SUBMISSION TO THE
HOUSE OF REPRESENTATIVES STANDING COMMITTEE
ON INNOVATION INQUIRY: *"PATHWAYS TO INNOVATION"*

DEPARTMENT OF COMMUNICATIONS, INFORMATION TECHNOLOGY AND THE ARTS' ROLE IN INNOVATION IN AUSTRALIA

The Department of Communications, Information Technology and the Arts (DCITA) has responsibility for a wide range of issues which impinge heavily on innovation in, and the efficiency of, the Australian economy. One of this Department's major objectives is to contribute to the establishment of efficient and effective communications infrastructure through its responsibilities for postal and telecommunications services, management of the electromagnetic spectrum, and broadcasting services. This infrastructure plays a critical role in underpinning efficiency across the economy and providing opportunities for innovation.

Coupled with these responsibilities, the Department has a range of other responsibilities concerned with national policy issues coming under the heading of the 'information economy' and for information and communications technology (ICT) industry development. These go directly to the contribution that the information economy and ICT can make to innovation and efficiency of the national economy. In addition through its cultural affairs responsibilities the Department has interests that impinge on opportunities for innovation arising from the increasing digitalisation of content. These opportunities are being encouraged through the Government's Digital Content Industry Action Agenda.

Developments in each of these areas are being heavily influenced by rapid technological change, particularly in ICT. As a result the department has a strong interest in the rapid development, and pervasive influence, of ICT as a general purpose technology in enabling economic and social development. Because of these responsibilities, and because of the long-term significance of the information economy, DCITA has been an active contributor to deliberations on innovation policy. In particular, DCITA has undertaken substantial research into the nature of the innovation system and the impact of ICT on productivity and economic growth in Australia. To assist the Committee in its deliberations, a brief overview on the process of innovation is in **Attachment 1**.

DCITA has also contributed to the two *Backing Australia's Ability* packages and to the associated report on the *Mapping Australia's Science and Innovation*. DCITA is one of five portfolios involved in the implementation and delivery of measures under the *BAA* packages. DCITA was also a major contributor to the Government's development of a world class investment vehicle (the Venture Capital Limited Partnership model) for the Australian venture industry and retains a critical interest in the availability of finance for innovative Australian companies.

ICT AS A SOURCE OF INNOVATION AND PRODUCTIVITY GROWTH

ICT, broadly defined, plays a central role underpinning economic activity in general and in enabling innovation in particular. ICT plays this central role because it is radically improving our capacity to collect, analyse, utilise, distribute and exchange

information and to organise economic and social activities, abilities that underlie all human activity. ICT is not only changing the way we communicate, it is revolutionising the way key services are delivered in the private and public sectors, the way defence services and national security arrangements are organised, business, the way scientific research is undertaken, the way health and education services are delivered, the way people care for each other and the way people play. Importantly, this technology also has wide scope for further significant improvement and elaboration. In addition, ICT is applicable across a very broad range of uses, it has the potential for use in a wide variety of products and processes, and it has strong complementarities with existing and potential new technologies.

The profound economic and social changes being effected by ICT are widely seen as being comparable to the 'disruptive' effects of the industrial revolution. This 'disruptive' transformation has been described in Australia by the term the 'information economy' and others have called the 'knowledge economy' or the 'networked society'. An information economy is not a separate 'new' economy – it is an economy in which the rapid development and diffusion of ICT-based innovation is transforming all sectors and aspects of society. This is a long-term transformation and one of the most important innovations in historical times. It has only just begun.

Australia has begun the transformation to an information economy well. In particular, ICT has significantly enhanced our productivity growth in recent decades (see **Case Study 1** on ICT-based innovation in the Australian manufacturing sector). Australia's continued ability to harness the power of the information economy will significantly influence its long-term economic prosperity, international competitiveness, national security, social cohesion, cultural richness and the ability to innovate. Australia's Strategic framework for the Information Economy 2004-2006 provides the policy platform needed to address these challenges. This Framework seeks to:

- Explain the challenges and opportunities and why they are important to government, business and the ordinary citizen;
- Show how the policy response is linked to wider national priorities;
- Demonstrate that the policy response is coherent across all levels of government and with our global peers; and
- Set out priorities and strategies over the three years of the Framework.

Meeting the associated challenges will require:

- Growing dependence on sharing knowledge and information between individuals, communities and organisations to coordinate economic and social relationships;
- Institutionalisation of continuous innovation, productivity improvement, and education and skills formation; and
- Openness to the global economy through trade, investment and exchange of information, knowledge and skill.

These influences will ultimately be reflected in new business models, new industry structures, new kinds of social interactions, and new forms of regulatory arrangement. These technologies will do much more than make business and personal communications more efficient. They will allow businesses and consumers to bring together integrated information transactions and services that will cut complexity and cost out of whole sectors of the economy.

With the fall in prices for computing power and increasing sophistication of software and communications systems, ICT has been adopted widely across economies. Countries are investing heavily in ICT-based innovations and ICT R&D, and new waves of ICT-based technologies are widely anticipated.

These challenges need a coherent response, comparable with that of our global peers. In particular, the provision of a highly innovative and effective communications infrastructure has a key role in enabling innovative industry, government and science. The communications network originally developed for voice communication now supports a much wider range of communication services, including audio, video, and financial transactions, while the Internet now provides a new international information infrastructure. These services are expanding rapidly. Thus the provision of high bandwidth capacity throughout the country is essential if we are to realise the full potential of this rapidly developing technology and the associated services. Indeed, broadband capacity will underpin future connectivity requirements of the whole economy, especially in respect of content delivery and service delivery more generally.

Digital technologies have also transformed the way in which text, data, audio visual and other content is created, managed, stored and distributed. The process of digitisation and the associated integration of technologies has led to the transformation of the information, communications and entertainment sectors and the emergence of new clusters of technologies, products, industries and users.

However, the application of digital technologies, the creation and manipulation of digital content and resultant industry transformations are not only restricted to the traditional content sectors of the economy. They also reflect shifts occurring in the wider economy where digitisation and digital content are increasingly associated with innovation and are adding value to industrial processes and production in areas such as design, production, marketing and sales.

Indeed, we are seeing the development of the communications network into a secure, interoperable and ubiquitous transaction environment, underpinned by a commoditised Internet Protocol infrastructure that will increasingly operate as a utility industry with growing similarities to the traditional utilities. Complementing this connectivity is the work that DCITA is undertaking on e-commerce standards, spam, internet regulation, and security. This regulatory activity underpins the development of a secure, reliable electronic transactions environment essential to innovation in many sectors.

THE CONTRIBUTION OF ICT TO THE INNOVATION PROCESS

ICT is also a critical part of the innovation process itself. Computer modelling has increased R&D efficiencies and ICT has provided the foundation and support for the creation of new tools. The biological sciences, for example, are currently undergoing a profound revolution, based largely on the use of genomics data and IT advances.

ICT is also enabling a major innovation in the way in which scientific research is conducted. e-Research, as it is called in Australia[1], involves a greatly enhanced capacity for large-scale, distributed, global collaboration in research, providing a new level of scope, scale and detail. It includes access to very large data collections, complex simulations, high performance visualisation, and virtual research organisations among geographically distributed researchers.

While relatively new as a structured concept, e-Research is starting to underpin all scientific disciplines including the social sciences and humanities. Because scientific and technological research underpins much innovation and our ability to absorb new technologies, this enhanced capacity for research has the potential to create a virtuous cycle of innovative activity. It is also emerging as a significant element in advancing the Information Economy more broadly because of the strong symbiotic relationship between e-Research and the information economy more generally.

