOMMENDATION FOUR:

'Increase awareness, understanding and information on SME-based investments to facilitate institutional and market responses affecting the superannuation and private venture/development capital funds.

- In meeting requirements to report annually on the amount and proportion of the total portfolio invested in different types of assets, a consistent definition of SME-based investments should be promulgated and adopted by the superannuation funds. These definitions should exclude management buy-outs and buy-ins.
- Section 2.19.3 of the SIS Act should be amended to signal the need to focus on the medium to longer term by requiring that fund performance also be reported on a medium term basis, say, rolling three year and five year periods.
- Superannuation trustees should be strongly encouraged to obtain training at both the basic and intermediate levels.
- To increase understanding amongst trustees and asset consultants of SMEs as a potential investment category, Government should encourage and facilitate the assembly and dissemination of new and existing information on the nature and role of SME-based investments.
- Government should publish annual statistics on the profitability and performance of SMEs. This information (including information from the ABS-BIE longitudinal survey of SMEs) should distinguish between different types of SMEs, including growth SMEs.
- To increase understanding by funds managers and other technical advisers of SME-based investments and to support the (sales) efforts) of the managers of the private equity funds, early agreement and adoption of consistent performance measurement principles and regular reporting by venture/development capital funds should be encouraged.

'RECOMMENDATION FIVE

'Examine ways to narrow the gap in SME financing for amounts between the upper threshold of potential business angels and below the minimum investments preferred by venture/development capital funds (approximately $0.5 to $2.0 million). In this examination, recognise the roles of the relative costs and incentives in determining the gap.

5.12 The above summary and recommendations from the *Financing Growth* report are, in the Committee's view, a major contribution to policy debate in this area.

Recommendation

5.13 **The Committee concurs with the National Investment Council report *Financing Growth* and recommends that the findings be adopted by Government.**

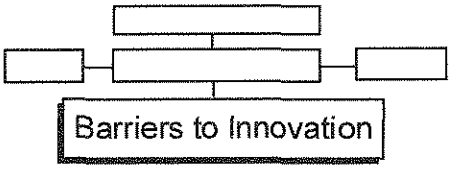
Financial Intermediaries

5.14 A significant barrier private sector capital providers face in investing in innovation is the cost of assessing individual projects. As discussed previously, superannuation fund managers prefer to utilise financial intermediaries whose expertise in specific sectors of the economy helps them overcome the sometimes high transaction costs of individual investments. A vital ingredient to increased private sector investment, especially from large fund managers, would appear to be the presence of financial intermediaries specifically focussed on innovative enterprises and activity.

5.15 The *Pooled Development Funds (PDF)* program was introduced in 1992. The scheme is a mechanism for channelling patient equity capital to SMEs. Up until the Government's 1994 Working Nation Statement, all profits derived from PDFs were taxed at 25%. Under the new arrangements, profits derived from investment by PDFs in SMEs are taxed at 15% and profits derived elsewhere are taxed at 25%. The change in the concessional tax rate for profit on investments in SMEs significantly increases the attractiveness of the program.[2]

5.16 It is a concern to the Committee that there does not appear to have been greater use made of the PDF scheme to date. In a recent article in the *Australian Financial Review* it was reported that of the nineteen registered PDFs only four have raised any capital. The small differential between the general tax rate of 33% and the concessional rate may have been one of the contributing factors to the initially limited utilisation of the PDF scheme. The Committee believes it would be of value to conduct a review of the PDF scheme with a specific focus on possible reasons for

2 *Australian Financial Review: Institutions fail to support Pooled Development Funds*, 13 December, 1994, p 25



the limited utilisation of the program. The scheme is due to be reviewed by June 1997, at which time funding for the program will end. It is important to examine whether the change in the concessional rate announced in the 1994 *Working Nation* statement has had any initial impact.

Recommendation

5.17 **The Committee recommends an immediate review of the PDF program. The review should have a particular focus on identifying barriers that have affected the utilisation of the concessionary tax rates offered to investors. The review also needs to consider the impact the PDF program has had on the availability of capital for innovative activity among SMEs.**

Reducing the Risk Factor

5.18 There are a number of effective policies the Government can consider to reduce the perceived level of risk associated with investing in innovation. Obtaining initial sales is a difficult hurdle innovators must overcome on the road to success. Purchasers are often reluctant to experiment on a commercially untried product. This makes obtaining finance more difficult for innovators. However, once an innovator has guaranteed sales, capital providers will be more willing to commit resources to the project. The Government can use its power as the single largest purchaser in the economy to support innovation through its procurement practices and policies. By using its procurement policies to target innovative Australian products, the Government can reduce the risk assisting innovators to obtain capital more easily.

Enterprise Management and Innovation

5.19 The report of the Industry Task Force on Leadership and Management Skills, *Enterprising Nation*,[3] reinforced the BCA's call for the Government to target the current deficiencies in Australia's management practices. The Task Force found that:

> 'Australian management must improve significantly in the next decade if enterprises expect to even meet today's world best practice standards. There are a few enterprises meeting these standards, and the best managers are equal to the best in the world. However, the evidence of Task Force consultations and research clearly indicates that the majority of Australia's managers do not have the education or skill levels of those of the major

3 The 'Karpin report'

trading nations, nor are most of our educational and training institutions providing world class services.'[4]

5.20 The management practices of some Australian enterprises still resemble those which prevailed in the cloistered Australian economy of the 1950s and 60s. These firms have to realise their long term viability depends on their ability to compete in the world economy. As competition from foreign enterprises increases, managers will face continuing pressure to change. Successful enterprises will be those in which managers pursue innovative practices. Mr Vernon Winley, Assistant Director of the BCA stated:

> 'In some situations where a country is as far away from others as Australia is, there is still some natural protection: there are still protective structures not yet dismantled. I think those enterprises [which currently benefit from protection] are going to be increasingly in for a terrible shock and their managers are really going to have to change very quickly. That is why we are very keen about changing management to introduce more innovative culture.'[5]

5.21 Recent analysis of Australian management reveals serious deficiencies that affect Australia's innovation performance. The Karpin report highlighted eight skill areas where Australian managers must improve, which impact on an enterprise's ability to innovate. The eight skill areas are:

- soft or people skills;
- leadership skills;
- strategic skills;
- international orientation;
- entrepreneurship;
- broadening beyond technical specialisations;
- relationship building skills across organisations; and
- utilisation of diverse human resources.[6]

5.22 Establishing competency levels for these skills would provide a useful guide to educational institutions' management training. Training should address skill development that will enable managers to put in place pertinent strategies for the enterprises they control. The Karpin report made the point that different industries and different enterprises have different priorities and management strategies should vary accordingly. As the Karpin Task Force stated in its report: 'Best practice management development is enterprise driven management development.'[7]

5.23 Management, not government, must shoulder much of the responsibility for creating innovative, competitive and highly successful enterprises. The Government cannot create innovative enterprises by prescription. However, the Government can ensure the infrastructure exists to train world class management.

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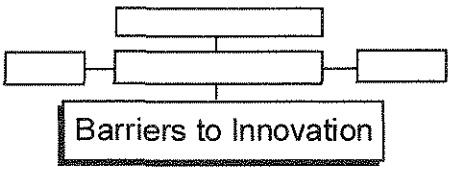
4 Industry Task Force on Leadership and Management Skills: op. cit., p xiv
5 Winley, V: *Transcript of evidence*, p 78
6 Industry Task Force on Leadership and Management Skills: op. cit., p xxxix
7 ibid., p xxxix



5.24 One of the major objectives of the Government's innovation strategy should be the delivery of appropriate training to the managers of the future. The Committee believes that government support in this area would not require considerable additional resources. The infrastructure for a well structured education program already exists.

5.25 The Committee considers that the quality of management education in Australia would be enhanced by a system of accreditation for institutions and educators. The Karpin Task Force found that the quality of information, training and advice for managers varies considerably across Australia. This problem is compounded by the dearth of information to assist managers make informed decisions on the selection of training alternatives.[8]

5.26 One way to improve the quality of management education in Australia would be to rate institutions on the basis of well developed accreditation standards. This system would provide potential clients with a guide to the institutions that best meet their specific requirements. The Karpin Task Force commented on the need for information on management education that is comparative in nature but is of a higher standard than is currently accessible to potential clients.[9] The Committee believes that improving the flow of information to potential students would lead to greater competition between management training institutions and to an improvement in the quality of management education.

5.27 The Committee considers that the Government's innovation strategy must focus on enterprises. An essential part of this strategy should be to improve Australian management. By promoting innovative enterprises through better management, the Government would also promote innovative industries and an innovative culture.

5.28 A significant deficiency in Australian management is the level of understanding of technology and its importance to enterprise improvement and innovation.[10] This is a result of the limited number of Australian managers who have qualifications in either science and engineering. Science writer Mr Julian Cribb highlighted the difficulties created by the fact that:

> 'so few Australians in positions of authority or leadership have acquaintance with science and technology. [Individuals with science and technology backgrounds] are almost universally lacking on the boards of our leading companies. '[11]

8 ibid., p 218
9 ibid., p 316
10 Department of Industry, Science and Technology: *The Pace of Change - Technology Uptake and Enterprise Improvement, Discussions of Science and Innovation 3*, An Occasional Paper in a series on Australia's research and technology, and their utilisation, AGPS, 1994, p 41
11 Cribb, J: *Submission no. 90*, p 2

5.29 Given the importance of science and engineering to innovation, the dearth of managers with backgrounds in these areas is of considerable concern. The Federation of Australian Scientific and Technological Societies (FASTS) stated that many innovative opportunities depend on an understanding of science and technology issues, as a result:

> 'There is a pressing need for a high level of scientific and technological literacy in the boardrooms, and senior management of the private and public sector in Australia.'[12]

5.30 FASTS highlighted the need for cross-fertilisation between MBA and science related courses. There is not only a need for science and technology training in management courses, so that managers will be better able to understand the potential of new scientific and technological developments, but also a need for management training within science and engineering degrees.

5.31 Currently, many scientists and engineers lack training in basic management and business skills. This creates a barrier to the advancement of scientists to management levels in enterprises. In order for Australia to become a more innovative society scientists and engineers need a better understanding of business skills and those in enterprise management need a better understanding of science and technology. The education and training system needs to adopt a more multi-disciplinary approach to achieve this spread of knowledge and skills.

LINKAGES

5.32 Innovation is very rarely the result of the guidance and skills of a single individual. Frequently the knowledge and skills that are required are not even found within a single enterprise. Innovation requires interaction between individuals, enterprises and perhaps even industries. The multi-disciplinary nature of innovation cuts across traditional demarcation of individual professions. Developing Australia as an innovative culture will depend on the formation of networks in the economy which bring together innovative people and their particular skills.

5.33 The existence of mechanisms that promote and facilitate links between the disparate players in the innovation process is vital if an economy is to achieve the full potential of its knowledge and skills base. Strong linkages impact on many parts of the innovation process. As networks spread across the economy so will knowledge. This forms a vital cog in the process of technology uptake and diffusion. Linkage mechanisms are also needed to connect all participants in the innovation process with customers and suppliers. This is crucial since demand driven innovation is the most likely to succeed.

5.34 Linkages within the innovation system may be formal or informal. They exist *within* both the private and public sectors and *between* the private and public sectors. Linkages are vitally important not only between institutions and individuals within

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12 Federation of Australian Scientific and Technological Societies: *Submission no. 93*, p 2

the domestic economy but between Australian institutions and individuals and their counterparts overseas.

Business Cooperation

5.35 A recent study by the Bureau of Industry Economics (BIE) defined business cooperation, one vital category of linkage, as 'special relationships between at least two firms that are beyond normal market transactions and have some permanence'.[13] Examples given of 'core' forms of business cooperation are partnerships, joint ventures, business networks, and preferred customer and supplier agreements. Less formal kinds of cooperation such as feedback from customer to supplier about likely future needs can also be very useful by allowing the supplier to better organise production processes.[14]

5.36 The BIE found that:

> 'around one-third of firms are involved in substantial or core forms of cooperation, ... up to two-thirds ... engage in some form of cooperative activity ... [and] one-third of Australian firms are not involved in any form of business cooperation at all.'[15]

5.37 Firms which cooperate with other firms tend to be 'larger in size, have a higher level of performance, be exporters, produce a high technology output and also produce capital goods'.[16]

5.38 The Industry Commission interpreted business cooperation more broadly in its R&D study, including as forms of linkages 'research corporations, joint R&D agreements, technology exchange agreements, direct investment, various licensing arrangements, and subcontracting'.[17] The Industry Commission referred to a number of examples of R&D cooperation in Australia through industry associations.

Why Firms Form Business Linkages

5.39 The benefits of cooperative arrangements are considerable and are not limited to innovation. The 1995 BIE report, *Beyond the Firm - An assessment of business linkages and networks in Australia,* provides a detailed assessment of the benefits of

13 BIE: *Beyond the Firm - An assessment of business linkages and networks in Australia,* Research Report 67, AGPS, Canberra, 1995, p 9
14 ibid., p 10
15 ibid., p 18
16 ibid., p 53
17 Industry Commission: *Research and Development - Report No 44*, May 1995, p 806

linkages to the firm.[18] This section focuses on those benefits that particularly affect innovation.

5.40 Linkages enhance a nation's innovation performance in a number of important ways, mostly to do with improved information exchange. The Industry Commission report on R&D referred to linkages providing:

> 'a means to access existing sources of technological knowledge ... [and] ...more importantly, ... facilitate the continuous interaction which is necessary to sustain advances in that knowledge'.[19]

5.41 The BIE tested the responses of firms to 15 suggested possible benefits from linkages. These were improvements in:

- profits or sales;
- market knowledge;
- new domestic customers or suppliers;
- product development;
- new overseas customers or suppliers;
- improved production processes;
- improved quality;
- access to technology;
- increased bargaining power;
- improved delivery or distribution;
- improved work practices or productivity;
- access to production facilities;
- improved management;
- improved training; and
- access to financial resources.

The 15 are ranked above in order of firms' responses to which benefits were 'major or critical'.[20]

5.42 As indicated above, one of the leading benefits of business cooperation, which enhances innovation, is in terms of improved product development.

> 'Improving products or developing new ones is at the heart of a firm's innovation activities and the importance attached to this benefit by cooperating firms is [an] important finding for those interested in the relationships between business cooperation and innovation. Other leading cooperation benefits which might have innovation elements are technology access, improved production

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18 BIE: Research Report 67, AGPS, Canberra, 1995
19 Industry Commission: op. cit., p 801
20 BIE: Research Report 67, AGPS, Canberra, 1995, p 81

> processes, improved delivery/distribution and even market knowledge.'[21]

5.43 The BIE found that firms of all sizes gain from business cooperation. However, the likelihood of benefits arising from business cooperation increases with firm size. Large firms achieve above average benefits in a number of areas; but the benefits they gain from improved access to technology and improved product development has led the BIE to believe there is: 'an underlying innovation rationale behind many large-firm linkages.'[22]

5.44 Firms that will benefit the most from cooperative arrangements also tend to be high technology firms and exporters. The BIE concluded that:

> ' the firms most likely to benefit tend to do so more through market-related activities than operational procedures'.
>
> 'This can be encapsulated by saying that the type of firms most likely to benefit from cooperation do so through an overseas focus and through better and improved products.'[23]

5.45 An interesting finding of the BIE study was that many of the benefits identified by firms from linkages they had established were 'spin-offs' - that is, they were not the expected benefits which had been the cause of the links being adopted. The most common of these unexpected benefits were: improved 'market knowledge, improved production processes, product development and improved quality'.[24] These are, of course, all of significant importance to innovation.

5.46 The following case studies demonstrate the benefits that can be realised through networking. The two case studies focus on different forms of networking and the benefits that result. The first of these (Box 5.1), taken from the *Working Nation* statement, demonstrates how a single enterprise can benefit from business alliances.[25] The second case study (Box 5.2) is taken from a report of the BIE on business linkages and demonstrates how networking can be used to successfully launch businesses into overseas markets.[26]

21 ibid., p 89
22 ibid., p 96
23 ibid., p 116
24 ibid., p 254
25 Commonwealth Government:, *Working Nation*, AGPS, 1994, p 69
26 BIE: Research Report 67, AGPS, Canberra, 1995, p 28

BOX 5.1: KEYCORP LTD

Keycorp Ltd, a medium sized Sydney company, specialises in the manufacture of computer peripherals mainly used in the banking sector. Its products include PINpads, transaction processing terminals and flat computer monitors.

Keycorp has grown dramatically in the last two years. Sales are increasing at an annual rate of 120 per cent, while exports are expected to reach $10 million this year (1994), up from negligible levels in 1993. Its success comes from close relationships with large firms. These alliances have provided access to vital technological support and marketing expertise as well as spurring the growth of exports.

As a direct result of a three year old alliance with Hitachi Data Systems of Australia (facilitated by Government) Keycorp has sold over 6000 flat computer monitors, mainly to overseas customers.

Keycorp has worked closely with the Commonwealth Bank, designing products to meet the Bank's specifications. At the same time it gets practical feedback from testing products in a commercial environment.

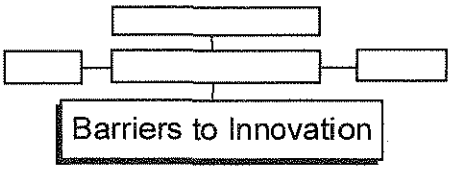
With the objective of increasing export sales, Keycorp entered into a marketing arrangement with Unisys in July 1993. This alliance offers the immediate security of an international sales and support network which could otherwise be prohibitively costly for a medium sized firm to develop. For Unisys the alliance provides access to a complementary range of computer equipment for the financial services market.

BOX 5.2: CONFECTIONARY MANUFACTURERS OF AUSTRALIA (CMA)

Early in the 1990s, the Confectionary Manufacturers of Australia (CMA), an association representing sweets producers in New Zealand and Australia, identified strong export opportunities for their members in the growing Asian market and poorer prospects in a stagnating domestic market. Australian producers were proficient at short production runs and Asian familiarity with Australian products gave Australia an edge over European and US producers. The CMA knew the cost of entry into this market for many individual companies was high. Small firms in the Australian confectionary manufacturing industry faced a range of impediments to export success. Individually, they lacked the resources necessary to gain the export knowledge, access export markets and maintain the production capacity to service exports.

In mid-1993, the CMA developed a novel solution - a distinctive brand of confectionaries targeted at the Asian market and owned jointly by industry members. The CMA (with the National Industry Extension Service and a facilitator) established a network of eight small confectionary manufacturers in Victoria and New South Wales called Southern Gold. The manufacturers shared similar competencies and were fierce competitors in the domestic market. The group established a comprehensive code of ethics, developed a structural mechanism for operation of the organisation and built up trust between members. They could then clearly delineate the areas where they could cooperate, while still competing with each other vigorously in the domestic market.

Southern Gold launched their jointly owned brand, Kazz, at the Singapore Food Trade Fair in April 1994.



Impediments to Business Cooperation

5.47 A number of barriers exist to the formation of business linkages and when links are formed problems may occur. Sometimes these problems are substantial enough to lead to the collapse of the cooperative arrangement. It is important for these barriers and problems to be understood so that they can be taken into account by the Government in the promotion of cooperative arrangements. The BIE study has uncovered interesting and useful information concerning each of those areas.

Problems encountered in business cooperation arrangements

5.48 Of the firms already involved in a cooperative arrangement that responded to the BIE survey, 80% identified some problems or 'negatives' associated with these arrangements. However, it is worth noting that only 30% encountered what they would describe as major problems and only 15% experienced more than one major problem.[27] Those which experienced the most problems ('large firms, exporters, firms with overseas linkages and firms with multiple arrangements') also tended to be the ones which received the greatest benefits.[28] The BIE's observation concerning the relative incidences of major problems and major benefits is very pertinent.

