

**CENTRE for INNOVATIVE INDUSTRY
ECONOMIC RESEARCH Consortium**

**Globally Competitive,
Domestically Undervalued:
The Australian Software Industry &
Vertical Applications Markets**

**Part C Vertical markets 6-8, Export
Analysis and Appendices**

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Acknowledgements

The conduct of a research task such as this cannot take place effectively without the support and freely given time of many people. The consultants wish to thank all of the individuals and firms who assisted us by providing helpful advice based upon their own experiences in software vertical markets, together with industry data and other input, and all the Government and industry bodies who have assisted us to conduct this research and analysis.

They include, in particular:

- State IT Ministers and their staff in Victoria, Tasmania, South Australia, Queensland, Northern Territory, Western Australia, and New South Wales, and officers and staff from the respective departments in each of those states;
- Staff and members of the AIIA, the ACS, Software Queensland, and the Pearcey Foundation, IDC Australia, Whitehorse Strategic Group; and
- Software developers and industry members, from every part of Australia.
- DCITA staff, including Mr. Greg Gurr and Dr. Janet Pagan;

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This report is derived from the original versions of that published by the Federal Govt, DCITA, in Jan 2006

Energy

The market for IT and software within the energy industry can be divided into two very broad groups that correspond with two facets of the industry itself. First, the energy supply side – energy utilities, energy supply and energy distribution. Second, the energy demand side – technologies that are concerned with monitoring and ensuring greater efficiency of energy use. These two broad groups themselves can be divided into a number of sub-segments.

The utilities Market (Supply Side) includes:

- Real time automation and controls (RTAC) – systems for monitoring and controlling generation, transmission, distribution, and other utilities' infrastructure;
- Geospatial and Field Automation Solutions (GFAS) – systems for mapping, facilities management, outage management, and workforce management;
- Asset Management Systems (AMS) – systems that manage the lifecycle, repair and maintenance of expensive infrastructure;
- Billing and Customer Information Systems (BCIS) – systems that manage the interaction with customers; and
- Trading and Risk Management Systems (T&RMS) – systems for trading in energy prices and such activities as emission credits trading and assessing probabilities and risks that have an impact on financial exposure.

The Energy Efficiency (Demand Side) includes:

- Energy efficiency in the built environment – systems used to design, monitor or assess energy consumption in buildings;
- Operational efficiency – systems to monitor and optimise or improve energy consumption in industrial processes; and
- Demand management – systems to monitor and control energy demand.

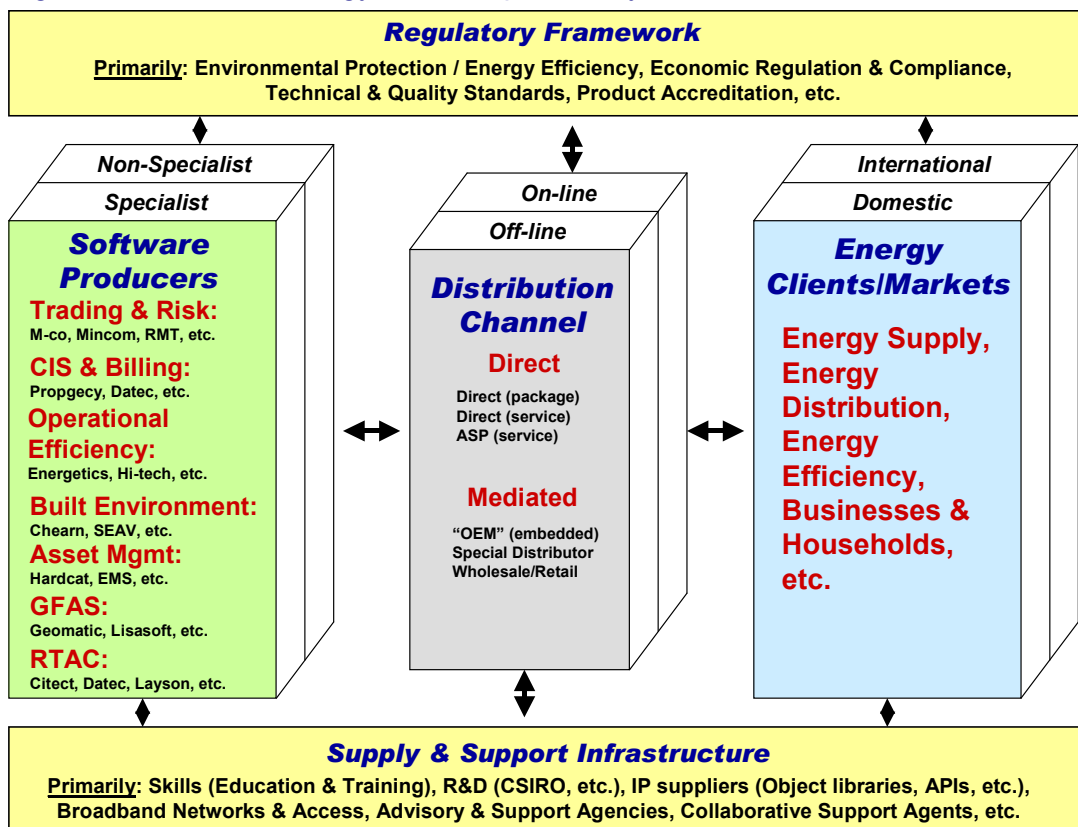
The energy software product system

There is considerable change in the energy sector giving rise to new ICT-related opportunities. As a result, the energy product system dynamics are also in flux. Regulatory developments are driving much of the change (e.g. emissions, energy efficiency etc.), with those in the supply and distribution sector responding to demands for greater operation efficiency (e.g. a change of emphasis toward technologies that reduce operating risk or support emission reduction).

Key relationships are between the energy sector and regulators, with software suppliers developing solutions to meet the needs of the sector to respond to new energy and regulatory demands. For software developers, collaboration with clients

and a deep understanding of the energy sector are essential, because the channel to markets in many cases is mediated through large suppliers of energy technology – almost all of these being foreign owned MNCs. Relationships between developers and regulators are required to ensure that software meets required standards and employs standard interfaces to support interoperability, as clients are seeking to move away from end-to-end solutions, towards integrated components supported by middleware. There are also some important local innovation linkages between the R&D infrastructure, developers and their clients (e.g. CSIRO’s Energy Transformed Program). Building on such linkages, partnering and commercialisation could offer additional opportunities.

Figure 1. The energy software product system



Source: CSES Analysis.

Software distribution (the channel) tends to be mediated. One important feature of the energy market is the role of equipment manufacturers (e.g. transformers, switches, metering, etc.), with some aspects of the vertical software market distribution mediated by equipment manufacturers (e.g. OEM/embedded). For local developers in such areas, the limited extent of local ownership and control in the electronic and electrical equipment manufacturing industry presents a challenge, and will make the building of channel partnerships with large foreign owned manufacturers and MNCs increasingly important.

There is recognition of the need for interoperability in the industry, although there is a plethora of bodies conducting this work, including the International Standards Organisation (ISO), which has convened a group to define industrial automation systems integration called ISO/TC-184. There also exist proprietary based consortia like the OPC Foundation, which is defining a set of protocols and standards for industrial automation suppliers based on the Microsoft COM/DCOM component model.¹ In the metering space there are several competing standards, such as IEEE SCC31 and ANSI C12. The Australian data interchange standard for electrical metering (AS 1284.10.1-1996) itself incorporates proprietary technology. It will be important for software developers to take account of, and work within these standards and standards blocs.

Energy markets

The world energy sector is undergoing a transition. Rapid change, especially in the electricity segment is being caused by privatisation, market de-regulation, under-investment leading to under-capacity, and greenhouse gas emission reduction requirements. This has resulted in significant upheaval in the sector in many countries, including Australia.

One past president and CEO of the US based Electric Power Research Institute noted that: “We face the twenty-first century’s burgeoning needs for energy armed with technologies that are fast becoming outmoded. The coming decades will place radically different and more challenging demands on the electricity system than can be met with today’s technology and current investments in the electricity infrastructure.”² In their 2005 survey of global energy firms and investors, PriceWaterhouseCoopers noted the need for investment to meet growing world demand, saying: “Investment averaging USD 355 billion pa is needed by the power generation, transmission and distribution sector to meet the world’s expected supply needs in the period to 2030. The cumulative investment adds up to almost USD 10 trillion, or 62%, of total energy investment over the period 2003 to 2030.”³

However there is investor reluctance, because of the perceived uncertainties in the regulatory environment. “This massive amount of capital will require utility firms to make a compelling case for investment. Yet many firms claim that they find themselves caught in a trap. They are striving to make their sector attractive to investors while grappling with regulatory uncertainty and market volatility that creates an investment hurdle.”⁴

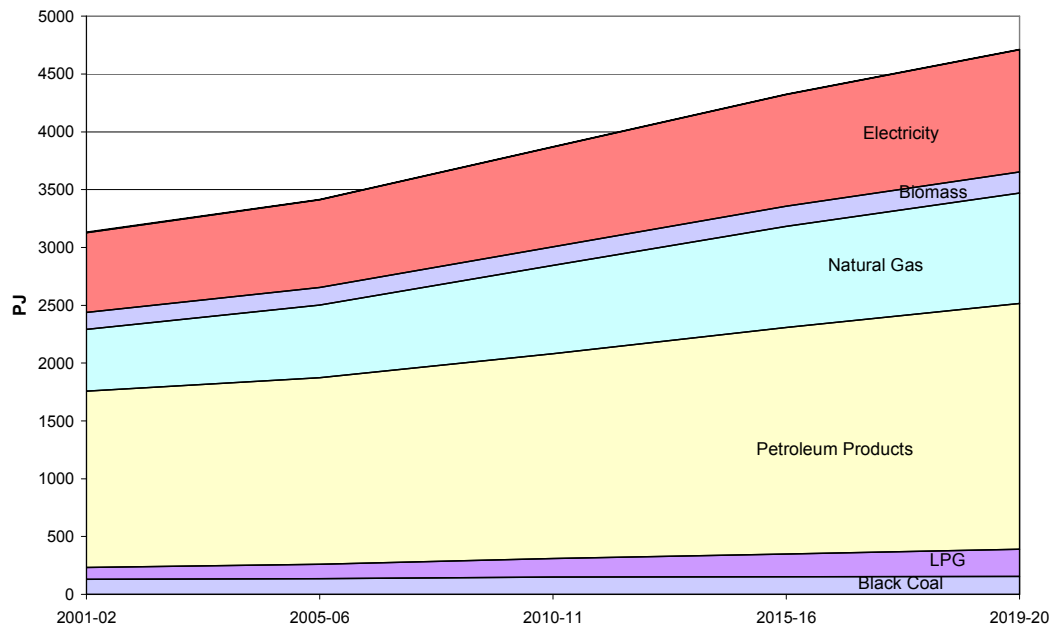
Australia’s energy market

Australia’s energy market is predicted to grow at a moderate rate, with final energy consumption to grow at 2% pa from 2000 to 2020 – electricity consumption growing by 2.1% pa and gas consumption to grow at 2.9% pa.⁵ There is evidence that demand may be approaching supply capacity in some situations with the NSW Department of Primary Industries reporting that while there is an over supply of base load capacity there are indications that during peak periods electricity demand

can approach generating capacity⁶ In Queensland the 2004 Somerville report concluded both Energex and Ergon Energy were over utilising their assets which resulted in a greater risk of supply failure⁷, which has resulted in greater network investment in that state. The South Australian Electricity Supply Industry Planning Council noted in its Annual Planning Report that there is ample capacity to meet the peak demand expected in an average summer, but in an extreme –one in ten year summer the reserve capacity margin is below the accepted standard⁸. It also provides a cautionary note on investment:

Given the projected tightening of the overall supply–demand balance across the entire National Electricity Market, the Planning Council is concerned that investment signals for new capacity may not be strong enough to ensure that investment keeps pace with the market’s reliability targets⁹.