Australia's ICT industry also has a role to play in meeting those challenges and as a source of high value added products and services. Though small by global standards this industry remains a very important part of the Australian economy. ICT production capability creates a symbiotic relationship between users and producers such that the level of sophistication of users is enhanced by the presence of producers of ICT goods and services. Indeed, the development of major applications in user industries is a significant form of ICT production in its own right. These developments are blurring the distinction between ICT production and use, a distinction that is yet to be adequately reflected in standard statistical measures (see **Case Study 2** on SME ICT Innovation and Production).

Nevertheless, the Australian ICT industry faces significant challenges under the influence of globalisation and the rise of China and India as significant ICT producers. The development of a world-class public and private ICT research base with critical mass is an essential component, not only of our ability to effectively deploy this technology as highly effective users, but also as highly competitive producers of ICT goods and services.

AUSTRALIA'S INVESTMENT IN ICT R&D AND INNOVATION

In 2002-03 business invested $2.15 billion in ICT R&D (36.4% of total private sector R&D)[2] – one third of this was invested by non-ICT businesses and two thirds by specialist ICT firms. Australia has been among the leading countries in business uptake of ICT. Most businesses use computers. In 2003-04, 74% of businesses used the Internet, 25% had a web presence and 12% received orders via the Internet.

While most of the ICT used was imported technology, Australian capability in ICT has been important to achieving significant productivity gains and generating new ICT-based products, services and methods of production.

Public sector investment in R&D was $0.35 billion in 2002-03. Some of Australia's ICT centres have established international reputations and there have been some

[1] While the term is used interchangeably with "e-science", the use of "e-research" emphasises its broader application.
[2] ABS cat 8126.0

commercialisation successes. (For example, see **Case Study 3** on Commercialisation of R&D: Radiata).

However, according to the 2003 mapping of Australia's science and innovation system[3] "investment in the development of strategic ICT capability is low, which may weaken the innovation base and the future competitiveness of the economy." Initiatives, particularly some from *Backing Australia's Ability,* will add to the public ICT R&D base, particularly through the establishment of a world-class centre of excellence in ICT (National ICT Australia, NICTA).

GOVERNMENT SUPPORT FOR THE ICT INDUSTRY

The Government's strategy for the ICT industry builds on the 1997 *Investing for Growth* strategy which targets the *environment* for ICT industry growth, emphasising the importance of strong leadership, attending to fiscal and competition settings, getting Australia online, and addressing market failures through general programs (eg the Innovation Investment Fund and R&D start programs administered by DITR).

Operating within and building on this context, the 2003 Framework for the Future report, "Enabling our Future", was developed as a shared industry, government, research community understanding to provide a guide for the key elements which are necessary to support the longer term development of the ICT industry and national ICT capability[4]. In particular, "Enabling our Future" recognises the changing nature of the ICT industry, where ICT is becoming so integrated into products and services across the economy, that traditional approaches to descriptions of the industry are being challenged.

The Framework recommended maintaining, and in some cases strengthening, policy settings to provide a long-term consistency of approach to developing Australia ICT capability, improved coordination of ICT-related initiatives and better integration of ICT into the national research infrastructure. Building innovative firms was a key focus as well as skills development, and attracting and retaining foreign investment. The report also highlighted the need for priority attention to communications infrastructure and associated standards development to overcome impediments to both research and commercial use of advanced networks.

DCITA is working with industry, the research and education sector and Government departments and organisations to implement the recommendations of the report (a summary of the recommendations is at **Attachment 2**).

Some sectors of the industry are working on action agendas. The Electronics Industry Action Agenda, which was launched on 3 September 2003, sets a ten-year vision with recommended actions for developing a sustainable and globally competitive electronics industry in Australia. The development of a Digital Content Industry Action Agenda was announced on 6 February 2004.

---

[3] *Ibid* p 15

[4] http://www.dcita.gov.au/__data/assets/word_doc/10229/Enabling_our_Future.doc

DCITA's programs supporting ICT innovation are set in the context of support for the science and innovation system through measures such as *Backing Australia's Ability.*

- The creation of NICTA through *Backing Australia's Ability,* aimed to achieve critical mass and focus for Australia's ICT research effort and complements ICT R&D undertaken in public research organisations such as CSIRO, DSTO, the universities and the Cooperative Research Centres.
- The Advanced Networks program is designed to strengthen the advanced communications infrastructure used by the research community complements the Australian Research and Education Network.
- The ICT Incubators program identifies and supports potential high growth ICT start-ups.
- The ITOL (IT Online) program catalyses the adoption of e-business solutions across industry.

DCITA INNOVATION RELATED PROGRAMS

ICT Centre of Excellence – National ICT Australia Ltd (NICTA)

Research is a significant contributor to innovation and is a major source of intellectual property that can be commercialised. Also, given the strategic importance of ICT to all sectors of the economy, a strong national capacity in ICT research is a foundation to the national economic growth.

The Australian Government has committed $380m to June 2011 for the ICT Centre of Excellence program. The program is being delivered by National ICT Australia Ltd (NICTA)[5], which signed a funding deed with the Australian Government in October 2002. NICTA is an independent, not-for-profit company, with its four founding members - the University of NSW, the Australian National University (ANU) and the NSW and ACT governments - each committing about $20m in cash and in-kind over five years to June 2006, with further contributions to be determined for the period to 2011.

The Government's objective for NICTA is that it will be a world-class, world-scale ICT research and research training institute that takes Australia's ability to create and exploit information and communications technology to a new level. The Centre's four core objectives are to:

- develop within Australia ICT *research* capabilities in existing and emerging fields;
- increase the availability within Australia of ICT research skills by providing postgraduate *training* and attracting ICT researchers from overseas;
- exploit for the benefit of Australia the *commercialisation* of research outputs; and
- become a catalyst for the development of ICT industry *networks* and clusters.

NICTA's research facilities and education program have grown rapidly since its establishment in 2002. At 31 December 2004 NICTA had some 155 researchers working on over 30 projects at four laboratories, and over 130 PhD students. NICTA will reach full operational level by December 2007 when its five laboratories (two in

[5] http://nicta.com.au/

Sydney, and one each in Canberra, Melbourne and Brisbane) will have 260 researchers working on over 50 projects across 17 programs.

The Centre's objectives include that it commercialise its outputs and assist the development of the Australian ICT sector, particularly SMEs. NICTA has to date lodged provisional patent applications and NICTA is spinning off a company, GreenPea Software, which is seeking venture capital and expertise to commercialise mobile middleware technology.

NICTA has established the basic infrastructure for its prospective commercialisation and linkages with the local ICT industry. These activities include:

- the development of an Intellectual Property framework for its research;
- the appointment of a commercialisation and IP manager;
- the systematic scanning for commercialisation opportunities for its research outputs;
- development and delivery of a program of IP commercialisation training and awareness across NICTA for its researchers and students;
- an Entrepreneur-in-Residence program involving an individual who has a history of successful venture capital backed, start-up company development, together with extensive experience and connections with investors and potential industry partners. NICTA has already selected its first EiR, Andreas Jonsson, who is working to commercialise GreenPea's technology;
- an industry leaders program, which provides experienced business developers with a short-term opportunity to work with the NICTA commercialisation team on a variety of projects, including evaluating spin-out opportunities, participating in commercialisation activities (such as market research or writing a first-cut business plan), and exploring opportunities for NICTA's technologies;
- recruitment of liaison officers to engage with SMEs on NICTA's research activities and capabilities and to seek commercial opportunities;
- establishment of a website subscription service to allow firms to register an interest in NICTA's programs and activities and receive relevant online updates;
- regular interactions with business through a variety of forums to improve mutual understanding of activities and needs of NICTA's work and SMEs' requirements; and
- the establishment of a Roundtable process, in conjunction with CSIRO, DSTO and ICT CRCs, providing a platform for improved coordination of research and linkages with industry.