> '[T]he proportion of cooperating firms receiving at least one major benefit from business cooperation is two and a half times the amount experiencing at least one major problem; and
>
> ' the proportion of cooperating firms receiving two or more major benefits is over four times greater than the amount encountering two or more major problems.'[29]

5.49 Additional time commitments was the greatest problem experienced by firms in business linkage arrangements. All other reasons were considered far less important by the majority of respondents. The size of the firm, the technology content of its product, the extent of overseas focus, the performance of the firm and the age of the firm appear to have no impact on the significance of time as the major problem encountered.[30] The BIE noted, however, that dealing with many of the other types of problems, or preventing those problems occurring, would also involve time costs which might help explain why it was referred to by two-thirds of the firms.

5.50 The next most common problems, experienced by about half of the firms, were: 'concerns about financial costs and commercial secrets, administrative and/or

27 ibid., p 178
28 ibid., p 198
29 ibid., p 178
30 ibid., p 198

legal matters and personality difficulties'. About 40% of the firms referred to difficulties concerning loss of control and lack of trust.[31]

Reasons for failure of business cooperation arrangements

> 'When considering the failure of cooperative arrangements, no longer was time commitment considered the most important factor. Of the firms in the BIE's survey 165 had been in failed cooperative arrangements with other firms. Of those firms, 44% indicated fear of loss of control and lack of trust as reasons for cooperative arrangements failing. The next most cited reason (by 32% of the firms) was the financial cost associated with cooperative arrangements.[32] The sample size is too small for very significant conclusions to be drawn about the differences between different categories of firms.'

Factors which discourage formation of business links

5.51 The BIE found that fear of 'loss of control' was the main reason given by firms which had never entered into cooperative arrangements with other firms. This finding has been supported by other recent surveys. As noted above, loss of control was also found to be a prime reason given by firms which had experienced the collapse of a cooperative arrangement; however, only 7% of firms in functioning cooperative arrangements regarded loss of control as a significant concern.[33]

5.52 A range of other reasons were each chosen by about 20% of the firms surveyed by the BIE. These were: not wanting to disclose commercial secrets; the financial costs; the administrative/legal burden; the additional time commitments; and lack of trust.[34] Approximately 20% of the firms gave reasons which indicated that they clearly 'could be ... amenable [to entering cooperative arrangements]... given the right circumstances'. These included reasons such as: no opportunity had arisen; linkages had not been considered; and they were waiting to be approached.[35]

5.53 There is an apparent information shortage, for example about potential linkage partners and opportunities for cooperation, which if properly addressed by government and industry associations could substantially increase the extent of business cooperation. The BIE found that non-cooperating firms are mostly uninformed about the prospective benefits of cooperation.[36]

> 'The major concern of non-cooperating firms - fear of losing control - could also be based on misleading (or at

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31 ibid., pp 198 & 199
32 ibid., p 201
33 ibid., p 212
34 ibid., p 212
35 ibid., p 214
36 ibid., p 224

> least, incomplete) information. Loss of control is not a significant problem in ongoing cooperative arrangements.
>
> 'If non-cooperating firms were more aware of the positive sides of business cooperation - and knew more about how to form linkages - it is hard to avoid the conclusion that many more would join the ranks of "the cooperators".'[37]

5.54 The issue of cultural differences that exist between professions was raised in some submissions to the Committee as a potential barrier to the development of effective linkages and communication networks, or as a problem which could emerge in cooperative arrangements.[38] This did not apparently feature significantly in the BIE's survey results. This could possibly be a problem which emerges more strongly in linkages between firms and research institutions. However, even within the same organisation, people with different training and work experience backgrounds may focus on and emphasise different aspects of the innovation process. They may, in effect, speak a different 'language'.

5.55 These 'cultural' differences are undeniable, but they can be broken down or ameliorated through people working together in collaborative arrangements. Achieving better cross discipline and speciality communication may be a slow and at times difficult process, but if adopted as a continuing task it will reap great benefits for the economy in the long term. Indeed, unless such communication is improved innovation will remain hamstrung.

External Assistance and Linkage Formation

5.56 There is clearly a role for external assistance in promoting the benefits of linkages and their role in the innovation process and to help overcome the information problems which the BIE survey identified. The BIE report made the following salient point concerning the role of external assistance.

> 'External assistance is not the panacea for all cooperative business arrangement problems and impediments. At the end of the day firms have to make the fundamental decisions themselves. External bodies can, however, play a significant role in informing and educating firms, as well as in overcoming impediments to cooperation - both informational and practical.'[39]

37 ibid., p 224

38 CSIRO, Division of Exploration and Mining: *Submission no. 101*, p 3; Ward, N: *Transcript of evidence*, p 182; Jones Hon. B., MP, *Submission no 73*, p 3

39 BIE: Research Report 67, AGPS, Canberra, 1995, p 249

5.57 The principal sources of assistance to firms seeking to form cooperative arrangements with other firms are the Government and industry associations. Other sources of external assistance not examined in the BIE's study include Chambers of Commerce and Chambers of Manufactures, business advisers, consultants and accountants.

5.58 The BIE identified eight categories of external assistance which were classed more broadly as either *information assistance* or *direct assistance*:

Information Assistance

- how to form linkages;
- possible partners;
- benefits of linkages; and
- identifying market/business opportunities.

Direct Assistance

- provision of broker/facilitator;
- actively introducing firms;
- training in the formation of links; and
- financial assistance.[40]

5.59 The main Commonwealth Government program specifically promoting firm to firm linkages is the Business Networks Program (BNP) run through AusIndustry. The BNP was a 1994 initiative announced in *Working Nation*, which expanded on a pilot program which had been in existence since 1990 and which operated through the National Industry Extension Scheme (NIES).

5.60 The BNP involves the use of 'network brokers' and financial assistance to help groups of at least 3 firms through the stages of feasibility study, business plan development, formal cooperation agreement and possibly even implementation. The intention is for the program to run for 4 years (at a cost of $25 million) and to establish at least 1000 networks. The implementation of the program involves 'a range of industry associations, federal and state governments, regional development authorities and private consultants'.[41]

5.61 The BIE found that under the pilot program and since the establishment of the BNP, 144 networks involving at least 1500 firms had been established with government assistance. 'Around half the networks are in the manufacturing sector, around one-quarter are in the services sector, while 11 per cent have a mixture of manufacturing and service firms.'[42] The Minister for Small Business, Customs and Construction, Senator the Hon Chris Schacht, announced on 19 October 1995 that another 300 network proposals were being worked on by the program's network brokers.[43]

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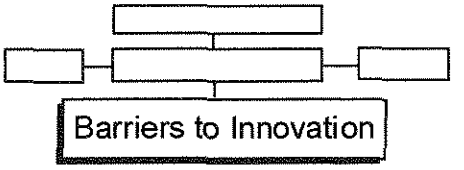
40 ibid., p 227
41 ibid., p 229
42 ibid., p 229
43 Media release no 372/95, 19/10/95



5.62 Two other Commonwealth Government business networking programs are the Food Industries Networking for Asia Export Program, administered by the Department of Industry Science and Technology (DIST) and the Rural Enterprise Networking Program, administered by the Department of Primary Industries and Energy (DPIE).[44] The BIE study identified over a dozen other Commonwealth Government programs and several state government programs which directly or indirectly help the formation of links between firms. These include the Partnerships for Development and Fixed Term Arrangements programs, programs run by Austrade, programs run by Aus AID, and programs focussed on promoting innovation and R&D.[45]

5.63 Approximately 10% of cooperating firms that responded to the BIE survey received some form of government assistance with their cooperative arrangement(s), mainly through 'DIST(and in particular NIES) and Austrade'. However, only 5% had been assisted by government sources with their 'key arrangement'.[46]

5.64 Surveyed firms were generally more satisfied with the provision by governments of information assistance than direct assistance; although the provision of finance was the single 'most applauded role' of governments.[47] Almost 70% of the firms in the BIE survey 'claimed they had no prior knowledge of appropriate government programs or departments which might help them form cooperative arrangements'; so there is clearly scope for much greater effort by governments in informing the business community of assistance which is available.[48] There would also appear to be the need to improve performance by governments in the following areas, where assistance was rated most poorly:

- 'introducing firms;
- 'identifying market and business opportunities; and
- 'providing training in forming links'.[49]

5.65 The BIE noted the important role that industry associations can play in promoting cooperation between firms. Industry associations directly assist cooperation through such means as organising focus groups and trade missions as well as helping 'firms find partners or cooperation opportunities'. The BIE commented that 'most industry associations are not in a position to finance linkage programs'; however, they are ideally placed to inform their members about government programs to promote linkages.[50]

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44 BIE: Research Report 67, AGPS, Canberra, 1995, pp 230 & 231
45 ibid., pp 301-312
46 ibid., p 233
47 ibid., p 233
48 ibid., p 235
49 ibid., p 233
50 ibid., pp 231 & 232

5.66 Industry associations were identified by nearly 40% of cooperating firms as having assisted them in the formation of business links, compared with 10% nominating the government sector. However, only 4% indicated they had received industry association assistance with their 'key cooperative arrangement', compared with 5% in relation to government assistance.[51]

5.67 As with the performance of the government sector, industry associations rated more favourably in the provision of information assistance than in the provision of direct assistance. Despite their apparently much broader reach, the performance of industry associations was generally rated lower than that of the Government. The BIE considered that:

> 'At a general level, industry associations have probably been slow to react to the changing business environment and the subsequent growth in importance of cooperation. However, many are now becoming involved in linkage formation. As this involvement grows, their performance in assisting firms is certain to improve'.[52]

5.68 Industry associations are yet to realise their potential as facilitators of cooperative arrangements. These bodies already provide advice, information and training to their members on a range of issues. The BIE considered that they are in an ideal position 'to promote intra-industry cooperation and guide its development'. The BIE observed:

> 'Until recently, most of the industry association assistance tended to be *ad hoc* and often an unintended outcome of other actions. However, industry associations are now more aware of business cooperation issues, as evidenced by their interest in AusIndustry's Business Networks Program. A considerable number applied for placement of network brokers under the program. ... In this, and other similar ways, they provide a useful link between firms and government for the dissemination of programs.'[53]

5.69 The BIE found that firms assisted by the Government are 'much more likely to benefit from new customers/suppliers, overseas and domestically'. In contrast, firms receiving assistance from industry associations 'are more likely than government-assisted firms to benefit from improved production processes, improved work practices/productivity and access to production facilities'. Product development is another area where firms receiving assistance from industry associations gain a greater benefit than firms receiving assistance from governments.[54]

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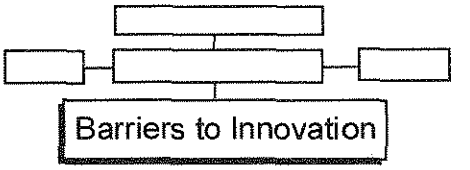
51 ibid., p 236
52 ibid., p 236
53 ibid., p 231
54 ibid., p 240



5.70 The BIE considered that these performance differences might reflect 'comparative advantages' of the Government and industry associations in the delivery of different types of assistance. If so, there are obvious policy implications for how different forms of assistance should be delivered.

5.71 The BIE highlighted the benefits of the Government and industry associations both being involved in encouraging and facilitating more business cooperation and in working together in doing so. 'The government's resources can be combined with the industry association's "local knowledge" and close contact with industry participants to develop specific, targeted packages for industries.'[55]

5.72 There is strong support among firms for government involvement in the provision of both information and direct forms of assistance. Eighty per cent of cooperating firms and 72% of non-cooperating firms in the BIE survey supported an information role for the Government with 65% and 60% supporting a direct assistance role. Eighty-four per cent of firms which have received government assistance favoured direct government assistance and 89% favoured information assistance.

5.73 Many firms indicated the most favoured outcome was a combination of information and direct assistance, for example:

> 'Government could publish details of firms seeking cooperative arrangements, and through teaching agencies provide training opportunities for staff of firms wishing to develop cooperative arrangements'.[56]

5.74 The least favoured form of direct support was found to be the provision by the Government of brokers or facilitators.[57] This should be a matter of considerable interest to the Government in that its main program to promote firm to firm linkages, the Business Networks Program (BNP), involves the use of network brokers. It is too soon to assess the effectiveness of the BNP and it may be that the operation of the program will result in a more favourable attitude among firms about its role. It could be that this finding simply reflects a lack of awareness of how the BNP works and the fact that the brokers actually come from the private sector. However, the findings of the BIE must give cause for concern about the focus of the Government's efforts.

5.75 **The BIE recommended in its report that:**

> **'In support of the Business Networks Program, AusIndustry should supplement its information material about the Program with new data**

55 ibid., p 250
56 ibid., p 243
57 ibid., pp 242-243

highlighting the many benefits of networks. The role of network facilitators needs to be marketed if they are to become acceptable to a wider range of firms'.[58]

5.76 In marketing the benefits of the Business Networks Programs, the Government should publicise the fact that the network facilitators come from the private sector.

5.77 It is worth noting that firms of different sizes have different views concerning the appropriate role of the Government and presumably different needs. Over 60% of large firms (in terms of employee numbers) in the BIE study did not believe that the Government should be involved in introducing firms to potential partners, while 60% of very small firms favoured government involvement in this activity.[59] This serves to emphasise the need for the Government to target its policies to the needs of particular sectors of the business community and to have a range of polices.

The Future of External Assistance for Networking

5.78 The study by the BIE revealed that about one-third of Australian firms are not involved in any kind of business cooperative arrangement. The study also revealed that firms in such arrangements found them to be of considerable benefit. There is therefore a clear need for firms to be more aware of the benefits to be gained.

5.79 The BIE's study also found that only 10% of firms which were in cooperative arrangements with other firms had received government assistance in establishing those arrangements. Whether cooperating firms received assistance in establishing business linkages through either a government program or an industry association they benefited. The Government clearly must accord a high priority to educating firms about the benefits of business cooperation and about the range of programs which exist to assist firms in establishing cooperative arrangements. Small to medium sized enterprises probably stand to gain most from an increased educational campaign since they are less likely than large firms to acquire such information through their own resources.

5.80 To effectively educate firms concerning the benefits of cooperative arrangements and to promote enterprise involvement, it will be essential for the Government, and in particular AusIndustry, to interact closely with other providers of assistance to firms. The relationship between the Government and industry associations is very important. Industry associations can perform the function of facilitators and delivery points of government assistance. They can also play an important role in the design of assistance policies.

5.81 The delivery of external assistance should be based on the comparative advantage particular agencies have in administering certain types of assistance. As discussed previously, industry associations are more proficient in 'providing assistance relating to operational or efficiency outcomes, while governments are

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58 ibid., p 258
59 ibid., p 245

better in helping firms to access markets'.[60] Collaboration between government and industry associations will lead to improved delivery and access to assistance. There will be major efficiency gains from combining the resources of these organisations. The Committee acknowledges that AusIndustry does work with the private sector but considers that even greater efforts should be made to increase such cooperation to improve community awareness of assistance programs and to improve the effectiveness of the delivery of those programs.

Recommendation

5.82 The Committee recommends that the Government, through AusIndustry, liaise more closely with other major providers of industry assistance, especially industry associations, business organisations and business advisers in promoting and assisting business cooperation. The relationships established between the Government and industry organisations should be used in the design and development of assistance programs to facilitate the spread of cooperation amongst Australian enterprises.

5.83 The Government must address how best to deliver information concerning the benefits firms can gain from cooperative arrangements. It is important to disseminate this information as widely as possible. The Committee believes an important and useful vehicle for the dissemination of this information would be an electronic information package. The recently launched *BizLink* program is one instrument which could be used.

5.84 The BIE highlighted how the *BizLink* program could be used, including in the identification of possible partners, business opportunities and markets.[61] Furthermore, the BIE recommended the creation of an electronic 'cooperation network'. This would be much broader than *BizLink*, providing assistance agencies and cooperators with a forum to access information on matchmaking, opportunities, case studies, financial assistance, and training issues related to business cooperation.[62] The Committee supports the concept of using the *BizLink* program to increase the level of business cooperation in Australia.

5.85 There is another fairly recent Government initiative which should serve as a useful means of promoting firm to firm linkages and of encouraging the commercialisation of innovative ideas. This is the *Ideas and the Investor* program, which has operated in South Australia for some years but which is now being extended nationally as part of the Government's Business Equity Information

60 ibid., p 264
61 ibid., p 266
62 ibid., p 267

Service, through the Chambers of Commerce. New ideas and opportunities are publicised through a monthly publication to encourage potential investors. The National Head Office is located in the SA Employers Chamber of Commerce and Industry. '

5.86 In only a short period of national operation, the *Ideas and the Investor* publication has had a very positive impact in business matching. From February to September 1995 some 249 ideas received exposure through the monthly publication produced under the program. Inquiries were received concerning 218 of these ideas which have resulted in 55 cases of some form of business matching.[63] Based on the favourable early outcomes from the *Ideas and the Investor* monthly publication, it is obviously important that it continue to receive support.

5.87 At the beginning of this section, the Committee emphasised the importance of links between customers and suppliers. A number of major firms in recent years have introduced a form of *supply chain management* which actively fosters such links. There is scope in the Australian economy for large firms to strengthen links with their local suppliers and to promote networks among those suppliers. By providing more detailed information to the network of suppliers concerning projected needs over a reasonably long time scale, the large firm can better manage its input inventory. The suppliers gain greater certainty in planning their own production. Through stronger linkages between the suppliers, reliable supply can be more assured and technology diffusion can more easily occur - increasing efficiency, reducing costs and making those firms more internationally competitive.

5.88 If more large firms will take the initiative in supply chain management then the networks which are built could also serve as channels of information concerning the availability of government programs to assist such network building.

Recommendation

5.89 **The Committee recommends that the Government encourage large firms to introduce *supply chain management* and to use the networks created to increase awareness of the benefits of business linkages and the availability of programs to assist the building of such links.**

SMALL AND MEDIUM SIZED ENTERPRISES

5.90 Small and medium sized innovative firms are likely to encounter particular difficulties because of their size. They are likely to have greater difficulty than larger firms in gaining access to finance; they are less likely to have the resources necessary to undertake sufficient R&D; and they are less likely to have the resources needed to pursue and fully participate in business networks.

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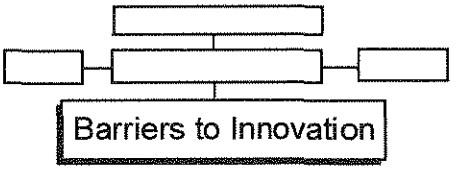
63 Personal communication between the committee secretariat and the National Coordinator of the *Ideas and the Investor* program, Mr Rod McInnes, 20/10/95



5.91 In order to devise and implement programs to assist SMEs to overcome their particular difficulties it is obviously necessary to define what constitutes an SME. The *First Corporate Law Simplification Bill 1995*, which is before the Parliament at the time of preparing this report, classifies a firm as small (or not large) depending on whether it satisfies at least two of the following tests:

- gross operating revenue of less than $10 million for the year;
- gross assets of less than $5 million at the end of the year; and
- fewer than 50 employees at the end of the year.

5.92 The difficulty of defining small (or medium) sized businesses was discussed in detail in the Committee's 1990 report, *Small Business in Australia - Challenges, Problems and Opportunities.* Definitions that are commonly used tend to vary between industries. The Committee in that report also considered that the decision making structure and the degree of financial exposure of its principals should be taken into account in any single definition. The Committee concluded that a small business could be defined as:

- being independently owned and managed;
- being closely controlled by owner/managers who also contribute most, if not all, of the operating capital;
- having the principal decision making functions resting with the owner/managers.[64]

5.93 In addition, the Committee suggested that a small business in a manufacturing industry could be one which employed up to 100 people and in a non-manufacturing industry up to 20 employees. There is undoubtedly a need for some flexibility in defining SMEs for the purpose of deciding eligibility for access to government assistance.

Undertaking R&D

5.94 The problem of scale has important implications for SMEs and their capacity to undertake R&D. Considerable resources are necessary to maintain an ongoing R&D program. Expenditure on R&D typically does not result in short term returns. SMEs generally have limited resources and cannot afford the luxury of resources committed to activity that does not result in short term returns. These difficulties can prove insurmountable and preclude SMEs from undertaking R&D.

