

What Is To Be Done?

The preceding sections have detailed how Australia is falling behind the world's leading wealth creators because it is not yet a high performing Knowledge Nation. They have shown that in the face of a changing world economy where knowledge is paramount, Australia is facing a national crisis. This section argues that the only way forward for Australia is to become a courageous and effective Knowledge Nation in which every one participates and shares the benefits.

What is an effective Knowledge Nation?

At its heart, the Knowledge Nation is about a national mind shift to a culture in which the national priority is to invest in the minds of all its people so they can deliver the new industries, transform existing industries, and take us down yet unimagined paths of discovery to provide a better life for current and future generations. The Knowledge Nation is not just for scientists and people working in 'emerging' industries. It will improve opportunities and security for all Australians, whatever their age or level of education, by strengthening traditional industries, creating new jobs, and helping people re-train and re-skill. The Knowledge Nation will be a fairer nation.

What will the Knowledge Nation look like?

1. A Government that creates and promotes effective linkages between research organisations - such as CSIRO, the universities, Cooperative Research Centres and Federal and State Government agencies - to ensure an adequate national database, and inventory of skills, resources and the environment (cadastre). The purpose is to enable effective coordination of national and regional efforts to tackle major problems that threaten the nation's viability, especially in regional and remote areas. Examples of such problems include desertification, soil salinity and acidification, pollution of rivers and erosion. 2. A government that works imaginatively and creatively as a catalyst, encourager, information provider, infrastructure supplier, major customer, and example of world's best practice. 3. A national strategy of ensuring investment in those key areas where it can establish a leading global position. 4. A twenty-first century education system that:

- provides all of its citizens with the opportunity to improve their skills and gain secure and well-paid jobs through properly funded lifelong learning and vocational education programs, including programs at the industry and enterprise level;
- makes every school - State and non-government - a centre of excellence and provides all children with a quality education;
- has universities that attract the world's leading researchers and teachers; and
- encourages fundamental research and the study of the humanities as well as applied knowledge.

5. An economic system based increasingly on innovation and the creation and commercialisation of ideas, and that reverses the serious imbalance in trade in high value added goods and services. This means:

- stronger manufacturing, extraction and service industries transformed by the application of new technologies and the re-skilling of their workforce;
- the development of industries in emerging fields such as biotechnology, nanotechnology, information and communications technology, and environmental management; and
- taking advantage of rapidly expanding export opportunities in service industries, particularly in education, health and environmental management.

6. Core economic and social objectives of leading-edge telecommunications, transport and research infrastructure in our cities and regions, and regional development. 7. Policies that regard saving the environment as an opportunity, and promote sustainability. The application of knowledge to

simultaneously promote energy efficiency and higher living standards and create more jobs. 8. A transformed national culture that emphasises knowledge, excellence and innovation, and aims for this to be reflected in its international reputation. Like Ireland, Finland and Israel, our international 'image' must be transformed by creating an inventory of internationally recognised goods and services. 9. The use of knowledge resources to promote the public good, encourage access and equity, provide resources for Aboriginal and Torres Strait Islander peoples, and overcome social, class, regional, ethnic and gender barriers. 10. The creation of a more challenging and creative environment to help reverse the 'brain drain' and assist us in importing the skills we need. 11. The strengthening of great national institutions such as the ABC, CSIRO, galleries, museums, libraries, the Australia Council, the Australian Heritage Commission, Telstra, Australia Post and the Bureau of Meteorology.

The Knowledge Nation will be a fairer nation

The Knowledge Nation is going to be the new source of power relations in the future. It is fundamentally blind to gender, race and other forms of difference. Far from being elitist, the Knowledge Nation is a force for inclusion, breaking down distance and differences, ensuring the benefits are enjoyed by women, Indigenous Australians, people from non-English speaking backgrounds, people with disabilities, in short, by all of those who too often have been excluded by the inequitable distribution of power and access in the past. Nobody should be excluded from the Knowledge Nation, and it is a specific duty of government to ensure that nobody is left out and that nobody is left behind.

Government leadership and commitment

Becoming an effective Knowledge Nation requires aggressive and sustained leadership from the Commonwealth Government in:

- creating a long-term vision;
- looking ahead for decades;
- promoting linkages;
- acting as a catalyst, encourager, information and resource provider, and major consumer;
- setting benchmarks for best practice; and
- promoting equity.

The Commonwealth Government, and particularly the Prime Minister, must be the driver of change. It must develop a national strategy and a determination to implement it through all relevant departments and agencies. It must change the national culture to one with an ingrained understanding of the importance of knowledge creation and its commercialisation to the nation's future, and sell this new reality abroad to help transform the rest of the world's understanding of us. The first step in this program should be a Knowledge Nation Summit. The primary purpose of this summit is to create connections between and within governments and the business, research and education sectors to hasten the creation of the Knowledge Nation. An international campaign to highlight Australia's culture of excellence must also be undertaken. The Prime Minister must take ownership of the delivery of the Knowledge Nation and produce an annual report to the nation outlining progress.

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Recommendation 1

The Prime Minister must take the lead in advocating Australia as a Knowledge Nation domestically and abroad, acting as a catalyst to change the culture to that of a Knowledge Nation. The Prime Minister should:

- call a Knowledge Nation Summit to begin the task of breaking down isolation and creating linkages between key players;
- outline a specific national strategy with specific priority industries and a supporting policy framework in education, training and research to propel those industries into global leadership;
- conduct an international campaign to change the world's image of Australia to that of a Knowledge Nation; and
- report annually to the Parliament on progress in creating a Knowledge Nation.

Create an inventory of existing knowledge resources (cadastre) as the starting point for making connections and utilizing Australia's full potential

While in some ways Australia is already on a path to becoming a Knowledge Nation, we are a disconnected and under-performing one. We already have many of the ingredients of a Knowledge Nation. To harness our impressive - but disparate - Knowledge Nation resources, and extract the full benefit of our national abilities, we must have a clear picture of our resources and optimise their use.

Recommendation 2

The Commonwealth should coordinate with the States and major research organisations the development of a comprehensive and broadly available inventory (or cadastre) of Australia's resources and knowledge capacity, as a basis for action and policy formulation. The information gathered must be accessible to all Australians.

The Glass Earth - Transforming our "traditional" industries by collecting new forms of data

We often think the Knowledge Nation means investment in new industries, and totally new sectors of the economy. And yet many of our most innovative ideas and inventions are coming out of what are often seen as 'old economy' industries like the mining and exploration sector. For instance the CSIRO is working with the private sector on a ten year project called The Glass Earth that aims to map completely the top one kilometre of the

entire continent of Australia. This project uses sophisticated computer modelling to 'see through' the earth's crust. The aim is nothing less than trying to find the next Mt Isa or Broken Hill, by building up a total geological picture of the country in 'virtual reality'. A large part of this project involves a collaboration of Australian companies at the cutting edge of Information Technology. The researchers and scientists are trying to answer questions about how we can map ancient fluid movements over vast distances, and where a major ore system is likely to occur in this pattern. The resources sector has always been a technology driven industry, its companies are leaders in IT and detection technologies. Exploration techniques, extraction processes and management practices are getting newer all the time. The industry is a key driver of research and development, and scientific endeavour across a wide disciplinary sweep in our schools, universities and research agencies. The Glass Earth is just the latest project that aims to ensure Australia's prosperity into the future, showcasing some of this country's smartest IT knowledge. It is a project keenly watched by the mining and exploration industry overseas, and it is something that should be nurtured by Government. It is a good example of the potential benefit of creating a Knowledge Bank of Australia's resources.

Increasing and targeting R&D

Research and development is too important to the Knowledge Nation to allow under performance, or even average performance. We have no less a task than leaping to the leading ranks of innovative nations. Not only must overall R&D spending be dramatically increased, it must be more closely targeted to key Knowledge Nation industry sectors, based on their prospects for commercialising new products and ideas here in Australia, and exports overseas. Five key emerging industries are identified in this report as worthy of targeted assistance (see Recommendations 5-9). A number of others, such as nanotechnology and supercomputing, could also be examined. In yet others, such as medical research (as distinct from biotechnology, although the two are linked), Australia needs to build on its existing success. Government should be in the business of determining priority industries; it should not be in the business of trying to pick winning companies. But fear of 'picking winners' should not be allowed to constrain Australia from developing a national investment strategy. Such a strategy would build on areas of strengths in existing globally leading industries (including those in the resources and manufacturing sectors and medical research) and potential strengths in emerging industries (including ICT, environmental management, and biotechnology). Government would work with them to provide a critical mass of infrastructure and R&D incentives and to develop management expertise and a skilled workforce. Government has an additional role as a 'knowledge broker' to forge linkages between such areas to create new fields of common endeavour.