Advanced Networks Program

As indicated in the opening paragraph of this submission the establishment of an efficient and effective communications infrastructure is one of this Department's major objectives. The Australian Government's $60 million Advanced Networks Program (ANP) is directly intended to contribute to this goal. It supports three projects, CeNTIE, GrangeNet and m.Net, to develop, trial and demonstrate advanced experimental networks and to support R&D using the networks as testbeds for innovative applications.

The projects have directly engaged Australian industry and public sector organisations in using the infrastructure for the development of commercial products and for the improvement of business processes. In addition to the consortium partners, including multinational and local ICT businesses, telecommunications carriers, universities and other public research organisations, the projects have worked with businesses and institutions in a wide range of sectors, including health, education, media, finance and transport. The ANP projects have supported more than 10 PhD students to date.

The Government's investment of $60 million is being supplemented by over $120 million in cash and in-kind contributions by the consortium members of the three projects. Over $47 million is being invested in advanced network infrastructure, including nearly $25 million of Australian Government funding. The remainder of the funding supports e-Research and the development of new leading edge broadband applications.

CeNTIE and GrangeNet provide multi-gigabit optic fibre networks linking research institutions in Perth, Melbourne, Canberra, Sydney and Brisbane. CeNTIE and GrangeNet interconnect to form a national research backbone from Brisbane to Perth.

m.Net is an advanced third generation '3G' wireless network based in Adelaide, with nodes in Whyalla, Melbourne and Sydney, and a wireless local area network testbed in Adelaide, enabling research into broadband wireless network technologies and applications.

Innovation

At the network level, the ANP has already delivered major innovations, such as building the first very high capacity (10 gigabits per second) network in the southern hemisphere and a patented new technology for traffic management on long-haul optical networks.

Some examples of innovation using the advanced network infrastructure are:

- CeNTIE has worked with the film post production industry to build an advanced high speed network linking the industry cluster in Sydney. This network allows companies to test new collaborative, parallel work processes which have led to significant time savings during film projects and helped create critical mass to win work on large projects. The project also has demonstrated a collaborative editing application between post production houses in different parts of Australia;
- CeNTIE has demonstrated a teaching model using networked haptic technology (simulating feel) for temporal bone dissection (a surgical procedure required for cochlear implants). CeNTIE is collaborating with Stanford University Medical School with an aim of conducting long distance teaching trials for surgical training using the haptic tools;
- GrangeNet and the Australian Institute of Sport have developed a sports training initiative using high-speed digital information transfer, which is being piloted at the AIS for swimming coaching;
- GrangeNet and the PARADESIC project, a collaboration between three universities which is digitising and storing fragile recordings of thousands of endangered Asia-Pacific languages and music, are researching methods for

meaningful access to the very large data set, requiring intelligent data transport systems, complex data management and rights management for access;

- GrangeNet experimental activities include wavelength reservation/cloud by-pass for high volume projects (e.g. in astronomy, particle physics, bioinformatics and research based video delivery systems); application of novel protocols; development of distributed, network-attached storage; and the access grid for high quality video and data sharing between multiple sites;
- m.Net's Gallery 4 initiative is providing rich media content developers with development support and facilities for testing new applications and services for wireless and mobile broadband environments. Gallery 4 facilitates commercial outcomes for the subscribing companies and assists with the commercialisation of Australian applications in international markets;
- m.Net and local company Medical Communications Associates have developed and trialled HealthSpring, a telemedicine application using wireless technology, with a portable handheld PC communicating with a pathology database, allowing improved access to medical test results by rural medical practitioners when working outside their general practice surgeries, for example when providing services to the local hospital or visiting patients in residential care facilities. Further development of the application supported by the Telstra Broadband Fund has been successfully completed.

Commercialisation

Commercialisation of some key innovations is underway and more is expected as the research conducted on the networks expands and matures. The examples to date come from CeNTIE and m.Net; GrangeNet's activities are more in the domain of public institutions and may not lead so directly to commercial outcomes.

- CeNTIE's patented optical network traffic management technology "time-sliced optical burst switching";
- The Virtual Critical Care Unit ViCCU™ uses digital video over IP technology developed by CeNTIE to allow a specialist to guide and interact with a team at a remote hospital via a high capacity broadband link that transmits very high quality video, sound and digital images. The system has been in operation linking Blue Mountains Hospital in Katoomba with Nepean Hospital in Penrith since November 2003 and has proved to be very successful both in improving patient outcomes and providing professional support to the medical staff. The ViCCU™ won the 2004 AIIA iAward for *Implementation – Telecommunications*, and is being commercialised;
- CeNTIE and Nortel Networks have collaborated to develop the "Extranet on Demand" product and are now examining its commercialisation prospects. This product allows film post-production companies to collaborate using secure, high-capacity network facilities created by the users for the duration of any specific project;
- CeNTIE has developed a browser for video content, Aida™, based on CeNTIE's Annodex™ software used to mark up video content in the same way that text is currently marked up for Internet browsing. A mobile phone version has been trialled on m.Net's network and several discussions on commercial use have taken place;
- A trial and subsequent commercial launch by ACTION buses in Canberra of miniTRAN, a location-based mobile service developed by Adelaide company

Kukan Studio under m.Net's Gallery 4 initiative, described above. MiniTRAN allows a user to receive SMS messages indicating where and when public transport is available. m.Net provides Premium SMS gateway services to deliver miniTRAN;

- m.Net has established a commercial "premium SMS gateway" which provides a conduit for application developers to multiple mobile networks on a fee for service basis, providing a pathway to market for Australian SMEs. The gateway will extend to the marketing of rich media services as Australia's 3G mobile networks expand over the next year or so. Examples of mobile services offered commercially include online competitions, news, sporting and entertainment information, horoscope and tarot services, ring tone downloads and lottery and real estate information;
- m.Net has also launched a subscription-based sports results service in partnership with AAP and Network Ten.

ICT Incubators Program (ICTIP)

The $122m (in total) ICT Incubators Program provides a direct pathway to innovation. The program is providing funding of $36 million to 2007-08 to eight incubators across Australia through *Backing Australia's Ability – Building our Future through Science and Innovation.* This program is an extension to the BITS Incubators Program which provided $78m to ICT incubators on mainland Australia and the BITS Intelligent Island Program which provided $8m of funding to an ICT incubator in Tasmania. These incubators provide seed capital, business advice and mentoring to promising ICT start-up firms with the aim of accelerating their growth and development.

A number of incubatees in the program have been recognised for winning industry awards, securing ongoing venture capital, achieving export successes and making technological breakthroughs.

Case Studies 4 and 5 show how the ICTIP can assist SMEs in the ICT sector achieve a pathway to commercialisation. Further case studies and information on ICT start-ups in the program can be obtained through the ICTIP web page on DCITA's website, DCITA's DATA magazine and in previous BITS Incubator Program annual reports.

Information Technology Online (ITOL) Program

The Information Technology Online (ITOL) program is an Australian Government funding program administered by DCITA designed to accelerate the national adoption of e-business solutions, especially by small to medium enterprises (SMEs).