64 House of Representatives Standing Committee on Industry, Science and Technology: *Small Business in Australia - Challenges, Problems and Opportunities* Jan 1990 p 9

5.95 In many cases it is neither practical nor possible for SMEs to undertake R&D on their own. The Committee believes that one of the goals of government policy should be to enhance the contact between SMEs and research agencies, especially public R&D agencies. Recommendations are made later in this chapter to facilitate the involvement of SMEs in the CRC program.

Linkages and SMEs

5.96 Small and medium sized enterprises (SMEs) in particular have much to gain from enhanced linkages in the economy. The Australian Manufacturing Council (AMC) commented in its report, *The Wealth of Ideas*, that few Australian SMEs establish links with other firms.[65]

5.97 Unfortunately, small firms face the greatest barriers to involvement in networks. Networking requires an investment of resources, especially time, which many SMEs find particularly difficult to afford. The information necessary to initiate useful collaborative arrangements is not readily accessible to SMEs.

5.98 The CRC program is one mechanism the Government has established to increase the involvement of SMEs in cooperative arrangements, especially in arrangements focussed toward enterprise innovation. However, the CRC program does not appear to have proved as accessible for small enterprises as it has for larger enterprises. Dr Nicola Ward, Strategic Planning Executive of Cochlear Pty Ltd stated in evidence to the Committee:

> 'Part of the problem is the amount of management that is necessary in the CRC. Our CRC directors working within the company feel that the amount of time that they spend in managing the projects within the CRC is more than they would spend on an equivalent project within the company ...
>
> 'So, when you come down to a very small company such as Cochlear was five or seven years ago, all their research effort is necessarily focussed on getting the core product out and every scarce resource is spent right within the company. It is possible and probable that those managers do not have the spare time to devote to other projects in CRCs.
>
> 'I know of one company that found it just too difficult to try to get the most out of the CRC and so has effectively let any additional work that they might want done by the CRC go because the bigger companies within the consortium were basically dominating the researchers'

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65 Australian Manufacturing Council and McKinsey & Co.: *The Wealth of Ideas - How linkages help sustain innovation and growth*, November 1994, p iv

time and they did not have time to argue their case and get a fair share.'[66]

5.99 The CRC Program Evaluation Steering Committee reported in July 1995 that there is an apparent time scale conflict between the objectives of CRCs and the business strategies of SMEs.[67] CRCs pursue long term research objectives while many SMEs seek immediate solutions to problems they face.[68]

5.100 The CRC Program Evaluation Steering Committee concluded that the involvement of an enterprise in the establishment phase of a CRC requires a level of management and resource commitment that is beyond a significant proportion of SMEs.[69] The Evaluation Committee recommended that the CRC Association provide support for identifying and achieving best practice among CRCs in providing access to SMEs.[70]

5.101 The Committee is also concerned that SMEs are currently not able to exploit all the opportunities presented by the CRC program and believes there is a need to provide support to SMEs that would facilitate their increased involvement in CRCs. The Committee has identified the resource requirements and the presence of large players within CRCs as the major barriers to increased involvement by SMEs. The Committee believes there is a need to create a second tier of CRCs which are principally for SMEs.

Recommendation

5.102 The Committee recommends that a second tier of CRCs be created which is reserved for the involvement of SMEs which meet two of the following criteria: they should have less than 50 employees, gross annual revenue of less than $10 million or gross assets of less than $5 million.

5.103 Some smaller firms apparently feel some reluctance to become involved in the CRC program owing to a fear of being overwhelmed by their larger commercial partners. A solution could be to allow SMEs to form networks and for those networks to participate in CRCs as a single unit.

66 Ward, N: *Transcript of evidence*, p 180
67 Report of The CRC Program Evaluation Steering Committee: *Changing Research Culture Australia - 1995*, July 1995, AGPS, Canberra, p 59
68 ibid., p 34
69 ibid., p 59
70 ibid., p 34

Recommendation

5.104 **The Committee recommends that networks of SMEs should be eligible for participation in the CRC program.**

Creating links with Public Agencies

5.105 Public research agencies are valuable resources Australian industry has available to it and which could be much better utilised. Unfortunately, there is poor community knowledge of the expertise present in Australia's public research facilities. These agencies are a vital cog in Australia's research environment, especially in performing pure or basic research.

5.106 A scheme which enhanced the access of firms to public research agencies would greatly benefit Australia's innovation performance. Enterprises, and especially SMEs, should be able to utilise the considerable resources of these agencies as the need arises and with minimal charges.

5.107 Mr Peter Nixon, Board Secretary of ANSTO, suggested a cost free advice service as one means of making the resources of public research agencies more accessible to the private sector.

> '[A] small Australian business theoretically should be able to pick up the phone and say: "Look, I have this problem. Can one of your guys there give me a hand?" It might be that a visit to that person's factory could assist. If you have to dock your time up like a lawyer and say: "We'll send you your bill at $200 an hour" you would be closing up that approach.'[71]

A scheme such as this presents many problems, especially for agencies' resource management. Yet this sort of program fits comfortably with recent moves toward greater cooperation between public sector research agencies and the private sector. Any such scheme would have to be carefully designed so that agencies could meet the needs of enterprises without an excessive drain on their own resources. The Committee considers that it is best left to individual agencies to decide how to allow greater access to firms.

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71 Nixon, P: Transcript of evidence, p 201

CHAPTER 6 - DRIVERS AND CATALYSTS

6.1 Previous chapters have commented on education and training, access to capital, management skills and linkages or networks. This chapter focuses largely on research and development - including an examination of the role of technology foresighting. The chapter concludes by returning to the innovative enterprise, organisational issues and industrial relations.

RESEARCH AND DEVELOPMENT

Some Definitional Issues

6.2 In addition to the information available in submissions and evidence given at public hearings, the Committee has been able to take account of the major inquiry into research and development which was completed by the Industry Commission in May 1995. The Industry Commission's report quoted the following OECD definition of research and development:

> 'Creative work undertaken on a systematic basis in order to increase the stock of knowledge - including knowledge of man, culture and society - and the use of this knowledge to devise new applications.'[1]

6.3 This definition is broad enough to encompass not only technological innovation (the use of 'new, usually more efficient methods of production'[2]), which is the prime focus of the Industry Commission's report, but also innovation in management techniques, organisational structure, marketing strategies, et cetera.

6.4 The following more specific definitions of basic research (both pure and strategic), applied research and experimental development, used by the Australian Bureau of Statistics and the Industry Commission in its inquiry, provide an appropriate framework for looking at the technological side of innovation:

- **pure basic research**: 'is experimental and theoretical work undertaken without looking for long-term benefits other than the advancement of knowledge';
- **strategic basic research**: 'is experimental and theoretical work undertaken to acquire knowledge directed towards specified broad areas in the expectation of useful discoveries. It provides the broad base of knowledge necessary for the practical solution of recognised problems';
- **applied research**: 'is original work undertaken to acquire knowledge with a specific application in view. It is undertaken to find possible

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1 Industry Commission: op. cit., p 1
2 ibid., p 59

uses for the findings of basic research or to identify new ways of achieving some specific and predetermined objectives';

- **experimental development**: 'is systematic work, using existing knowledge gained from research or practical experience, directed to producing new materials, products or devices, installing new processes, systems or services, or improving substantially, those already produced or installed.' [3]

6.5 As the Industry Commission commented,[4] such clear definitional distinctions sometimes may be artificial and misleading; nevertheless, the definitions provide an essential basis from which to examine R&D in Australia and for making cautious international comparisons.

6.6 The words 'research and development' are so often expressed as a single phrase that they come to be thought of as a single process. It is important to recognise that 'research' and 'development' are not synonymous and the inter-connections are not simple or one-way. Consideration of the 'right mix' between pure, strategic and applied research and experimental development, which is returned to later in this chapter, needs to take into account that the solution to a shortage of expenditure at one end of the spectrum may not be as simple as transferring funds from the other end.

6.7 It is also important to note that experimental development needs to be followed by commercialisation if successful innovation is to occur. Commercialisation can involve pilot programs, test products and market research, and can require the skills of marketing, accounting, engineering and management.

The Pattern of R&D

Public and Private Sector Roles

6.8 There are two major features to be noted in relation to the respective roles of the public and private sectors in Australia in R&D activity. Firstly, the public sector (including higher education institutions and government research agencies) accounts for the bulk of total R&D expenditure (55% in 1992/93).[5] Secondly, the comparative roles of the public and private sectors changes as one moves along the spectrum from basic research to applied research and experimental development, with the public sector overwhelmingly dominating the research end of the spectrum.

6.9 Table 2 and chart 3 below illustrate the percentage contribution of each sector in 1992/93 to each type of R&D activity.

3 *ABS Catalogue No. 1297.0* — referred to in Industry Commission: *Research Development - Report No 44* Volume 1, May 1995 p 60
4 Industry Commission: op. cit., p 61
5 ibid., p 99

6.10 Nearly 95% of pure basic research in Australia in 1992/93 was undertaken in the public sector with 87% being carried out by higher education institutions. The public sector in Australia also undertakes the bulk of both strategic basic research (82%) and applied research (66%). Within the public sector, the role of higher education institutions progressively decreases in relation to strategic and applied research (39% and 24% respectively) while that of government research agencies becomes more important (43% and 41%). Only 3% of Australia's pure basic research was undertaken by business enterprises. Business enterprises on the other hand undertook 80% of all experimental development work.

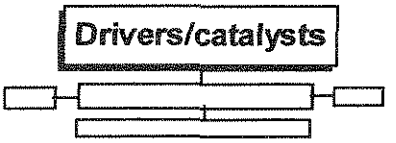
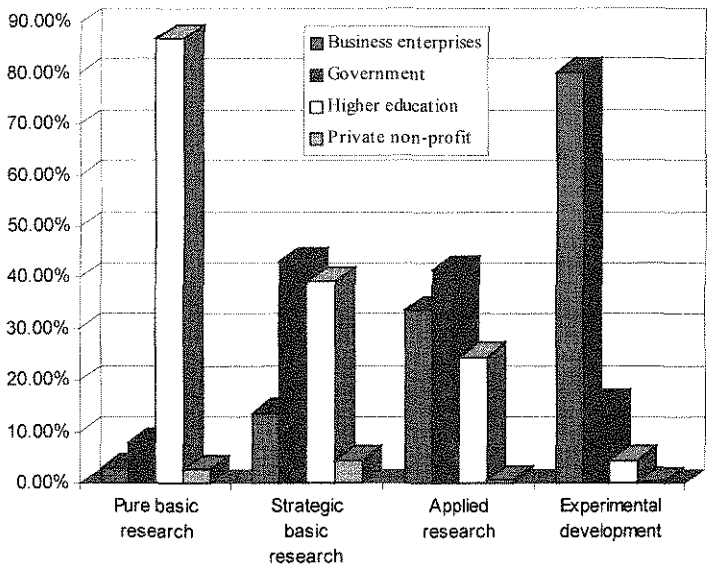


Table 2: GERD *1992/93*	Pure basic research	Strategic basic research	Applied research	Experimental development	% of TOTAL
Business enterprises	*2.86%*	*13.55%*	*33.52%*	*80.08%*	**44.19%**
Private sector	2.80%	11.50%	30.35%	73.59%	**40.32%**
Public sector	0.05%	2.05%	3.17%	6.49%	**3.87%**
Government	*7.75%*	*43.09%*	*41.44%*	*15.37%*	**27.64%**
C'wth	4.44%	33.86%	23.07%	10.85%	**17.88%**
State	3.32%	9.23%	18.37%	4.53%	**9.76%**
Higher education	*86.85%*	*39.05%*	*24.45%*	*4.32%*	**26.87%**
Govt. plus Higher education	*94.61%*	*82.13%*	*65.89%*	*19.69%*	**54.51%**
Private non-profit	*2.54%*	*4.32%*	*0.59%*	*0.22%*	**1.30%**
TOTAL	100%	100%	100%	100%	100.00%

Source: Calculated from figures in: Australian Bureau of Statistics: *1992-93 Research and Experimental Development All-Sector Summary Australia* Catalogue No. 8112.0, 15 May 1995, Table 5, p. 5

Chart 3: Public & private sector contributions to each type of R&D activity (1992/93 expenditure)

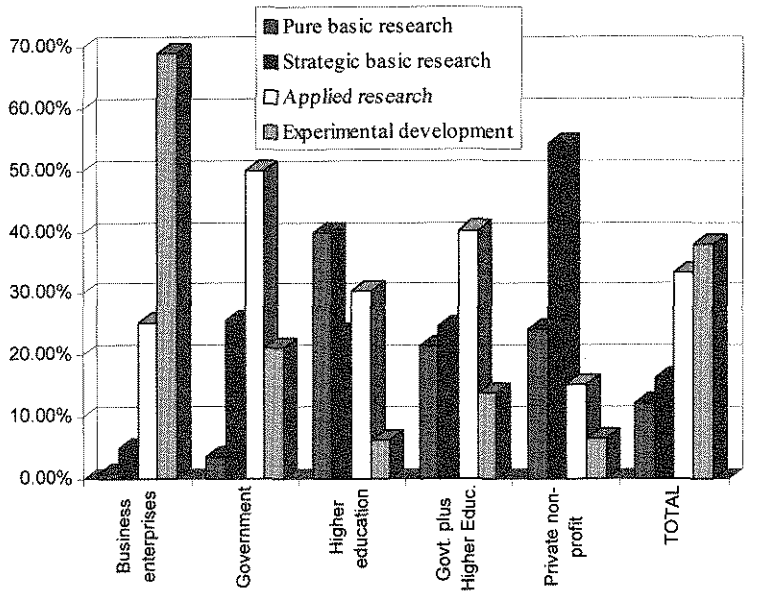


6.11 Table 3 and chart 4 below provide a percentage break-down of R&D expenditure within each sector in 1992/93. This shows from a slightly different angle the contribution to gross expenditure on R&D by each sector and the pattern of activity within the different sectors.

Table 3: GERD 1992/93	**Pure basic research**	**Strategic basic research**	**Applied research**	**Experimental development**	**TOTAL**
Business enterprises	*0.80%*	*5.00%*	*25.29%*	*68.92%*	100%
Private sector	0.86%	4.65%	25.09%	69.40%	100%
Public sector	0.16%	8.66%	27.32%	63.85%	100%
Government	*3.46%*	*25.41%*	*49.98%*	*21.15%*	100%
C'wth	3.06%	30.86%	43.01%	23.07%	100%
State	4.20%	15.42%	62.75%	17.64%	100%
Higher education	*39.87%*	*23.69%*	*30.33%*	*6.11%*	100%
Govt. plus Higher Education	*21.41%*	*24.56%*	*40.29%*	*13.74%*	100%
Private non-profit	*24.11%*	*54.17%*	*15.13%*	*6.59%*	100%
% of TOTAL	**12.33%**	**16.30%**	**33.34%**	**38.03%**	100%

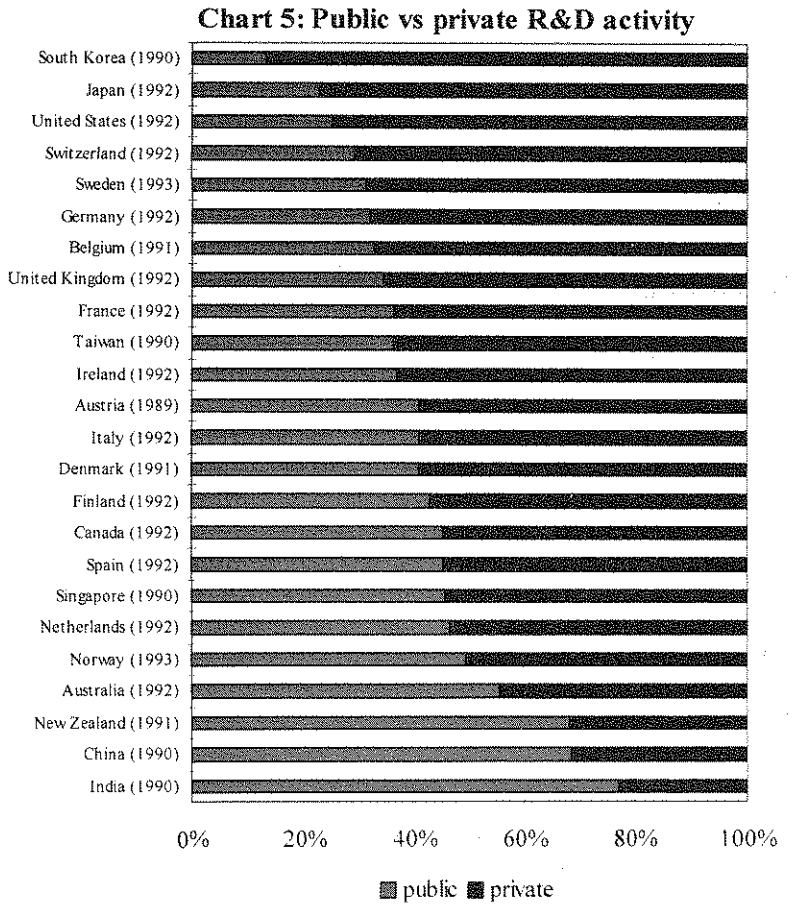
Source: Calculated from figures in: Australian Bureau of Statistics: *1992-93 Research and Experimental Development All-Sector Summary Australia* Catalogue No. 8112.0, 15 May 1995, Table 5, p. 5

Chart 4: % Break-down within each sector by type of R&D activity (1992/93 expenditure)



6.12 Sixty-nine percent of business R&D expenditure was on experimental development, 25% was on applied research and only 6% was on basic research. Forty-six percent of the public sector expenditure (including higher education institutions and government research agencies) was on basic research with the higher education institutions being particularly focussed on pure basic research. Nearly 50% of government research expenditure was directed to applied research. Twenty-one percent of government expenditure (excluding the higher education institutions) was on experimental development.

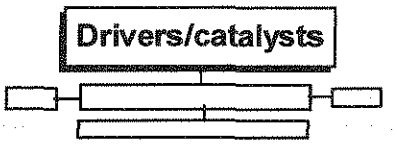
6.13 Chart 5 illustrates the relative importance of the public and private sectors in the total R&D effort of a number of countries including Australia. The figures on which the chart are based ignore the contribution of the private non-profit sector to R&D. Table 2 demonstrates that the percentage contribution of this sector, in Australia at least (1.3%), is not substantial. In only four countries does the public sector account for more than half of the country's national R&D expenditure. These are India, China, New Zealand and Australia. In Australia the public sector accounts for 55 per cent of total R&D expenditure.



Source: Tables 8 & 9 of the *Science and Technology Budget Statement 1995-96* presented by the Hon. Peter Cook, AGPS, Canberra 1995, pp. 4.6-4.7

6.14 As noted in chapter 3 of this report, spending on R&D by the public sector in Australia, measured as a percentage of GDP, compares favourably with that in other OECD countries. However, despite improvements in recent years, Australia continues to rank below the average for OECD countries in terms of gross expenditure on R&D as a percentage of GDP (GERD/GDP). The problem of Australia's overall low ranking in R&D expenditure arises from the comparatively low level of spending by the private sector. The consequence of this is that there is an apparent 'bias' in the nature of R&D activity in Australia - away from the experimental development end towards the research end and, in particular, towards basic research.

6.15 The existence of the pattern, whereby the business sector becomes increasingly more involved as research moves from basic to applied and then to experimental development, reflects the fact that the closer research work is to the commercialisation stage the more likely it will be that individual businesses can



capture the commercial gains. However, experimental development work would not be able to occur without the initial basic and applied research.