Figure 2. Final energy consumption in Australia by type, 2001-02 to 2019-20



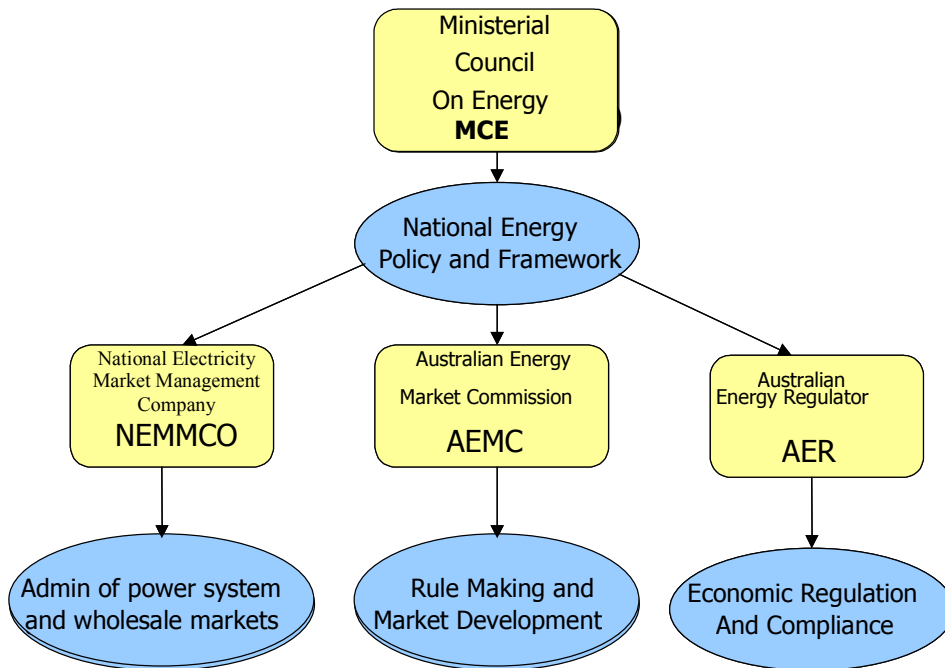
Source: ABARE 2004.

Energy supply (Utilities)

In the past in Australia there have been criticisms that the desire of utilities to take risks and innovate was impaired by aspects of the market’s operation¹⁰, and investments in essential infrastructure needed to take advantage of energy reserves.¹¹

Over the last decade there has been significant effort to improve the operation of the sector. In response to the calls for a consistent regulatory framework, the Ministerial Council on Energy commenced a series of reforms in 2003, including forging intergovernmental agreements, establishing two new governance bodies and frameworks for distribution and retailing. In March 2005, the State Premiers announced that they would be establishing a carbon emission trading scheme – a major change for the industry, and a potential opportunity for software developers as such an initiative is likely to involve software systems to monitor and record carbon emission and to conduct trades in emissions.

Figure 3. Australia’s regulatory structure



Source: CIER Analysis.

The Energy Supply Association of Australia (ESAA) has estimated that, for the period 2003-12, expenditure of between AUD15 billion and AUD18 billion is needed for new distribution facilities in Australia, with an additional AUD 5 billion required for power generation facilities, AUD 3 billion for transmission facilities and AUD 3 billion on renewable energy generation, and that the changes to the structure of regulation in Australia will result in investment of up to AUD12 billion in new generating capacity.¹² This investment will have flow on effects to the wider utility infrastructure market. Energy companies in NSW have indicated that they are ready to invest AUD 2 billion within the next few years under the right regulatory conditions.¹³

As governments work toward providing regulatory certainty and investor confidence returns to the area, there will be opportunities for Australian firms to provide software to manage and operate the new plant and equipment that must be built, and other software opportunities to provide greater efficiencies and higher return on investment within existing operations.

The Utilities market in Australia can be broken into the power generation and the distribution/retail segments. The following two tables show the approximate market shares for the major electricity generators and energy retailers.

Table 1. Australian Electricity Generation Market Share and Ownership

<i>Utility</i>	<i>Ownership</i>	<i>Approx Market Share</i>
Macquarie Generation (NSW)	public	14%
Delta Electricity (NSW)	public	12%
Loy Yang Power (VIC)	private	8%
Eraring Energy (NSW)	public	8%
International Power Australia (SA)	private	8%
Tarong Energy (QLD)	public	7%
CS Energy (QLD)	public	7%
Yallourn Energy (VIC)	private	7%
Enertrade (QLD)	public	6%
Stanwell Corporation (QLD)	public	6%
Edison Mission Energy (VIC)	private	5%
NRG Flinders (SA)	private	2%
Snowy Hydro (NSW, VIC, CWTH)	public	2%
Intergen Australia (QLD)	private	2%
TXU Torrens Island (SA)	private	1%
All others	-	5%

Source: Australian Department of Industry Tourism and Resources¹⁴

Table 2. Australian Energy (Electricity and Gas) Retail Market Share

<i>Retailer / Distributor</i>	<i>Ownership</i>	<i>Customers</i>
AGL	private	3.0 million
Origin Energy	private	1.9 million
Energy Australia (NSW)	public	1.3 million
Energex (Qld)	public	1.1 million
TXU (Vic)	private	1.0 million
Integral (NSW)	public	0.9 million
Western Power (WA)	public	0.8 million
Country Energy (NSW)	public	0.7 million
Ergon Energy (Qld)	public	0.6 million
Alinta Gas (WA)	private	0.5 million
Aurora Energy (Tas)	public	0.4 million

Source: Department of Industry Tourism and Resources¹⁵

Energy Supply (Gas Resources)

The principle sources of supply of domestic gas in Australia include the Esso/BHP joint venture off the Gippsland Basin which supplies much of Victoria's gas; the Cooper/Eromanga Basin in South Australia operated by Boral which supplies gas to South Australia, Queensland and New South Wales; and the North West Shelf project operated by Woodside Petroleum which domestically is only supplying Western Australia at present.

Despite Australia's huge gas reserves and growing domestic demand, the domestic gas sector has been hampered by a reluctance to commit to investments in pipelines and other essential infrastructure to take advantage of these reserves.¹⁶

Energy demand (Efficiency)

The issue of more efficient energy use is receiving considerable attention in the energy demand (energy efficiency) segment, with much of the activity being driven by concerns about sustainable energy and global warming. It is recognised that an important response to this concern is to reduce or limit growth in energy consumption through approaches such as greater efficiency. It is also recognised that greater efficiency in energy use has potentially significant positive flow on effect to the economy. Allen Consulting (2004) noted that: "Achieving annual energy savings of 1% beyond 'business as usual' ... would deliver an increase in [economic] consumption of approximately 0.18% by 2014 (\$1 billion), while reducing electricity prices to end users and saving 16.5 Mt CO₂ emissions of greenhouse gases."¹⁷

Government approaches have increased the increased focus on demand management. For example, the Victorian government mandated that all new homes built after July 2005 must be 5 Star energy rated, and that the rollout of interval meters for all electricity customers should commence in 2006.¹⁸ The introduction of interval metering will have ramifications for IT. For example, the National Electricity Market Management Company (NEMMCO) have noted that there is a "need to change the way metering data is managed, to minimise costs and risks, and to ensure appropriate levels of audit and traceability for the increased data."¹⁹ NEMMCO are considering significant change to the data model to deal with interval metering, and that is likely to require substantial software development to realise the potential gains.

The CSIRO, as part of its Energy Transformed Flagship Project, has set the goal of achieving big gains in energy efficiency by 2020. It is seeking to halve energy losses in end-use processes, double fuel efficiency and expand the use of gas (including hydrogen) in vehicles.²⁰ These developments may bring significant opportunities for software suppliers able to contribute to energy efficiency and

demand management techniques, in the built environment, plant performance assessment, billing or embedded systems.

International Energy markets

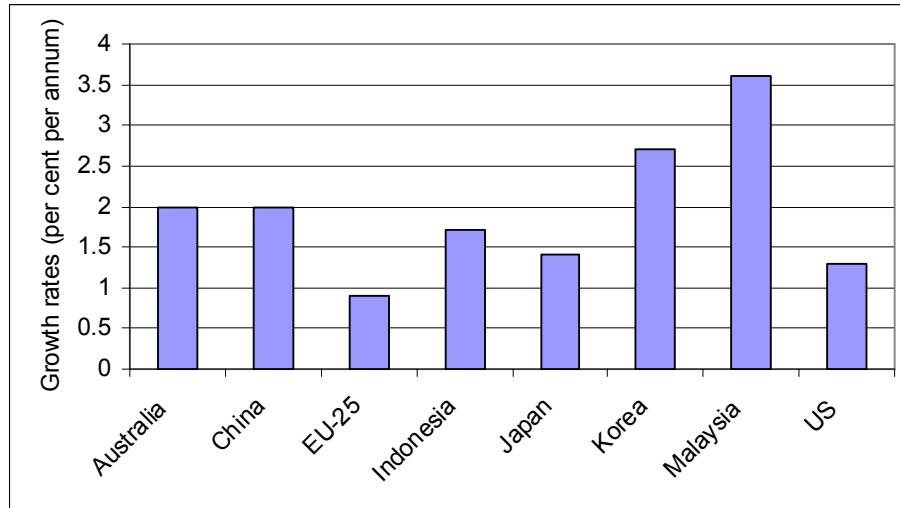
Despite the impacts in some regions of over regulation or deregulation, business cessations and greenhouse gas policies, all markets are displaying solid growth prospects and all are displaying huge demands for investment.