The ITOL program encourages industry groups and small business to identify and adopt commercial uses of the internet to support productivity and profitability. The program is a catalyst for industry groups to work collaboratively to solve common problems on an industry wide basis, rather than working individually and developing multiple solutions and in some cases unnecessarily duplicating efforts. The preferred e-business solutions are open and inclusive for all participants.

Since 1996, about $12 million has been allocated to 110 projects across a diverse range of industry sectors including agriculture, health and pharmaceutical, building and construction, automotive and welfare groups. These projects have been located in regional and metropolitan areas and in all Australian states and territories.

The following are two successful stories of Australian technological innovations supported by the Australian Government through the ITOL program.

Collaborative B2B for SMEs in the Mining Industry

The project *Collaborative B2B for SMEs in the Mining Industry* was to address the need for SMEs to be able to trade electronically with both their larger trading partners who were enabled for e-Business already, as well as their trading partners who had no present e-Business capability. The project delivered two (2) products, namely TradeRoute™ a B2B "middleware" solution appropriate for SMEs, and TradeForms™ an advanced Web services based solution for electronic trading with partners who previously used manual methods such as fax, email and post.

Overall, the desired outcome was to enable the SME to trade more effectively with a much higher percentage of their trading partners, both large and small. A specific goal of the SME Supplier was to lift their service level performance in order to offer excellent customer service, which would improve and consolidate the trading relationships with their customers and suppliers. The e-Business solutions, TradeRoute and TradeForms resulting from this project have delivered both tangible, measurable benefits, as well as benefits that are harder to quantify but are significant nevertheless.

The project was developed by, XML Yes Pty Ltd, in collaboration with MSA (Australia) Limited, PT Newmont Mines, Quadrem International, IBM Australia and Mincom.

Global Electronic Invoice Presentment and Payment

The project *Global Electronic Invoice Presentment and Payment* was to develop an export e-commerce service trusted by both exporters and importers that can be secured simply and cost-effectively over the Internet without paperwork or time delays. The secure service provides reliable cross-border, multi-currency invoicing and payment capabilities designed for small business exporters and importers.

Only 31,000 of 1.1 million Australian SMEs are exporters. To effectively buy and sell goods worldwide, importers and exporters must have an effective, efficient way to send and receive payments. They need cost-effective logistics services to ship goods and track shipments globally. They need to meet cross-border regulatory and compliance requirements and make their businesses scalable for global trading without large upfront investments.

The MyExports portal is a platform to enable businesses to ramp up their global trading without increasing staffing or any technology investment. Allowing overseas buyers to pay from their bank accounts in their local currency at no cost can increase

sales by making it simple and convenient. Australian sellers can avoid the high costs and risks of credit card payments with a flat AUD$5.50 per payment received.

The project was developed by Payment Pty Ltd, in partnership with Australian Trade Commission and Danzas Pty Ltd.

Case Study 1 - ICT-based innovation in the Australian manufacturing sector

A recently commissioned research study into the use of ICT by "non-ICT" manufacturers has revealed the powerful influence ICT has on business innovation[6]. Based on interviews with managers in industry the report found there was pervasive exploitation of ICT throughout the manufacturing sector in all aspects of the value chain – research, product development, production, supply and distribution, customer relationships and post sales service. ICT is also found to be extensively used in corporate management and administrative support functions.

A key finding is that innovation in the application of ICT has a significant impact on productivity and profitability. ICT is a significant enabler of product, process and business model innovation within the manufacturing sector so that the clever use of ICT and incorporation of ICT becomes a product and service differentiator.

The availability of digital information was found to be one of the direct drivers of innovation. It is enabling new management arrangements and the development of new business models. For example, geographically dispersed supply chains can be monitored and controlled through ICT. Overseas supplied enterprise software often requires further developments of specialised production facility based intelligence systems and process execution systems in order for to achieve the full potential of ICT in industry and business specific operating environments.

The report found that the Australian manufacturing sector relies on a strong Australian capability in the ICT services sector that is capable of implementing, customising and developing software in the Australian industry to support both breakthrough and continuous innovation in manufacturing businesses.

Manufacturing focussed industry-university cooperative research centres were identified as playing a significant role in supporting the hidden use of ICT. The research outputs of many centres are ICT software, hardware, tools and products designed for use in manufacturing processes.

The study concludes that, as the pervasive impact of ICT grows, ICT is likely to become a less easily distinguishable cause of improved productivity and performance. The paradox which arises is that the stronger the productivity impact of ICT, the harder it is to measure the impact. It also implies that existing studies under-estimate ICT's role in transforming manufacturing.

---

[6] *Digital Factories: the Hidden Revolution in Australian Manufacturing*, Howard Partners, (in draft), April 2005.

Case Study 2 - SME ICT Innovation and Production

There has been a significant underestimate of the widespread innovation in, and production of, ICT and other goods and services with embedded ICT by Australian firms.

A recent Sensis report for DCITA on ICT production in Australian SMEs[7] found that 16% of SMEs across the economy were involved in one or more facets of production of ICT goods or services and that 89% of firms involved in ICT production were not specialised ICT firms. Based on the sample of 1800 SMEs, Sensis estimated that the total amount of revenue from the production of ICT goods and services by all SMEs for sale or for own use was about $15.5 billion over the 12 months to April 2004. SMEs were also estimated to be contributing at least $850 million in ICT exports.

This performance reflects widespread innovation by SMEs exploiting ICT. The role of ICT innovation is also reflected in the prevalence of ICT producing SMEs as exporters – over a quarter (26%) of ICT producing SMEs were exporting compared with 16% of all SMEs. SMEs in the ICT sector were even more likely to export (29% of firms).

The Sensis survey has revealed part of the contribution of ICT to national innovation performance and the related competitiveness of business. Further research is required to understand the importance of ICT research to innovation.

[7] Sensis Business Index, ICT Production in Australian SMEs, November 2004. (http://www.dcita.gov.au/ict/ict_industry_information/ict_production_in_australian_smes)

Cade Study 3 - Radiata

The success of Radiata Communications, a high-speed wireless networking start-up company, is underpinned by excellence in R&D, a long-term investment in basic research, inter-personal networks, active business leadership and a groundbreaking technology that reached the market ahead of its competitors.

Radiata was formed in 1997 to commercialise development work that had been undertaken by CSIRO and Macquarie University in wireless local area networks (LAN), and in response to the market potential that had been created by a new international standard (IEEE 802.11a) in wireless LAN. R&D into wireless LAN began at CSIRO in the late 1980s, building on the radio-astronomy research program that had been developed over several decades, and which as a result had established networks of researchers with strong links to industry.

In 1998, Radiata obtained an AusIndustry R&D Start grant of $750 000 that enabled the company to complete an early, working prototype of its technology. Over the following two years, Radiata developed the first integrated wireless LAN chip that conformed to the IEEE 802.11a standard, and this achievement generated significant interest from a number of large US companies.

In 2000 the company was bought by Cisco Systems in a deal then valued at $US295 million, as part of Cisco's move into wireless networking. The move resulted in Cisco locating its wireless LAN research hub in Australia in order to capitalise on the strength of Radiata's research capabilities. At the time, Radiata was one of a small number of companies with the capability to produce a single chip solution for 802.11 networking, and the acquisition enabled Cisco to secure a prominent place in the wirless networking arena. However, with the maturing of the market for wireless chipsets and the erosion of margins, Cisco decided to wind up the operations of Radiata in 2003.