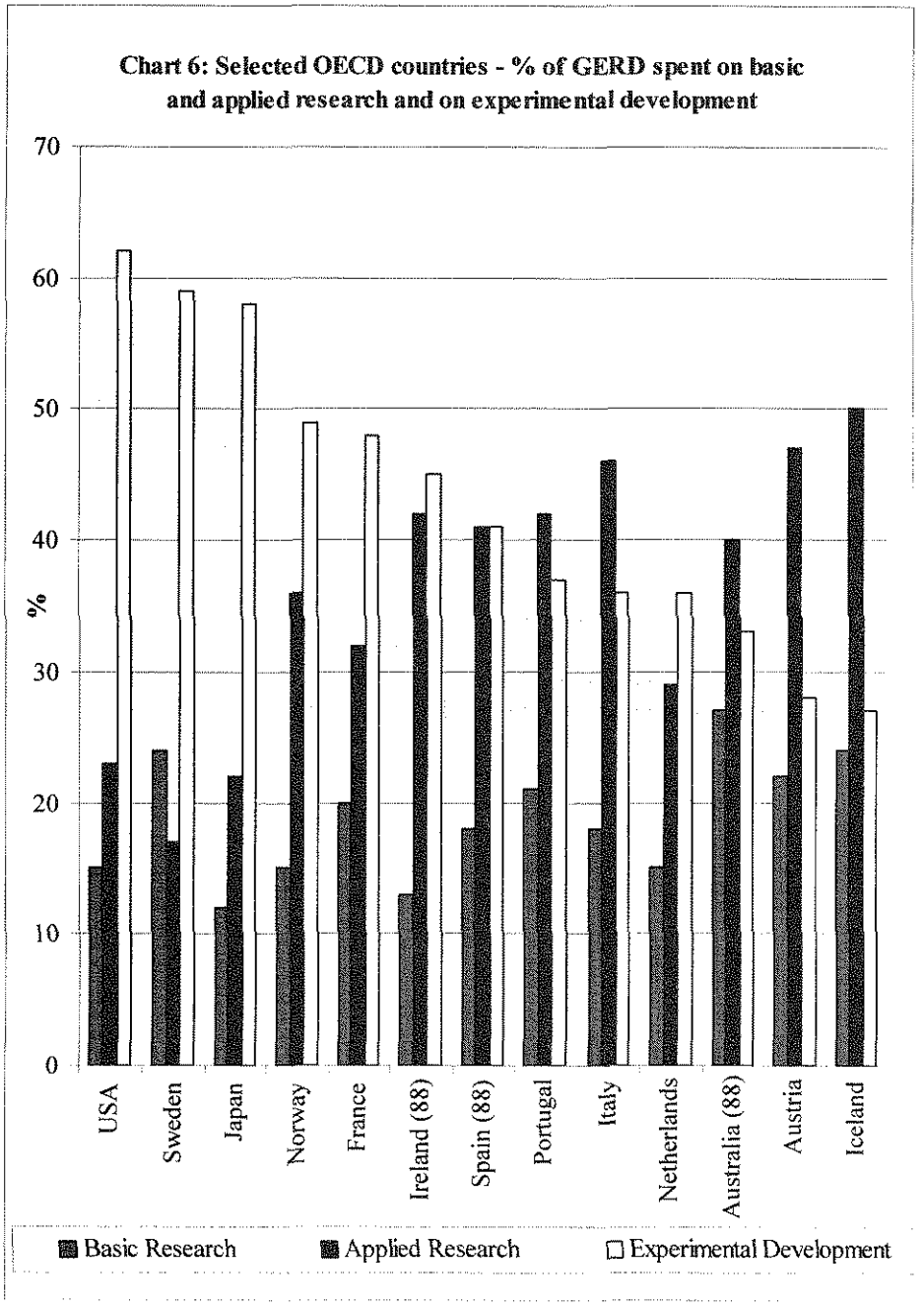
Getting the 'Right Mix'

6.16 Each of the different categories of research, and experimental development, are obviously vital to the innovation process. Pure and strategic basic research are essential to the expansion of the knowledge base on which applied research builds. Such research also helps provide the nation with the skills and knowledge base necessary to understand, adapt and expand on imported technology.

6.17 Because applied research and experimental development are closer to the commercial end of the innovation chain, there is a temptation to consider them more important than basic research. In fact, applied research and experimental development depend on basic research. They may in turn throw-up questions which stimulate further basic research or give rise to unexpected discoveries which have unanticipated commercial application. The interconnections are not simple or one-way but they are extremely important. Likewise, the process of diffusion of technology in an economy is critical in driving innovation.

6.18 As shown in table 3 above, 29% of R&D performance in Australia in 1992/93 was basic research (12.33% pure and 16.3% strategic), 33% was applied research and the remaining 38% was experimental development. An OECD study using 1988 and 1989 figures referred to in the Industry Commission's report provided an international comparison (see chart 6).[6]

6 Industry Commission: op. cit., Table A3.4 p 109



Source: Based on Table A3.4 in Industry Commission: *Research and Development* Report No. 44 May 1995 p. 109. Figures are for 1989 except where 1988 is indicated. Figures for Japan, the Netherlands and Australia do not add to 100% owing to a non-specified component of research.

6.19 As the Industry Commission report stated, such international comparisons must be treated with great caution because of the subjective judgements involved in attributing work to the different categories. Nevertheless the contrasts are quite

striking. In the USA 62% of gross expenditure on R&D in 1989 was directed to experimental development, in Sweden 59%, and in Japan 58% compared to 33% in Australia (1988 figures). This is consistent with the low level of spending on R&D generally by the business sector which is responsible for the great bulk of experimental development. It should be noted that the percentage expenditure figure for Australia in 1992/93 had increased to 38% (see table 3 earlier in this chapter). BERD increased in 1993/94 by a further 4% in real terms which would have led to another improvement in spending on experimental development.[7]

6.20 It is possible for the balance to be weighted too much towards experimental development and too little towards basic research. The Department of Employment, Education and Training (DEET) commented that:

> 'There is mounting evidence that industrialised and rapidly industrialising nations are placing greater emphasis on basic research, recognising it as a key input to the innovation system and the economy as a whole.'
>
> 'Japanese White Papers during the last 20 years have discussed the importance of increasing the support of basic research ... The current Japanese position is that enhancing its basic research capacity is not only important, but urgent.'[8]

6.21 Any policy measure which attempted to redress the balance in Australia by lowering expenditure on basic research would be quite ill considered if the problem is predominantly one of under spending on experimental development.

6.22 Similarly there has been criticism of attempting to force basic research to be more commercially relevant. As Professor Keith Pavitt of Sussex University put it:

> 'Dealing with deficiencies in business R&D by making basic research more 'relevant' is like pushing a piece of string.'[9]

6.23 There has been increasing budgetary pressure on public research agencies to seek private funding with the aim that this will lead to: closer links between the private and public sectors; and research programs which lead more frequently to

7 Coopers & Lybrand in conjunction with the Industry Research and Development Board: *Scoreboard '95 - Business Expenditure on Research and Development* DIST October 1995 p 2

8 Department of Employment, Education and Training: *Submission no.* 119, p 2

9 Attributed to Professor Keith Pavitt, University of Sussex, in: Department of Employment, Education & Training: *Submission no.* 119, p 4

commercialisation. Agencies now find their work programs tied more closely to the demands of their private sector contributors.

6.24 Many within the public research agencies and universities have criticised the pressure on them to become more commercially focussed.[10] One submission from the private sector as well did not favour a greater commercial focus in public sector agencies. Dr Phillip Reece of Biota Holdings argued :

> 'The pharmaceutical industry is heavily dependent on Universities and organisations such as CSIRO. These organisations must be able to engage in basic research. In fact, in many respects, they should be discouraged from pursuing the more developmental side of research.
>
> There appears to be a trend in some research organisations in Australia, and I include the CSIRO in this, towards more applied research with the intention of pursuing their own commercialisation. In many cases, this simply creates a more difficult environment for [companies] such as Biota to pick up on these new opportunities. For a start if the organisation itself is trying to commercialise, then there is little room for the company to pick up on the commercialisation opportunity. The question then arises as to who is likely to be best at commercialising. I would argue in every case that it is the industry.'[11]

6.25 The forging of closer links between public research agencies (and universities) and the private sector undoubtedly will result in research which takes greater account of market considerations. However, there is always the risk that the forging of these closer links might lower the level of basic research conducted by the public sector to such an extent that there would be long term costs. The Western Australian Department of Commerce and Trade stated in its submission that:

> 'Collaboration with industry is, of course, desirable but it must be in addition to, not in place of, their core research activities. If the core [pure research] is replaced there is a danger that the nation's science base would be eroded with consequent long term damage to R&D output generally.'[12]

6.26 Differences in the industrial structure of different economies undoubtedly help explain the wide divergences in the mix of R&D activity and expenditure which are demonstrated in chart 6 above. Also, undeniably, there are differences in natural comparative advantages which should make the Government cautious about setting precise targets for the 'right' mix of R&D in Australia. R&D expenditure in a

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10 For example, the President of the *Academy of Australia* as reported in Lowe, I: *Radical ideas from across the Tasman* in *New Scientist* 3 June 1995, p 46

11 Biota Holdings Ltd: *Submission no.* 91, p 2

12 Western Australian Department of Commerce and Trade: *Submission no.* 69, p 1

commodity based economy such as Australia can be expected to differ considerably from that in a manufacturing based economy such as Japan.

6.27 Mr Peter Laver, the Corporate General Manager External Affairs of BHP, argued that the level and nature of research should be determined not by some artificial formula but by consideration of the outputs which are sought. Mr Laver expressed confidence that industry will not continually ignore attractive opportunities. So long as the environment is in place that is conducive to innovation and barriers to innovation are eliminated, there should not be an assumption that business is committing a level of resources that differs greatly from what is optimal.

> 'That Australia's expenditure on research relative to GDP, particularly by the private sector, is low on a world scale should be seen as no more a matter of major concern than low levels of risk investment elsewhere such as Switzerland's low expenditure on minerals' exploration relative to GDP or Somalia's on tourist resorts. Each country faces a different situation which means inputs should not be seen as the problem. Incremental returns on any investment made, the outputs from research, are the matters for attention.'[13]

Justification for Government Intervention

6.28 In economic theory Government support for research is justified when market failure of one kind or another results in a less than optimal level being undertaken by the private sector. Market failure of this kind is frequently the result of the 'public good' characteristics exhibited by research outputs.

6.29 A 'public good' is one: to which the supplier of the good cannot exclude users from gaining access; and to which a number of users may gain access at the same time.[14] Another way of describing this is to say that there are 'spillover' effects from the provision of the good - that is, people other than the supplier of the good and the person who purchases the good gain some benefit without having to pay the supplier.

6.30 The effects of this 'spillover' problem are likely to be magnified if the R&D activity requires a large minimal investment cost to make it technically or

13 BHP: *Submission no.* 84, p 26

14 The extent of 'non-rivalry' and of 'non-excludability' varies widely from good to good and from service to service.

commercially worth doing and the cost is not able to be shared.[15] If the private sector researcher is not able to capture the full economic worth of the research output, a less than socially desirable level of such research will occur. In such cases it may be considered justifiable on public interest grounds for the Government to subsidise research or to directly conduct such research. [16]

6.31 Recent experience in Britain reveals that the market is not always sufficient to ensure adequate resources are allocated to R&D. During the 1980s the British Government devolved responsibility for industry innovation to markets and reduced expenditure and employment in Government funded R&D establishments.[17] Yet in an environment where company profits were growing, capital investment and expenditure on R&D continued to decline.[18]

6.32 One of the other principal disincentives for the private sector to undertake R&D is the uncertainty of outcome and therefore the perception of high commercial risk. This is particularly the case the further the research stage is from likely commercialisation. It may also be difficult for a firm to exclude others from sharing in or exploiting the commercial potential of the results. If firms are too risk averse and do not succeed in spreading the risk through insurance or other market arrangements, it may be necessary for the Government to intervene. This is why the public sector has gained such a pre-dominant role in the basic end of the research spectrum.

6.33 The Industry Commission's study of R&D can be referred to for a discussion of a number of other arguments for government intervention which do not need to be outlined here.[19]

6.34 It has been clear for many years that the structure of the Australian economy needs to change in order to capture a greater share of the high growth areas of world trade. Australia, because of its natural endowments, relies heavily on primary commodities for export income. Unfortunately, the commodities share of the total value of world trade has long been on a downwards path. Australia has to develop value adding industries and expand its export markets in manufactured goods and services. There is nothing new about these statements. They provide the justification behind the progressive dismantling of tariff barriers, in order to throw Australian industries open to international competition, and much of the changes that have taken place in the last ten years and more in manufacturing, trade and R&D policy.

6.35 It is also clear that R&D expenditure in Australia, particularly on experimental development, needs to be increased. The 1993 report by the Bureau of Industry Economics (BIE) noted that Australia ranks thirteenth in the OECD in terms of per capita GDP but only sixteenth in terms of gross expenditure on R&D as a

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15 Referred to in the Industry Commission's report as the 'indivisibilities' problem - see Industry Commission: *Research and Development - Report No 44* Volume 1, May 1995 p 173

16 BIE: Occasional Paper 16, 1994, p 1

17 Walker, W, cited in Nelson: *National Innovation Systems: A Comparative Analysis*, Oxford University Press, 1993, p 184

18 ibid., p 171

19 Industry Commission: op. cit., pp 169-177

percentage of GDP (GERD/GDP).[20] The level of spending on R&D by the public sector as a percentage of GDP compares very favourably with that in other OECD countries, ranking Australia fourth in 1992/93.[21] However, the 1992/93 figure on business expenditure on R&D as a percentage of GDP (BERD/GDP), although having increased substantially in recent years to 0.69%, was still well below the OECD average of 1.18%.[22]

6.36 The reasons for the inadequate levels of spending are many and complex. The Industry Commission, in its report on research and development, made the following observations about the nature of Australia's industrial profile:

- *'Small size of the manufacturing sector* - In all countries, manufacturing industries perform a high proportion of business R&D. In Australia, the manufacturing sector accounts for a smaller share of GDP than in many other countries;

- *'Different industry structure within manufacturing* - Within manufacturing, the ratio of R&D expenditure to value added (R&D intensity) varies across industries. Compared to the OECD average, Australian manufacturing has a bias towards low and medium R&D-intensive industries; and

- *'Low R&D intensity within manufacturing industries* - Within most manufacturing industries, Australian companies tend to be less R&D intensive than their overseas counterparts.'[23]

6.37 Industry Commission's report also made the following comments about the low level of business R&D expenditure in Australia:

- the gap between R&D spending by Australian companies and their overseas counterparts may in part be a legacy of the earlier protectionist policies which reduced the incentive to innovate;

- the 'large scale involvement of [the] CSIRO in industrial research might also have been a disincentive to carry out some types of R&D'; and

20 BIE: Research Report 50, AGPS, Canberra, 1993, p 10
21 Cook, Senator the Hon. Peter: *Science and Technology Budget Statement 1995/96*, AGPS, Canberra, 1995, p 1.3
22 Industry Commission: op. cit., Table A3.2, p 106
23 ibid., p 493

- taking all forms of assistance into account, 'government funds a higher proportion of BERD in Australia than in most other countries' therefore lack of government assistance is unlikely to be one of the causes of under-performance of BERD.[24]

6.38 Another explanation often suggested for the poor R&D performance of Australia's business sector is the high degree of foreign ownership. The argument is that subsidiaries of multinationals source their R&D and technology from the home country of the multinational. The Industry Commission received evidence during its inquiry into R&D suggesting this is a problem.[25] Ampol Ltd, commented:

> 'The overseas ownership of a significant proportion of Australian business has reduced the attention given to R&D. With large research and development facilities located overseas, there has been little incentive to create similar operations, or operations of any significance, in Australia.
>
> [With regard to the petroleum industry - Ampol stated that] 'All of our competitors are multinationals. They have no research and development facility of any significance in Australia. Ampol has no overseas parent or affiliate and so all its research and development is done within Australia.'[26]

6.39 The Commission, however, referred to research from the BIE revealing that foreign-controlled firms in fact exhibit a higher R&D intensity than Australian-owned firms. This varies across industries and may in fact be attributable to the R&D intensities of industries where there is a high degree of foreign ownership.[27] Based on the evidence available it is very difficult to determine the exact impact of foreign ownership on the level of R&D in Australian businesses.

Government Policies to Promote R&D and Commercialisation

6.40 Australian Government policy initiatives in recent years have aimed to increase the level of private sector involvement in innovation. In doing this the Government is attempting to leverage funds into innovative activity that would otherwise have been attracted to different sectors of the economy. Other countries are also implementing a similar policy agenda.

6.41 In Japan, innovation policy is set within a broad framework that is conducive to innovative activity. The emphasis is on 'inducing policy' by stimulation rather than by 'direct investment'. The Japanese approach of 'inducing policy' can be highly effective in triggering a surge in R&D investment from a limited amount of

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24 ibid., p 649
25 ibid., p 496
26 ibid., p 496
27 ibid., p 496

Government expenditure, although this effect will only be optimised in an overall policy environment that encourages innovation.

6.42 Similarly, policies in Germany and the United States have targeted increased involvement of the private sector in innovation. German State and Federal Governments have placed increasing emphasis on indirect policy measures which promote greater investment by the private sector in research and development. During the 1980s, America's innovation strategy focussed on market-oriented incentives to stimulate private sector R&D as well as creating research environments more conducive to collaborative and joint R&D efforts by universities, industries and governmental agencies.[28]

6.43 Australian's innovation policies have focussed principally on encouraging R&D and there has been some criticism that not enough thinking has been given to the innovation process as a whole. The Committee also received the comment that any policy change needed to be more imaginative than simply throwing money at research in the hope that it will lead to commercially successful innovations.

6.44 The experience of Japan indicates that a successful policy process is founded upon cooperation and consensus. The Japanese Ministry consults with business, advisory and scientific bodies at each stage of policy development. By involving all interest groups, a strong and mutually beneficial relationship has developed between government, universities and industry, thereby reducing uncertainty about the future as well as promoting brisker market activity.[29]

6.45 BHP's Corporate General Manager, External Affairs, Mr Peter Laver, said of government policy development: 'government thinking in the past has had this blind faith that, if you push money into the bottom of the innovation system, something good comes out the top'.[30]

6.46 Apart from implementing the appropriate macro and micro economic policies, the Government has two more specific forms of action it can take to increase a sub-optimal level of R&D. It can and does provide incentives to the private sector, such as the R&D tax concession, and the competitive grants scheme. The Government also acts more directly by funding research in public research agencies, such as the CSIRO and ANSTO, and in tertiary education institutions.

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28 Ballard, S., James, T: *Innovation Through Technical and Scientific Information: Government and Industry Co-operation*, Quorum Books, 1989, p 51

29 Watanabe, C. and Santoso, I: *The Inducing Power of Japanese Technological Innovation*, Pinter Publishers, London, 1991, p 55-56

30 Laver, P: *Transcript of evidence*, p 24

6.47 Because of the uncertainty of the relative impact of these support alternatives, it is important that there be a high degree of variability in the suite of Government programs offered. It is equally important that the Government's strategy be flexible and subject to review and assessment. Government strategy should be able to evolve so that it meets the changing needs of industry and the economy.

6.48 The Industry Commission identified the following broad principles that should be considered when developing government R&D policy:

- **diversity should be encouraged**, as varied forms of interventions are always desirable;
- **private incentives should be built on where possible**, with government action targeting user-driven research;
- **assistance schemes should be simple and transparent, with well defined criteria;**
- **assistance levels should be broadly consistent** between programs;
- **research should be monitored and evaluated**, because continued support must be dependent upon benefits being realised;
- **'contestability' should have a major role in research funding**, so that support targets the researchers and organisations that produce the best, most cost-effective research; and
- **government's roles in sponsoring R&D should be clear and its requirements clearly articulated** as the government has responsibility in determining priorities, choosing specific research projects and disseminating the results.[31]

6.49 Government policy to overcome market barriers faced by the private sector should focus where possible on leveraging research funding from the private sector. As the submission from BHP stated:

> '[Governments] should place greater emphasis on using existing government funding to leverage research funding from other sources. The CRC program and the Rural Research Corporations are good examples of this but there [are] still places where industrially oriented research is being funded 100% with government money. This joint funding approach has the combined effect of increasing the sense of ownership for the work done, so making it more likely that successful outcomes will be adopted, and of reducing the cost/risk for the main sponsor.'[32]

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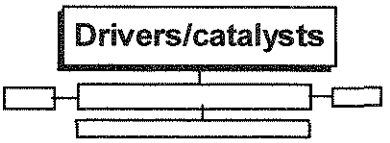
31 Industry Commission: op. cit., p 11
32 BHP: *Submission no.* 84, p 3



6.50 Despite problems that exist in the current suite of policies, successive Australian Governments have achieved some success at promoting innovation. The major current programs designed to enhance innovation are the:

- 150% tax concession for R&D and the associated syndicated R&D program;
- competitive grants for industry;
- cooperative research centres (CRCs) program;
- technology access program; and
- concessional loans for commercialisation of technological innovation.