The US Department of Energy predicts that primary energy consumption in the US (the largest market) will grow from 98.2 quadrillion Btu to 133.2 quadrillion Btu over the period 2003 to 2025 (1.4% pa), and that petroleum and electricity will be the energy sources with the greatest growth over that period.²¹ Growth in final energy consumption will be 1.3% pa over the same period.

US utilities have shifted from their earlier strategy of global expansion and there is now a trend toward regionalisation, with firms seeking to expand within their own region.²² This is reinforced by a state-based regulatory landscape in the US. Carbon trading is also a strong likelihood in the US, despite not ratifying the Kyoto Treaty, as a coalition of nine northeast and mid-Atlantic states move forward with implementation of a 'cap and trade' plan under the Regional Greenhouse Gas Initiative (RGGI).²³ The overall US trends of increasing growth in consumption and the pressure for investment in infrastructure and services is somewhat similar to that of the Australian utilities sector. Thus software firms with a demonstrated ability to add value in the Australian context, particularly in areas that offer improved investment attractiveness, may have parallel opportunities in the US markets.

The European Union, with its limited natural energy resources, its slower population growth and its strong commitment to greenhouse gas reduction targets, will have a much slower growth in demand for energy than elsewhere. The 25 member Union's final energy demand is anticipated to grow at only 0.9% pa to 2030.²⁴ Electricity is the fastest growing final energy source – currently growing at 1.6% pa. However, Europe's demand for investment in the energy sector is substantial, with the need to increase electrical generation capacity from the present 580 GW to 950 GW by 2030. In addition, the EU anticipates that the primary fuels for electricity generation will change substantially, away from coal, oil, and nuclear, to gas and renewables. This substantial demand for investment and the commitment to change its energy mix suggests that there will be significant investment in infrastructure and as a result, a demand for software.

Figure 4. Predicted growth rates in final energy consumption to 2020



Source: ABARE, APEC, DoE, European Commission.

The Asia-Pacific region already accounts for 29% of global net consumption of electricity, with the nations with the greatest generation capacity being China, Japan, Russia, South Korea, and Australia²⁵. An energy deficit combined with strong economic growth make it a crucial market for utility firms. The rapid population and economic growth of China and India, in particular, present opportunities for software companies whose product can play a part in the overall infrastructure growth needs of these nations.²⁶ Energy demand in the APEC region is expected to grow at an overall rate of 1.8% pa.²⁷ APEC predicts energy investments of USD 3.4 trillion to USD 4.4 trillion will be needed in the region over the 20-year period through 2020. Nearly half the total, USD 1.9 trillion to USD 2.2 trillion, will be required for generating and transmission capacity in the electric power sector, and some USD 0.5 trillion to USD 0.7 trillion will be needed for domestic oil and gas pipelines.²⁸ Electricity demand is expected to increase at 3.2% pa for the years to 2020 for the whole region, with China contributing 30% of this increase in demand.²⁹

The energy software market

Predicted increases in global demand for both energy and changes to the supply, such as economically efficient and environmentally sustainable processes, and associated investment in energy infrastructure will increase demand for relevant software. As new investments are planned and implemented there will be a corresponding demand for software, whether it be in switching equipment, maintenance and planning software, asset management software or enhancements

to customer and billing software to handle new pricing scenarios for demand management.

There are limited signs that the market for utilities software is becoming more positive. In a recent survey of 42 primarily US based software firms that focus on the energy sector, Skipping Stone Consultants found signs of stability and growth after some difficult years. They also identified a trend away from developing all-in-one solutions, with only 15% of the vendors indicating a focus on providing an end-to-end solution.³⁰ “Energy firms no longer want to spend USD 20 million on a SAP system; they want to spend USD 1 million at Siebel for a knowledge management system, and USD 1 million at another vendor for a customer system, and so on.”³¹ This suggests a trend toward best-of-breed components, integrated using sophisticated middleware technology. Software vendors who are able to offer niche products that are excellent in their field will find willing customers, provided that the software is equipped with standard interfaces and is capable of integration.

IDC report that spend on ‘contestable’ software in the Australian utilities segment was estimated at AUD 140 million in 2004, rising to AUD 144 million in 2005³² (i.e. excluding operating systems, platforms and standard desktop systems). This is consistent with the general upswing in expenditure occurring in the US³³ Indeed, US data are indicative of overall trends in the marketplace.

The customer base for energy software

Energy utilities themselves are obviously a major user of utility software and supply chains may also represent market opportunities for software companies operating in energy or related verticals (eg transport). Access to market is often mediated through third parties. Large infrastructure projects undertaken by utilities can often be decided by a competitive bidding process with consortiums of engineering / integration firms and large suppliers bidding for the work. Firms such as GHD Pty Ltd , Sinclair Knight Mertz, Connell Wagner are just some of the large engineering consultancies operating in Australia who design energy generation and must make decisions about instrumentation and control equipment to be used in projects and consequently the software to be used. Thus, depending on the nature of the software and its relationship to specialist hardware, access to markets for software providers is often through these direct suppliers to the industry.

Real time automation and controls

The real time automation and control (RTAC) segment covers all of the electronic equipment and software used for monitoring and controlling the distribution of energy. This includes Supervisory Control and Data Acquisition (SCADA), Energy Management Systems (EMS), Distribution Management Systems (DMS), Distribution Automation (DA), Remote Terminal Units (RTUs) and Metering Equipment; and Communications Systems.³⁴ All of these systems utilise software in some form. In some cases it is used to control specific hardware, such as solenoid

operated valves or electrical switching equipment, and thus is an integral part of the equipment.

In the US, expenditure on RTAC by electric utilities was predicted by Michael Marullo to grow from USD 312 million in 2004 to USD 537 million in 2007, a growth rate of 14% pa.³⁵ Equivalent market size data on the Australian and other regional markets has been difficult to obtain, however given that the general trends in energy use are fairly consistent, and given the expectations of large investment in Australia, we would expect a somewhat similar growth pattern in RTAC expenditure in Australia and other regional markets.

Aspects of the RTAC market receiving particular attention are the area of interval metering and demand management systems. The push in this area is coming from governments seeking to cope with increases in demand without the expense of installing new capacity. In Australia, rollout of interval metering for gas consumers is already underway. In Western Australia, consumers of gas over 10TJ must have interval metering installed if they change retailers.³⁶ Typically, large consumers of energy all across Australia have interval metering installed, but Victoria's Essential Services Commission is the first body to mandate electrical interval metering for all consumers.³⁷ The consequence of this is that large volumes of metering data must be gathered, stored and utilised.³⁸ Current systems will require change to store and process this extra data, and we expect significant IT investments to occur in the utilities, the regulators and the manufactures of the meters – who will be required to make their meters compatible with the evolving IEEE-SCC31 meter interfacing standards.

MNCs dominate this market segment. Such companies as ABB, Areva, GE Energy, Open Systems International and Siemens are major suppliers in the US Market,³⁹ and foreign companies are also active in the local market. For example, in 2002 the Australian Gas Light Company (AGL) installed turbine controller equipment from GE, SCADA from ALSTOM, and a unified operator interface from Yokogawa.⁴⁰

Australian software firms are only moderately represented in the segment, and those that do exist face stiff competition from these foreign firms with strong relationships to manufactures of the electrical hardware (e.g. transformers, switches, meters, etc.) used in the utilities industry. Of the seven major manufacturers (the seven top firms based on total revenue) in the Australian electrical equipment manufacturers industry, only one is Australian owned and headquartered (i.e. Oliver J. Nilsen Ltd), other players with significant manufacturing bases and headquarters in Australia include Tyree, although IBIS do not include them within their top seven grouping.⁴¹ This lack of local manufacturers of utility hardware must tend to limit the linkages that Australian software firms can establish.

Table 3. Australian firms in the RTAC market segment

<i>RTAC</i>	
Citect Pty Ltd.	An Australian listed firm, with 2004 revenue of \$61.5 million, focusing on industrial automation software and SCADA.
Datec	Australian developer of a range on utility focused products including metering, billing and energy management.
Hi-Tech Software	Involved in an indirect way through the provision of C-compilers and embedded systems software for the industrial devices and remote metering market.
Layson Pty Ltd	A manufacturer of complex electrical devices and controllers, such as data loggers and stepper motor controllers. These devices require embedded software to operate and exchange data with master devices and a remote meter reading system.

Source: CIIER Analysis.

One Australian firm, Queensland based Citect Pty Ltd, stands out as a large Australian company operating in this field. It achieved \$61.5 million in revenue in 2004.⁴² Citect develops SCADA and industrial automation software for utilities, including energy and water as well as for other sectors. Citect has received assistance from Queensland Government Department for State Development and Innovation, via a Queensland Investment Incentive Scheme (QIIS) agreement, and has seen significant growth.⁴³ Citect has sales offices and sales representative around the world, and Citect's approach to market access is to develop multi-level relationships. It maintains relationships with hardware manufactures and offers Citect's software as an integral part of a manufacturer's hardware, thus ensuring sales when the manufacturer's hardware is selected.

Geospatial and Field Automation Solutions

Applications in the geospatial and field automation solutions (GFAS) segment are focused on coordinating and controlling network maintenance and upgrade activities. It includes such things as: geographic information systems (GIS); automated mapping/facilities management systems (AM/FM); mobile computing systems; outage management systems; and workforce management systems. In the US, the expenditure on GFAS by electric utilities was forecast to grow from USD 215 million in 2004 to USD 471 million in 2007, a growth rate of 21% pa.⁴⁴ We would expect a similar growth pattern in Australia as the anticipated growth in distribution facilities will increase demand in this market segment.