The Australian Defence Force and Department of Defence can also play a role in exploiting information technologies to maximise the effectiveness of our defence force. A knowledge edge is the most important capability for any modern military organisation. It is essential for Australia's Defence Organisation to take advantage of technological advances and other trends, particularly in integrating the command, control, communication and intelligence systems that underpin that knowledge edge. To maintain a knowledge edge, it is essential that Australia have a modern and innovative industry base to support our Defence Organisation. The Australian Defence Force's acquisition program can play a crucial role in supporting and growing that industry base and encouraging research and development of leading-edge technologies. The Knowledge Nation must also encompass a deep commitment to the manufacturing industry. In 1999, our trade deficit in elaborately transformed manufactures (ETMs) was nearly \$60 billion. As the report *A Comparative Performance of Australia as a Knowledge Nation* makes clear, a good performance during the 1980s and early 1990s in ETM exports has been allowed to slip since 1996. Taken together, exports of ETMs in the areas of pharmaceuticals, computing equipment, telecommunications, road and other transport vehicles, and clothing, grew by 21.3 per cent per annum between 1985- 86 and 1995- 96. Over the same period, imports of these ETMs grew at less than half the annual rate (10.2%). Since 1995- 96, however, annual export growth for these ETMs has slowed from 21.3 per cent to 9.3 per cent, and been overtaken by import growth of 13 per cent per annum. Before

1996, ETM exports grew at double the rate of ETM imports. Since 1996, ETM imports have grown faster than exports. (35)

The linkages between Australia's manufacturers and the nation's research infrastructure are underdeveloped, resulting in a much slower rate of new product development, new company formation and technology commercialisation than in other OECD countries. The creation of an Institute of Manufacturing will provide a focus for strengthening these linkages and making manufacturing a key component of the Knowledge Nation. Australia's Investment Promotion Program and other measures must focus on securing new investment to expand the nation's productive capacity in ETMs.

(35) Considine et al. op. cit., pp. 39-42

In addition, many economists and business-strategy consultants correctly argue that manufacturing will actually become more important in the first several decades of the twenty-first century because of the emergence of what is referred to as service-enhanced manufacturing. As MIT Professor Richard Lester points out:

- The high value added goods of the twenty-first century will be services enhanced products. Such products bring together manufacturing and services in ways that defy our conventional statistical categories. They bundle together in desirable combinations the capabilities of advanced manufacturing systems, and new possibilities in design, customisation, rapid delivery, quality and product novelty - all enabled by information technologies. The services that make these new generations of products possible depend heavily on information and its rapid diffusion...
- The importance of taking this broader view is all the greater in light of the global trend towards what we call here service-enhanced manufacturing - the growing significance of intangible products attributes in manufacturing competition. In a very wide range of markets, factors such as convenience of use, speed, delivery, brand identity, fashion, quality, reliability and a variety of services designed to enhance the experience of buying and using the product are featuring more and more prominently. The key to manufacturing competition in the coming decades will be the ability to bundle together a tangible good with an array of intangible services to produce the most desirable product. (36)

Recommendation 3

Australia should increase its public and private sector R&D performance by:

- Doubling Australia's overall R&D as a percentage of GDP by 2010, bringing Australia to the top of the OECD tables.
- Targeting R&D incentives and action agendas to key Knowledge Nation industries, including the industries with currently globally competitive positions such as wool, tourism, wine, iron ore, coal and beef; established potential growth industries such as education, health and medical research; and emerging industries such as ICT, environmental management and biotechnology. Additional areas for national effort should be decided through a national foresight process that brings together experts from across society to identify opportunities for economic improvement.
- Using the nation's investment promotion program and other measures to expand our productive capacities in ETMs and foster the linkages that will accelerate the rate Australia develops new products, forms new companies and commercialises technology.
- Drawing on existing university and non-university research bodies to build three national institutions of global standing in the three key emerging sectors of ICT, environmental management and biotechnology.
- Creating an Institute for Manufacturing as a centre of excellence for industry research and development.
- Introducing additional R&D concessions for businesses in selected sectors that conduct research in conjunction with public sector research bodies and universities.
- Promoting the core enabling disciplines within the fields of science, engineering, the social sciences and the humanities, in school and higher education.

- Increasing support for the CRC program while ensuring rigorous selection processes for the establishment of new CRCs. This should include the creation of additional CRCs in ICT, environmental management and biotechnology.
- Significantly increasing funding to public sector research bodies, including the CSIRO, AIMS, the NHMRC, the ARC, the Bureau of Meteorology, ANSTO, DSTO and others.
- Using the Australian Defence Force's acquisition program to support Australia's high-technology industry base and encourage research and development of leading-edge technologies.

Commercialising Australian R&D

Other recent reports have made recommendations on how to improve the commercialisation of research in Australia. Recommendations have included:

- expanding the CRC program to improve the commercialisation of university research;
- encouraging more clustering through additional programs that provide a strategic industry sector focus, similar to the Building on IT Strengths (BITS) model;
- establishing innovation centres, a technology incubator program and appropriate commercialisation advisory services to build management expertise;
- creating pre-seed capital funds for public sector research institutions; and
- providing more opportunities for public sector researchers to share the benefits of commercial spinoffs from their intellectual product. (37)

(36) S Berger and R Lester (1997) *Made by Hong Kong*, Oxford University Press pp xiii & 30 (37) *The Chance to Change*, pp. 44-53; *Innovation Unlocking the Future*, pp. 20-31

The Taskforce endorses these recommendations, but would like to see an even greater focus on issues that will make Australian companies in emerging industries more competitive and that will attract overseas companies to Australia. Unless Australia addresses this issue, we will fail to maximise the benefits from public and private investment in research through CRCs, incubators, institutes, universities and other bodies. Australia needs to acknowledge that we are competing with other nations that have tax and other incentives for commercialising research in emerging industries. One challenge that has been neglected is providing for an employee share options program that creates incentives for entrepreneurs. Options are used to create an environment of shared ownership. They create an incentive for employees in these high-risk enterprises to work at aligning objectives and creating the maximum possible wealth for all shareholders in the business.

But it is recognised that the success rates of start-up companies is very low. Even in those that are successful, the original shareholders rarely realise any return on their equity for several years. In these circumstances, employees are encouraged to consider options as a 'long shot' bet in a game in which they have limited control over the odds. What control they have is completely related to their abilities and willingness to commit themselves to the business endeavour in the medium to long term. The present employee share options framework urgently needs reform, and although the government has acknowledged this, it is yet to develop a new program. It is important to note that any new options program must be immune to the potential of tax avoidance schemes. It would be immensely damaging to a nascent entrepreneurial culture should a program be introduced, only to have it discredited. It is urgent that an Employee Share Option Program be made available to fast growing start-up companies. Two approaches are needed: benchmarking ourselves against other competitor nations, and examining all the impediments to commercialising Australian research, including taxation. Just as important, though, is changing the culture of Australia. Just as we are seeking to generate greater public acceptance of the need for research and development, so we need to generate greater acceptance of the need for more entrepreneurial activity. Those who take risks and ultimately succeed in opening global markets for Australian research should be as prominent and praiseworthy as the researchers themselves.

Recommendation 4

The Commonwealth Government should undertake a thorough review of the impediments to the commercialisation of Australian research, in targeted emerging industries. This strategy should:

- benchmark Australia against other successful Knowledge Nations, such as Ireland, Israel, Singapore and the United States; and
- recommend tax and other incentives that will encourage greater commercialisation (see also Recommendations 3, 5, 6 and 7).

The Taskforce believes, however, that the commercialisation of Australian research will only be improved significantly if we send strong signals to business by getting the fundamentals right. This means attracting large players in the worldwide pharmaceuticals industry to commercialise home-grown biotechnology research (see Recommendation 6). It means securing investment in a wide range of ETM industries to upgrade their organisational capabilities and management systems, thus improving their capacity to commercialise Australia's research outputs. This must include the capacity for firms to upgrade their organisational capabilities and management systems. The Karpin Report of 1995 flagged fundamental changes required for management education. (38) It means getting the telecommunications and digitisation policies right (see Recommendation 5). And it means getting environmental regulations right. But the final and possibly most important factor is to convince business that there is the leadership and the strategy to make Australia a Knowledge Nation (see Recommendation 1).