150 per cent tax concession for R&D and syndicated R&D

6.51 The 150% R&D tax concession was introduced in 1985 as a temporary measure for six years. After two years of operation there was an interim review of the concession which saw it extended until June 1993 at the 150% rate, after which it was to be reduced to 125%. Subsequently, the 1992/93 Commonwealth Government budget announced the tax concession would be retained at the 150% level indefinitely.

6.52 The objectives of the R&D tax concession as stated in the second reading speech of the *Income Tax Assessment Act Amendment (Research and Development) Bill 1986* are to:

- 'provide an incentive for greater levels of research and development in Australia;
- 'concentrate new research and development efforts in industry by greater business investment in, and responsibility for, research and development;
- 'provide positive support for research and development activities in industry, on the basis that significant benefits accrue both to industry and to the wider community through enhanced competitiveness of industry;
- 'provide mechanisms for encouraging effective use of Australia's existing research and development expertise; and

- 'encourage a capacity in industry to be aware of, and exploit, technological development occurring in other countries'. [33]

6.53 The concession allows claimants to deduct from their taxable income up to 150% of the value of eligible expenditure on R&D activities. Eligible expenditure includes:

- salaries, wages and other overhead costs which are directly related to the company's R&D activities;
- contract expenditure;
- capital expenditure on R&D plant and equipment; and
- up to 10% of R&D expenditure undertaken overseas.

6.54 The purchase of, or purchase of the right to use, technology for the purposes of the company's R&D activities attracts 100% deductibility.

6.55 To receive the full 150% deduction, annual expenditure must exceed $20,000. The amount had been $50,000 prior to the May 1994 Working Nation statement. The intention of the change was to make the program more accessible to SMEs.

6.56 R&D expenditure that has taken place since 1985 and meets all other eligibility criteria will attract a concession under the tax concession scheme. The retrospectivity of the concession is not only very unusual, but makes the scheme highly attractive to businesses which use the scheme.

6.57 Following the 1987 mid-term review of the R&D tax concession, the Government introduced syndication to complement the tax concession. The scheme is designed to cover projects which are considered too large or risky for any single enterprise to undertake and allows the inherent risk to be spread among a group of firms.

6.58 To be eligible under the syndication program a project's expenditure must exceed $500,000. Tax exempt bodies such as universities and government research agencies cannot participate in syndicates unless the investors are fully at risk.

6.59 There are some fundamental differences between syndication and the tax concession in its original form. Syndication is used to generate finance by allowing syndicate members to claim the concession 12 months ahead of R&D activities being performed.[34]

6.60 Syndicates generally consist of investor firms which contract research firms to undertake R&D. In many instances these research firms are realising financial losses and are unable to benefit from the 150% tax concession. By receiving capital from investors research companies give up their tax loss position and gain the ability

33 Hansard, House of Representatives, 4 June 1986, p 4571
34 IR&D Board submission to Industry Commission inquiry into R&D, p 21

to undertake research. The investment funds are fully tax deductable against the investors' taxable income.[35]

6.61 A typical syndication research firm is medium size, has a high R&D intensity and conducts a large amount of R&D by Australian standards.[36] The past restriction that minimum eligible expenditure exceed one million dollars excluded small firms from participating to a large extent. The recent reduction to $500,000 hopefully will result in greater participation by small firms.

6.62 Financial institutions, particularly banks, are the major suppliers of finance in syndicated R&D projects.[37] Promoting involvement of these institutions was one of the aims of the syndicated R&D program and evidence suggests these institutions account for as much as 80% of the finance obtained through syndicated R&D.

Impact of the 150% R&D tax concession scheme

6.63 The recent increase in Australian business R&D expenditure can probably be attributed, at least in part, to the introduction of the 150% tax concession on R&D expenditure in 1985/86. Other changes in economic policy which have taken place in and since the mid-1980s presumably also contributed. In the two years to 1992/93 business expenditure on research and development (BERD) grew 28% in real terms.[38] This was associated with a 17% real increase in claims under the tax concession in the same period.[39] Since the introduction of the tax concession, Australian business expenditure on R&D has grown at an average annual rate of 15%, faster than in any other OECD country.

6.64 The difficulty in measuring the impact of the tax concession can be demonstrated by looking more closely at the changes which have occurred in BERD from the start of the 1980s to 1992/93, the latest year for which figures are available. The Industry Commission report stated that BERD increased in real terms by about 15% per year from 1981/82 to 1984/85 - that is before the introduction of the tax concession scheme. The largest yearly increases in BERD in the 1980s did occur in 1985/86 and 1986/87, the first two years of operation of the scheme, but from 1988/89 to 1990/91 BERD grew by only 2% per year - the same rate of growth as

35 BIE: *Syndicated R&D - An evaluation of the Syndication Program,* Research Report 60, AGPS 1994, p 7

36 ibid., p 23

37 ibid., p 21

38 Australian Bureau of Statistics: *1992-93 Research and Experimental Development All-Sector Summary Australia* Cat. No. 8112.0, p 1

39 Cook, Senator the Honourable Peter: *Science and Technology Budget Statement 1995-96,* AGPS, Canberra, 1995, p 1.4.

GDP.[40] The Industry Commission commented that uncertainty surrounding the continuity of, and level of support for, the scheme may have reduced its effectiveness.[41]

6.65 It is even more difficult to calculate the precise impact of the tax concession on Australian innovation. Reviews have found that the tax concession affects the level of R&D taking place in Australia but R&D is only one part of the innovation process. The analysis is further complicated by the fact many projects which are assisted by the tax concession would have been undertaken regardless of the existence of the scheme.

6.66 Both the Bureau of Industry Economics (BIE) and the Industry Commission have recently examined the performance of the tax concession program.

6.67 The BIE concluded that 'the concession clearly contributes to increased innovativeness and is likely to contribute to increased international competitiveness'.[42] The BIE report estimated that 'the concession might have made eligible R&D expenditure around 10 to 17 per cent a year higher than it otherwise would have been'.[43] The corollary of this, of course, is that '83 to 90 per cent of eligible R&D would be carried in the absence of the concession'.[44] The BIE also noted that not all types of enterprise, nor all types of R&D, have utilised the concession to the same extent:

> 'the most responsive companies tend to be small, young, R&D intensive and fast growing.....the more responsive projects involve new or significantly improved products/processes and pilot plant'.[45]

6.68 The Industry Commission similarly concluded that 'the 150% tax concession has [brought] net social benefits'[46] to the Australian economy but did not support 'increasing the tax concession, either to restore the effective value that applied in earlier years, or to match rates that apply in other countries'.[47] The Industry Commission did not support 'extending the provisions of the ... tax concession to commercialisation activities'.[48]

6.69 The Committee received submissions, just as the Industry Commission had done, proposing that the rate of the tax concession should be increased above 150% either to restore the incentive eroded by reductions in the company tax rate or to match the incentive provided in similar schemes in some other countries. The decrease in the tax rate has reduced the after tax subsidy provided by the scheme; however, it is not clear that this reduction has had, or will have, a significant effect

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40 Industry Commission: op. cit., p 489
41 ibid., pp 537 & 541
42 BIE: Research Report 50, AGPS, Canberra, 1993, p 158
43 ibid., p 182
44 ibid., p 183
45 ibid., 1993, p 182
46 Industry Commission: op. cit., p 654
47 ibid., p 545
48 ibid., pp 30 & 36

on the amount of additional R&D undertaken.[49] It is also not established that the higher tax concession rates offered by countries such as Singapore, Malaysia and Taiwan have a significant effect on the decisions of companies concerning where to locate their R&D activities.[50] There is an argument for maintaining stability in the tax concession scheme, rather than repeated changes in the level of the concession.

Recommendation

6.70 **The Committee recommends that the 150% R&D tax concession scheme be retained.**

6.71 Use of syndication has increased significantly since its introduction with 91 syndicates registered by November 1993. In 1989/90 (the first year of operation of syndication) R&D expenditure by syndicates totalled $105 million. By 1992/93 this had grown to $293 million, more than doubling as a proportion of business R&D expenditure - from 4% to 10%.[51]

6.72 Syndication has been very important for those firms involved in the scheme. For the research firms using syndication, it is very unlikely they would be able to obtain capital from alternative sources. Many of the projects undertaken through syndication otherwise would not have taken place.

6.73 The BIE presented results from a survey of syndicate participants indicating over 75% of these firms believed syndication was critical to the R&D going ahead.[52] This is considerably higher than the 10-17% of R&D the general 150% tax concession is estimated to induce. Syndication therefore results in a minimal amount of tax revenue being sacrificed on support for projects that would have proceeded in any case.

6.74 The BIE estimated that:

> 'The [syndication] program could be expected to induce an additional $2.6 million of R&D for every $1 million dollars of R&D that would have been conducted in the absence of syndication.'[53]

49 ibid., pp 539-541
50 ibid., pp 542-544
51 ibid., p 552
52 BIE: Research Report 60, 1994, p 58
53 ibid., p 120

6.75 Syndication improves the likelihood of successfully commercialising R&D. The BIE concluded that syndication has an important impact on commercialisation. This is because syndication:

- brings forward R&D, overcoming the problem of being late to market; and
- enhances access to finance for production and commercialisation following the R&D stage.

6.76 The Industry Commission report on R&D recommended that:

- syndication not be used for tax losses incurred in activities other than R&D
  $\Rightarrow$ nor should it be used by public or private tax exempt entities.[54]

Competitive Grants for Industry R&D

6.77 In the May 1994 White Paper, *Working Nation*, the Government announced that five grant schemes operated by the IR&D Board under the Industry Innovation Program (IIP) would be subsumed into one scheme, the Competitive Grants for R&D Scheme. The five superseded schemes were the:

- Discretionary Grants Scheme (DGS);
- Generic Technology Grants Scheme (GTGS);
- National Procurement Development Program (NPDP);
- Advanced Manufacturing Technology Development Program (AMTDP); and the
- National Teaching Company Scheme (NTCS).

6.78 The five schemes had been brought together in the Industry Innovation Program in February 1993 and the application and selection processes had undergone some initial simplification at that time. The adoption of a single scheme was intended to reduce confusion by providing one set of eligibility criteria while still serving the broad objectives of the previously separate schemes.

6.79 As the Industry Commission's R&D review pointed out, the five schemes had distinctive individual objectives as well as ones that were shared by more than one scheme.[55] The objectives of the new scheme are:

- 'to encourage companies, particularly small to medium sized enterprises, to develop internationally competitive goods, services and systems;

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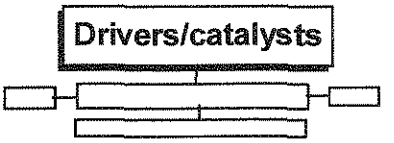
54 Industry Commission: op. cit., pp 33-35
55 ibid., pp 573-575



- 'to encourage companies to adopt new products, materials and methods to improve manufacturing capability, productivity and quality;
- 'to strengthen linkages between technology developers and technology users;
- 'to encourage the development of technologies, including emerging and enabling technologies, that are likely to have wide application in Australian industry; and
- 'to foster collaboration between companies and research institutions.'[56]

6.80 The six essential eligibility criteria for grants require that:

1) projects involve R&D 'or product development ... or trial or demonstration or related market research';
2) projects should be 'directed to the development of internationally competitive goods, systems or services';
3) projects have results which 'will be exploited for the benefit of Australia';
4) projects should be ones which 'will not proceed satisfactorily without grant support';
5) 'the grant ... not exceed 50 per cent of eligible project expenditure'; and
6) 'the project will be completed within three years'.

Successful projects are also required to meet one of the following criteria:

7) 'the applicant ... is unable to obtain full financial benefit under the 150 per cent Tax Concession for Research and Development ... while in receipt of a Competitive Grant';
8) 'the project involves a significant proportion of activities ... that are outside the scope of eligible activities under the 150 per cent Tax Concession'; or
9) 'the project involves a graduate working on a specific company based research and development project which results in the formation of new

56 ibid., p 518

and appropriate linkages between a company and a tertiary/research institution.''[57]

6.81 It is still too soon to properly assess the effectiveness of the Competitive Grants Scheme. The Industry Commission's R&D review instead commented on the effectiveness of the five replaced schemes, as well as offering some comments on the eligibility criteria and the selective nature of the new scheme.

6.82 The Industry Commission commented that:

> 'The eligibility criteria for the single scheme are considerably broader than under previous arrangements. ... the competitive grants scheme has evolved into a form of support primarily for potentially successful companies rather than assistance to R&D as an activity subject to appropriability problems and spillovers.''[58]

6.83 The Discretionary Grants Scheme (DGS) was targeted at companies not able to take advantage of the 150% tax concession because they did not have sufficient tax liabilities. However, the Industry Commission found that:

- 'relatively few companies that were unable to benefit from the tax concession actually applied for DGS assistance';[59]
- 'only a minority of companies which applied for DGS grants were successful [38% between June 1986 and November 1994]';[60]
- 'the DGS funds were concentrated in a relatively small number of firms ... 6 per cent of those which applied for support [between 1986 and 1994] ... received around half the funds awarded, and some companies received several grants'.[61]

6.84 The DGS also differed from the tax concession scheme in that: it was a competitive, merit-based scheme; it provided a higher nominal rate of subsidy than did the tax concession; the DGS had more stringent eligibility criteria; the eligibility criteria gave the DGS a focus on internationally traded goods and services; the DGS was focussed on projects rather than on R&D expenditure generally; purchases of core technology were not covered by the DGS but expenditure on market research could be; and a wider range of legal entities were covered by the DGS including non-taxable organisations.[62]

6.85 One of the principal purposes of the Generic Technology Grants Scheme (GTGS) was to promote collaborative projects. The Industry Commission noted that the 213 grants under the GTGS involved 228 different commercial partners. Of these

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57 ibid., p 519
58 ibid., p 665
59 ibid., p 583
60 ibid., p 584
61 ibid., p 584
62 ibid., pp 584-585

44 companies were involved in more than one project 'and their overall involvement amounted to 148 projects'. BHP was involved in 22 grants and ICI Operations Australia was involved in 10. The IR&D Board considered that, given the size of these 2 companies and their contribution to industrial research and that 'spillover' effects were likely to be expected more from the larger size projects, this outcome was not surprising. The Industry Commission, however, commented:

> 'It could also be that these companies were favoured by grant committees because they might have had a better track record in undertaking R&D and commercialising its results.'[63]

6.86 The quotation above reflects a concern the Industry Commission has with schemes that involve a merit selection process, particularly when one of the bases of selection is likely commercial success. One of the dangers that the Industry Commission sees is that 'the administrator ... has an incentive to pick non-risky projects that the firm would have researched anyway in order to show off his acumen for picking winners'.[64] The IR&D Board reported to the Industry Commission, however, that 'the degree of commercial success of supported projects ... [was] not atypical of market outcomes generally'.[65] The Industry Commission interpreted that outcome as indicating that the administrators were not especially good at picking winners. The Committee suggests that an equally likely alternative interpretation could be that the administrators of the scheme did not fall prey to the alleged incentive to pick non-risky projects.

6.87 As the Industry Commission R&D report commented, one significant difference between the Competitive Grants Scheme and the 150% tax concession is that the Grants Scheme involves a 'competitive merit-based selection process' whereas the tax concession is available for all eligible R&D expenditure.[66]

6.88 Payments made under the five schemes in 1993/4 amounted to almost $37 million but over $34 million of that went to projects under the Discretionary Grants and Generic Technology Grants schemes.[67]

6.89 Recent studies examining the impact of the grant schemes looked at the level of inducement they provided. An interesting outcome was the variability across the

63 ibid., pp 586-587
64 Industry Commission: *Research and Development,* Volume 2, Report No. 44, May 1995, p. 576 quoting Folster, S: *The Art of Encouraging Invention: A New Approach to Government Innovation Policy* Stockholm 1991, p 36
65 Industry Commission: op. cit., pp 662-663
66 ibid., p 518
67 ibid., p 577

five schemes. For GTGS grants, 69% of respondents indicated they would not have proceeded without the support. The GTGS tended to support earlier stage projects which had more uncertain commercial outcomes and for which 'spillover' effects were likely to be more significant.[68]

6.90 In a 1991 study the BIE 'found that two thirds of projects supported under NTCS would have proceeded in some form' without support from the scheme. However, this varied depending on company size. For large firms (100 or more employees) 75% would have taken place without the scheme, while only 45% of much smaller firms (fewer than 15 employees) would have proceeded without the scheme.[69]

6.91 A survey by Invetech reported that 59% of companies that received grants under the Discretionary Grants Scheme, would not have undertaken R&D without this support. Those firms that indicated their R&D would have proceeded anyway still derived some benefit from the DGS as it brought forward the completion date of their projects. The Industry Commission commented that 'speed to market ("first mover advantage") is often an important contributor to the commercial success of an innovation'.[70]

6.92 The Invetech survey of grant recipients found that 64% experienced improved access to capital after being awarded a DGS grant. The IR&D Board argued to the Industry Commission's inquiry that this is because financiers recognised the rigour of the grant selection process.[71]

6.93 The Industry Commission report on R&D recommended that:

- a generally available non-taxable grant should be introduced in place of the competitive grants for tax loss companies, at a rate equal to the nominal value of a tax deduction of 50% of the cost of undertaking R&D

  $\Rightarrow$ the grant should be payable in advance through the IR&D Board; and

- the 'contamination' provisions of the tax concession should be revised so that companies receiving a grant lose an equivalent value of tax deduction.[72]

Cooperative Research Centres (CRCs)

6.94 The CRC program establishes collaborative research ventures that generally involve government research agencies and industry. The CRC program aims to:

- support long-term high-quality scientific and technological research;
- strengthen collaborative links between researchers and industry;

68 ibid., p 591
69 ibid., p 591
70 ibid., p 590
71 ibid., p 603
72 ibid., pp 33-35

- make better use of research resources; and
- stimulate education and training, particularly at graduate level.

6.95 Companies in the CRC program can utilise the support of the CRC environment and retain the benefits of the full R&D tax concession that would normally be available to them. Currently there are 61 CRCs. These CRCs involve over 300 companies conducting research under six broad categories which are:

- agricultural and rural based manufacturing (17 centres);
- manufacturing technology (9 centres);
- information and communications technology (8 centres);
- mining and energy (9 centres);
- environment (11 centres); and
- health (8 centres).[73]

6.96 CRCs generally have around 30 researchers and an annual budget of around $6 million. Each CRC receives $2 million in Commonwealth program funds annually, with participating organisations providing the remaining capital, contributing two dollars for every dollar of Commonwealth funding.