In the US market, large MNCs are dominant, with Autodesk, ESRI, Intergraph and GE Energy the four top suppliers.⁴⁵ All have a presence in the Australian market. There is a vast array of vendors in some application areas within this segment, such as outage management and mobile applications, but there are now signs of consolidation and mergers.⁴⁶

There is little evidence that Australian producers play a significant role in this market segment. For example, South Australia's state electricity utility ETSA recently selected US firm Intergraph's Outage Management and Mobile Workforce Management system for use by their field personnel.⁴⁷ Similarly, Victorian headquartered utilities systems integrator TUSC, offers a range of services around the integration of such things as SCADA, distribution management and workforce management. TUSC nominates a single Australian firm, Citect, as a supplier of equipment. Its other partners, MSDI, SNC Lavalin, and GE-Fanuc are all foreign owned.⁴⁸

Table 4. Australian firms in the GFAS market segment

<i>Geospatial and Field Automation</i>	
Geomatic Technologies	An Australian firm providing consulting and IT solution in geo-spatial asset management in rail and motorway infrastructure, but not currently in energy.
Lisasoft	An Australian firm developing GIS integrated software tools for the utilities, telecommunications and other markets.
Geometry	Developers of geo-spatial information management systems.

Source: CIIER Analysis.

Australian based producers involved with geospatial technology are not typically focused on the energy and utilities market. Some Australian companies, such as Geomatic Technologies and Lisasoft, provide solutions that may have potential to be adapted to the utilities context, but this is not certain and there is little evidence of a strong focus on this sector. Moreover, the Cooperative Research Centre for Spatial Information (CRCSI) does not seem to be undertaking research with direct application within the utilities market, and an examination of its commercial partners reveals no representation from the utilities sector.⁴⁹

Enterprise Asset Management Systems

Enterprise Asset Management (EAM) systems in the energy industry are used to manage and control the lifecycle of the hugely capital intensive assets. Asset management systems can be used to develop capital spending plans for equipment lifecycles, optimise preventive maintenance, for reliability centre maintenance, root cause analysis, modes of failure analysis and so on. The worldwide market for EAM was USD 1.6 billion in 2004, and it was forecast to grow at 3.1% pa, to USD 1.9 billion, in 2007.⁵⁰

Table 5. Australian firms in the EAM market segment

<i>Asset Management Systems</i>	
Hardcat	Australian developers of asset tracking and maintenance management software.
Mincom	Mincom is a large Australian consulting and software firm in the mining and utilities sectors. Mincom offer ERP systems, asset management and trading systems.
EMS Solutions	Developers of asset and works management software. The asset management software is used to manage the full lifecycle of the expensive hardware assets. EMS counts over 12 electrical distribution firms as its customers.

Source: CIER Analysis.

Asset management systems are receiving attention as utilities, constrained by lower prices for their energy, attempt to obtain improved return on investment in their assets. The systems currently on the market have evolved over time. In the past, multiple systems were needed for the unique characteristics of different asset classes. This resulted in functional silos. Platforms with broader capability are now available, with a trend developing for convergence with ERP systems, as explored in the "Manufacturing" chapter of this report. Leading EAM systems (including those supplied by Mincom, Indus International, MRO Software and Datastream) and integrated asset-intensive ERP suites (including SAP, PeopleSoft and EnterpriseOne) now offer a combination of functions that span work management and asset management, making the use of separate systems unnecessary.⁵¹

Australian company Mincom is a medium sized and successful player in this market. Other Australian companies we have identified are significantly smaller and, although offering product in the asset management market, do have a significant presence in enterprise level applications, with their offerings appearing to be positioned at a more mid-market level targeting customers looking for less complex and expensive solutions.

Trading and Risk Management Systems

Trading and risk management systems are designed to allow energy companies and traders to interface with brokers and conduct trades, to view their financial exposure to trades, manage forward contracts, conduct 'what if' analyses, examine physical limitations on trades (e.g. gas capacity, storage levels and volumes), and show currency and pricing conditions.

Deregulation and competition have led to a situation where utilities are now needing to manage energy supply pricing in a more sophisticated way, with both long term contracts and spot pricing occurring together, and to manage the potential downside risk of those trades. In addition, global warming concerns are starting to

be addressed through trading in carbon credits. This has led to a market for trading and risk management systems.

This market segment in Australia seems to be somewhat fragmented, with a big role played by systems integration and consulting firms (e.g. Infosys, Accenture, etc.) which offer services to integrate the various components needed to achieve an comprehensive system.⁵² The foreign software producers in this market include such companies as KWI, OpenLink, Allegro and SAS. British firm KWI evolved from a consulting firm specialising in designing trading techniques, to developers of trading platform software. There appears to be little involvement in this segment of the big names in energy systems (e.g. ABB and Seimens), nor do we see a large presence from players in the ERP world (e.g. SAP and Oracle). This adds weight to the view that this market segment is in an early stage of growth, with niche players currently making the running, and large consulting firms conducting the integration.

Table 6. Australian firms in the T&RMS market segment

<i>Operational and Financial Risk Management Systems</i>	
Mincom	Mincom is a large Australian consulting and software firm in the mining and utilities sectors. Mincom offer ERP systems, asset management and trading systems.
The Marketplace Company	M-co provide consulting services and IT solutions to regulatory authorities, governments and utilities wishing to implement wholesale energy trading markets and green energy markets.
Risk Management Technologies	Producers of enterprise-wide, risk, compliance and knowledge management systems and chemical risk management software and services.

Source: CIIER Analysis.

Mincom offers a product in this segment called 'EnergyPoint'. Another Australian company, which is not strictly a producer but rather a consultant on energy markets and trading, called the Marketplace Company, could potentially be in a position to tread the same path as KWI and convert their intellectual capital into intellectual property in the form of packaged software systems. With the market in an early stage of growth, and as trading and risk management becomes a more important feature of the Australian and world energy landscapes, there are opportunities for Australian firms to participate.

Billing and Customer Information Systems

Billing and Customer Information systems (CIS) are software platforms that support utilities' revenue collection process and customer interaction. In the 1980s

and early 1990s, CIS systems tended to be custom made, by the likes of IBM and Anderson Consulting, to suite particular business needs. The cost of these projects could be in the tens of millions of dollars, and the failure rate was high.⁵³ In the late 1990s, off-the-shelf solutions evolved to reduce the implementation risk. The segment now has a significant number of new entrants, in part, as a result of utilities trying to productise their custom made CIS solutions.

Table 7. Australian firms in the CIS market segment

<i>Customer Information Systems</i>	
Datec	Australian developer of a range on utility focused products including metering, billing and energy management.
Prophecy International	Australian developers of utility Customer Information Systems (CIS) for the worldwide utilities industry, with customers in transport, government, electricity retailing and water utilities.

Source: CIER Analysis.

This, and the slowdown in the US market of the pace of de-regulation, has caused a substantial contraction in the market, with utilities wary of the massive expenditures of previous years. Major utility CIS installations have dropped from 5 to 10 per year in the late 1990s to an average of less than 1 per year since 2000. Evidence of the effect of the slowdown can be seen in Anderson Consulting's decision to leave the segment in the late 1990s.⁵⁴ SAP is still a major player in this market, and is now licensed by more than 500 utilities.⁵⁵ It appears, given the conditions operating in this segment and the state of the competitive environment, that firms operating in this area will face long and difficult sales cycles so long as SAP maintains this dominance.

Energy efficiency in the built environment

This market segment includes software designed to ensure that energy usage in domestic and commercial buildings is minimised, and includes computer aided design and mathematical modelling to assess the energy usage characteristics of buildings. This is a smaller market, focussed primarily on architects and engineers.

Given the apparently early stage of development in this market it is difficult to identify which are the major players. In Australia, the Victorian government is a player with its FirstRate software package, developed to provide architects with an affordable energy analysis tool that could accurately quantify the energy 'Star Ratings' of building proposals. Where a government decides to commission specialised software development, it is a possible indication that satisfactory applications are not yet readily available commercially, or that they have not been sufficiently well marketed, and that a market failure may exist.

Another company specialising in mathematical modelling software, with direct application to energy modelling, Hearn Scientific, offers a product developed with the CSIRO. Since this market is in the early stages, competition is limited. Nevertheless, we would expect large, dominant companies, such as Autodesk, to be looking to build or acquire this capability to fill out their CAD product suites.

Table 8. Australian firms in the energy efficiency market segment

<i>Energy Efficiency: Built Environment</i>	
Hearn Scientific	An Australian developer and distributor of a range of software utilizing complex mathematical algorithms for modelling behaviour. Their offering includes a product developed with the CSIRO called Energy Express, which is designed to allow architects and engineers to model energy efficiency in the built environment.
First Rate (Sustainable Energy Authority Victoria)	Although not a software firm, the Sustainable Energy Authority has developed and markets energy rating software for builders and architects.

Source: CIER Analysis.

Operational Efficiency Systems

Systems in this area include data loggers, environmental sensing equipment and modelling software to optimise the real-time use of energy. Once again, the market appears to be quite new and unstructured. It is an area where environment and energy consultants play a significant role. The involvement of Murdoch University in the development of RAPSIM is evidence of linkages to publicly funded institutions, and demonstrates the requirement for sophisticated specialist knowledge to provide the initial understanding, before product development can occur.

There is no information on the size of the market, and the product suite does not appear to have formed into a set of well known functions and applications. It is, however, an area that we expect will become more important over time, and an area where consultant knowledge may be successfully productised.

Table 9. Australian firms in the OES market segment

<i>Operational Efficiency</i>	
RAPSIM (Murdoch University)	Murdoch University in conjunction with Research Institute for Sustainable Energy (RISE) have developed a software simulation package for remote area power supplies called RAPSIM.
Energertics	A consulting firm offering strategic energy procurement, energy efficiency and Greenhouse consulting services. As an adjunct to this service they offer energy rating software to their customers.
Datec	Australian developer of a range on utility focused products including metering, billing and energy management.
Hi-Tech Software	Involved in an indirect way through the provision of C-compilers and embedded systems software for the industrial devices and remote metering market.
Layson Pty Ltd	A manufacturer of complex electrical devices and controllers such as data loggers and stepper motor controllers. These devices require embedded software to operate and exchange data with master devices and a remote meter reading system.

Source: CIIER Analysis.

Energy software suppliers

The energy software vertical market map shows how these firms are distributed across the various market segments. The lists are non exhaustive.

The potential for opportunities in the energy market are good, because it is likely that governments, both in Australia and overseas, will increasingly focus on the economic benefits and the potential reduction in expenditure on infrastructure that can be delivered by more efficient energy use in both domestic and industrial settings.

Figure 5. Energy vertical software market map

Source: CIIER Analysis.