(38) D Karpin (1995) *Enterprising Nation: renewing Australia's managers to meet the challenges of the Asia-Pacific century*, Canberra

Key Industries

The engine of wealth creation for the past two centuries was built around goods-producing industries, particularly manufacturing. Today, a new engine of wealth creation is emerging, based on information processing, the Internet and supporting infrastructure. But it is a false dichotomy to argue that there is a 'new economy' and an 'old economy'. On the contrary, it is the application of advances in science, engineering and information technology, and the utilisation of the online economy by companies in mining, tourism, agriculture, manufacturing, warehousing, transport and a wide range of service industries, that is and will continue to render obsolete any hard and fast dividing line between old and new industries or companies. These terms are used occasionally simply to facilitate comparisons and communication and highlight differences. Similarly, the key industries on which the Taskforce has focused for future growth and development do not exist in isolation. A nation cannot realise the full potential of its ICT, environmental management and biotechnology industries without a strong service-enhanced manufacturing industry, world-class science and engineering facilities, and a host of other industries and occupations through which linkages are established. The reader should bear this in mind when considering the Taskforce's findings on the emerging growth opportunities in the following key industries. They are not the only growth opportunities of the future. But they are critical to the success of Australia as a Knowledge Nation.

Key industries 1: Information and Communications Technology

Information and communication technologies (ICTs) represent an industry sector that is yet to reach its full potential in Australia as a result of policies that have stifled innovation and growth. As ICT is an enabler of innovation in the public and private sector, the combined strategy of identifying ICT as a key industry and pursuing affordable, high bandwidth access to communications infrastructure will complement other strategies to build Australia's capacity to become a Knowledge Nation. Due to policy failures, Australia is not a pace setter and leader in ICT; we are a user and follower. We must become both a technology user and a technology creator. Australia must build on its strengths as an early adopter of ICT to create a larger software and hardware industry. Government must play a leading role by moving government services online, in particular, education, health and innovative forms of government administration and service delivery. Extending government services online may create savings that could be used to expand broadband digital access to all Australians, thus helping to avoid the widening of the digital divide, an expression to describe the inequities between those who have Internet access and those who do not. Government must also use its purchasing power to ensure that government contracts are

available to small to medium enterprises (SMEs) in the ICT sector. With governments responsible for over 40 per cent of ICT purchasing in Australia, there is potential to provide strategic growth opportunities for existing SMEs, particularly those expanding their export opportunities. There are relatively under-developed opportunities for growth in niche sectors of ICT. One such sector is photonics, the use of particles of light to communicate, store and process information, including optical fibre networks. Photonics is a strategic growth industry in its own right and an enabling technology providing broadband solutions to underpin the transformation of existing industries. (See breakout box on Photonics). ICT is embedded in almost every industry and activity of a Knowledge Nation. Creating high-level capacity in ICT infrastructure and skills is an essential prerequisite to modernising Australia's education, health and other services, strengthening existing manufacturing industries and creating new industries. For government administrations, researchers and business, the availability of high bandwidth is a prerequisite to a culture of innovation. Broadband communications networks will form the backbone of new industrial organisations. Business-to-business trading environments will become, if they are not already, the platform on which companies do business with each other, and the Internet will be the internal communications medium through which businesses organise themselves. As more and more businesses and people are linked to the electronic nervous system of global business, the thirst for bandwidth will explode. However, capacity and influence to expand broadband access also requires improving the current telecommunications regulatory arrangements. While Australia does have high Internet use compared to many other nations, we must ensure that we improve as other nations implement ambitious programs to boost their own levels of digital technology use. The Commonwealth should retain its majority public ownership of Telstra - Australia's leading ICT company - to help ensure that affordable digital broadband services are available to all Australians. A key strategy for achieving universal digital broadband access will be to move from the existing Standard Telephone Service to a Standard Communications Service. The current Standard Telephone Service guaranteed to all Australians requires only the provision of voice telephony services. The Standard Telephone Service mandates a standard data speed (bandwidth) of 2.4 kilobits per second (kbps). This is the minimum necessary for voice telephony of reasonable quality. However, it is totally inadequate to provide even basic dial-up Internet services. The Howard Government's recent announcement that it will encourage, though not legislate for, Telstra to provide a minimum 19.2 kbps data speed is also insufficient to provide all Australians with reasonable dial-up Internet access. By contrast, for example, it is expected that by 2005, 95 per cent of households in Denmark will have access to at least 256 kbps, and 70 per cent will have access to 2 Megabits per second (Mbps). The Digital Data Service Obligation (DDSO), introduced in 1999, provides all Australians with access on request to a minimum 64 kbps ISDN or equivalent data service. The DDSO no longer reflects the latest in available broadband technology, nor has the subsidy available under it proven to be attractive. To date, only 74 Australians have taken up the DDSO on other than fully commercial terms. The Customer Service Guarantee framework sets maximum timeframes for telecommunications carriers to connect customers to their network, or to repair or service the connection of existing customers. Currently, the Customer Service Guarantee only ensures the timely connection and repair of voice telephony services. It should also be upgraded to take into account data services. Timing is important. For Australia to develop into a Knowledge Nation, we will need to be at the forefront of some world developments. Digitising Australia's cable networks and ensuring access to broadband as urgent national policy priorities will bring us into the lead, along with a small number of other countries, in having the platform to develop the next generation of services.

Recommendation 5

The Commonwealth should make it an urgent national priority that all Australian households and businesses have the option of access to digital broadband. This could be done by:

- Using the array of Commonwealth powers, capacity and influence to expand broadband access. This will include improving the current regulatory arrangements and maintaining majority government ownership of Telstra.
- Upgrading the current standard telephone service, which mandates minimum levels of voice telephony service, to a standard communications service that mandates minimum levels of data transmission.
- Improving the competitive and regulatory environment to ensure fair access to the Customer

Access Network and to ensure that broadband cable networks are open, digitised and inter-connectable as soon as possible.

- Providing incentives, including investing in broadband networks, for the take up of broadband technology.
- Making Government a leader in the use of high broadband technology, including innovative online government services.
- Ensuring that all Australians, particularly those in regional areas, have the opportunity to access fixed price, untimed calls nationwide, for both voice telephony and data services.
- Removing the existing restrictive and failed datacasting regime and opening up a new digital spectrum to the exciting, potential new services of the future.
- Building a national strategy around the growth and development of Australia's software and digital content sector, including a comprehensive capability inventory.
- Using improved government procurement policies to encourage the further development of an Australian ICT industry.
- Closing the digital divide by using community and regionally based strategies to improve skill levels and assure affordable Internet access.

Photonics - A Strategic Growth Industry for Australia

Photonics, the use of particles of light to communicate, store and process information, presents a unique combination of three features that mark it out as an industry worthy of special Government attention. Firstly, as a strategic growth industry in its own right. Secondly, as a foundation, national, enabling industry to underpin the development of all other industries, and thirdly for the opportunity it presents, through the conjunction of the first two features, to develop a suite of new answers the growing inequities in society that are related to access and use of information technologies (the digital divide). 1. Because of investment in Photonics in the early 1990s, Australia today has a rare opportunity to be a leading participant in the next generation of giant, global high tech industries. Photonics networks are the optic fibre pipes and light-based switches that will be the backbone and nervous system of the Internet, which means it can only continue to grow. Australia has already developed a global reputation for excellence in this field and therefore is strongly positioned to develop core photonics technologies for the global market. Even post the "tech wreck", photonics is one of the most exciting industries in the world, attracting \$US3.4 billion in venture funding for optical networking in the first nine months of 2000. Total optical networking equipment sales are predicted to increase from \$US30 billion in 2001 to \$US70 billion in 2006 (Insight Research Corp). Already, Australia has produced a handful of global leading niche Photonics companies and captured the attention of the photonics world with its innovative science. Being a leading participant in the industry in the next decade is an opportunity so important it is worthy of the status of a national mission. 2. Broadband communications networks will form the backbone of new industrial organisation, and will be at the core of all industries. Business to business trading environments such as the auto industry electronic trading market, will be the platform on which companies do business with each other, and the Internet will be the internal communications medium through which businesses organise themselves. As more and more businesses and people are linked to the electronic nervous system of global business, the thirst for bandwidth will explode. High bandwidth access will be the enabler for businesses wanting to participate in international trading platforms or to employ the latest management techniques.