6.97 The CRC program creates linkages in the innovation process and helps break down the communication barriers to successful innovation. The Committee received a number of submissions commenting on the success of the CRC program and the positive impact it has had on innovation in Australia. The CRC for Tropical Rainforest Ecology and Management commented on the change in research culture resulting from the CRC program:

> 'The research profile of Australia has changed as a result of the introduction of the CRC program. The emerging culture demands greater communication among academic, government and industry bodies, greater cooperation among scientists in different institutions, greater accountability of research expenditure and greater flexibility and effort in mission-oriented research. The CRC program is an important initiative, a far cry from the

73 CRC Program Evaluation Steering Committee: op. cit., p 20

> government-sponsored research centres of other developing and developed countries.
>
> Not only is the Program itself innovative, but it also provides opportunities to encourage and generate innovative solutions to Australia's problems.'[74]

6.98 The program also provides researchers with long term stability in their activities. At the same time each centre must perform to ensure its funding continues. The CRC for Molecular Engineering and Technology: Sensing and Diagnostic Technologies valued the stability of the program highly. At the same time they saw tying the survival of the each centre to its demonstrable success as an important attribute:

> 'The responsibility for long-term survival depends on the success of the project. If unsuccessful the project terminates and the funds are released for other applicants to vie for. The mechanism for determining success is also built into the programme in that an end-user is identified and contributes to the project funding.'[75]

6.99 In July 1995, a review of the CRC Program was finalised by the CRC Program Evaluation Steering Committee. The Committee's report, *Changing Research Culture Australia - 1995*, examines many aspects of the CRC Program. In it's overview of the Program, the Committee found that:

> 'the CRC Program is very well conceived and that the prospects of the Government's broad objectives for the scheme being achieved are excellent. Indeed there is already clear evidence of a significant and beneficial change in research culture – especially insofar as it concerns universities and their cooperation with government research agencies and industry. The change in culture extends to industry and other research users who are showing a general willingness to become actively involved with longer term and more basic research. Reports indicate that generally the quality of CRC research is high and that the education and other interactive elements of the program are developing well.'[76]

6.100 The many benefits that flow from the CRC Program are very important to innovation. The following statement from the Evaluation Committee Report illustrates how important this Program is to the innovation process:

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74 Cooperative Research Centre for Tropical Rainforest Ecology and Management: *Submission no. 103*, p 3

75 Cooperative Research Centre foe Molecular Engineering and Technology, Sensing and Diagnostic Technologies: *Submission no. 98*, p 4

76 CRC Program Evaluation Steering Committee: op. cit., p 1

> 'the [CRC] Program provides benefits such as collaboration, a critical mass of research effort, additional research funding, multidisciplinary research, additional focus to research projects, customer focus, outcome focus and enhanced technology transfer.'[77]

6.101 The Evaluation Committee's Report highlighted some of the distinctive features of the CRC Program which collectively have been important to it's success. The CRC Program:

- 'is based on strategic collaboration;
- *develops research user linkages;*
- has central education and training focus;
- is tightly focussed and outcome oriented;
- has up-front industry commitment of funds and resources based on legally binding agreements;
- places the onus on participants to achieve good governance and management control;
- places the onus on centres to be accountable for their own direction, progress and outputs;
- represents a significant untied funding base;
- has manifest diversity in the range and cooperation of CRCs; and
- selects centres on merit against published criteria.'[78]

6.102 Specific aspects of the CRC Program which affect particular parts of innovation are discussed in other areas of this report. However, some of the broader impacts of the CRC Program are briefly examined in the following sections of the report.

77 ibid., p 24
78 ibid., p 6

Business Expenditure

6.103 Since the introduction of the CRC Program the business sector's contribution to Australia's R&D effort has increased significantly. The CRC Program has provided large and increasing levels of up-front industry commitment. At the same time the program has had a significant impact on research users attitude to conducting R&D. This evidence suggests that the CRC Program appears to be having an impact on total R&D expenditure in Australia. However, in it's report the Evaluation Committee stated that a causal link could not be proven.[79]

Universities

6.104 The impact on universities of the CRC Program has been quite apparent. In assessing the benefits to universities of the CRC Program, the Evaluation Committee found that:

> 'Universities are now working much more closely with the users of research and especially with industry. The benefits to universities include research user input into research directions, broadening the range of activities undertaken within universities and an added commercial focus to research environments.'[80]

6.105 The Evaluation Committee's Report qualified these comments by noting that these benefits have sometimes been associated with difficult management issues and a considerable administrative load for university administrators.[81]

CSIRO

6.106 One organisation which has had widespread exposure to the CRC Program is the CSIRO. With the CSIRO involved in 53 of the 61 established CRCs, it is undoubtedly a key player in the program. Just as important however, is the impact the CRC Program has had on the CSIRO. Many of the benefits realised by the CSIRO from it's involvement in the CRC Program are similar to those experienced by universities detailed above. For the CSIRO the program has meant more research user support with research users having a greater input into the research priorities of CSIRO. This has contributed to the Government's aim of improving research-industry linkages.[82]

6.107 The Report of the Evaluation Committee considered the criticism that the CSIRO now has a substantial amount of resources committed to the program and the seven year duration of centres means the CSIRO has lost some of it's flexibility and it's capacity to respond to emerging research needs.[83] While the Committee certainly

79 ibid., p 50
80 ibid., p 51
81 ibid., p 51
82 ibid., p 55
83 ibid., p 55

recognises this problem, it does not believe this should be a major concern given the very important benefits of the program not only for the CSIRO but for the R&D sector more generally. The principal outcome of the CRC Program is the promotion of research-industry links. The attainment of increased interaction between researchers and industry will be one of the fundamental steps leading to increased levels and more successful innovation in the economy.

Industry

6.108 For industry, the CRC Program has been similarly important. This is reflected in the considerable commitment of resources to the program of approximately $580 million to date. One of the most positive outcomes of the program has been the increased level of input industry now has into the direction of public sector research.[84] This has resulted from the enhanced research-industry linkages the program has produced.

6.109 The program Evaluation Steering Committee found that industry is strongly supportive of the CRC Program. The major problem identified by industry has been the level of resources required for managing centres. However, overwhelmingly, industry response to the Evaluation Committee was positive. The cultural change that has flowed from the program is extremely important. The research community now appears more responsive to the needs of industry than previously. Industry has also developed greater interest in long term research. Other responses from industry participants regarding the positive impact the CRC Program has had from their perspective included:

- 'the breaking of academic-industry barriers;
- 'has expanded the network of expertise ;
- 'introduced an industrial input into research;
- 'has led to a more reliable source of funding;
- 'was a way of focussing limited research dollars;
- 'represents a critical mass of research people;
- 'has enabled multidisciplinary teams for R&D;
- 'enhanced technology transfer;

84 ibid., p 57

- 'was a unique education program; and
- 'it allows us to indicate to our customers that we are in forefront of research.'[85]

6.110 In considering the individual comments of industry participants in the CRC Program, the Committee noted the similarity between the benefits highlighted by industry and the goals the Government must target to improve Australia's innovation performance. All nine of the positive impacts identified above by industry respondents give testimony to the importance of the CRC Program in the further development of Australia's innovative culture and performance.

Technology Access Program

6.111 The Technology Access Program is designed to facilitate technology diffusion and uptake by improving awareness of leading edge technologies amongst Australian firms. It is essential that innovation from R&D is widely adopted throughout the economy to ensure that entire industries remain world competitive. For a small to medium sized economy like Australia the capacity of firms to adopt and adapt new technologies to their specific circumstances is a key part of the nation's innovation performance. For this to occur firms and/or industries must be able to identify and evaluate appropriate technologies.

6.112 Competitive grants are available for groups of institutions or centres looking to jointly upgrade and expand facilities and services to assist firms improve their ability to uptake new technologies. The grants are for feasibility studies or for seed funding. Technology awareness and demonstration projects are being developed to help individual firms understand and adopt critical technologies necessary to improve their competitiveness. These projects will specifically target SMEs.

Support for Development and Commercialisation

6.113 Innovation requires increasing levels of resources through the research, development and initial commercialisation phases. The Australian Graduate School of Engineering Innovation acknowledged the significant role of the research stage of the innovation process but also commented:

> 'the greater challenge lies in seeing new concepts to successful implementation and commercialisation. Most importantly, development and commercialisation of a new product concept are generally many more times expensive, and hence of higher commercial risk, than research activities.'[86]

6.114 Research tends to have 'public good' characteristics because the principal output at that stage is knowledge. Once the knowledge is converted into goods and production processes, which begins to occur in the applied research and

85 ibid., p 58
86 Australian Graduate School of Engineering Innovation: *Submission no.* 43, p 3

experimental development stages, the 'public good' characteristics may tend to diminish. There can, however, continue to be major spillover benefits for the economy from the output of the development and commercialisation stages. The argument can be made on public interest grounds for government support to continue at these later stages. However, upon considering this issue, the Committee does not believe it is appropriate to have the eligibility criteria for the current programs extended so that additional support is afforded the development and commercialisation stages of innovation.

Concessional Loans for Commercialisation

6.115 Commercialisation is a key step in the innovation process. It is the process that differentiates innovation from invention. Facilitating commercialisation through support programs is an area where the Government can achieve considerable success promoting innovation in Australia as very few R&D projects are ever commercialised.

6.116 Time to the market is crucial to determining the eventual success of an innovative product or process. The concessional loans program offers finance to small, high-technology oriented firms with fewer than 100 employees that have the capacity to manage the commercialisation process. The loans are for early commercialisation activities, including:

- product/process design;
- trial production runs including tooling up costs;
- regulations and standards compliance;
- protection of core intellectual property;
- trial and demonstration activities; and
- products documentation.

6.117 There are a number of ways that the Government can enhance the flow of capital to innovation. The principal methods the Australian Government currently employs are:

- direct provision of venture capital;
- incentives for investors to move into venture capital markets; and

- reducing the actual and perceived level of risk associated with providing venture capital for innovation.

6.118 There are a range of government programs that provide public money as venture capital for innovation. Appropriations to public research bodies such as the CSIRO and ANSTO are an example. Public funds are also available to innovative enterprises through the Competitive Grants Scheme and concessional loans. Funds made available to firms through these programs are awarded on a competitive basis.

Conclusions

6.119 The Committee considers that freely operating, well informed competitive markets are the ideal mechanism for deciding the appropriate mix and level of research investment and commercialisation expenditure. However, market barriers may result in a less than adequate commitment of resources to research, especially from the private sector.

6.120 It is undeniably essential for the Government to create an environment conducive to research and commercial activity through the use of appropriate macro and micro economic policies. However, this alone is unlikely to be sufficient to overcome market failures caused by factors such as 'spillovers' and 'risk and uncertainty'. Where the Government can act to remedy market failure, at a cost which is less than the benefits to be obtained, then it should do so. This is not to underestimate the difficulty of assessing accurately those costs and benefits.

6.121 The Committee agrees with the Industry Commission that there should not be a 'catch-up target based on some international ratio of BERD to GDP'.[87] The Committee also does not seek to identify an ideal 'mix' of the different types of R&D activity. However, there is clear evidence that the pattern of R&D expenditure in Australia needs to change. This change should not occur by shifting resources away from the research end of the spectrum but by increasing the amount of expenditure on experimental development. It is also clear that this increase in expenditure must be achieved by raising the contribution of business enterprises. As mentioned earlier, there is evidence that business expenditure on R&D is increasing in real terms and that the pattern of R&D spending is shifting accordingly.

6.122 The Committee considers that the solution to Australia's R&D problems does not require a suite of new programs but the continued application of programs already in place with a strong focus on making those programs operate as efficiently and effectively as possible.

6.123 In order to be able to monitor properly the effect of government R&D policies it is important that there be reliable information concerning the level of expenditure on R&D. The Committee notes that the Department of Industry, Science and Technology published in October 1995 the first 'scoreboard' of business R&D spending. The document contained a comment that the data in it was derived from companies either directly or indirectly through annual reports or the ASX database.

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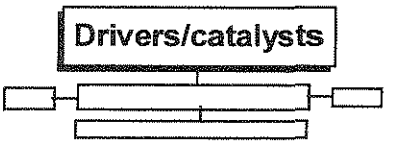
87 Industry Commission: op. cit., p 649



The document also commented on the variability in the R&D accounting and reporting practices of companies. The Committee considers that it would be highly desirable if organisations which are required to submit annual reports, in both the public and private sectors, should also be required to include in their annual reports information collected in a consistent manner on their R&D expenditure.

Recommendation

6.124 **The Committee recommends that organisations in both the public and private sectors which are required to submit annual reports should also be required to include in their annual reports information on their R&D expenditure. The Committee further recommends that the Government, in conjunction with the Australian Bureau of Statistics and industry, develop an agreed basis according to which such expenditure should be measured.**

PLANNING FOR INNOVATION

6.125 There has been much community discussion on the issue of targeting Government funding towards specific industries. Some have argued that there is too little targeting. Professor Asbjorn Baklien, of Monash University, recently commented:

> 'Government support is handed out willy-nilly. We cannot continue to go in all directions. Our innovative capacity is limited. Choices have to be made [as] fragmentation dooms us to failure.'[88]

6.126 Others, such as Mr Peter Laver, the Corporate General Manager External Affairs of BHP, have stated that there is a considerable amount of targeting:

> 'The Government is picking winners all the time; it just does not own up to it. The IR&D Board is picking winners; CSIRO's priority setting is. Somebody decides that CSIRO is going to put money into project X as against project Y.'[89]

88 Baklien, A.: *The battle by Australia to be competitive looks set to fail*, in *The Australian Financial Review*, 26 May 1995, p 26

89 Laver, P: Transcript of evidence, p 33

6.127 Government policy in recent years has largely moved away from the principle of allocating support toward specific industries identified as having the greatest potential growth. To some extent, however, there is still a process of targeting industries. This is certainly true of the funding for government research agencies such as ANSTO and the CSIRO. Also, the funding of industry research agencies sees government funding tied to a limited range of projects.

6.128 The difficulty with targeting is how to decide where Government funding would be best directed. ANSTO commented that one of the greatest challenges facing public research agencies:

> 'includes the development of an adequate process for choosing projects which are relevant to their organisation, in which they have the promise of being at the forefront internationally or which [are] unlikely to be done elsewhere in the world because of the particular needs of Australian industry.'[90]

6.129 It is important that the scarce resources devoted to enhancing Australia's innovation performance should be effectively used to improve the international competitiveness of industry. There is concern that Australian resources directed toward innovative activities are spread across too many areas and their impact is lessened as a result. In a large economy such as the United States, the sheer enormity of it's R&D system allows it to be highly diverse. However, the challenge for a small to medium sized economy like Australia is how best to use it's limited resources in both the public and private sectors to maximise the benefits to the economy.

6.130 The Committee concurs with the view that a freely operating, fully competitive, perfectly informed market would be the best mechanism for allocating resources in a way that would maximise Australia's innovation performance. Unfortunately, deficiencies in the market mechanism, such as imperfect information, frequently prevent the ideal result from being achieved.

6.131 Investors tend to regard longer term projects as involving higher risk because of the lack of knowledge of future markets. The lack of any clear notion of what is likely to happen over, say, a 10 to 20 year period means that investors will prefer shorter term projects, of which they can be more certain.

6.132 Many argue that investors in Australia are more risk averse than are investors in other more successful economies - that there is a kind of cultural bias in Australia against long term projects. Some argue that the short term focus is reflected in the kind of R&D programs that companies undertake:

> 'Where companies do support significant research, development and design programs these seem to be

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90 ANSTO: *Submission no.* 80, p 4

> focused on short-term needs, often in the absence of any real long-term strategic analysis.'[91]

6.133 Many also argue that Australian investors lack understanding of science and technology matters and are excessively biased towards other forms of investment, such as property or established enterprises. The information problem and short term focus makes ideal decision making more difficult in both the public and private sectors.

Technology Foresighting

6.134 Foresight programs attempt to look at emerging trends in science and technology, perhaps in a 10 to 30 year time frame. Many governments around the world have instituted technology foresight programs in an attempt to encourage and improve long term planning of technology investment.

6.135 The Australian Science and Technology Council (ASTEC) is currently engaged in a major study, *Matching Science and Technology to Future Needs: 2010*, which is evaluating international experience in this area and the possible usefulness of technology foresighting to Australia. ASTEC has commented that foresighting is not the same thing as forecasting:

> 'It does not attempt to estimate or predict the future. Foresight implies an active approach to the future. It reflects the belief that the future can be created through actions we choose today. ...
>
> 'It does not rely on the definition of a desirable future as a starting point. It can propose a variety of futures - some of which may not be preferred options. In this way it is quite different to strategic planning processes.'[92]

6.136 There are a number of techniques that can be catalogued under the general heading of foresight analysis.

6.137 The *critical or generic technologies* approach identifies technologies that will be important to major areas of industrial growth. The technologies identified tend to be those which may have importance for a number of industry sectors. This approach:

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91 Centre for Design at RMIT: *Submission no. 34*, p 3

92 ASTEC: *Matching Science and Technology to Future Needs: An International Perspective*, 1994, p 7

> '... normally involves gathering together a group of experts in relevant fields ... to work through a structured process of group based analysis and forecasts.
>
> 'Analysis is centred on [identifying] technologies that will be significant economic supply forces in the future.
>
> '[The critical technologies approach] focuses on pre-competitive and strategic research which is likely to have applications and products ... over a period of about 10 years'.[93]

6.138 The *Delphi* survey method involves large numbers of experts in a wide range of scientific and technological fields. Typically, the experts are asked to identify possible developments, rank those by importance and likelihood, indicate the likely realisation time and possible impediments. The results are tabulated and distributed to the experts for further comment.[94]

6.139 The critical technologies approach has been used by agencies in the United States, Germany and France while the *Delphi* survey method has been used in Japan, Germany, France and recently in the United Kingdom. There are, of course, variations in the methods used in the different countries. The ASTEC study refers to differences in the results obtained in the different countries even where similar methodology has been used. However, there has been

> 'close agreement between the Japanese and German Delphi results [which] suggests that visions of future technological developments are reasonably consistent across different countries'.[95]

The *Delphi* Method of Foresighting in Japan

6.140 Given the great success of Japan's economic development since the early 1950s and, in particular, her technological and manufacturing prowess, the *Delphi* technology foresight methodology used there is of particular interest. The *Delphi* method has been used by the Japanese Government for more than 30 years. It provides an extensive information pool from which government and industry alike can draw. The *Delphi* survey periodically requires the scientific community to become more aware and active in addressing key national socio-economic priorities while similarly alerting government to future trends and demands upon the national system.[96] As such, the Japanese *Delphi* method represents an important contribution to the shaping of private firms' technological ventures and corresponding investment promotion and support by government.

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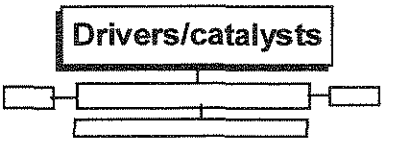
93 ibid., p 9
94 ibid., pp 8 & 9
95 ibid., p 14
96 Nelson, R: *National Innovation Systems: A Comparative Analysis* Oxford University Press 1993, p 126



6.141 Responsibility for technology foresight and the overall planning and coordination of Japan's scientific and technological activity rests with the *Science and Technology Agency* (STA) and its subsidiaries, the *National Institute of Science and Technology Policy* (NISTP) and the *Institute of Future Technology* (IFTECH). Every five years, the STA produces a 30 year *Technology Forecast Survey* which aims to:

- analyse the state of technology (monitor);
- explore its potential for development (forecast);
- estimate its impact on the national socio-economic environment (impact assessment); and
- formulate policy directions accordingly (innovation strategies).[97]

6.142 Following a questionnaire format, experts from sixteen science and technology fields are assigned to identify possible technological and scientific developments in their respective areas, rank them by importance, and list the factors affecting the likelihood and time of their realisation and use.[98]The 1992 Japanese *Delphi* exercise, for example, formed committees under the direction of the NISTP for each of the various technological areas, consisting of experts from both the public and private sectors. These committees collectively prepared questionnaires across 1149 survey topics and selected 3000 respondents, ensuring a balance between industry, academia and government. Respondents made an assessment of the research, development and commercial applicability of experimental technologies over a forecast period from 1991 to 2020, thereby identifying the extent of consensus and disagreement within the expert sample.