One of the founders of Radiata, Dr Neil Weste, who left Cisco prior to the winding down of Radiata, has gone on to form g2 Microsystems, a wireless technology venture focused on the Radio Frequency ID (RFID) market. The new venture has managed to attract substantial interest from investors, including the successful closing in 2005 of a $US6 million investment round with new investors Starfish Ventures and return backers DB Capital Partners, the private equity and venture capital arm of Deutsche Asset Management (Australia) Ltd.

The strong track record of G2's founders, built up as a result of their involvement in Radiata, was a deciding factor in securing investment capital. DB Capital was quoted as saying that it was the Radiata "pedigree" of G2's founders that played a significant role in convincing it to invest in the start up at an earlier stage than normal[8]. G2 Microsystems demonstrates the significance of serial entrepreneurship, where successful teams of entrepreneurs build on the experience and knowledge from previous companies to develop other successes.

[8] Australian Venture Capital Journal, June 2004, pg 15

Research being done at the University of Cambridge's Centre for Entrepreneurial Learning has shown the historical significance of relationships between researchers, industry and investors in the rapid growth of Cambridge's high tech precinct or "Technopole", and the importance of continuing to encourage and capitalise on these relationships if new technologies and new ventures are to flourish[9]. The success of Radiata clearly illustrates the importance of relationships between individuals in the development and growth of successful companies, and the potential importance of those relationships to new ventures.

[9] S. Vyakarnam et al, "Entrepreneurs and Entrepreneurship as key drivers of the Cambridge Technopole" Paper presented by Shai Vyakarnam at the Second AGSE International - Entrepreneurship Research Exchange 10-11 February 2005, Melbourne.

Case Study 4 – ICT Incubator Programme: Windspring

Zentronix developed intellectual property in data miniaturisation technology (DMT) using informal sources of capital – family friends and personal savings. DMT is an innovative and unique data miniaturisation technique and encoding algorithm that has been proven to dramatically improve the speed of access to text files, databases and vector-based images, and significantly minimise the electronic storage requirements of data on storage devices.

In mid 2003, Zentronix invited BlueFire (now known as Divergent Capital), a Sydney-based investment and incubation business under the BITS Incubator Program, to conduct a due diligence on its DMT and review an application for early-stage investment funding.

BlueFire considered whether the technology was innovative, non-imitable and whether its proposed first generation of applications, in the areas of storage area network (SAN), wireless networking and remote computing fields, could follow a realistic pathway to commercialisation.

BlueFire considered that Zentronix had a genuine break-through in the field of compression and that DMT was a unique (and patented) technique for the reduction of lossless data in data streams. It also considered that there was a significant need in the international market for lower storage costs and higher speed transmission for the massive data repositories being built by organisations around the world. Zenotrinx's Windspring was able to provide working demonstrations of order-of-magnitude jumps in this area.

Having appointed a CEO and a chairman with significant experience in technology commercialisation, BlueFire decided to lead a capital fund raising round of $900 000 to fund its migration to the United States.

On the re-launch of the business in San Jose, California, further capital fund raising was undertaken that netted a further US $2.8 million (AUD $4.2 million) at a valuation uplift of about 80 per cent within three months of Zentronix reaching the United States.

In 2004, Zentronix renamed itself Windspring, accomplishing significant milestones, filling out its management team, releasing its first fully commercial product, and engaging Motorola, Microsoft, and Qualcomm in partnership and distribution relationships.

Further information on Windspring can be found at *www.windspring.com*

Case Study 5 – ICT Incubator Programme: Mediaware Solutions Pty Ltd

The three founders of MediaWare Solutions were senior research scientists at the CSIRO Division of Information Technology. The founders worked on a successful project to develop a general toolkit to allow content searching of MPEG video. Moving Picture Experts Group (MPEG) is a standard method of transmitting digital video and sound in a compressed format using less bandwidth than the traditional analogue method. The founders licensed the background technology from CSIRO and founded MediaWare Solutions in 1997. MediaWare subsequently acquired ownership and all rights to the original technology from CSIRO in 1999.

The founders subsequently developed an MPEG technology platform to cover decoding, encoding and editing in addition to the content-based searching. With the MediaWare products, large unwieldy digital video files become easily accessed assets for marketing, entertainment and information retrieval. The MPEG tools deliver fast visual indexing, scene and shot separation with standard still frame output for integration into database systems and networked video browsers as well as powerful stand-alone MPEG video processing. The technology is Internet ready and is compatible with existing and emerging industry format standards.

MediaWare Solutions has since released a series of products on SPARC/Solaris and PC/Windows platforms: MPEG-1 and MPEG-2 editors, transcoders, a video asset management tool and a range of specialised components for integration into defence and broadcast market Original Equipment Manufacturer (OEM) solutions.

The MPEG digital video market is growing rapidly. MediaWare's software development resulted from an increasing customer demand for access to MPEG video over the Internet and intranet. The volume of MPEG-1 and MPEG-2 content available on the Internet is constantly increasing—to make the data useful the end-user required technology that enabled this data to be sorted, edited and accessed through existing browser technology. The MediaWare solutions are adaptable to networks and offer both local and distributed solutions for media access. The software allows a significant level of interactive media manipulation regardless of the bandwidth available to the customer.

MediaWare Solutions was accepted into the Epicorp incubator in February 2002 and graduated in June 2003. BITS funding of $450 000 was provided over a period of six months on the meeting of established milestones.

MediaWare Solutions received assistance from Epicorp to:

- recruit key personnel including a CEO and marketing personnel—these appointments were crucial to the company's development from an R&D-based company to a commercial enterprise;
- develop strong corporate governance policies and establish an operational board;
- develop a commercialisation strategy, including clearly defining the product lines and the services being provided;
- develop the company forward financing plan; and
- develop a network of contacts to raise additional funds.

MediaWare Solutions has supplied its technology to a number of major defence and broadcast companies including the Australian Department of Defence, Raytheon (United States), General Dynamics, Thomson, Lockheed Martin, CBS, CNN, SBS and ABC (US). MediaWare Solutions also sells to digital video OEMs such as N2BB and Pathfire and has competed for a number of major overseas-based tenders while updating its range of products. Today over 95% of its revenue is sourced from the US.

In April 2005, MediaWare Solutions announced that it was expanding its recently opened office in Washington DC on the back of winning a significant contract with the US navy to supply video processing software for Unmanned Aerial Vehicles (UAVs). Its technology is used by the US forces to capture, download and manipulate video while still in a compressed form providing savings in time and bandwidth resources.

MediaWare's technology has also been included as part of a consortium which is currently tendering to supply the Australian Army with pilotless aircraft.

Further information on MediaWare Solutions can be found at *www.mediawaresolutions.com.*

Attachment 1

Key features of Innovation and Innovation Systems

Innovation is the key to long-term international competitiveness, faster economic growth and better living standards, and offers the best prospect of meeting the productivity challenge posed by our aging population.

In the context of rapid change, the rising importance of knowledge and skills, globalisation, and increasing customer sophistication, other countries are using innovation policy, including information economy policy, to position their economies along higher growth trajectories.

Competitive advantage resides not only within the firm but is shaped by the external environment. Improving competitiveness, therefore, becomes a collaborative process involving multiple levels of government, companies, educational institutions and institutions of collaboration.

The increasing efforts of our competitors means that over-reliance on a fast follower strategy is unlikely to close this gap.

In such an environment, policy learning becomes important particularly as policy actors are significant in innovation systems, and policy interventions face high levels of uncertainty.

What is Innovation?