Australia needs to encourage the rollout of world-best broadband networks in the same way as it had to build world-class roads, rail and ports to allow past generations of industry to compete internationally. 3. The combination of a strong and innovative Australian photonics industry and a business sector savvy to the opportunities presented by broadband

communications will enable a national strategy to address regional development and the digital divide. As the demand for broadband and the domestic capacity to provide it grow, it will create an opportunity for communities to connect into the new networks. Already, Canada and the US have seized opportunities to bring communities into the mainstream of new job, education and social opportunities through projects such as the Canarie network in Canada and community-based schemes in cities such as Palo Alto and Cedar City in the US. Australia, with its photonics industry, educated and technology-aware population and advanced economy, can lead the world in bridging the Digital Divide.

Key industries 2: Making Australia a world leader in biotechnology

Dr. Peter Andrews of the Institute of Molecular Bioscience at the University of Queensland has argued that Australia is at the cusp of the third great economic revolution of the modern era - the biotechnology revolution. (39) The world-wide explosion of the transformational impact of the second revolution of the modern era - that of ICT - did not prevent Australia's standard of living slipping to 26th in the world. A century earlier, Australia ranked first in the world. Australia also slid from being the first to the fourth largest economy in East Asia. And we enjoy the ignominy of now being second last after Argentina among OECD exporters of high technology. Dr. Andrews' challenge is whether Australia will fall further and further behind in its terms of trade and the international table of nations if it fails to capitalise fully on the next quantum transformation of the world economy: the revolution in biotechnology. The Taskforce's response to this challenge is that our national government must establish a clear-cut national goal of making Australia a world leader in biotechnological research, development and commercialisation by 2010, building on our existing strengths in medical research. This will require specific action plans.

A national biotechnology meeting should be convened involving the States, the life science research community and biotechnology companies to determine a coordinated national biotechnology strategy to develop the industry in Australia. If Australia is to become a world leader in this industry, it must concentrate its efforts on those sub-fields in which it has an existing research base - rather than spreading that effort too thinly. The NHMRC and ARC grants system should be restructured (or augmented by the establishment of a specific National Biotechnology Research Grant) to allow for large-scale biotechnology projects of national significance. The Taskforce recommends at least two such national projects. 1. An Australian Genome Project to explore the genetic and molecular characteristics of key animals, plants and micro-organisms of relevance to Australia's unique biodiversity and of commercial significance to the global economy. 2. A National Proteomics Project aimed at the commercial application of the emerging body of genomic research to diagnostic and therapeutic medicine. In part, it may take the form of providing advanced research platforms for the high-speed processing of protein data under different conditions. The Taskforce further supports the creation of a radically improved environment for life science researchers to reverse the brain drain and secure the return of the brightest and the best Australian expatriate life scientists from abroad. In part this relates to employment conditions and in part, to the international standing of Australian research institutes compared with their competitors. To this end, Australia should develop three life science research institutes of undisputed global standing. One of these may be designated a National Life Sciences Centre.

(39) PR Andrews. 'The Technology Environment for the 21st Century: Biotechnology', paper presented at the 1998 Symposium of the Academy of Technological Sciences and Engineering: Technology-Australia's Future: New Technology for Traditional Industry <http://www.atse.org.au/publications/symposia/proc-1998p2.htm>

All three should be built on the existing (and largely rusting) institutional base. A further priority is the creation of a network of biotechnology business incubators. These incubators should involve the co-location of researchers, entrepreneurs and venture capitalists. Where possible, this would occur within the precincts of universities and/or research institutes. Xcelerator, a company in North Ryde that already provides bio-incubation services to biotechnology start-up enterprises, may provide a model. The creation of a biotechnology industry-wide information Internet portal - or a 'BioInfoHub' would provide an industry-wide free flow of information as well as a range of satellite sites for Bioentrepreneurs, BioResources, BioMentor, BioJobs, BioInvest, BioNews, etc. It should be jointly funded by government

and industry. To oversee biotechnology developments requires the establishment of a National Biotechnology Advisory Committee headed by a chairperson of global standing in the industry. This committee should be serviced by an Office of Biotechnology within the relevant agency in Canberra. This modestly staffed machinery would drive the implementation of the National Biotechnology Strategy. Australia urgently needs a National Life Sciences Education Strategy for the long-term development of the national skills base necessary for the nation's future biotechnology industry needs. This would address the inadequate supply and quality control of maths and science teachers through the nation's school system, the structure of undergraduate courses, and the incentives necessary to expand the nation's doctoral and post-doctoral programs. To boost commercialisation of biotechnology research in Australia, we need a detailed review of the impact of the tax system on biotechnology start-up companies. This would cover roll-over provisions, CGT treatment and employee share ownership schemes. Building on Ireland's experience with ICT, it might also include a 0 per cent company tax on defined biotechnology start-ups for a period of five years as a means of symbolising government's strategic commitment to the sector. One task that must not be overlooked is the development of a National Code of Ethical Practice for the Australian biotechnology industry. This is a gaping hole at present and serves to exacerbate the concerns of those critical of the contemporary manipulation of the molecular structures of plants and animals. It could draw readily on the code already developed by the Queensland Government. It is crucial to provide a certain framework for researchers, entrepreneurs and the community.

Recommendation 6

The Commonwealth must build on Australia's strengths in medical research by adopting a goal of making Australia a world leader in biotechnological research, development and commercialisation by 2010. This will require:

- A meeting of the nation's biotechnology experts to determine a coordinated National Biotechnology Strategy for the development of the industry in Australia as a priority.
- Restructuring NHMRC and ARC grants to allow for large-scale biotechnology projects of national significance.
- Funding an Australian Genome Project and a National Proteomics Project to concentrate research effort and build on existing Australian strengths.
- Developing three life science research institutes of undisputed global standing. One of these may be designated a National Life Sciences Centre. All three should be built on the existing (and largely rusting) institutional base.
- Creating a network of biotechnology business incubators.
- Creating a biotechnology industry-wide information Internet portal - or a 'BioInfoHub'.
- Establishing a National Biotechnology Advisory Committee headed by a chairperson of global standing in the industry, serviced by an Office of Biotechnology within the relevant agency in Canberra.
- A detailed review of the impact of the tax system on biotechnology start-up companies and foreign investment.
- Specific adjustments to national immigration policies to encourage global-leading biotechnologists to come to Australia and expatriate Australian leaders to return.
- Developing a National Code of Ethical Practice for the Australian biotechnology industry.

Xcelerator Biotechnology Incubator

Xcelerator is a professional biotechnology incubator business located in the 'Biohub' of North Ryde NSW. Xcelerator provides complete support to start-up companies working in the biotechnology sector and an environment and infrastructure which is highly conducive to allowing start-up businesses to get on with the task of developing their new venture and growing rapidly. Xcelerator has three key aspects to its business.

Biobusiness Incubation

Xcelerator provides clients with a competitive edge through access to its unique combination of experience, insights, knowledge and networks in business and science, all critical factors to the future success of incubator companies. The aim of Xcelerator is to add value to early stage companies through the provision of its incubator services, and in assisting companies to reach a point where they have become strong independent businesses. Xcelerator seeks in return to derive value from its investment in an incubator company. In return for its original investment Xcelerator takes an equity position, the level of which depends on a number of factors such as: the level of risk, the stage of the technology development and the need for future resource allocation to the company or project.

Bioentrepreneur

Bioentrepreneur. net (website: www.bioentrepreneur.net.) is a business unit of Xcelerator Ltd, which develops and presents continuing education workshops on business development for those working in the life sciences. Xcelerator has developed Bioentrepreneur to service a gap in the market, and as part of its commitment to developing educating and growing the life sciences biobusiness sector in Australia in line with international worlds best practice.

Commercialisation & Advisory Services

Xcelerator assists with all aspects of biotechnology commercialisation, from project evaluation, due diligence, business planning and introductions to potential investors. Xcelerator works with investors who wish to have technical and commercial evaluations performed.