Innovation base and support infrastructure

As noted earlier, Murdoch University and the CSIRO have played a role in the development of software for the energy market. This linkage stems from the highly specialised mathematical modelling needs of the software. The CSIRO's Energy Transformed Flagship Program is also playing a role in the future of Australia's energy sector, with CSIRO undertaking research into low emission energy, low emission electricity, and the so far under-utilised technique of distributed electricity generation.⁵⁶ This research is still in the early stages, but it is reasonable to expect that any technologies developed will require sophisticated control technology and will provide opportunities for Australian software firms in the development and application of this technology in the future.

The Cooperative Research Centre for Spatial Information (CRCSI), on the other hand, does not appear to have a focus on the opportunities for the use of geospatial technologies in the energy sector at this time. However, the CRC for Integrated

Engineering Asset Management (CIEAM) has developed models and decision systems, sensors and diagnostics relating to asset management, with a focus on utilities and process manufacturing.⁵⁷

Energy market conclusions

Investment in both the utilities and the energy demand management sectors is likely to increase in the coming years, providing opportunities in this vertical market for software firms.

Within the utilities sector there are several Australian firms positioned to take advantage of the opportunities in the RTAC segment (e.g. SCADA and Interval Metering) as well as trading and risk systems, and asset management systems. The demand for all of these systems will continue to grow, so apart from sometimes strong competition, market conditions look positive. Australian software firms looking to increase their presence in these areas may find that establishing strong relationships with the manufacturers of electrical and gas hardware (e.g. transformers, switches, meters, etc.) will help them to participate successfully in the market.

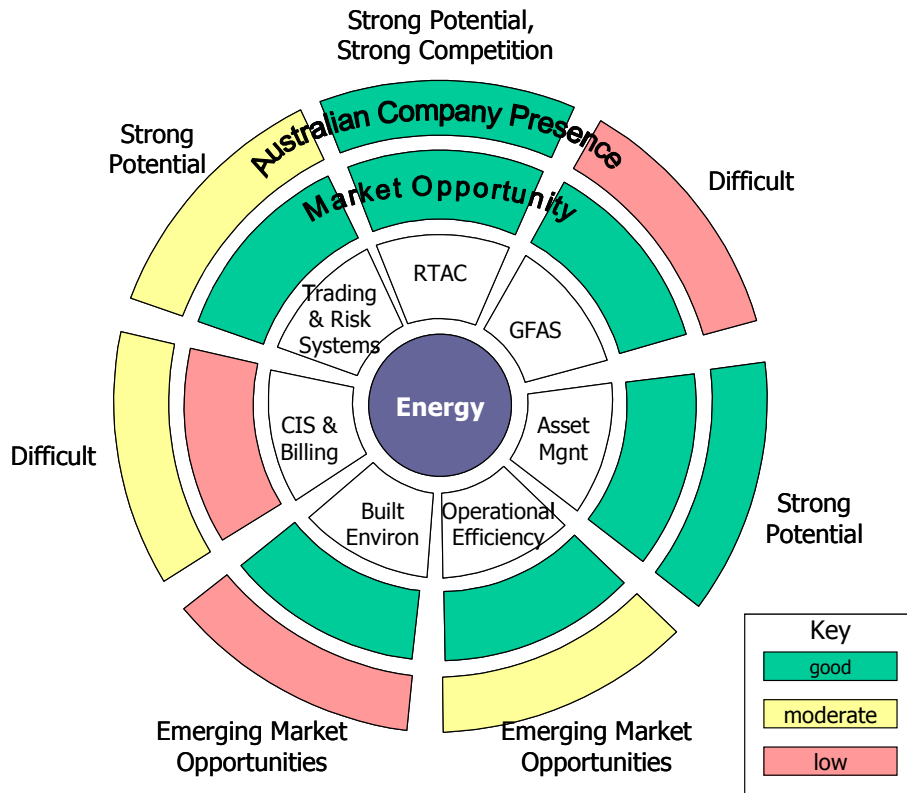
Table 10. Overall SWOT analysis of Australian energy software firms

Strengths	<ul style="list-style-type: none"> Several Australian firms are well positioned within the RTAC, Trading and Risk and Asset management segments.
Weaknesses	<ul style="list-style-type: none"> The lack of electrical hardware manufacturers in Australia reduces the opportunity to establish links with these important players. There is a lack of Australian producers in the GFAS segment. Geospatial research bodies seem to have low exposure to the energy sector as opposed to other areas.
Opportunities	<ul style="list-style-type: none"> RTAC trading systems, EAM systems; risk management systems; and demand management are all likely to be growth areas as investment in energy rebounds. Mandated rollout of Interval metering in Victoria offers potential opportunity for firms involved in the metering space within the RTAC segment. Increasing focus on energy efficiency as Australia begins to grapple the problem of climate change provides opportunity right across the energy efficiency segment. Advances made by the CSIRO in energy efficiency and new generation techniques may provide opportunities for Australian software firms which are positioned to make a contribution.
Threats	<ul style="list-style-type: none"> The greatest threat in the utilities area is competitive pressure from large conglomerates, such as ABB, GE and Siemens. They can develop both software and electrical hardware, and offer bundled packages – something unavailable to smaller Australian software firms. Despite a strong Australian company presence, and good growth potential in the RTAC segment, foreign competition in this area is also very strong.

Source: CIIER Analysis.

In the GFAS segment, Australia has a number of spatial information firms that could participate in this area, but presently do not. The potential also exists for these firms to team up with other firms supplying asset management systems, and thus add a geospatial element to these packages, and potentially take a lead in both areas.

Figure 6. Potential for Australian software firms within the energy market segment



Source: CIIER Analysis.

The increasing focus on sustainable energy will stimulate innovation in the energy efficiency segment. The market for architectural products for designing energy efficient buildings and determining energy ratings will continue to grow, but we expect strong competition to come from the likes of Autodesk and other CAD package developers. In the area of operational efficiency, the opportunities are again that of a new and unformed market. Those firms which can productise the specialist knowledge resident in the consulting firms and universities are likely to be the successful players in these areas.

Health

The application of software within the health sector ranges from embedded software that drives IV fluid pumps, through roster systems, to software for coding of admissions and cost allocation. The various software application segments can be categorised into broad groups, including:

- Clinical (e.g. Clinical systems, GP Systems);
- Clinical Support and Other (e.g. Pharmacy, Pathology, Radiology, Allied Health, Therapies, Nutrition);
- Patient Administration (e.g. PAS Systems, GP Practice management);
- Finance, Supply and Administration (e.g. Procurement and Supply, Payroll, Claims processing);
- Infrastructure (e.g. Security, Messaging); and
- Medical devices (e.g. hearing aids, scanning microscopes, imaging and image manipulation).

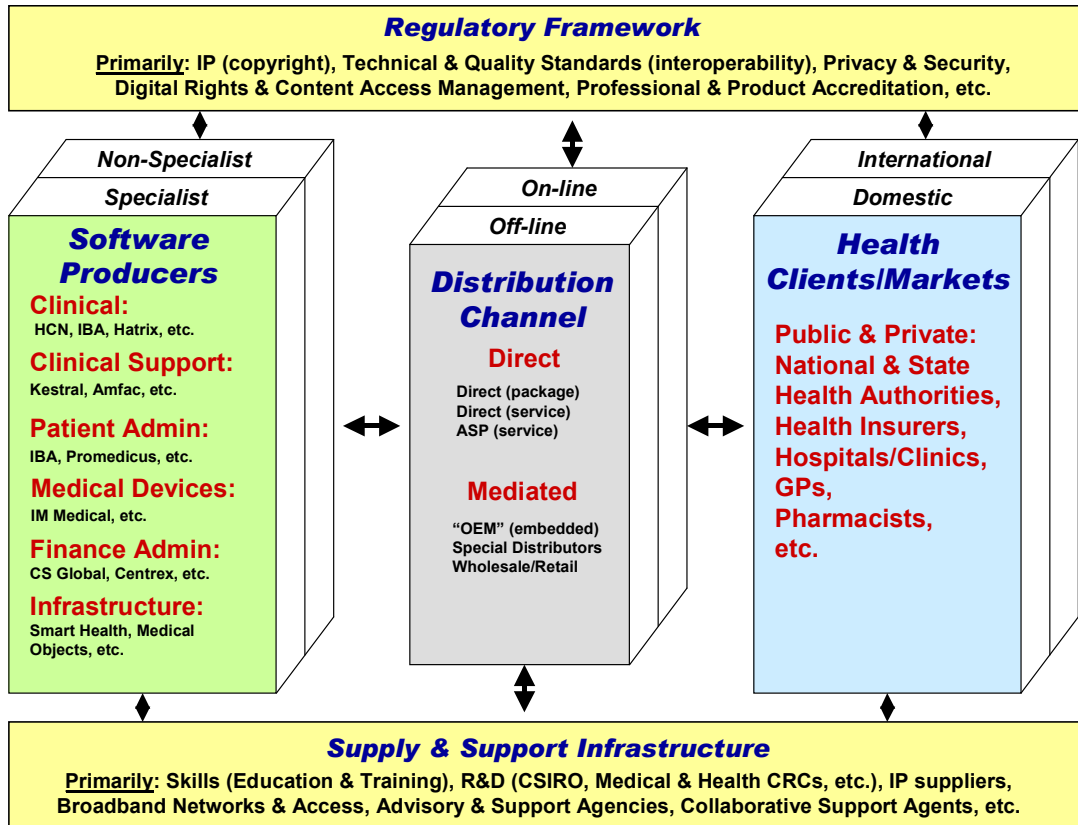
The health software product system

The health software product system has a concentration of powerful players on the demand-side, with national and state health authorities, health insurers, general practitioner and pharmacy groups acting as demanding clients with high expectation for the performance and integrity of systems. In many countries, health care and the adoption of e-health is driven by the public sector and dependent upon public funding and government initiatives. In many cases, e-health programs are coordinated centrally, adding to demand side concentration and power.

There is also a range of private sector clients (e.g. private hospital chains, insurance firms and health management organisations), and the roles they play in the adoption of e-health and health software markets vary from country to country. In some cases they are leaders in innovation, and followers in others. However, the overarching need for interoperability and integration within the health care system encourages public and private sector clients and producers to work closely together.

Collaborative linkages between producers and clients, and within producer and client clusters, are crucial for market entry, innovation and development. Given the size and complexity of the e-health market, smaller software firms often find it necessary to partner with major providers and systems integrators as a path to market. These mediated channels are dominated by major multinational firms.

Figure 7. The health software product system



Source: CSES Analysis.