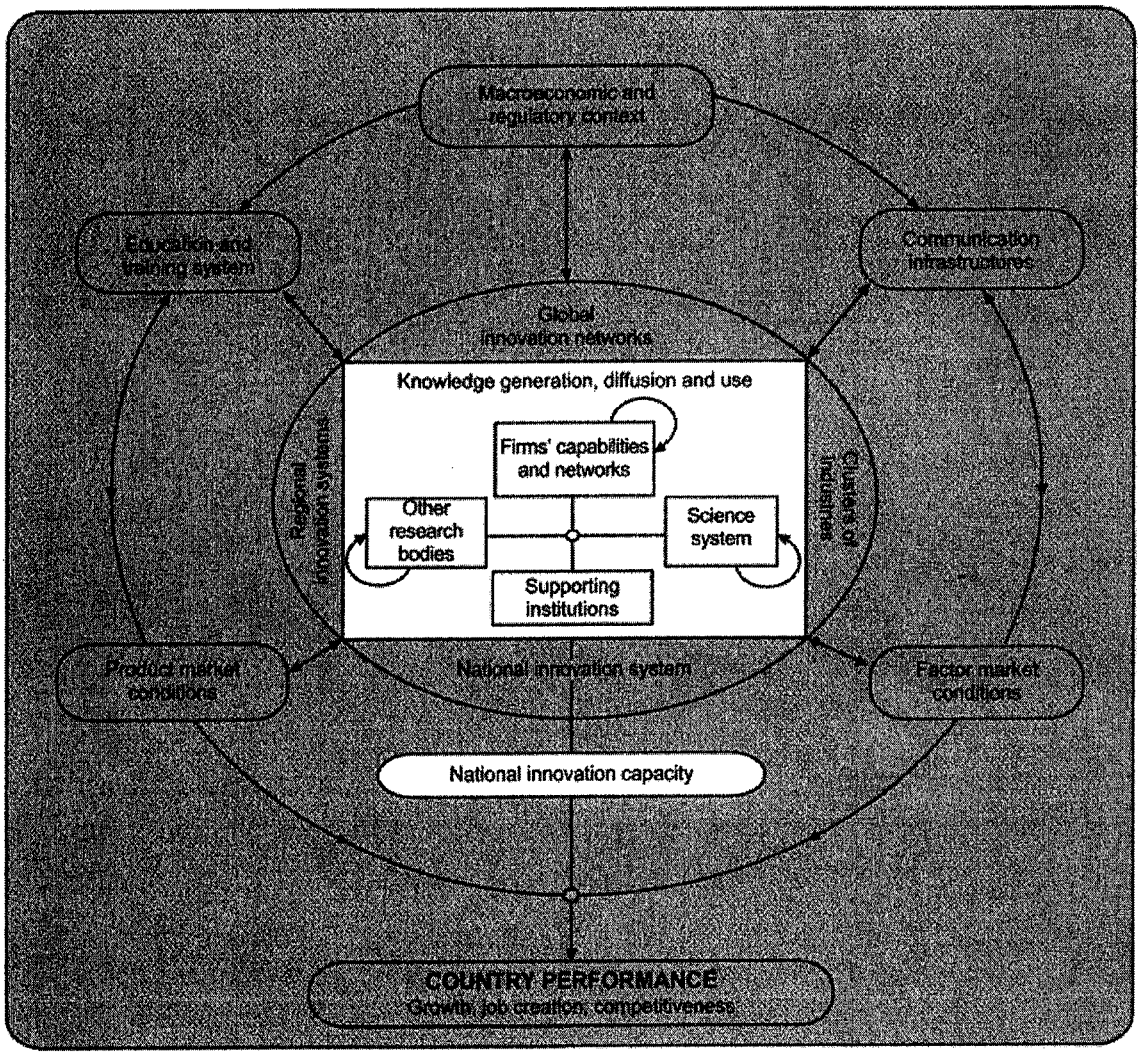
Innovation is a complex, creative, adaptive, symbiotic, learning process whereby knowledge and new ways of generating additional value are developed and applied either through product, process and organisational innovation. It is a complex, interactive, and interdependent social process, characterised by continuous feedbacks rather than linear transitions. It is also continuous rather than intermittent, in which capability and performance develops cumulatively over time.

Innovation depends on the accumulated array of learning and investments in the economy over time, including the past technological sophistication of firms and the size of the technical and scientific workforce. Consequently, a country's or a region's industrial and innovative capacities tend to be path dependent with significant barriers to moving to a trajectory. In particular, increasing returns reinforce path dependency by benefiting prime movers rather than latecomers. Also innovation involves occasional major transitions, as technologies change in discontinuous and fundamental ways.

It impacts across the economy and, consequently, innovation policy is not just about, or even primarily about, high-technology industries. Innovation arises in numerous domains, including in products, processes, marketing, services, management and use. There is a danger that a concentration on high technology industries can obscure important processes of knowledge creation and innovation across the economy.

Industrial sectors in many countries are reorganising themselves under the influence of innovation.

Because innovation is the result of a complex, emergent system, it cannot be modelled in a reductionist way. Thus, while elements of the system are necessarily described in a serial fashion, it is important not to take these descriptions as implying linear causal relationships. In particular, it is not generally true that the lines of causality flow from science to technology, to commercialisation, and then to use, though it can be true in particular cases. The OECD has used the follow diagram to illustrate the complex interactions involved in the innovation system.



Consequently, innovation cannot be immediately identified with particular inputs such as the level of R&D (though it is agreed that the level of R&D is important to the system) or with particular output measures such as MFP growth. For these strong conceptual reasons, the innovation system and policies impacting on it, have to be considered in a holistic fashion. Firms do not innovate alone, but by interacting with customers, suppliers, competitors, consulting companies, technological institutes and universities in ways that are complex and uncertain but which seeks to exploit knowledge and reduce risk. The relevant knowledge is distributed across many sectors and agents.

Australia seems to show a relatively high-level of path-dependency, which is only slowly generating sustainable new paths of technological accumulation. While we have emerging new firms and niches, there are few major new trajectories.

Commercialisation is only one important method of extracting economic benefit from innovation. The OECD has modelled the complex interactions

What does creating a competitive innovation system involve?

It is accepted that knowledge and innovation are characterised by significant market failures, justifying government action to create a competitive system which appropriates the benefits for Australia. An effective, competitive system requires each of the following elements, and a failure in any one element can degrade the performance of the whole system:

1. A cultural environment supportive of creativity, good design, quality consciousness, innovation, enterprise and entrepreneurship. This involves:
    - Promoting these values throughout society and discouraging stereotypes that undermine them. Such values provide the social capital underpinning the system and their promotion is an investment in a public good.
    - Providing adequate social recognition and material incentives.
    - Removing structural barriers to resource, knowledge and people flows between research institutions and firms,
    - Effectively managing the risks to researchers and entrepreneurs,
2. Specialised competencies across the system, and their successful integration:
    - economically useful knowledge is the complex outcome of interactions between many knowledge-producing agents, and its creation and management is a problem of systems integration.
    - user competencies, eg by encouraging leading edge use.
    - marketing competencies,
    - design and quality competencies– important but neglected elements in the innovation process
    - production competencies.
    - distribution competencies.
    - managerial competencies.
    - competencies in financing innovation.
    - entrepreneurial competencies.
    - technological competencies – involves different, though complementary, complex knowledge bases from science, including tacit or practical knowledge which can only be acquired from experience in particular contexts.
    - creating the knowledge infrastructure particularly a strong education sector that keeps abreast of current developments.
3. Strong linkages between users, customers, suppliers, producers, and the knowledge base.
    - particularly by building geographical concentrations of the above competencies, technology-based firms and the institutions supporting knowledge creation and transfer.
        - spatial proximity is important in promoting competition pressures, interactive collective learning and trust among networks of firms and