Key industries 3: The environment as an opportunity

Australians are now realising the enormous damage we have inflicted on our continent and the need to create a sustainable future. The environment is an opportunity as well as a challenge. If we use our Knowledge Nation capacity in a focused way we can fix environmental problems, prevent further damage and create a potentially huge export industry in environmental management technology and intellectual product, particularly in the areas of land care, water and waste management, and sustainable energy. All levels of government and the private sector must be involved. Currently, Australian companies are behind other leading nations in their level of awareness of sustainability principles. There are enormous benefits for regional and rural Australia in particular. By fully using Australia's intellectual capacity we can fix problems relating to salinity and efficient use of water, improve rural quality of life and provide income-producing technologies. The Taskforce believes that Australia urgently needs a strategy to concentrate more public and private resources into creating environmental technology and environmental management export services industries. The Taskforce also believes that we need to create greater awareness in the community of sustainability principles, particularly 'dematerialisation', and build 'triple bottom line' (financial, social and environmental) principles into government and corporate investment decisions. Creativity will flow if as a result.

Recommendation 7

That the Commonwealth initiate a massive campaign, in conjunction with the States and all major research organisations, to start a ten-year program to tackle the problems of salinity, land degradation and

acidification of soils, polluted rivers and sea coasts, land clearing and deforestation, loss of species diversity, and to implement a strategy to expand Australia's environmental management industry, for which we already have a high-level capacity. Elements in this strategy should include:

- a goal of obtaining a significant proportion of the global market of environmental management goods and services by the year 2010;
- development of a specific set of quantitative metrics and milestones for the year 2010 and each year beforehand to monitor success and highlight failures as the program unfolds;
- a targeted environmental management R&D program, including support to improve the sustainability performance of industries that have traditionally been both environmentally damaging and global leaders, and to generate new export industries from the expertise developed in doing so;
- the creation of environmental management CRCs, innovation investment funds and venture funds leading to the development of significant indigenous industries in environmental management;
- an environmental technology and services export program;
- renewable energy and energy efficiency initiatives;
- specific adjustments to national immigration policies to encourage environmental scientists and management professionals who are global leaders to migrate to Australia and the return of expatriate Australian leaders; and
- a campaign to promote understanding of the process of 'dematerialisation' in industry and the community.

Heartlands - towards sustainable land use in the Murray-Darling Basin and the creation of Australian IP

The CSIRO's Heartlands project illustrates how by using our knowledge capacity in a coordinated way we can address difficult environmental problems, export valuable intellectual product, create new jobs and make regional Australia a central part of the Knowledge Nation. Land and water degradation, especially dryland salinity, poses a serious long-term threat to the sustainability of the Murray-Darling Basin. Changed management of agricultural landscapes, including well-targeted revegetation on a broad scale, is the most viable means to reverse the ongoing environmental degradation. The Heartlands initiative will develop efficient strategies for well-targeted land use in the Murray Darling Basin. It will support implementation of the strategies, and verify their effectiveness. Heartlands is developing and applying the knowledge required to target revegetation works for maximum benefit. It will build on existing knowledge and related research being undertaken by CSIRO and other organizations. Heartlands is an innovative long-term program combining on-ground-works with research and development. Scientists will work closely with catchment managers and the community to:

- Support catchment management;
- Help to rehabilitate the landscape in a way that is sensitive to the needs of society and the communities affected;
- Assist rural communities to manage land use change;
- Estimate the benefits and costs of changed land management; and,
- Provide confidence that the proposed solutions work.

The Heartlands initiative will:

- Contribute to new land use options that combine commercial success with sustainable resource use;
- Provide the ability to locate appropriate land management options - reforestation, environmental plantings, and improved agriculture - in specific locations in a catchment to maximise environmental benefit;
- Build understanding of the extent and nature of land use change necessary to meet salinity and

- water quality targets, maintain water security and enhance biodiversity conservation;
- Verify the effectiveness of landscape design strategies in meeting these environmental imperatives whilst providing long-term economic returns;
- Provide practical support for community-based catchment planning, monitoring, and the implementation of adaptive catchment management processes;
- Deliver support for policy initiatives to help in implementing necessary land use change; and,
- Provide practical examples of techniques and guidelines for broad-scale land use change that can be adapted and replicated elsewhere in Australia and exported overseas.

Key Industries 4: An education export industry

One of the major potential uses of information technology is online education, which provides one means for offering accessible and affordable opportunities to many Australians who are currently locked out of higher education by geography, disability, lack of ability to attend the campus, and cost. Unless Australia establishes a leading online education industry with the emphasis on quality, millions of dollars and highly-skilled jobs for Australians will be lost overseas. Due to our expertise in distance learning, Australia is currently strong in online education. Already, a number of Australian universities offer extensive courses online and have incorporated online elements into their day-to-day activities. Australia must take full advantage of the head start we have established and become a world leader in online education at both university and school levels. But online university education must not be an alternative to providing proper levels of funding for existing universities. It should be one of a variety of learning environments for students to choose. Online education is only worthwhile if there is a commitment to providing high-quality courses and teaching, and if it replicates many of the strengths of traditional universities, such as one-on-one teaching and broad subject offerings across all disciplines. Governments must ensure that the benefits of online education are available to all Australians, not just those who can participate in a fee-paying market.

Recommendation 8

Australia must aim to become a world leader in online education at all levels within the next few years, winning at least 10 per cent global market share of revenue. Achieving this will require:

- ensuring that courses are as good as, if not better than, those offered in traditional formats;
- upfront investment to create quality online courses and retrain teachers and academics in their effective use;
- developing a leading online education content industry and encouraging the industry to adopt leading-edge methods of online marketing and distribution to attract students;
- research into the most effective online teaching, user interface requirements and online customer service infrastructure;
- improving necessary infrastructure, including access to affordable bandwidth (particularly in regional Australia), adequate computer backbones and digitised libraries;
- financial incentives for students to study online, the availability of widespread public information on courses, and simple 'one stop shop' enrolment processes; and
- ensuring that individual academics, universities, TAFE colleges and private vocational education providers benefit from the creation of intellectual property.

The Connected Learning Community - John Paul College, Brisbane

[John Paul College](#), a co-educational P-12 school in Brisbane, recognised in the early 90s the changing dynamics of education and the immediate benefits of using Information Technologies as a vehicle to enhance teaching and learning outcomes and deliver its

student-centred philosophy of education. This has now developed into one of the world's largest school computer Notebook programs and an internationally recognised exemplar of integrated teaching and learning delivered through a technology program which sees over 1800 staff and students using their notebooks and an online curriculum on a lesson by lesson basis. The College has recognised that, for its students, learning is no longer confined to the hours and walls of a classroom, but rather, takes on a global and multicultural perspective as students become active participants in developing our knowledge economy through collaboration with teachers, parents and the wider community. This new reality is reflected in the College's vision, near to completion, of a Connected Learning Community. New technologies have been implemented to facilitate anywhere, anytime learning. These include wireless connectivity throughout campus to both the Internet and College information learning portals, the introduction of a learning management system, Encarta Class Server (ECS) to facilitate the development of interactive digital content and deliver online curriculum, student personal and public web pages and email accounts, and web cameras in classrooms.

A Virtual Private network from home provides access to all school community members. Underpinning the program is a massive commitment to professional and curriculum involvement which is critical to the ongoing success of the program. This blending of infrastructure, access, knowledge and empowerment of students, teachers, parents and the community are features that distinguish John Paul College as an example of a 21st Century learning community. The next stage of the College vision will be realised when the College launches its myjpc.com community gateway on July 26 2001 by Paul Lucas, the Queensland Minister for Innovation and Information Economy.

myjpc.com is the central knowledge gateway of the JPC connected learning community. It will link students, teachers, parents and the community to:

- Administrative information such as attendance, College calendars, daily notices;
- Results from co-curricular activities such as golf, hockey, netball and rugby;
- Study hints for students and support mechanisms for parents;
- Hot sites - educational, sporting, cultural, financial;
- Video conferencing and chat groups for special interest groups, parents, students and alumni;
- Community professional training sessions in technology that provide certification such as the International Drivers' Licence;
- An email account and web site for each family in addition to student and staff accounts;
- Community Virtual Shopping mall;
- Community Radio station; and,
- Web streaming of major College events.

Online Universities and TAFE - making lifelong learning a reality and creating a new export industry

Online education is regarded as one of the crucial areas of content development for the Internet. Unless Australia established a leading online education industry, overseas institutions will fill the void and we will miss the opportunity to create thousands of skilled jobs for Australians.