The healthcare market is very complex and varied, with significant potential benefits to accessing information and connecting patient records across the system (eg pharmacies, doctors, hospitals etc.) while maintaining privacy. Integration of the system at the national level (or supra-national level in Europe) is one of the principal goals of e-health and given the many and diverse clients, standards play a crucial role. There are standards covering identifiers for patients, healthcare providers and products which can vary between jurisdictions.⁵⁸ Participation in standards bodies is an important part of operating in the e-health market, and when assessing export market opportunities software developers need to choose between standards blocs (e.g. HL7 versus the European openEHR for health communications).

The health product system also features non-commercial developers, especially among the research support base and clients (e.g. hospitals). As discussed elsewhere in this report, and as the examples of the Repatriation General Hospital and Cooperative Research Centres (CRCs) discussed below demonstrate, hospitals are one of the more common sources of non-ICT industry external supply of telemediated software development and maintenance services.⁵⁹

E-health markets

This section examines key drivers and trends in the domestic and international e-health markets and their implications for demand for health related software. It identifies the centrality of major clients and differences between various national health systems.

Market drivers

The major driver of ICT investment in the health sector is the desire to fully utilise the capacity of ICT to reduce costs and improve the operational effectiveness of the health system. E-health is expected to reduce incidence of preventable illness, take pressure off hospitals, GPs and community care, reduce duplication of treatment and testing, reduce hospital re-admissions, reduce medication error, encourage and enable people to take more responsibility for their own health and enable the health system to be more responsive to community needs.⁶⁰

Until recently purchasing of health software tended to be localised, resulting in many different legacy systems using a mosaic of specialised software. The market for health software is now changing, moving from stand-alone software solutions towards establishing a set of software solutions that are interoperable. Software systems are becoming more sophisticated as the user base works towards greater integration of systems.

Patient management systems form the core of many e-health systems, and are increasing in sophistication as attention is given to standardising the reporting of patient data and to privacy protocols. In parallel, rapid progress is being made in integration of hospital management systems, which involves moving from individual hospital systems to a regional, state or national system. Electronic transaction systems are rapidly emerging to connect medical services with health insurance and pharmacy services in order to facilitate payments, convey information and consolidate transaction data bases, thereby reducing costs and improving linkages.

While these trends are evident across developed countries, the market for e-health related product is very much determined by the nature of national health systems, the wealth of the country, the levels of funding provided by government and the role of the private sector in delivering health services. The most sophisticated markets are in the richer countries of Europe, the United States, United Kingdom and Japan. But these markets also have the most intense competition, with more entrenched and established players. Because of market differences, e-health systems are being individually developed and customised to national health systems, making each national health software market different and narrowing international market opportunities.

Dimensions of change

E-health is advancing on several fronts. All are underpinned by a need to share health data between different organisations, systems and applications right across the sector. As a result, there are six key initiatives that are common to the e-health strategies of developed countries.

- e-Prescribing – the end-to-end management of prescriptions from script generation to fulfilment, invoicing and cost allocation;
- Electronic Health Record – sharing patient health data, including admissions records, treatment information and medication history, between health care providers for the purposes of providing consistent and efficient high-quality care;
- PACs (Picture Archiving and Communications Systems) – to store, archive and transfer medical images and other visual data, such as x-rays and ultrasounds;
- Telehealth – the use of real-time video technology for emergency and clinical consultations;
- Health Administration and Support – for achieving efficiencies in the support infrastructure, including health claims processing, supply chain efficiency, etc.; and
- Mobile Health – mobile or remote health care technologies for such things as home based and rural care.⁶¹

The relationship between these initiatives and the broad software product groups we have identified is shown in the accompanying figure.

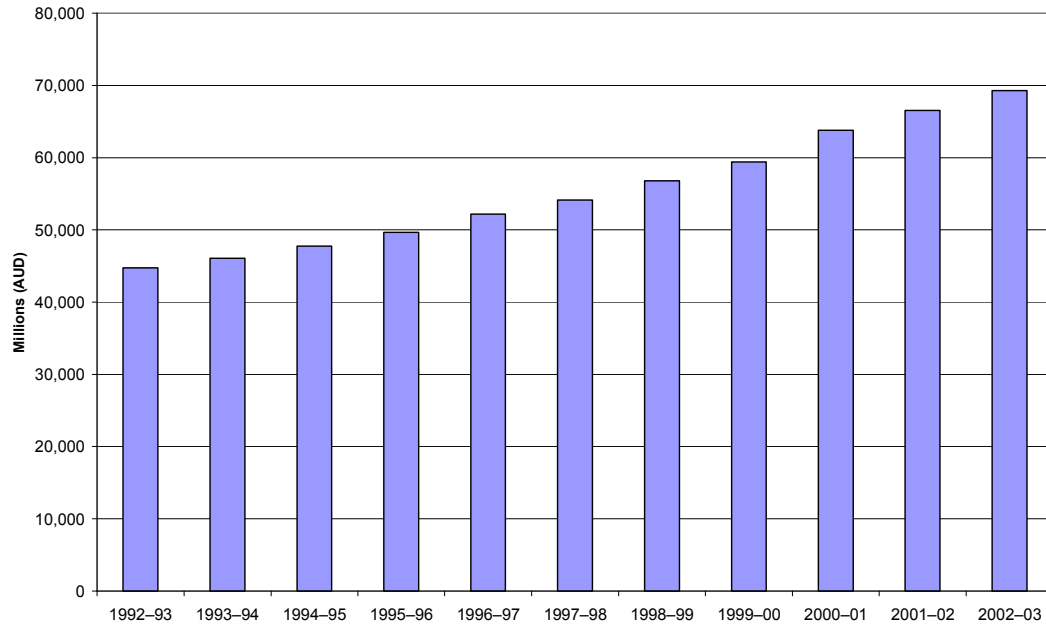
Figure 8. Relationship between software segments and e-health drivers

Source: CIIER Analysis.

The e-health market in Australia

The Australian e-health landscape is complex. Both State and Commonwealth health departments co-exist along with rural and regional health care organisations, and a raft of other important stakeholders with varying degrees of autonomy. Private hospitals provide about a quarter of all hospital beds in Australia. Private medical practitioners provide most non-bed medical services and perform a large proportion of hospital services alongside salaried doctors.⁶² Some private hospital groups are following a growth by acquisition strategy (e.g. Ramsay Health Care recently acquired Affinity Health, formerly Mayne Health)⁶³ and diagnostic groups (e.g. Sonic Health Care) are also seeking opportunities for growth overseas.⁶⁴ Such consolidations and expansion involve, and are made possible by, the adoption of ICT systems which provide necessary operational support.

Figure 9. Health expenditure expressed in 2001-02 dollars (AUDm)



Source: Australian Institute of Health and Welfare⁶⁵

Health expenditure in Australia increased in real terms at an average of 4.5% pa over the decade 1992-93 and 2002-03. Total government expenditure grew at an average of 5.4% pa over the period, and accounted for 68% of the total health expenditure in 2002-03. Non-government funding grew at 3.1% pa over the same period.⁶⁶ In 2002-03, there were 748 public hospitals operating in Australia offering 52,200 beds (66% of all beds in the hospital sector). Total days of hospitalisation for public health patients during 2002-03 amounted to 16.4 million.⁶⁷ During 2003-04, there were 525 private hospitals operating in Australia providing 7.3 million patient days and employing more than 48,500 people. Private hospital income reached almost \$6.3 billion.⁶⁸

IT solutions and e-health projects are being fostered to improve the efficiency of the operation of the health system and help reign in increasing costs. Frost and Sullivan highlight a general shift in focus within Australian health IT.

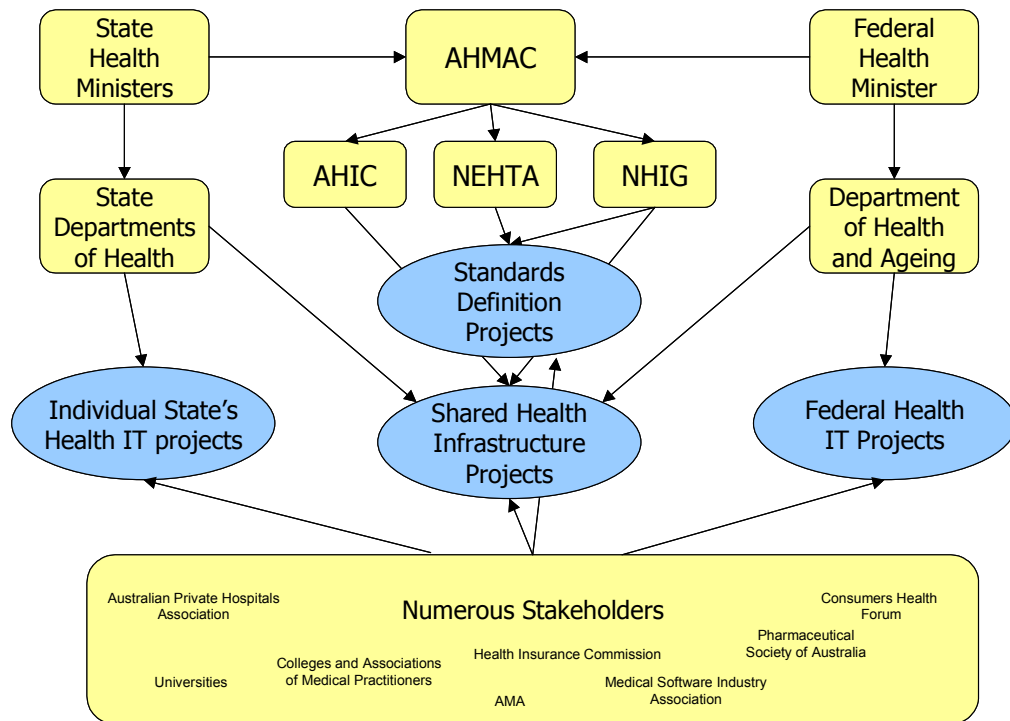
“The mandate of IT solutions in the Australian healthcare sector has changed from administrative requirements as first priority in the 1990s, to clinical needs and healthcare delivery needs as first priority from 2000 onward. This is mirrored in the move from organisation-centric processes to patient-centric processes.”⁶⁹

Because of the substantial public sector contribution to health care expenditure, the direction and pace of e-health is primarily driven by the State and Commonwealth

governments, with contributions from the many stakeholders – including health insurance firms, private hospitals, pharmaceutical firms and others.

Several bodies have been created under the auspices of Australian Health Ministers Advisory Council (AHMAC) to help set national directions and goals. Groups such as the Australia Health Information Council (AHIC), The National e-Health Transition Authority (NEHTA), and the National Health Information Group (NHIG) have been formed to help coordinate activities. Under the auspices of AHMAC, governments are also working to coordinate their activities in order to achieve greater shared benefit.