other knowledge producers, and creates the capacity to assemble fragmented and tacit knowledge, maximising knowledge spillovers.
    - clusters increase the level of productivity of constituent firms, the capacity for innovation and productivity growth, and stimulate and enable new business formation – all in a virtuous cycle.
    - they often involve direct foreign investment.
  - an innovative business sector emphasising rapid technology uptake, business process improvements and knowledge assets and management.
  - a sufficient number of innovative large and small firms to capture the benefits of innovation.
    - a lack of innovating Australian –based firms, particularly in areas matching our public research efforts, has been a major weakness in the Australian innovation system. In particular, we have few large R&D intensive firms.
    - while most SMEs are not innovators, innovating SMEs play a major role undertaking more intensive and original innovations.
    - direct foreign investment by TNCs provides a possible mechanism for technology transfer into Australia and a focus for new Australian-based innovation.
  - Without strong linkages scientific and technical advances can diffuse to other countries faster than they can be exploited at home.
  - Strong linkages to the innovation systems of other countries are also important.
4. Specialisation in selected areas.
  - Australia has a relatively low level of technological specialisation for a small economy.
  - Australia's existing specialisation is in agriculture, primary metals, mining and oil & gas
  - small countries like Australia have little choice but to focus their innovation efforts if they are to achieve any critical mass in any area.
  - this will happen either by accident or by deliberate choice.
  - it makes sense therefore to coordinate research priorities and industrial efforts to a greater extent than in larger countries. In particular, there is advantage to focussing on integration and building capacity in areas of excellence as a platform for growing new knowledge and industries and addressing problems unique to Australia.
  - the existence of economies of scale in innovation efforts implies that Australian firms must either specialise, or develop strong international links, or both.
5. Creating, appropriating and diffusing technologies
  - a research sector that understands the technology necessary to produce knowledge and innovations relevant to Australian conditions, resources and opportunities, and link to new knowledge developed overseas;
  - 98% of technological innovation occurs overseas and much is imported in capital goods or through direct foreign investment.
  - small economies benefit strongly from capturing overseas knowledge and innovation.
6. A robust knowledge base, with higher education and research bodies that have a strong commitment to excellence and a good understanding of the significance of the knowledge base to the innovation system.

7. A globally competitive innovation infrastructure in universities, research organisations etc.
    - appropriate selection procedures are needed to ensure the quality of research and a focus on the areas of greatest value.
    - there are often long time lags involved between investment in science and research and the realisation of directly related economic benefits
    - investment in the creation of high quality human capital
8. Promoting the application of ICT because of its particular role as a general purpose technology in enhancing knowledge creation and transfer, and in enabling innovation in business operations, government processes and society processes more generally.
    - it is increasing the productivity of traditional industries while providing opportunities for new businesses in ICT or based on ICT infrastructure.
    - advances in computing, information storage, software and networking are leading to new opportunities for research in most fields and extending the possibilities of what can be done. ICT infrastructure, particularly advanced networks, will influence the way science is done and provide the basis for the next generation of services.
    - The Department of Communications, Information Technology and the Arts (DCITA) and the former National Office for the Information Economy (NOIE) have completed a number of studies indicating the significant impact that ICT has on productivity and economic growth.
    - The promotion of ICT through studies and Government programs is an important factor in advancing the ICT agenda in Australia.
9. Diversity and flexibility – this means building redundancy into the system with structures with built-in responsiveness to change and new challenges.

Attachment 2

ENABLING OUR FUTURE: THE ICT FRAMEWORK FOR THE FUTURE REPORT - RECOMMENDATIONS

LEADERSHIP

Recommendation
1. Commonwealth, State and Territory governments should work together to articulate ICT goals, and develop and urgently implement strategies to harness ICT to achieve broad national objectives in areas such as health, education and security, and improve coordination of programs. • A meeting of the Online Council (OC) should be convened by the Commonwealth within the next three months to discuss the outcomes and recommendations of this Report, and take the Report's agenda forward, including addressing issues of coordination of ICT strategies and priorities between jurisdictions.
2. A forum of industry leaders should take place within the next three months to: • discuss practical ways in which industry can take forward the recommendations in this report and the Framework agenda; and • develop a plan setting out actions to be undertaken by industry in the Framework's implementation. Industry associations should convene the forum.
3. Governments and leaders in industry, education and the research community should: • recognise the critical enabling role of ICT in improving productivity, driving business efficiencies and supporting innovation, and the importance of a strategic information capability to achieving broad national economic and social goals; • explicitly reflect this role in the development of their organisational strategies and policies, and the implementation of programs to achieve those strategies; and • work together to ensure that Australia's business environment is conducive to fostering ICT innovation, including regularly reviewing and benchmarking innovation strategies against international best practice, and focusing on longer-term initiatives that are given time to make a difference.
4. A meeting should take place in early 2004 between representatives of government, industry, the research community and the education sector, to: • review progress in implementing this Report's recommendations; and • take stock of developments in the ICT sector. It should be convened and coordinated by DCITA and NOIE.

RESEARCH AND DEVELOPMENT

Recommendation
5. The amount and effectiveness of public sector support for ICT R&D should be increased. Governments, research funding bodies such as the ARC, and research performing bodies such as CSIRO, DSTO and universities should: • give ICT a prominent focus in research supported under priorities already identified; • coordinate processes for priority setting and the allocation of resources to ICT R&D, to minimise overlap and ensure consistency of areas identified; and • build scale and critical mass in excellent research, focused on: o areas where Australia has world-class ICT research strengths, or the clear potential to develop them; o areas where there are existing commercial strengths in Australia, or clear potential to create such strengths; and o areas of national interest such as solving problems of importance to Australia.

6. Cross and multidisciplinary research should be encouraged and funded, including in areas where ICT intersects with other technologies.
   - Universities, public sector research organisations, and research funding bodies such as the ARC and the National Health and Medical Research Council (NHMRC) should take steps to facilitate such research including changing funding structures and guidelines if necessary.

7. NICTA, CSIRO and DSTO should provide national research leadership by developing themselves as hubs of ICT research activity, with close links to other ICT research teams, and strong links to industry.
   - These three organisations should coordinate the establishment of a regular round-table of major publicly-funded ICT research groups, including the ICT-related CRCs and appropriate larger groups in universities, to:
     - develop an implementation plan setting out actions to respond to recommendations in this Report in a coordinated fashion;
     - share information on ICT R&D, including international developments, and build relationships;
     - explore ways of more effectively commercialising R&D and linking with industry;
     - coordinate research efforts and priority setting activities; and
     - assist in efforts to build and coordinate ICT R&D infrastructure.

   An annual report on round-table activities should be provided to the Minister for CITA.

8. Commercialisation of ICT research should be a major focus of all publicly funded research organisations, and research funding bodies, in their strategic research planning, and commercial goals should be built into all stages of their ICT research activities. Businesses and industry associations should take action to communicate their R&D needs effectively to public sector research organisations, and engage and partner with those organisations in the development of their commercialisation strategies and the conduct of their ICT R&D.

9. Industry and research organisations such as CSIRO, NICTA, DSTO, CRCs and universities should work together to more fully integrate and embed private sector R&D facilities and centres into the Australian ICT R&D community.