- Many of the world's leading universities, including Stanford, Princeton, Yale and Oxford, have recently combined to offer online courses.
- The Massachusetts Institute of Technology (MIT) is offering its curriculum to the world free of charge as an incentive to attract international students to its courses.

- The Blair Government is establishing a UK [eUniversity](#) and extending the principle to vocational education through its [University for Industry](#).
- The United States Army - a large-scale educator - has established its own [online university](#) to provide tertiary education to its members.

Online learning is already an established part of traditional campus-based teaching in all tertiary institutions, particularly the world's leading universities, such as Harvard, with lectures webcast, tutorial discussions held online, and written work submitted electronically. In fact, by using ICT, universities and VET providers can potentially increase the level of interaction between students, tutors and lecturers. The conversion of library holdings into digital format - an essential feature of online universities - holds the promise of easing the problems associated with increasingly crowded and understocked libraries. In short, online learning is about helping existing universities and VET providers do even better the things they already do. Australian tertiary institutions are in the vanguard of this change. The following table lists just some of the online initiatives currently under way, particularly at joint university and TAFE institutions.

University of Southern Queensland

Has a subsidiary - [USQ Online](#) - that provides courses in Nursing, Commerce (including MBA) and ICT degrees.

Central Queensland University

Is currently developing 3 online degrees.

Edith Cowan University

Has a virtual campus, that provides tutorials, chat rooms, reading lists, etc.

The University of Ballarat

Has a subsidiary - [UBOnline](#) - that offers a wide range of online courses.

Charles Sturt University

Provides tutorials, chat rooms and teleconferencing for students.

Newcastle University

Has a [subsidiary](#) that provides postgraduate courses.

Murdoch University

Has a subsidiary - [Murdoch Online](#) - that offers 23 postgraduate only certificates, diplomas and degrees across 3 faculties - social sciences, humanities and education, science and engineering, and business, information technology and the law.

The University of New England

Provides 300 online courses through a subsidiary [UNE Online](#).

La Trobe University

La Trobe has a [Centre for Online and Multimedia Education Technologies](#) that works with teaching staff to develop online courses and improve the use of ICT in campus teaching.

The TAFE Virtual Campus

[TAFE VC](#) is an umbrella shopfront for online courses at Victorian TAFE campuses.

U3A

[University of the Third Age](#) has an online presence. These are not-for-degree, leisure courses. Other institutions are combining with the intention of bundling courses for delivery through large international Internet/datacasting companies, spreading the risk across a number of universities. The opportunity exists for Australia to become a world leader in online university education.

Key industries 5: A medical export industry

Australia produces world-class medical services and we have developed innovative ways to deliver these services across vast distances. Our health system is particularly good in training our health workforce, including workers in the speciality areas. There is a high demand for our medical expertise in the Asia-Pacific region and with appropriate support, these services can be exported, providing important revenue that will enable our own services to be further enhanced. Done properly, the development of a major medical export industry can be a win-win for Australia, improving the health of Australians while creating thousands of well-paid jobs. Such an export industry must, though, build on the further improvement of Australia's system of universal health provision. A large proportion of the health sector, such as hospitals, is under the control of government(s), and certainly much of the rest of the sector is influenced heavily by government policies. The Commonwealth and State Governments, therefore should take the lead in transforming the sector and encouraging the development of international markets for those areas in which we are competitive. Many countries around Australia do not have the high-end services available here, but their populations are prepared to pay for them. The high costs of health care in the United States and some European countries, possible alternative suppliers, makes Australia very competitive. A key area of opportunity is telemedicine. Developments in telemedicine pioneered in Australia provide significant export opportunities. Telemedicine can now be used to transmit x-ray images and scan images, view pathology slides from remote sites, and conduct face-to-face consultations in real time. Australian hospitals are already using telemedicine links to provide Australian cancer patients with access to multidisciplinary tertiary cancer specialists thousands of kilometres away without having to travel vast distances. The technology also enables specialists to provide online guidance and support to doctors and health workers in small communities, thus improving the quality of care and preventing unnecessary travelling and referrals. Super-specialty areas of medicine require significant throughput to keep them at the leading edge of developments and experience. In some speciality areas, Australia is not a sufficiently big catchment area. Therefore, to be successful these areas have to look to establishing centres of regional excellence. Singapore, a recent mover into super-specialties, has recognised this and is funding its centre of excellence to significant levels. This is a major growth area in high value added services. If Australia does not act decisively, there is the risk that some super-specialty areas will exit the country to locations that support their objectives.

Recommendation 9

Australia should develop and implement a strategy to make Australia a leading provider of health services to the Asia-Pacific region. This strategy should include:

- developing and marketing medical, paramedical and nursing training programs for the international market, utilising all the latest education tools including online learning;
- funding and administrative support for the development of super-speciality centres of excellence in Australia, which are directed at the international market as well as the Australian market;
- supporting areas of strength in Australian medical research, such as tropical medicine;
- further developing the nation's telehealth capacity and marketing these services internationally; and
- establishing relationships with surrounding countries so that Australia can sell complex medical treatment for their populations, enabling Australia to lock into a leadership position in the region in those areas in which it is world competitive.

A Year-12 school retention target

There is a mistaken view that the Knowledge Nation is only about universities and scientists. Knowledge Nation is about raising the standard of education at every level. In the twenty-first century, everyone will require access to post-compulsory education of some kind. A highly educated and trained population is the foundation of an effective Knowledge Nation. A vital step, therefore, must be to create a better education system, with opportunities for all.

This will require a massive reinvestment programme in schools, universities and vocational education. Australia's educational performance must be raised dramatically, starting at the level of primary and secondary schools. Year 12 retention rates are stagnating in the low 70 percentage points range, down from almost 90 per cent in some States at the start of the 1990s. Retention rates are significantly lower in public schools than private schools. While Australian students perform above average in international measurements of maths and science, we must aim to be at the top of these tables. There is concern that the situation is actually worse than these tables suggest; in the knowledge world, average will not be good enough. A starting point for improving our education and training system must be a steep rise in Year 12 equivalent retention rates and ensuring that the remaining people gain a post-compulsory education qualification that will improve their prospects of gaining a well-paying job.

Recommendation 10

Australia must ensure that by the year 2010, a minimum of nine out of ten young people leave their teens with a Year 12 equivalent qualification, and that all young Australians achieve a formal education or training qualification at the post-compulsory level.

Revolutionary Improvements to our Schools

Achieving these targets will require thorough overhaul and modernisation of our education system, with significantly increased funding. We do not need just little changes; we need revolutionary changes. Our aim must be to ensure that all children, regardless of their parents' wealth, have access to a quality education and the same chance to achieve their full potential. To compensate for disadvantage, our best schools should be in the poorest areas. We must assist and encourage all schools - government and non-government - in innovating and sharing with other schools their successful ideas for improving teaching, developing new curricula and utilising new learning technologies. Creating the Knowledge Nation will depend largely on the professionalism and dedication of Australia's teachers. They are one of our nation's most important assets. We must value them and give them the resources they need to fully develop the nation's knowledge potential. Achieving this will require the Commonwealth to play a far more direct and

active role in improving outcomes in Australia's public schools. No longer can the Commonwealth afford to be a remote funder of primary and secondary education.

Recommendation 11

The Commonwealth and the States should overhaul and modernise Australia's schools by:

- increasing the proportion of Commonwealth money going to public schools and funding non-government schools on the basis of need;
- raising school participation through a targeted program that tackles the causes of disadvantage;
- creating more linkages and co-location between schools and universities, including ongoing teacher skill development programs and mentoring programs for disadvantaged high-school students;
- investing in the creation of a modern teaching profession through ongoing training and re-training programs, providing financial incentives to teachers to upgrade their skills and qualifications, and, in partnership with the States and Territories, raising the standing of the teaching profession, particularly in critical areas of shortage such as science and maths;
- making ICT literacy a core component of learning alongside literacy and numeracy by providing ongoing training for teachers in the use of ICT in the classroom, ensuring there is a national educational Internet portal for all schools and members of the community to use, expanding 'cyber libraries', making Internet access more affordable for all schools, and encouraging schools to develop and share high-quality online curricula; and
- providing children, from kindergarten through to Year 12 with a variety of experiences, encouraging a spirit of curiosity, excitement and their capacity for conceptual thinking to make linkages, form judgments, and to feel a sense of empowerment in a variety of disciplines, including language, music, art, sport, mathematics and communications.