Figure 10. Relationship between government bodies and health IT projects



Source: CIER Analysis.

Considerable investment is being made through initiatives designed to create greater national alignment and connectivity between Australia’s various health markets, for example:

- national/centralised electronic health record – HealthConnect was allocated \$123 million in 2004-05 budget;
- medication history record – MediConnect, which is included within the HealthConnect budget;

- integrated health supply chain – the Health Supply Chain Reform Task Force;
- e-prescribing pilots in Victoria and Northern Territory;
- PACS – with almost all states having independent initiatives to implement PACS systems in their hospitals; and
- development of a set of national health informatics standards called IT-14, which covers clinical data, imaging standards and supply chain messaging standards.

There is also significant expenditure by various state governments on general system improvements. The Victorian HealthSmart project, an AUD 323 million upgrade program for hospital systems, is an example. These investments aim to provide interconnection between patient administration, clinical and finance system capability within and between hospitals and other health providers

By 2010, a large portion of the e-health system in Australia should have been implemented. Such a rapid pace of development provides a window of opportunity, but it can be expected to quickly narrow as the major contracts are concluded for this procurement cycle. For SME software developers such ‘lumpy’ markets can be difficult.

In general practice, computer use is high but the major focus is still upon financial and accounting functions. In 2002, computers were used in almost 90% of all Australian GP practices and 95% of all specialist practices – with 72% using computer for financial management and accounting purposes, and just 57% using them for electronic patient record management.⁷⁰

The General Practice Computing Group (GPCG) was established in 1997 as the peak body for general practice computing in order to foster development. The Australian government contributed AUD 9 million to their 2001-05 work plan, with AUD 2 million targeted to standards development.⁷¹ The GPCG has had a significant involvement in a number of e-health initiatives, including:

- Assistance with standards development, including Electronic Health Record (EHR) archetypes and vocabularies;
- A GP software engagement strategy to assist software vendors with requirements;
- Support for messaging applications;
- Trialling the EHR in conjunction with the HealthConnect project; and
- Support for the development of a software accreditation scheme for health.⁷²

In addition, the Australian Government Department of Health and Ageing is funding a AUD 35 million program, called the *Access to BroadBand Technology*

for GPs, which is designed to provide broadband access for GPs right across Australia.

The high levels of ICT spending currently taking place in the Australian health market, and the government drive to implement standards and a shared e-health infrastructure, makes the Australian market very attractive for health IT firms. A British study, conducted on behalf of Intellect UK, evaluated a number of foreign markets for British health IT firms looking to export and identified Australia as one of the most attractive markets (for British firms?), having the right mix of high opportunity and moderate competition.⁷³

International and regional e-health markets

The international market for e-health related software is very much determined by the level of sophistication and nature of each country's health systems. The most sophisticated markets are the countries of Western Europe, the United States and Japan. However, these markets also have the most intense competition, and entrenched and established players.

Table 11. Health market indicators for selected countries- 2002?

	<i>GDP Per capita</i> (\$)	<i>Number of Public Hospitals</i>	<i>Number of Private Hospitals</i>	<i>Health Spend per capita</i> \$	<i>Spend % funded by Govt</i>	<i>Spend % Private</i>	<i>Number Health IT Firms</i>	<i>Market concentration Top 10 firms</i>
Australia	27,614	748	549	2532	67.9%	32.1%	475	33.5%
Canada	29,235	1033	58	2792	70.8%	29.2%	450	25.6%
India	1050	10,560	4571	80	17.9%	82.1%	75	30.0%
Malaysia	9030	115	224	345	53.7%	46.3%	110	34.5%
NZ	20,764	85	360	1724	76.8%	23.2%	45	51.4%
UK	26,273	1227	200	1989	82.2%	17.8%	240	37.7%
US	36,056	1408	4402	5274	44.9%	55.1%	600	30.0%

Source: WHO⁷⁴; Australian Institute of Health and Welfare⁷⁵; Espicom as cited by Frost & Sullivan⁷⁶.

Europe

Health is a significant component of total economic activity in many European countries. In Germany, for example, health expenditures account for almost 12% of GDP, having increased at 1.8% pa between 1998 and 2003. The average spending increase across OECD countries for the same period was 4.5% per annum.⁷⁷

In March 2005, Frost and Sullivan reported that the European health IT market would double by 2010.⁷⁸ During 2003, the USD 3.13 billion health IT market grew by an estimated 9.7%, primarily driven by the implementation of Hospital Clinical Information Systems, a key building block in e-health. The public sector controls 75% of health IT procurement in Europe.

There are significant differences in structure and operation of the various health systems operating in Western Europe. Nevertheless, the general trend is toward greater integration. The French are implementing integrated systems, based on extensive use of smartcard technology for patient authentication and accessing patient records. The UK National Health Service (NHS) has been investing heavily in improving the capability of its health service and its underlying infrastructure. Its budget has grown from GBP 33 billion to GBP 67.4 billion since 1997, and the average spending per head of population has risen from GBP 680 to GBP 1,345.⁷⁹ The e-health initiatives that form a part of this upgrade are receiving significant funding, with a budget of GBP 2.3 billion over the 3 years from 2004 to 2007, and a total GBP 6 billion over 7-10 years.⁸⁰ UK initiatives include:

- Contact – An email and directory service;
- NHS Care Records Service – an electronic health record project;
- Choose and Book – an electronic service booking facility;
- Electronic Transmission of Prescriptions – e-prescribing;
- New National Network & Network upgrading;
- QMAS supporting GP practices – a system to support quality of service;
- Picture Archiving and Communications Systems (PACS); and
- Secondary Uses Service (SUS) –for improved data gathering and analysis.

The prime contractor roles for many of these initiatives have already been granted to major multinational ICT suppliers, including BT, Accenture, CSC, Fujitsu, Atos Origin and Cable and Wireless.⁸¹ Software contractors include such firms as Cerner. In general, the level of competition in the UK market in 2003 was high, with some 240 healthcare focused IT firms, and the top ten vendors taking 38% of the market.⁸²

An indicator of the relative sophistication of the UK market is the level of computerisation in general practice, which reached 98% in 2003.⁸³ Most practices are fully automated for the purposes of reporting patient demographics, prescribing and some pathology results. This is a very high level, and is a direct consequence of the removal of the government requirement for paper-based records in October 2002. Competition in this sector of the UK marketplace is intense, with market leaders entrenched. There are more than 20 suppliers of GP Patient Management Systems in the UK, and the top three have a combined 85% share of the market.⁸⁴

Australian firms wishing to benefit from investments in e-health in Europe will need to establish relationships with prime contractors, as well as ensuring that their products are recognised by the health care providers themselves. They must deal with public sector clients and be able to sustain long-term contract relationships. With national standards and accreditation also playing an important role, partnering arrangements with major system integrators may be a solution for Australian SMEs,

but these arrangements can place a smaller company in a weak position if the larger partner decides to change direction.

North America

The United States is the largest health care market, with aggregate and per capita spending significantly greater than other countries, even those with older population profiles.⁸⁵ The United States is unusual among OECD countries in not providing universal health coverage and in having a much greater reliance on private health insurance.⁸⁶

The Canadian health system on the other hand has similar characteristics to Australia's. It has a decentralised health care administration, with service delivery managed at the provincial and territorial level, and standards and funding managed centrally.⁸⁷

In both these markets, health care spending is increasing strongly, with spending in the US rising by 7.7% during 2003, four times the rate of inflation.⁸⁸ In Canada, per capita health spending increased by 3.4% pa over the decade to 2001, with an overall trend towards increasing costs.⁸⁹

United States

In the United States, more than 55% of health care funding comes from private sources. As a result, many decisions relating to IT strategies and investments are made within the private sphere, by health insurance firms and Health Management Organizations (HMOs). Nevertheless, the Federal Department of Health and Human Services (HHS) is responsible for setting the direction of health systems interoperability in the US and rules relating to the methods of e-prescribing and Medicare electronic claims are being developed.⁹⁰ The Health Insurance Portability and Accountability Act (HIPAA) led to significant expenditure to ensure compliance to federal standards. For example, it promoted stringent security and privacy controls on health systems, resulting in increased expenditure on IT to address these requirements. HHS released a report in May 2005 on the future of IT in the US Health Sector, by the Lewin Group. It suggested that:

- Widespread adoption of interoperable health IT should be a top priority for the US health care system;
- The federal government should use its leverage as the nation's largest single health care payer and provider to drive adoption of health IT; and
- Private sector purchasers and health care organisations can and should collaborate alongside the federal government to drive adoption of health IT.⁹¹

In 2004, Garter predicted an annual growth rate of 7% in the US health IT market, and expected the market to be worth USD 48 billion in 2006. Frost and Sullivan observed in 2003, that insurance firms were the largest spenders on health IT in the

US, with an estimated expenditure of USD 16.4 billion, while hospitals spent USD 15.9 billion and private practices USD 4.4 billion. The insurance firms have been early adopters of technology to ensure compliance with HIPAA regulations.⁹²

The goal of interoperability being promoted by HHS is consistent with the broad thrust of the e-health initiatives occurring in Australia, and Australian firms may well be able to offer product of value to the US market. Access to the US market might be improved by better government linkages, especially in the area of informatics standards. This may help reinforce the credibility of Australia as a source of expertise. However, Australian firms entering the US market face strong competition as some 600 health IT firms are operating in the sector.⁹³

Canada

In Canada, e-health initiatives are controlled by a non-profit vehicle called Canada Health Infoway. It has CAND 1.1 billion available for investment in e-health infrastructure projects, of which CAND 158 million has already been committed to 17 projects.⁹⁴ These include:

- Electronic Health Record and development of new informatics standards;
- Provider Registry Program – which provides details about health provider services and capabilities, authentication and access mechanisms, and a unique patient numbering system;
- diagnostic imaging – an implementation of a shared services model for diagnostic imaging;
- drug information systems – which provide online access to patient medication data; and
- National Electronic Claims Standard – a partnership between public and private health sectors to establish a more streamlined claims process.

The penetration of patient management systems in Canadian general practice was 57% in 2000, with only 12% of GPs using the full patient management functions and the rest simply using administrative capabilities.⁹⁵ This penetration level has almost certainly increased in the last 5 years and could be expected to be similar to Australia's, with similar opportunities and challenges for software developers.