10. The Commonwealth Government should take the lead in exploring options to support joint R&D activities with businesses, as a way of developing the cutting-edge ICT products and services that agencies need to improve agency performance.

INFRASTRUCTURE – CONNECTIVITY

Recommendation

11. The Broadband Advisory Group recommendations—including the role for the Commonwealth Government in developing a National Broadband Strategy, supporting and coordinating e-health and e-education initiatives, and encouraging SMEs to take up broadband services—are broadly supported. The Government should give close consideration to the recommendations of the Regional Telecommunications Inquiry including those relating to access to high-speed data services in regional Australia.

12. Ongoing priority must be given to the continued and coordinated upgrading and spread of advanced research networks, by governments, public research institutions and universities, as a key infrastructure underpinning the development of next generation broadband activities.
    - The role of the Commonwealth in driving the development of e-science should be examined by the NOIE & DCITA.
    - The proposed National Broadband Strategy Implementation Group should consider developing a coordinated national framework for research broadband networks as part of the National Broadband Strategy.

13. Research and development needs and priorities related to the security of Australia's information infrastructure should be identified, and action taken to better coordinate and harness Australia's existing R&D effort related to that security. The Department of Communications, Information Technology and the Arts and the National Office for the Information Economy should work with the Department of Defence (including DSTO) and other relevant Commonwealth agencies on this issue.

INFRASTRUCTURE – STANDARDS

Recommendation
14. Industry-based forums should be established by industry and industry associations to progress practical issues needed to implement an environment of trust for online business and transactions.
15. A framework to guide Australia's involvement in international ICT standards setting should be developed and implemented by NOIE, DCITA and Standards Australia, in consultation with industry. • These organisations should also establish a strategic group with membership drawn from industry, researchers and government to determine which areas of ICT R&D have the potential to yield products for markets where international standards are still fluid, and determine the most appropriate means of shaping standards in those areas.

INFRASTRUCTURE – INTELLECTUAL PROPERTY

Recommendation
16. The Commonwealth Government's review of its Digital Agenda legislation should examine the balance of rights between creators and users in a digital environment, in the context of Australia's future as an information economy, and focus on ensuring that Australia's copyright regime does not hinder innovation and investment. • ICT business leaders and industry associations should ensure that the perspectives of the ICT industry are considered during that review.
17. In relation to government ownership and use of intellectual property (IP): • the Commonwealth should adopt and promulgate management practices for its IP which encourage and maximise industry development, consistent with the management of government IP as a public asset, and should regularly audit their IP to review opportunities for its commercial development; • DCITA, and AG's should ensure that the Commonwealth's information technology IP guidelines are up to date, encourage their widespread adoption and use, and disseminate best practice examples of IP management; • the Auditor-General should conduct an audit of practices adopted by Commonwealth agencies for the management of IP, and report on the extent to which the guidelines are being followed, and whether IP resources are being used efficiently and effectively to achieve government objectives including industry development; and • the Commonwealth should work with State and Territory governments to achieve uniform policies in the use of Crown IP. Recommendation 16(c) of the Broadband Advisory Group, that the Commonwealth should ensure that its IP policies do not act as a barrier to the development of digital content industries, is supported.
18. Industry associations should continue to work with their members, particularly SMEs, to inform and educate them about IP rights and the processes required to protect them, and to provide appropriate assistance services.

SKILLS

Recommendation
19. University and other ICT course providers should: • develop courses and curricula to ensure that students studying in areas other than ICT develop the broader conceptual and practical skills to be ICT-fluent in their own profession; • link ICT and other science and engineering courses at both undergraduate and postgraduate level, so that ICT students are exposed to issues in other disciplines; and • give greater emphasis to the development of business, project management and entrepreneurial skills in ICT students and staff.
20. Tertiary education institutions, individual businesses, and industry associations should work together to: • develop and design more flexible, responsive and targeted courses in ICT to provide for specific industry needs; and • more closely involve industry in education programs, for example through sponsorship, direct involvement in teaching, support for staff exchanges and secondments between industry and education institutions, and the provision of work experience for students.
21. Universities should fully examine the significant structural issues relating to ICT teaching, including the substantial growth in the student-staff ratios and the difficulties in attracting and securing teaching staff in a competitive market, and take action to redress them.

PROMOTING *"TECHNOLOGY AUSTRALIA"*

Recommendation
22. The Commonwealth Government should provide additional investment support, targeted at ICT investments of strategic significance to Australia. There should be a particular focus on projects which would increase Australia's innovation capacity and build strong links into our R&D infrastructure.
23. Australian governments should work with each other and with peak industry bodies to: • adopt well-coordinated, aggressive investment attraction and embedding strategies, which focus on maximising the linkages of MNCs into the Australian economy, to obtain the greatest possible flow through into Australian firms in terms of skills, knowledge and access to global linkages and networks; and • undertake coordinated and sustained efforts to promote Australia's ICT strengths internationally.
24. Local branches of MNCs should expand and develop their role in investment attraction and retention including through: • close involvement with governments in the development and implementation of appropriate strategies; • providing leadership by pursuing those strategies through their overseas linkages; and • ensuring ongoing information flows to head offices.
25. Research organisations and individual researchers should make concerted and coordinated efforts to develop and promote Australia's international profile as a nation with a growing, leading-edge ICT R&D capability. • Such promotion should be a key objective of NICTA, CSIRO, DSTO, the universities and other ICT research organisations, who should report annually on their activities in this area.
26. Better ways of accounting for the total national ICT capability (including ICT capabilities in other industries outside the traditional ICT industry) should be developed and implemented by governments, industry and the research community. • Benchmark data should be identified which demonstrate Australia's strengths and level of competitiveness in ICT, including ICT R&D.

BUILDING INNOVATIVE SMES

Recommendation
27. The Commonwealth Government should keep under review measures to encourage the provision of early stage capital, including recent changes to taxation laws, and the need for any further adjustments to these laws or to programs.
28. Proposals to improve the preparedness of SMEs to undertake their initial market entry should be identified and implemented by governments and industry, to: • facilitate access for SMEs to particular markets within Australia and overseas; and • expand overseas network support for SMEs.
29. Governments should continue to work with industry to make it easier for SMEs to sell to governments and big business by examining issues such as: • access by SMEs to information about opportunities to tender for business; • the structure and complexity of contract documents and other requirements of doing business, the associated costs of providing tenders, and the time taken to evaluate them; • approaches to risk management, and insurance and indemnity requirements; • the extended use of e-purchasing arrangements in order to improve access by SMEs to business opportunities; • consistency of approaches between jurisdictions; and • the use of government purchasing to create reference sites for SME products and services.

NETWORKS AND CLUSTERS

Recommendation
30. State and Territory governments should take the lead in bringing together major focal points of R&D activity and the innovation infrastructure (such as CSIRO, DSTO, NICTA, CRCs, the BITS incubators, and the GrangeNet, CeNTIE and mNet test networks) with potential industry partners, to drive cluster development. • These activities should be coordinated through the Online Council, to ensure that activities are linked and networked across jurisdictional boundaries.

THE INFORMATION BASE FOR THE ICT INDUSTRY

Recommendation
31. Commonwealth, State and Territory governments, working with industry associations, should: • develop comprehensive collections of data about the ICT industry which fully recognise its breadth and pervasive nature and move beyond traditional classification categories; • explore ways of improving the timeliness of ICT statistical collections; and • undertake further work to more comprehensively understand and measure the productivity benefits of ICT across the economy, and its contribution to exports in other sectors. Government involvement in this work should be coordinated through the Online Council.