Coffs Harbour Senior College - a revolutionary approach to public education

Coffs Harbour Senior College (CSHC) is a part of the Coffs Harbour Education Campus which combines the senior college with a campus of the North Coast Institute of TAFE and a campus of Southern Cross University. The senior college offers students access to a very wide range of facilities allowing for a variety of different approaches to study. It offers an adult oriented learning environment in which students are encouraged to take greater personal responsibility for their own learning. This approach has proven highly successful. Retention rates have improved markedly and in 1999 60 percent of CSHC's year-12 students won a place at university - a result twice the State average - and another 13 percent went on to TAFE. Students have a wide choice of subjects for their year 12 Higher School Certificate (HSC) studies, including vocational courses which contribute both to their HSC studies and formal TAFE certificates. For example, in 1999 the college developed new course arrangements allowing students to complete Information Technology and Child Studies courses and receive both credit towards HSC and a TAFE Certificate Level III. Students can also take units from Southern Cross University - in areas like Information Technology - as part of their HSC.

End the tertiary education funding crisis

The most visible effects of our national investment crisis can be seen in our universities and TAFE colleges. Libraries are being overwhelmed, student: staff ratios have increased, and research infrastructure needs renewal. Funding pressures are forcing our universities to neglect core enabling disciplines within

the fields of science, engineering, the social sciences and the humanities. Our universities and TAFE colleges need a reinvestment and modernisation strategy based on increased funding for core activities, new programs, such as those to boost online education, and incentives for people to enrol in key Knowledge Nation disciplines.

Recommendation 12

The Commonwealth should tackle the university funding crisis by:

- boosting the number of university positions by an amount necessary to meet industry needs and maximise Australia's capacity as a Knowledge Nation by 2010;
- significantly increasing overall public funding of universities, including base operating funding, so they can continue to provide quality education and attract the best academic staff;
- improving staff development opportunities in universities;
- providing more incentives for people to study science and mathematics;
- reviewing HECS to ensure it does not act as a financial barrier to students, particularly mature-aged students and those from lower socio-economic backgrounds; and
- ensuring that all universities have the capacity to identify their own priorities and specialities from within the suite of national priorities and not be forced into a one-size-fits-all model.

A stronger vocational education and training system

VET has two functions in a Knowledge Nation - improving equity and enhancing innovation. The overwhelming majority of those who will be in the workforce in ten years time are existing workers. If these workers are to participate in the Knowledge Nation rather than be condemned to increasingly temporary and insecure employment, there must be specific initiatives to increasing their access to vocational education and training. Such employees need access to education and training to improve their capacity to adapt to technological and workplace change and improve their opportunities in the labour market. As a recent report has stated, VET plays a vital role in enhancing innovation by ensuring that those who actually make products and provide services have skills and knowledge to translate innovation into real productivity gains. Despite this, VET has not been included in the Howard Government's innovation statements. (40)

(40) V Fitzgerald (March 2001) *Skills in the Knowledge Economy: Australia's National Investment in Vocational Education and Training*, The Allen Consulting Group p1

Recommendation 13

Australia's vocational education and training system should be strengthened by:

- increasing funding to TAFE, targeted towards strategic industries and skills and those in the community who are in danger of being excluded from the Knowledge Nation;
- ensuring that employers increase their level of investment in employee training that will lead to national qualifications;
- requiring companies restructuring their business to provide adequate notice and allow staff time off to participate in recognised education and training;
- improving vocational education and training in the workplace by adequately resourcing vocational education and training at the industry and enterprise level and further developing industrial partnerships through Industry Training Advisory Boards and the Australian National Training Authority; and
- creating strong quality assurance mechanisms for vocational education.

Invest in early learning

The Taskforce believes that if Australia is to become a Knowledge Nation we must invest in all our

citizens from the earliest possible age. We have the capacity to make the Knowledge Nation vision a reality for all Australians born in the twenty-first century. This requires a government that focuses on the early years of each Australian child's life. The latest neurological research shows that the most sensitive period of brain development in children occurs in utero and in the first three to six years of life. This early period of brain development is critical to the wellbeing of our community; not just in physical and mental health, but also in literacy and numeracy. (41) Research also shows that health and early relationships with care givers influence infant brain development. The evidence suggests that children who lack at least one attentive and consistent care giver, such as a parent or skilled child-care provider, are at risk of suffering severe and long-lasting developmental problems. The message coming from the growing literature on early childhood development is clear. What happens in the first three years of a child's life strongly influences that child's performance at school, whether he or she will work and in what kind of job. The lesson of the research is that if governments want to enhance children's life chances they must promote affordable, quality childcare that provides a positive early childhood experience. Governments should also aim to help parents balance work and family life, and provide other supports where appropriate, ranging from financial assistance, family services, and parenting advice. There is now overwhelming evidence that if you get the platform of child and family services right you have fewer adults who cannot read, fewer spending time in prison and fewer without work. Australia should not waste talent and lives in this way. The evidence suggests that each dollar invested upfront can save up to seven dollars in the long run. (42) Unfortunately, Australia currently lacks an integrated set of Commonwealth, State, and Local Government-funded services for children and families. It needs such a strategy now.

(41) MN McCain and JF Mustard (1999) *Reversing the Real Brain Drain: Early Years Study Final Report*. Toronto, Canadian Institute for Advanced Research p7 (42) Schweinhart et al (1993) *Significant benefits: The High/Scope Perry Preschool Study through age 27*. Ypsilanti, MI: High/Scope Press

Recommendation 14

The Commonwealth Government should develop a comprehensive National Early Assistance Strategy for Australia's children and families, encompassing all levels of government and local communities. This strategy should be developed with the State and Territory Governments and be designed to deliver services such as:

- effective and accessible high-quality childcare and early childhood education, especially in lower income areas, in both the cities and the country, which enables parents to balance work and family life and promotes early childhood development;
- home visiting, or similar outreach programs for families with newborn children;
- linked family and community centres;
- locally responsive social security and employment services;
- linked community health services; and
- coordinated information and support services, including telephone advice lines for parents.

Rebuild the ABC

The Knowledge Nation is not just about education and industry; it is about deepening and broadening the culture of the whole community. To be an intelligent country, boundaries have to be pushed and the conventional wisdom challenged. Commercial networks do not seek to do this, and the ABC cannot do it well enough in its current emaciated state. The task requires the existence of a well funded and independent national public broadcaster. The most effective way to achieve this is to adequately fund the ABC, enabling the creation of new Australian content, boosting the production of educational programs in science and the humanities, and making the ABC a leader in the digital TV revolution.

Recommendation 15

Provide an adequate level of funding for the ABC as the quintessential Australian portal and to ensure a

well resourced, genuinely independent and truly national public broadcaster. In particular, to ensure that adequate funding exists for the production of popular, original, world-class Australian drama, comedy and current affairs programming that may not otherwise be commercially self-sustaining in small markets such as Australia.

A plan to tackle the 'brain drain'

Every year thousands of highly educated young Australians leave Australia to work abroad, and many educated people migrate to Australia. Australia benefits enormously from this two-way exchange. Not only do we gain many new skilled workers, Australian researchers return with valuable experience, knowledge and commercial contacts that can be used to the benefit of the nation. Despite this, the Taskforce believes that more must be done to encourage more Australian researchers to return home. While Australian Bureau of Statistics (ABS) figures show that Australia is numerically a net importer of skilled professionals generally, (43) we are losing too many quality business people, academic and scientific researchers in key fields because of lack of opportunities here, and too few are returning to share their experience and contacts. For instance, nine Australian medical researchers, including Nobel Laureate Professor Peter Doherty, work in just one American research institute- the St Jude Children's Research Hospital in Memphis, Tennessee. We need them and thousands of others like them to return to Australia. We also need many scholars, researchers and business people of international calibre and from other nations to choose Australia as a place to live and work. The brain drain problem will only be fully addressed in the long term by creating a vibrant Knowledge Nation with dramatically increased levels of funding and research activity. Turning around the drain of talented Australian business people overseas will also be a long-term exercise that will depend on our ability to create competitive new industries that can offer high rewards. However, the difficult nature of this exercise cannot be an excuse for doing nothing. Urgent action is needed. To start the process, Australia needs a concerted public and private sector campaign to get more Australian educated researchers in key fields to return home. Other countries such as Ireland and Canada have tackled this problem by creating joint public and private funded commercial research positions and university research chairs. Australia should adopt a similar approach.