6.143 These opinions were subsequently categorised and tabulated, re-interpreted by the original respondents in the knowledge of the overall trend of responses, and collated and statistically analysed a second (and final) time.[99] The *Prime Minister's Council for Science and Technology* and its various supporting committees then presented the forecast survey results to the Prime Minister as an input in the policy process.[100] While the final results are undeniably the principal reason for technology forecasting, considerable emphasis is also placed on the process through which they are achieved, for the opportunity its consensual approach affords for the exchange

97 ibid., p 71
98 ASTEC: op. cit., p 8
99 ibid., p 11
100 ibid., p 32

and interaction of ideas and strengthening the bonds and awareness between industry and the scientific community.[101]

6.144 The role of the STA and its subsidiaries in this foresight process is central. The preparation of appropriate questions across a broad range of highly complex and rapidly evolving areas of technology, requires a substantial initial level of knowledge of the issues involved. The format is crucial. The 1992 Japanese *Delphi* survey, for example, gave a choice of eight factors which could hinder the chance of a successful outcome with the researched topic and categorised the results according to the percentage received for each of these categories.[102] The main advantage of this method is that by offering respondents a specific choice, all opinions will be recorded on the same basis thereby allowing a simpler and more efficient collation and analysis. The danger, of course, is that if the approach is too highly structured this may reduce the accuracy and, moreover, the credibility of survey results.

6.145 The extent to which government and industry decisions depend upon the *Delphi* survey results, rather than other factors, may be difficult to determine. However, the survey outcome undoubtedly helps provide a focal point for the formation of innovation strategy.

6.146 Attempts at quantitative measurements of the importance of the *Delphi* exercise have been made. In 1990, NISTP conducted an evaluation of the impact made by the 1987 *Technology Forecast Survey Report*. Seventy percent of the organisations examined used the report as a basis for R&D activities or the forming of innovation strategies generally. Of these, 73% claimed the report was of some use in fulfilling these plans.[103] At a broader level, ASTEC has noted the adoption of *Delphi*-like forecasting programs by a number of large Japanese firms and associations, and even more significantly, the German Government's trial of the Japanese approach using a similar format to that employed by Japan in 1992.[104]

Technology Foresighting in Germany

6.147 The value and importance of foresight studies has only recently been recognised and endorsed in Germany as increased research demands and costs from unification have forced the Federal government to increasingly prioritise and predict.[105] Specifically, the *Fraunhofer Institute* in 1993 completed a study to forecast the future of science and technology at the beginning of the 21st century by seeking 'plausible indications' of future technological developments. The study concentrated on the fields of information technology and biotechnology, identifying nearly 100 'critical technologies' under nine sub-groupings. Having identified recurring phases in technological development from first exploratory research

101 National Board of Employment, Education and Training: *Using Basic Research, Assessing Connections between Basic Research and National Socio-Economic Objectives,* AGPS, March 1995, p 73

102 ASTEC: op. cit., p 28

103 Kuwahura, cited in National Board of Employment, Education and Training: *Using Basic Research, Assessing Connections between Basic Research and National Socio-Economic Objectives,* AGPS, March 1995, p 72

104 ASTEC: op. cit., p 32

105 ibid., p 33

through to first commercial research, the study made a general conclusion that pure research will continue to dominate over the next decade.[106]

6.148 As part of the increasing international interdependence of national innovation systems, the federal *Ministry for Research and Technology* (BMFT) has also conducted a joint *Delphi* study with the STA in Japan using the same questions as those used in the 1992 Japanese exercise. The primary objective of the exercise was to compare the conclusions reached by both nations, highlighting the differences and explaining them.[107] Despite the interest aroused internationally by this study, it appears to have had little impact on national policy in Germany, which remains largely State driven.[108]

Technology Foresighting in the USA

6.149 The approach to technology foresight adopted in the US has been to have panels of experts prepare lists of 'critical' technologies, categorised under six broad technology areas. Within each of the broad areas a number of developments are identified,[109] many with 'dual-use'.[110]

6.150 Although these 'critical' technologies are widely held to have many potential applications beneficial to the nation at large, none of the major studies that have led to lists of critical technologies have been systematically concerned with key strategic questions.[111] As Branscomb noted, what is a 'critical' technology has always depended on context. Critical technology lists remain at a high level of abstraction.[112]

6.151 Despite the establishment of a number of foresight oriented organisations, including the *National Science and Technology Council* and the *Council on Competitiveness*, the emphasis by the Clinton administration has been more on the mechanisms to coordinate the development of national policy rather than on the foresight process itself. Achieving this objective has taken the form of shaping the planning, budgeting and evaluation of research according to national goals. Supporting this priority-setting process are a number of agencies including the

106 ibid., p 34
107 ibid., p 36
108 National Board of Employment, Education and Training: *Using Basic Research, Assessing Connections between Basic Research and National Socio-Economic Objectives,* AGPS, March 1995, p 70
109 In the 1991 National Technologies Plan, 22 technologies were identified.
110 ASTEC: op. cit., p 37
111 Branscomb, cited in National Board of Employment, Education and Training: *Using Basic Research, Assessing Connections between Basic Research and National Socio-Economic Objectives,* AGPS, March 1995, p 52
112 ibid., p 53

National Institutes of Health, the *National Science Foundation*, and the Departments of Health and Energy. However, within these organisations, the emphasis has been increasingly on the development of management practices to link programs to national goals.[113]

Technology Foresighting in the UK

6.152 The *Technology Foresight Program* (TFP), a product of the 1993 White Paper, *Realising Our Potential*, has as its stated objectives to develop industry-academic interaction and to inform decisions on the balance and direction of publicly-funded technology. A three stage approach was adopted:

- The *Pre-Foresight Stage.* A 10 person *Foresight Steering Committee* was established involving 15 sector panels from academia, industry, finance, consumer research and government. Panels were selected on the basis of a survey of 1394 researchers and industrialists in which their level of expertise in a variety of fields was recorded (similar to the Japanese *Delphi* method). Respondents were also required to nominate up to six people whom they believed were most influential in their field. 6695 nominations were received, 50% from industry, 40% academics and 10% others.[114]

- The *Main Foresight Stage* in which the trends and capabilities in science were assessed as well as perceptions of technological need. Technological need included a consideration of both demand-pull (social and economic needs) and cost-push (science and technological opportunities) factors.[115] The respondents were asked to list four trends that may have an impact on their field over the next 20 years, possible new products/processes and market opportunities arising from these, and the technological and scientific advances needed to underpin these.

- The *Post Foresight Stage* results were collaborated and analysed in a report released in January 1995. The 1993 White Paper envisaged that these results would be fed into the system at every level, thereby maximising the impact. The *Council of Science and Technology*, which prioritises the process of publicly funded R&D, is to draw on the findings as will the *Office of Science and Technology* (OST). The OST will present a prospective (5-10 year) strategic statement identifying educational and training deficiencies, and fostering collaboration within and across sectors.[116]

6.153 Despite support in the UK for the foresight exercise to continue, there has been concern that the process has become overly focussed on industry with

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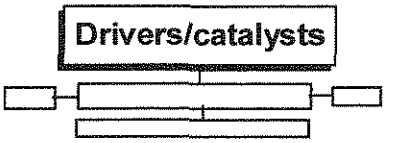
113 ibid., p 58

114 National Board of Employment, Education and Training: *Using Basic Research, Assessing Connections between Basic Research and National Socio-Economic Objectives,* AGPS, March 1995, p 61

115 ibid., p 60

116 ibid., p 63



insufficient attention paid to the need for basic research. Officials at the *Office of Science and Technology* have reportedly expressed fear that funds for basic science will be diverted towards industry programs. There have also been reminders of the importance of the response of the private sector and the necessity to put the results of the studies in a form that is readily accessible to, and easily digestible by, interested private sector groups. [117]

Technology Foresighting in the Netherlands

6.154 As the ASTEC report notes, there are similarities in population size and in the size of the economies of Australia and the Netherlands. As well, 'much of [the] industrial sector [of the Netherlands] is made up, like Australia's, of small and medium sized firms with a generally poor record in industrial research and development'.[118]

6.155 The Netherlands Government, in order to maximise the effectiveness of the resources devoted to R&D, has adopted technology foresighting, focussing on critical or generic technologies. The Government has also aimed at keeping the research focus on areas relevant to the needs of the community.

6.156 The *Ministry of Economic Affairs,* which has responsibility for technology policy, has used foresighting since 1989 primarily to help set priorities in deciding between 'competing proposals for government support.'[119] However, important 'secondary objectives are to share the information generated with small and medium sized firms ... and to stimulate the creation of information-sharing networks in particular areas of technology'.[120] What began as an experiment has 'since been adopted as an integral part of the policy development process'.[121]

6.157 The foresighting methodology used by the *Ministry of Economic Affairs* involves a multi-stage process overseen by a steering committee which includes an adviser from the *Netherlands Organisation for Applied Scientific Research* and the 'chair of an organisation called Forum: a group consisting of senior managers of large companies and universities professors'.[122] An initial list of technologies is distributed to experts selected by the *Forum.* The experts provide their views on the 'likely future developments in each technology' taking account of:

- 'the economic importance of the technologies';

117 *Crystal balls develop cracks*, in *New Scientist*, April 1 1995, p 6
118 ASTEC:op. cit., p 53
119 ibid., p 53
120 ibid., p 55
121 ibid., p 54
122 ibid., p 55

- 'the value of the potential applications';
- 'the current state of development'; and
- 'the knowledge base and innovative capacity that can be applied to their development'.[123]

6.158 The Ministry then produces a short list of technologies that:

- are at 'a sufficient stage of maturity for successful applications to have been demonstrated';
- 'involve several disciplines';
- have 'potential benefits for several sectors of the economy';
- have 'potential for networking'; and
- are 'relevant to the needs of small and medium sized firms'.[124]

6.159 A further technology selection process is carried out, involving the *Forum*, 'sector organisations, employer groups, unions and other ministries'. An additional consultation stage involves 'a conference, typically eighty to one hundred people, drawn from the relevant areas of industry and the research community'.[125]

6.160 In 1992 the *Ministry of Education and Science*, which has responsibility for science policy, set up an independent *Foresight Steering Committee* (OCV) which, although not itself undertaking foresight activities, 'assists other organisations to perform foresighting'. The intention is to 'allow choices to be made in the practice of scientific research ... based on an understanding of the functions of research and the quality and relevance of the research'.[126]

6.161 The OCV has used a process of round-table conferences on specified areas of scientific, technological and community interest. The *Netherlands Science and Technology Advisory Council* decided for the OCV which policy areas should be addressed. The *Central Planning Bureau* prepared economic scenarios for the period 1990 to 2015 which are used as background to the foresight process. Again a multi-stage consultation method is used. There is flexibility in the techniques used which depend on the particular area being examined and the wishes of participants. There is particular emphasis placed on involving both the users of technology and the performers of research so that the needs of society will be fully considered. The participation process itself is seen as being even more important that the report produced as the end product.[127]

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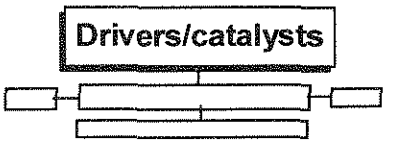
123 ibid., p 55
124 ibid., p 55
125 ibid., p 55
126 ibid., p 53
127 ibid., pp 53-54



Conclusions

6.162 **The Committee considers that the Government should closely study the various foresighting methodologies and the experience of other countries with them. There is a need for Australia to use such studies to help provide better direction to research and development investment both in the private and public sectors. Foresight analysis has the potential to greatly enhance Australia's innovation performance. The information and analysis provided by a foresight program is essential to the decision making process that allocates resources between competing interests.**

6.163 Foresight programs must be ongoing, as they are in Japan, and not simply one-off exercises which quickly become dated by unanticipated advances in science and technology. They should include projections over a range of time scales from 10 to 30 years and the methodologies used must be frequently reviewed. There must be a considerable level of involvement by industry and researchers. The Committee awaits with interest the report of ASTEC's *Matching Science and Technology to Future Needs: 2010* study.

Recommendation

6.164 **The Committee recommends that the Government make a commitment to introduce technology foresight analysis following the outcome of the ASTEC study, *Matching Science and Technology to Future Needs: 2010* and to adequately fund such analysis on an ongoing basis and to disseminate the findings widely to industry and to research institutions. The technology foresight process adopted should involve a high level of consultation with industry, researchers and community groups.**

The Innovative Enterprise

6.165 The enterprise is the commercial unit that brings together human and other capital to create wealth. It provides the vehicle that turns good ideas into successful innovation. The innovative activity of individual enterprises determines collectively the level of innovation in industries and in the nation as a whole.

6.166 The Business Council of Australia's (BCA) 1993 report, *Managing the Innovating Enterprise*, focused on the enterprise as the source of innovation. The BCA

highlighted the need for Government policies which promote change at the enterprise level:

> 'An industry policy with a focus on enterprises would emphasise outcomes. There are currently some elements of that perspective within public policy, but they have not been followed through strongly, consistently or comprehensively. The object of such policy should be to facilitate the strengthening of Australian enterprises.'[128]

Management

6.167 The importance of management to the innovation culture results from the impact managers have on all aspects of enterprise activity. Enterprises are essentially the product of their managers. Managers are the 'shapers' or 'drivers' of enterprise change. World class managers will ensure enterprises have effective organisational structures and will develop employee relations that promote innovation. By bringing Australian management standards up to world levels, Australian enterprises will increase their level of innovative activity.

6.168 As expressed by Mr Vernon Winley, Assistant Director of the BCA, management is the foundation of a successful innovation culture and success in innovation from other policy areas will only be possible if:

> 'we [persuade] the government to support this function of introducing a more innovative culture into the management of companies. I guess it does not primarily involve money but probably some money is involved ... Introducing a more innovative culture into the management of companies is ... perhaps the one single most important thing.'[129]

6.169 Promoting an innovation culture depends upon achieving change in Australia's companies. The Committee strongly supports the view expressed in the Australia Quality Council's submission:

> 'From a workplace perspective the organisational climate has to be such that all stakeholders and all employees must buy into this cultural change'.[130]

6.170 Mr J C Fraser, Chairman of Unilever's Australasian Group pointed to three attributes of the enterprise essential to successful innovation:

> 'The key is to combine good people with sound management principles which are built upon exposure to best international practice.[131]

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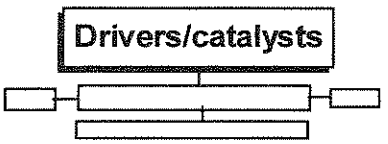
128 Carnegie, R, Butlin, M, et al.: *Managing the Innovating Enterprise*, Business Council of Australia 1993, p 324

129 Winley, V: *Transcript of evidence*, p 78

130 Australian Quality Council: *Submission no. 26*, p 8

131 Unilever Australia Ltd: *Submission no. 96*, p 1



6.171 One of the major objectives of the innovation strategy should be the delivery of appropriate management skills to the managers of the future. Australian management schools must ensure they retain their relevance to the needs of the enterprises that will be run by the managers they train.

6.172 Developing linkages at all stages of the innovation process is important. This is equally true for educational institutions which rely on information exchanges to keep up with changing standards. There are two important facets of this. Firstly, interaction between industry and management schools must be constant. A fundamental component of this interaction should be enterprise secondments for students and lecturers as well as placements in tertiary institutions for industry participants. Secondly, it is equally important that Australian management schools keep pace with overseas trends in teaching management techniques. One way to monitor international standards is to actively engage in exchanges with overseas institutions.

6.173 The accessibility of training for management is a further issue that needs to be considered in relation to the delivery of training. Managers, especially of SMEs, face many demands on their time. For this reason, traditional delivery of training may not enable all managers to access such training easily. Diversity is one approach to overcoming this problem. The greater the opportunities individuals have to access management training the more likely they are to participate in a program.

6.174 A key to effectively improving management standards through education is to enhance the accessibility of management training. To achieve this Government and training institutions must be aware of the different needs of individual managers. Obviously, training institutions should regularly check through consultation and market research methods that their courses meet the needs of managers and potential managers. The Government should also ensure that the mix of courses offered by institutions as a whole offers the variety in format, duration and content that mangers need.

6.175 Australian managers have certain immediate needs which formal management training cannot adequately meet. Today's managers must be able to access expertise that will help them overcome specific problems they face. Managers also require current information on management and innovation issues. Access to such information and assistance is of considerable value to managers, especially managers of small firms who do not have the time to undertake formal management training courses. This type of support exists through AusIndustry as part of its range of business information, referral and advisory services.

6.176 Managers of innovative enterprises must achieve best practice management to ensure their success. The provision of information on management best practice

principles and benchmarking are vital to this goal. The Karpin Task Force recommended that best practice management development in small, medium and large enterprises be promoted by way of case studies, seminars and the provision of information for benchmarking purposes. Case studies would demonstrate best practice management development at an enterprise level as well as provide an overview of best practice in business management more generally.[132]

6.177 The provision of this information should not be limited to service providers such as lawyers, accountants and bankers. These advisers provide a valuable point through which such information can be diffused; however, the Government should take an active role in promoting and disseminating this information.

6.178 One of the most useful resources managers can utilise is the experience and knowledge of other managers. Many managers cannot readily access traditional forms of training through educational institutions. The Karpin Task Force found that many managers have a perception that courses are far too generalised for their specific needs.[133] If managers, especially of SMEs, were able to network more readily, many of the problems individual enterprise managers face could be effectively addressed. A mentoring system would not rely on consultants, but rather on close interaction, primarily in the workplace, between managers of small business and experienced former or present managers of other small enterprises who have considerable practical experience.[134]

Recommendation

6.179 **The Committee recommends the development of a self help program for Australian management, whereby enterprise managers assist each other with advice. Under the program AusIndustry would develop a database that brings together managers who are seeking assistance and those willing to provide assistance.**

Organisational Structure

6.180 Over recent decades there has been a global trend away from a hierarchical structure in enterprises to a flatter structure. Important characteristics that a flat organisational structure introduces are better internal communications, more team based operations and considerably greater enterprise flexibility. These enterprise traits, namely: flat structure; team based operations; considerable flexibility; and good internal communications characterise innovative enterprises.

6.181 *Enterprises must be flexible so they can respond to opportunities quickly.* A flexible enterprise is one which can readily adapt to changes in the market and devise

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132 Industry Task Force on Leadership and Management Skills: op. cit., p 289
133 ibid., p 222
134 ibid., p 222

and implement the small incremental changes to existing technologies which are such an important part of innovation.

6.182 Team based operations create a cooperative and communicative environment that enhances innovation. Team based operations require and help reinforce a multi-disciplinary, multi-functional approach. The Australian Graduate School of Engineering Innovation stated:

> ' ... we see a multi-functional, team-based approach to projects as the model structure for innovation. Small organisations have this structure by default. At least initially, they generally have insufficient staff to isolate them in functional departments, and often have individual staff performing more than one functional role. Large organisations which break down functional barriers and delegate responsibility to multi-functional teams for projects, are effectively replicating a small company structure within the larger organisation.'[135]

6.183 While the flat structure and more team-based approach common among SMEs might place them in a strong position to engage in innovative activity, it is certainly not the case that large enterprises cannot be innovative. Large enterprises in fact have many advantages over small enterprises in undertaking innovation and, additionally, large enterprises can overcome the organisational and structural impediments to innovation.

6.184 The Government can play a role in promoting the emergence of innovation in both small and large enterprises. One option is to encourage increased cooperation between small and large enterprises so that they can benefit from each others' capacities and experience. The Australian Graduate School of Engineering Innovation stated:

> 'Australia cannot afford to rely completely on our small enterprises for innovation, but must also look to foster innovation in our established companies. Small and large organisations often have complementary strengths and weaknesses with regard to their capacity for innovation, and greater joint venturing between these two sectors is likely to prove in the national interest.'[136]

135 Australian Graduate School of Engineering Innovation Ltd: *Submission no. 43*, p 5
136 ibid., p 5

Employer/Employee Relations

6.185 Working conditions and employer-employee relations can have a major impact on enterprise innovation. The stable enterprise culture and strong industrial organisation of Japan has greatly contributed to the R&D performance in the private sector. The employer-employee relationship in Japan has tended to be far more stable and long-term in Japan than in Western nations. The result for the enterprise is to have employees who identify strongly with the long term performance of the firm.[137] Additionally, long-term worker-company attachment also promotes the development of personal linkages across departments within companies. The production and market awareness of R&D departments is thereby strengthened and technology uptake proceeds efficiently and smoothly.