Recommendation 16

The Commonwealth should create an inventory of all recent Australian graduates with research degrees who are living abroad, and a register of resumes and contact details for private sector employers. It should also create at least 1000 additional publicly and privately financed commercial and university research positions to enable those wanting to return to Australia to do so and to attract leading scholars and researchers from other countries and researchers to move to Australia to live and work.

(43) ABS 3412.0, February 2000.

A National Information Policy

Equitable access to information is a prerequisite for an inclusive Knowledge Nation. Access to information in Australia is currently very poor. Too much information is not publicly available, and much of what is made available through agencies such as the Australian Bureau of Statistics is prohibitively expensive. Many universities and scientific businesses and organisations cannot afford to purchase access to the world's scientific, humanities and social science databases. Australia needs a National Information Policy to ensure access and equity in securing knowledge and to guarantee that information is available as a public good, outside commercial exploitation. Our principle should be that information paid for by the Australian people through their taxes should be readily available to all Australians. As a part of this, all Australian students, academics and researchers should have access to the leading research databases across all disciplines, including those in digital form, through a coordinated funding approach to national information infrastructure. This access should also include all universities, TAFE colleges and major public libraries. In the era of lifelong learning, all citizens need access to knowledge and information

throughout their lives. Every citizen should have access to the world's knowledge through an online virtual bookshelf easily accessible through public libraries, educational institutions and at home via the Internet.

Recommendation 17

There should be a National Information Policy to ensure access and equity in securing knowledge, to set out the rules by which information will be available as a public good, outside commercial exploitation, and to provide the basis of public policy that will be applicable to new technological developments. This policy should ensure that:

- There is wide public access to the world of knowledge, including leading scholarly journals and other publications, through public libraries, education institutions and at home via the Internet, provided to the nation through the aggregation of the Commonwealth and the State's purchasing power.
- Important ABS data is free of charge to those who need it.
- There is adequate public consultation and debate on ethical and human rights issues, including disability access, privacy and security, which arise as we move towards a society where more confidential information than ever before may be in an accessible electronic form.

A Population Policy

In the face of increasing global competition for knowledge and skills, Australia should develop a national population policy that plans for future skill needs in existing and emerging industries and builds the right age profile for future economic development. Shorter-term immigration programs must be an addition to, not a substitute for, developing the knowledge and skill capacity of Australia's existing population. To maximise our human capacity, we must value the contributions of everyone and reject the prevalent negative connotations of ageing. Australia has about 2.3 million older citizens in the Third Age who are physically fit, mentally alert, and not welfare dependents. We must recognise people in the Third Age as an underused resource with much knowledge and wisdom to contribute to the creation of a Knowledge Nation.

Recommendation 18

Australia must adopt a National Population Policy that is based on a national, rational debate about Australia's carrying capacity and the implications for resource use; relies on an adequate database drawn from the cadastre; and distinguishes population policy (inevitably long term) from immigration practice (decisions made year by year). As a matter of urgency, visa processes for highly skilled scientists and technicians must be streamlined and overseas students with sought-after skills must receive greater encouragement to remain in Australia. Australia should also do more to use the experience and knowledge of people of the Third Age.

Improve the position of the humanities, social sciences and the arts in Australia

In becoming a Knowledge Nation, Australia must not adopt an overly instrumental approach. If we are to become an innovative society as well as a modern economy, we must not replace the richness of a broad and deep education for 'knowledge' that concentrates only on science and 'skills', important though these are. The education system must remain broad and encourage basic as well as applied research, and the humanities as well as the sciences and skills training. Vocational courses, too, should emphasise problem solving and communication skills in a broad social, cultural and economic context, in addition to teaching basic competencies. The pressures of commercialisation must not be allowed to weaken the intellectual integrity of our universities. Every school and tertiary institution should be enabled to participate in scientific and technological education, and also to study the ethical and environmental implications of these developments. Unfortunately, over the past decade the relative position of humanities and social

science faculties has deteriorated. Student:staff ratios in the humanities and social sciences have increased by 19 per cent and 14 per cent respectively. There are few entry-level positions for academics due to an increasing casualisation of the academic profession, leading to the loss of a whole generation of humanities and social science researchers. The humanities' share of ARC funding for Large and Small Project Grants has declined. The picture is illustrated by looking at the changes in the number of teaching staff between 1990 and 2000 in the departments of history and philosophy in the universities that comprise the 'Group of Eight' (Australian National University, Adelaide, Melbourne, Monash, the University of New South Wales, Sydney, The University of Western Australia, and Queensland) (see Table 11).

TABLE 11: Teaching staff at the Group of Eight universities 1990-2000

| Departments | 1990 teaching staff | 1995 teaching staff | 2000 teaching staff |
|--------------------|----------------------------|----------------------------|----------------------------|
| <i>History</i> | 200 | 174 | 139 |
| <i>Philosophy</i> | 65 | 89 | 72 |

Source: the Commonwealth Universities Handbook for 1990, 1995-96 and 2000.

While not of themselves definitive evidence, these figure suggest a clear trend - there has been a dramatic fall in full-time employment in these disciplines, especially since 1995. The expansion of the university system to create a Knowledge Nation must include a corresponding improvement in the position of the humanities and social sciences. The Howard Government's neglect of the arts, most significantly through cuts to the Australia Council, the ABC, and film and television, has put great pressure on one of Australia's most innovative and creative industries. There was not one mention of the creative industries - the arts - in the Howard Government's innovation statement. Governments must recognise the importance of authors, journalists, historians, poets, playwrights, designers, software developers, dancers, composers, musicians, visual artists and others to 'innovation' and the 'knowledge economy'. These creative industries need to be nurtured through adequate public funding.

Recommendation 19

The humanities, social sciences and creative industries in Australia should be strengthened by:

- creating extra entry-level positions for a new generation of humanities researchers and lecturers in our universities;
- a reasonable share for the humanities and social sciences of funding increases for research through the ARC;
- creating partnerships in the humanities and social sciences to explore the commercial application of these disciplines and boost the creation of educational content;
- a renewed national effort to boost second language training;
- strengthened government support for the arts and creative industries through funding for the ABC, the Australia Council, the nation's galleries and other important public institutions; and
- humanities and social science representation on the Prime Minister's Knowledge Nation Council, which will replace the Prime Minister's Science Engineering and Innovation Council (PMSEIC) (see Recommendation 20).

New government structures to implement change

One of the factors holding back the creation of a Knowledge Nation is the failure of government to coordinate policies across departments and between Commonwealth, State and Local Governments. To

assist the Prime Minister in the task of leading the creation of a Knowledge Nation (see Recommendation 1), Australia needs a whole-of-government approach to this problem. New structures will be needed, but these must occur within the context of a greater coordination effort within and between governments. An important first step should be making the Prime Minister the Minister for the Knowledge Nation, supported by a cross-cutting Knowledge Nation Unit in the Department of The Prime Minister and Cabinet to develop and implement cross-departmental programs towards an agreed Knowledge Nation strategy. Government advisory structures must be changed to provide the Prime Minister and the government generally with wider sources of advice and help make connections. As a starting point, a Prime Minister's Knowledge Nation Council with participation by scientists, educators and researchers across the knowledge spectrum, manufacturers and experts from emerging industries should replace the existing PMSEIC. This must be done in the context of a strong effort to build additional linkages between government departments and State, Federal and Local Governments. Creating the Knowledge Nation will need a coordinated effort between Commonwealth, State and Local Governments to improve education outcomes, solve environmental problems, maximise the benefit to the nation of investment in emerging industries, and ensure that all parts of Australia benefit. To achieve this goal, the Council of Australia Governments (CoAG) must be given a wider role.

Recommendation 20

To drive the creation of the Knowledge Nation across government(s) the Commonwealth should:

- adopt a whole-of-government approach to the creation and commercialisation of knowledge;
- elevate the importance of science within the Commonwealth Government and make the Prime Minister the Minister for the Knowledge Nation;
- broaden PMSEIC into a Knowledge Nation Council, with the full resources of a Knowledge Nation policy unit within the Department of the Prime Minister and Cabinet; and
- ensure that CoAG maximises the overall benefit to the nation of strategic investment in knowledge-based infrastructure, including school funding, university research investment, environmental management, and public health provision and research.