6.186 The Committee received evidence that, in some cases, managers and supervisors do not attempt to bring about needed changes because of a defeatist attitude. For some in the business sector there is a reluctance to try changes and the industrial relations system is used as an excuse:

> 'To some extent people have just stopped trying to do things creatively and differently because they have got this in-built thing saying: "the unions will not wear it". ...
>
> 'You say to the supervisors in the mine: "Why don't you do that?" They say: "We have not tried it, but the union wouldn't let us do it."'[138]

6.187 Mr Vernon Winley, Assistant Director of the BCA, argued that problems in the industrial relations system are of secondary importance.

> '... in the industrial relations system, if you have got good employer [/ employee] relations ... it is possible to do things on what you might call ... continuous improvement .... Industrial relations are not a major problem in a well managed enterprise.'[139]

6.188 Management and employees must take joint responsibility for developing workplace flexibility that is conducive to continual improvement and innovation. Effective enterprise management involves encouraging a cultural shift in the workforce so that employees respond to change positively and play an active role in promoting innovation from below.

6.189 It is equally important that unions recognise the important role they have in facilitating innovative activity in the enterprise. A workplace that is responsive to change will be in a better position to adopt innovative practices that improve competitiveness and enhance enterprise performance. This will result in more secure employment and greater opportunities for workers. Sensible working arrangements

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137 Nelson, R. op. cit., p 106
138 Laver, P: *Transcript of evidence*, p 24
139 Winley, V: *Transcript of evidence*, p 68

between employers and employees will be to the advantage of both management and unions.

6.190 CEA Technologies' submission to the inquiry commented on the importance of human capital to the innovation process. CEA referred to the considerable value it places on it's employees which is reflected in the flexible working conditions that operate and the financial interest employees are given in the firm's performance. Employees are encouraged to participate creatively and are given a voice in the firm's future success. CEA stated:

> 'It is important that a company does not stifle the creative process of its staff and there is no better way to stifle this process than to enforce a traditional hierarchy where the individual does not exist. The organisational structure must ensure that the individual has a feeling of place and worth within the organisation. Everyone in an organisation must be made to feel their input is valuable. All people on all levels must be given the opportunity to have a say, have a voice.'[140]

6.191 The Government is obliged to ensure the industrial relations environment does not inhibit the existence of innovative workplaces. If management mistakenly perceives industrial arrangements as inhibiting innovation, they may not attempt to undertake beneficial enterprise change.

The Hon. Alan Griffiths MP
Chairman
28 November 1995

140 CEA Technologies Pty Ltd: *Submission no.* 39, p 3

APPENDIX I: CONDUCT OF THE INQUIRY

On 16 November 1994 the Minister for Industry, Science and Technology, Senator the Hon Peter Cook, requested the Committee to inquire into and provide advice on innovation issues. In particular, the Committee was requested to:

- suggest key measures and policy structures for the Government to develop an innovative culture in Australia; and

- identify options for Government activity, including program design and resources.

The central objective of these policy and programs options was to develop an environment supportive of pursuing and maintaining international competitiveness in industry, science and technology.

The Committee advertised the inquiry nationally in major metropolitan newspapers. In addition, submissions were sought from relevant Commonwealth Government Ministers, State governments and industry.

The Committee has received 123 submissions (not including supplementary submissions) which are listed at Appendix II. In addition, the Committee received 82 exhibits. These are listed at Appendix IV.

Three public hearings were held in Melbourne, Sydney and Canberra. Twenty-four witnesses appeared before the Committee and 266 pages of evidence were recorded at these public hearings. The witnesses are listed in Appendix III. The transcript of all the evidence will be made available for inspection at the Committee Office of the House of Representatives and at the National Library of Australia.

APPENDIX II: LIST OF SUBMISSIONS

Submission No	Person or Organisation
1	Mr Richard Powell ACT Department of Education & Training (date received 12/12/94)
2	Mr Allan McColl (date received 12/12/94)
3	Mr Malcolm Mummery Jarvis Software (date received 14/12/94)
4	Mr Stanley Robe (date received 15/12/94)
5	Mr Ron Murnain Ron Murnain Consulting (date received 15/12/94)
6	Professor Danny Samson Centre for Manufacturing Management, University of Melbourne (date received 20/12/94)
7	Mr D S Clark Pest Control Technicians Guild (date received 20/12/94)
8	Mr John Saint Strategies Functions Expertise (date received 20/12/94)
9	Dr Chris Rigney Horticultural Research & Development Corporation (date received 20/12/94)
10	Professor Trevor Cole The Warren Centre for Advanced Engineering (date received 31/12/94)
11	Ms Margaret Michael-Johanson (date received 4/01/95)
12	Ms Sandra Welsman (date received 5/01/95)
13	Mr Ted Roach Roach Industries Pty Ltd (date received 7/01/95)
13.01	Mr Ted Roach Roach Industries Pty Ltd (date received 5/05/95)
14	Mr S G Whitty (date received 8/01/95)
14.01	Mr S G Whitty (date received 20/01/95)

15	Dr Bruce Whan Victorian Innovation Centre Limited (date received 16/01/95)
15.01	Dr Bruce Whan Victorian Innovation Centre Limited (date received 22/05/95)
16	Mr Robert Draper (date received 16/01/95)
16.01	Mr Robert Draper (date received 14/01/95)
17	Mr D Brian Grindrod The Pacific Institute Inc (date received 11/01/95)
18	Mr Alan Mitchell (date received 16/01/95)
19	B Hewitt (date received 16/01/95)
20	Ms Ann Brennan (date received 16/01/95)
21	Mr Guy Ward (date received 16/01/95)
21.01	Mr Guy Ward (date received 12/04/95)
22	Mr Greg Dolan CMP Innovations (date received 13/01/95)
23	Mr Leigh Harkness Buoyant Economies (date received 18/01/95)
24	Dr John White Transfield Shipbuilding Pty Ltd (date received 18/01/95)
24.01	Dr John White Transfield Shipbuilding Pty Ltd (date received 17/02/95)
25	Mr John F Stephens (date received 18/01/95)
25.01	Mr John Stephens (date received 30/03/95)
25.02	Mr John Stephens (date received 7/07/95)
26	Mr Richard Barton Australian Quality Council (date received 23/01/95)
27	Mr Russell Griffin (date received 23/01/95)
28	Mr Malcolm Good Australian Robot Association (date received 16/01/95)
29	Mr Owen M Earner (date received 16/01/95)

30	Professor Mary O'Kane University of Adelaide (date received 20/01/95)
31	Ms Jennifer Christiansen (date received 23/01/95)
32	Professor L Murray Gillin Swinburne University of Technology (date received 23/01/95)
33	Mr Chris Dawson Creative Visions International Pty Ltd (date received 18/01/95)
34	Professor Chris Ryan & Mr Henry Okraglik Centre for Design at RMIT (date received 20/01/95)
35	Mr Brian Williams Brian Williams & Associates (date received 20/01/95)
36	Mr Michael Clohesy Best Engineering Science Technology (date received 20/01/95)
37	Mr Ian Sheehy Dekkon (date received 23/01/95)
38	Ms Kashonia Louize Carnegie (date received 20/01/95)
39	Mr David Gaul CEA Technologies Pty Ltd (date received 20/01/95)
40	Mr Desmond R Wyatt Export & Innovation Marketing (date received 20/01/95)
41	Mr Grahame Reynolds Auscript (date received 20/01/95)
41.01	Mr Grahame Reynolds Auscript (date received 3/02/95)
42	Mr John Plunkett Industry Research & Development Board (date received 23/01/95)
43	Dr Alec Cameron Australian Graduate School of Engineering Innovation Limited (date received 23/01/95)
44	Mr Peter Ness (date received 20/01/95)
45	Mr George Aslanis Auburn Consulting Group (date received 24/01/95)
46	Mr Hugh Loewenthal (date received 23/01/95)
47	Mr David Pinnock (date received 20/01/95)

48	Mr Peter Pick Invetech Operations Pty Ltd (date received 24/01/95)
49	Mr Daniel Phillips Macquarie Bank Limited (date received 24/01/95)
50	Mr Charles Smith Charles Smith Inventions (date received 27/01/95)
51	Mr R L Down (date received 27/01/95)
52	Ms Janice McHugh (date received 27/01/95)
53	Dr A T Phillip (date received 30/01/95)
54	Mr V J Winley Business Council of Australia (date received 31/01/95)
55	Mr Michael Perkins Hooton & Perkins (date received 2/02/95)
56	Mr Michael Rice M R Rice & Associates (date received 30/01/95)
56.01	Mr Michael Rice M R Rice & Associates (date received 21/04/95)
57	Dr Michael Hewitt-Gleeson The School of Thinking (date received 1/02/95)
58	Ms Joy Dudine Australian Academy of Technological Sciences & Engineering (date received 6/02/95)
58.01	Dr Robert Brown Australian Academy of Technological Sciences & Engineering (date received 17/03/95)
59	Ms Maggie Deahm MP (date received 10/02/95)
60	Professor J A G Irwin (date received 13/02/95)
61	Mr Laurie Prandolini The Institute of Marine Engineers (date received 14/02/95)
62	Mr Tom Forgan The Australian Technology Park Sydney Limited (date received 14/02/95)
63	Dr Paul Satchell Sattress Pty Ltd (date received 15/02/95)
64	Mr Jeffrey Cook Open Access Cable (date received 17/02/95)

65	Dr Neil Bergmann IREE SOCIETY (date received 17/02/95)
66	Mr Graeme Paul The Royal Australian Chemical Institute (date received 20/02/95)
67	Dr Bruce Godfrey Energy Research & Development Corporation (date received 17/02/95)
68	Mr Michael MacKellar Plastics & Chemicals Industries Association (date received 22/02/95)
69	Mr R A Field Department of Commerce & Trade (date received 22/02/95)
70	Dr W P Macmillan CSR Limited (date received 20/02/95)
71	Mr B M Bindon CRC for the Cattle & Beef Industry (Meat Quality) (date received 20/02/95)
72	Professor Carmel Maguire School of Information Library & Archive Studies, University of New South Wales (date received 21/02/95)
73	Hon Barry Jones MP (date received 20/02/95)
73.01	Hon Barry Jones MP (date received 11/05/95)
73.02	Hon Barry Jones MP (date received 17/05/95)
74	Mr C R Barling (date received 20/02/95)
75	Mr C R Winston National Association of Testing Authorities (date received 21/02/95)
76	Mr Geoff Crittenden The Association of Consulting Engineers (date received 22/02/95)
77	Mr/Ms Kerry Bell Australian Pharmaceutical Manufacturers Assoc (date received 22/02/95)
78	Mr Robin Whittle First Principles Research & Expression (date received 24/02/95)
79	Mr Kevin H Kitch National Information Technology Council (date received 24/02/95)
80	Prof Helen Garnett Australian Nuclear Science & Technology Organisation (date received 24/02/95)

81 Mr Michael M Gore Questacon (date received 27/02/95)

82 Mr Harry Sebel The Harry Sebel Consultancy (date received 27/02/95)

83 Mr Leigh W Purnell MTIA (date received 27/02/95)

84 Mr Peter Laver The Broken Hill Proprietary Company Ltd (date received 27/02/95)

85 Senator the Hon Robert Ray (date received 27/02/95)

86 Mr Don Lennard (date received 27/02/95)

87 Ms Roslyn Clark CRC for Cellular Growth Factors (date received 27/02/95)

88 Dr John Hamblin CRC for Legumes in Mediterranean Agriculture (date received 28/02/95)

89 Mr Allan Hawke Department of Veterans' Affairs (date received 28/02/95)

90 Mr Julian Cribb (date received 28/02/95)

91 Dr Phillip A Reece BIOTA Holdings Limited (date received 28/02/95)

92 Dr Nicola Ward Nucleus Ltd (date received 1/03/95)

93 Professor Graham Johnston Federation of Australian Scientific & Technological Societies (FASTS) (date received 3/03/95)

94 Dr Ann Hamblin (date received 3/03/95)

95 Dr Norman F Eaton CRC for Materials Welding & Joining (date received 1/03/95)

96 Mr J C Fraser Unilever Australia (date received 1/03/95)

97 Professor Joan Dawes CRC for Biopharmaceutical Research Pty Ltd (date received 1/03/95)

98 Dr Bruce A Cornell (date received 2/03/95)

99 Mr E J Pope Nestle Australia Ltd (date received 2/03/95)

100	Professor Gordon Dunlop CRC for Alloy & Solidification Technology (date received 2/03/95)
101	Mr Raymond E Smith (date received 3/03/95)
102	Dr Geoff Norton CRC for Tropical Pest Management (date received 3/03/95)
103	Professor Jiro Kikkawa (date received 6/03/95)
104	Mr Ian Dalkin Stop Laughing This is Serious (date received 6/03/95)
105	Dr A J Robinson CRC for Biological Control of Vertebrate Pest Populations (date received 7/03/95)
106	Mr G R Edwards Morris Productions Pty Limited (date received 9/03/95)
107	Mr Peter Upton Australian Information Industry Association Limited (date received 13/03/95)
108	Professor Ronald Topsom La Trobe University (date received 15/03/95)
109	Mr Russell Reichelt Australian Institute of Marine Science (date received 16/03/95)
110	Hon Carmen Lawrence Minister for Human Services and Health (date received 16/03/95)
111	Mr Bryan Douglas Australian Electrical & Electronic Manufacturers' Association Limited (date received 21/03/95)
112	Mr C D S Buller Plant Science Centre (date received 10/03/95)
113	Ms Jennifer Clark (date received 24/03/95)
114	Mr Peter Clarkson Faculty of Education School of Graduate Studies Monash University (date received 28/03/95)
115	The Hon Robert Tickner MP Minister for Aboriginal & Torres Strait Islander Affairs (date received 30/03/95)
116	Ms Elisabeth Bastian Arts Out West (date received 24/03/95)
117	Mr W R Ellis Department of Transport (date received 12/04/95)

118	Mr David Pollak (date received 13/04/95)
119	Mr D Volker Department of Employment Education & Training (date received 2/05/95)
120	The Hon Kim C Beazley MP (date received 4/05/95)
121	Mr Warwick Pearse Worksafe Australia (date received 31/05/95)
122	The Hon Brian Howe Deputy Prime Minister, Minister for Housing & Regional Development (date received 1/06/95)
123	Mr Stuart Hamilton Department of the Environment Sport & Territories (date received 13/06/95)

APPENDIX III: LIST OF HEARINGS AND WITNESSES

Melbourne, 17 March 1995

Australian Academy of Technological Sciences and Engineering
Dr Robert Brown, Fellow and Member of the Activities Committee
Dr Neville McCarthy, Councillor and Chairman of the Activities Committee

Biota Holdings Ltd
Dr Phillip Reece, Director of Research and Development and Acting CEO

Broken Hill Proprietary Co
Mr Peter Laver, Corporate General Manager External Affairs

Business Council of Australia
Mr Vernon Winley, Assistant Director

M R Rice and Associates
Mr Michael Rice, Principal

National Key Centre for Design
Mr Henry Okraglik, Associate Director
Professor Christopher Ryan, Director

Swinburne University of Technology
Professor Laurence Gillin, Director, Centre for Innovation and Enterprise

Victorian Innovation Centre Limited
Dr Bruce Whan, Director

Private Citizen
Mr Guy Ward

Sydney, 24 March 1995

Arts Outwest, Charles Stuart University Mitchell
Ms Elisabeth Bastian, Regional Arts Promotions Officer

Australian Graduate School of Engineering Innovation Ltd
Dr Alexander Cameron, Program Manager

Australian Nuclear Science and Technology Organisation
Mr Peter Nixon, Board Secretary

Australian Technology Park Sydney Limited
Mr Thomas Forgan, Project Director

Cochlear Pty Ltd, Nucleus
Dr Nicola Ward, Strategic Planning Executive

Federation of Australian Scientific and Technological Societies
Professor Graham Johnston, President

The Warren Centre for Advanced Engineering
Professor Trevor Cole, Executive Director

Private Citizen
Professor Carmel Maguire
Mr John Stephens

Canberra 11 May 1995 (informal briefing)

Ms Maggie Deahm MP
The Hon Barry Jones MP

APPENDIX IV: LIST OF EXHIBITS

Exhibit No	Title/Document
1	Ford Motor Company of Australia Limited: *Supplementary submission to the Industry Commission* 1/12/94
2	Gorman, Alfred H, Mr: *Corporate Creativity & Innovation*
3	Dawson, Brett, Mr: *Mass Creative Employment (Idea)* 15/06/93
4	Dawson, Brett, Mr: *Scenic Rim Walking Track: Section 1 Business Plan Report* 7/07/94
5	Dawson, Brett, Mr: *Marketing Plan Report "Eco-Eco" (Ecological Economics)* 8/12/94
6	National Science & Technology Analysis Group: *Science and Technologoy creating Wealth for Australia (1990 Forum)* 13/11/90 associated with sub. no. 24
7	Australian Quality Council: *Strategic Plan* 1/06/94 associated with sub. no. 26
8	Australian Quality Council: *An Invitation to the Quality Journey* associated with sub. no. 26
9	Australian Quality College: *Innovation and Quality Management Module in Student Guide* 1/01/94 associated with sub. no. 26
10	Australian Quality College: *Innovation and Quality Management Module in Instructor Guide* 1/01/94 associated with sub. no. 26
11	Australian Quality College: *Innovation and Quality Management Module in Student Task Sheets* 1/01/94 associated with sub. no. 26
12	Australian Quality Awards Foundation: *Australian Quality Awards in Australian Quality Awards Criteria 1995* 1/12/94 associated with sub. no. 26
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APPENDIX V: RESERVATIONS CONCERNING THE INQUIRY PROCESS

This inquiry was referred to the Committee by the Minister for Industry, Science and Technology on 16 November 1994. Before the referral of the inquiry the Minister had set in train a parallel national consultation process under an Innovation Task Force resourced from within the Minister's Department. We wish to place on the record our dissatisfaction with the course followed by the Minister in commissioning parallel inquiry processes.

There are three major undesirable consequences from this kind of duplication.

Firstly, a degree of public confusion, and perhaps irritation, is inevitably generated. It would not be clear to individuals or organisations why they should be requested to prepare submissions to two separate bodies concerning virtually the same subject. It is certainly not clear to us why such a course was followed.

Secondly, the extensive public consultation process set in train by the Task Force, before the Committee was able to launch its own inquiry, inevitably hindered the gathering of evidence by the Committee. For example, the CSIRO indicated to the Committee secretariat that since it was making an input through the Innovation Task Force process it would not be making a submission to the Committee. The Minister's Department, which is the major relevant policy Department, Industry, Science and Technology, similarly did not make a submission to the Committee because of the Task Force exercise. There were doubtless many other organisations and individuals who did not convey their views to the Committee because they had already contributed, or were about to contribute, to the Task Force inquiry.

Thirdly, the Standing Committee of the House of Representatives which comprises Members of all political parties, could have issued a report and recommendations which had wider commmunity support had it not been undermined by the Minister's actions.

It is our view that as a result the report the Committee has been able to produce has suffered from a lack of direct evidence and opinion given to it. This has resulted in delay in producing the report and a lack of precision in the report's recommendations.

We would strongly urge Ministers in future not to set in train parallel inquiry processes. This is both wasteful of resources and counter-productive.

Bruce Reid MP
Deputy Chairman
1 December 1995

Bob Charles MP
1 December 1995

Michael Cobb MP
1 December 1995

I have a number of reservations concerning the outcomes of the Innovation Inquiry. The duplication of the Inquiry by the Minister for Industry, Science and Technology was unnecessary and unhelpful, and the assumptions underpinning the Inquiry too narrow.

Philip Cleary MP
1 December 1995

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