The competitive environment in Canada is also similar to that of Australia, with 450 health IT firms – although the top 10 firms have a lower market share (25.6%) than in Australia, suggesting a somewhat more open market.⁹⁶ The expenditure in health IT infrastructure provides an opportunity for Australian health IT firms looking to export and Canada may provide a better opportunity than the UK. Different provinces manage their own e-health projects under the guidance of the Canada Health Infoway and this decentralised approach allows smaller Australian firms to compete for more appropriately sized contracts and deal with customers who are more amenable to approaches from smaller firms.

Asia Pacific

The Asia Pacific is a diverse region, consisting of countries at very different levels of development, with different cultural backgrounds and national philosophies.

Malaysia

The level of competition in the Malaysian market is relatively low, with only approximately 110 health IT firms present.⁹⁷ However, the Malaysian health sector is becoming increasingly capable and sophisticated. Public health funding has increased in line with the growth in the economy, from RM 3.4 billion in 1996 to RM 7.6 billion in 2003⁹⁸ – an average annual growth rate of 8.3%, and equivalent in 2003 to almost 7% of the national budget. The public health sector in Malaysia is administered centrally by the Ministry of Health, which oversees public hospitals, specialist medical institutions, dentistry, state health departments, public health insurance and the pharmaceutical control bureau. There are 13 major public hospitals, with a capacity greater than 600.

The health sector has received significant emphasis in the 7th and 8th Malaysia Plans, with health being part of the Malaysian multimedia super corridor project. The 9th Malaysia plan is yet to be announced, but it would be surprising if the health sector were neglected as the Deputy Minister of Health, Datuk Seri Dr Suleiman Mohamed, announced to the Malaysian Medical Association in June 2002 that health spending would be increased from 3.77% of GDP to 5%.

India

India's population is over 1 billion, and it is becoming an increasingly important force in international trade. Goldman Sachs predicted that India's economy could grow at a rate higher than 5% pa over the next 30 years, although its per capita income will still be low compared with the G6 nations (France, Germany, Italy, Japan, UK, US).⁹⁹ In 2001, India's per capita GDP was USD 1,560 compared with Australia's USD 27,614.¹⁰⁰ India's health system is large, with over 100,000 doctors and approximately 16,000 hospitals.¹⁰¹ This compares to a total of 1,297 hospitals in Australia. However, India's health system is still facing many challenges. Its per capita health spend is only 3% of Australia's.

In 2002, McKinsey & Company forecast that the health care sector would grow by 13% pa, and noted that medical tourism had been growing at 15% pa having seen growth of 30% during 2000.¹⁰² In June 2004, India's President announced that the government would raise its public health allocation from 0.9% to 2% of GDP over the next 5 years, but suggested that this increase would be spent on primary healthcare and disease prevention strategies aimed at the poor, rather than focusing on the acute/curative services of the public hospitals. Hence, it is anticipated that India's public health sector will have relatively low expenditure per capita, and is unlikely to provide attractive opportunities to Australian health IT firms.

It is in India's private sector that the greatest opportunity may lie. Private health spending in India accounts for more than 80% of the total spend. The rapidly growing wealth of the middle class is fuelling the development of exclusive private health centres and private health insurance designed to service the wealthier segment of the market. One of the most significant of the private hospitals groups is the Apollo Chain, which owns or operates 45 hospitals and is positioning itself as a provider of medical tourism, offering healthcare at costs one fifth to one tenth of those in the US or Europe. It is also expanding beyond India, with facilities in Bangladesh, Sri-Lanka, Saudi Arabia and Africa. Besides medical tourism, Apollo is investing in telemedicine and has its own IT subsidiary, Apollo Health Street.

The significance of the growth in private health insurance should not be underestimated. This sector is reported to be growing at 23% pa, and it is being encouraged by government as a means of improving the sector without increased government funding.¹⁰³ This may provide opportunities for those Australian IT firms that specialise and have a track record in private sector health care systems.

New Zealand

New Zealand has a system of public and private health services similar to Australia's, with approximately 80% of health care being publicly funded.¹⁰⁴ The public system is divided into 21 District Health Boards, whose annual budgets vary from NZD 48 million to NZD 870 million. New Zealand is well advanced in its health information infrastructure. The use of computers by GPs is high, with 99% of GP practices using a patient management system and 94% of practices connecting to the health intranet.¹⁰⁵

New Zealand has in place a national health index with a unique personal identifier, something that Australia is attempting to achieve with the HealthConnect program. In 1996, The New Zealand Ministry of Health initiated a health intranet project that commenced rollout in 1999. The Health Intranet service is provided by two organisations: Telecom New Zealand and Healthlink (owned by Orion Systems International, a New Zealand headquartered firm with a substantial presence in Australia). The health intranet offers secure, authenticated data transfer between health care providers. New Zealand is also advanced in automated hospital procurement systems using a central e-commerce exchange. The Australian firm, Pacific Commerce, is playing a role in this initiative. Due to strong similarities and deep economic and cultural linkages, New Zealand is likely to remain an attractive market for Australian health IT firms.

New Zealand is certainly well advanced with its health IT infrastructure and its use of ICT at the GP level, and no new areas of focused government investment that might indicate a specific market opportunity have been revealed. Despite this, the strong similarities between Australian and New Zealand health systems and the deep cultural linkages, suggest that New Zealand overall is an attractive market for Australia Health IT firms to explore.

The e-health software market

The e-health vertical software market consists of a number of segments. In the following sections each is discussed briefly, leading to a consolidated mapping of the health software vertical market.

Clinical systems

Clinical Information Systems provide information to assist decisions based on the patient record and current symptoms. The patient record is expected to become increasingly sophisticated and may eventually hold a wide range of information about the patient, including genetic, environmental and social contexts. It is the data contained within the patient record of clinical systems and other health IT software that allows the creation of a sharable electronic health record (EHR) and is one of the pillars of e-health. Thus the benefits of acquiring interoperable clinical systems are experienced not just by the health provider, but across a broader health care system.

Health care organisations typically purchase clinical systems from the big, well-known vendors as a means of reducing risk. There is also a convergence of functionality provided by the large vendors, with increasing standardisation. Large vendors are also adopting a bundling strategy, offering a full suite of products and services with their systems (e.g. including monitors, lighting room design, redesigning the clinical process).¹⁰⁶ Competition in the global market includes a number of large firms, such as Siemens, GE Health Care, Cerner, McKesson, Perot Healthcare Systems, iSoft and Dinmar Inc.

Table 12. Australian firms in the clinical systems market segment (non exhaustive)

<i>Clinical Systems</i>	
IBA Technologies	A local health care information systems provider with a comprehensive suite of clinical and administrative products. It will soon deliver its managed services technology to the South Manchester University NHS Trust and the Kettering NHS Trust (north of London).
Health Communications Network (HCN)	An Australian firm with over 80% share of the GP market for patient management software. They also develop complementary GP practice management software.
Matrix	Developers of medication management and medications decision support systems.

Source: CIIER Analysis.

TrackHealth is a significant Australian player in this market. The Medtrack system has been selected for use by Queensland Health. Another significant Australian player is IBA Technologies, which appears to be undertaking a growth by

acquisition strategy – acquiring several companies, including Monet Technologies in June 2005. A licensing agreement which would transfer ownership of IBA’s Clinical Systems, PAS Systems and Pharmacy System to Kodak in 2009 was reported to be “under a cloud” at the time of writing this report, as aspects of the deal are renegotiated (See also ASX announcements 12/9/05).¹⁰⁷ Also, at the time of writing this report, an announcement as to which clinical systems vendors will be selected to be on Victoria’s HealthSmart panel was pending.

Clinical support and other systems

Clinical support and other systems include pharmacy systems, pathology systems, radiology systems, medical imaging equipment and other systems, such as those used in the allied and community health areas (e.g. Dietetics, Speech Pathology, etc.).

Providers of clinical support systems face clearly defined global markets. Interoperability with core clinical and patient administration systems is a common demand, and adherence to standards such as HL7 for health record data and PACS for managing images is now a requirement. The advances in imaging equipment, such as 4D Ultrasound, High Speed MR and 16 Slice CT, are forcing radiology departments to manage hugely increased volumes of data. This is resulting in demand for the imaging functions of PACS to be fully integrated with Radiology Information System (RIS) functions.¹⁰⁸ Although this is a relatively new market, Frost & Sullivan estimated the market for consolidated RIS/PACS products at \$500 million to \$784 million in 2004. Australian companies that develop systems with dependencies to imaging data without addressing the imperatives of PACS integration and image storage and retrieval will face declining opportunities.

Box 1. True Life Anatomy

True Life Anatomy (TLA) is an IT development company based in Adelaide, which has produced innovative desktop software which provides interactive access to real-time 3D images of a patient’s injury at the bedside, in the clinic or in the operating theatre. TLA combines 3D animation tools, typically used for computer games applications, with conventional anatomical imaging (CT scans) to give a real time view of bones and surrounding tissues. For the first time, orthopaedic surgeons and other clinicians can view an injury and manipulate the image to accurately show a patient or a medical team what has happened and what is planned.

The unique advantage over competitors in the radiology 3D medical imaging market is the ability to export the TLA 3D models to clinicians. The images can be conveniently manipulated and viewed in real time which does not require specialised computer hardware or computer skills. This form of technology has established a benchmark for image distribution and is now being used clinically and, in the future, will allow true virtual surgery and 3D arthroplasty templating.

Source: DCITA (2005) *Secrets of Australian IT Innovation*, Department of Communications, Information Technology and the Arts, Canberra.

The market for pharmacy systems is significant, with the US market alone worth USD 1.4 billion in 2003.¹⁰⁹ There are quite a number of Australian developers of pharmacy systems, which may be a sign of maturity in this market. If so, consolidation might be expected.

Australian diagnostic service provider Sonic Healthcare developed its own web based radiology system in 2003,¹¹⁰ and such internally developed products are not unusual. Some Australian hospitals' IT departments have developed their own systems, especially in support of allied and community health needs and for capturing data needed by state governments for monitoring service levels. This begs the question as to how well the existing products and specialist developers are addressing the needs of health service providers, but it does indicate that there may be additional market opportunities for packaged software in this area.

Table 13. Australian firms in the clinical support market segment (non-exhaustive)

<i>Clinical Support and Other Systems</i>	
Kestral Computing	An Australian firm developing HL7 health message interchange software as well as offering radiology and pathology management systems.
Pen Computer	An Australian firm developing health software for mobile hand held / pen devices, which has broadened its scope into several different clinical support systems and health status recording systems.
TrakHealth	Australian developers of a suite of patient administration, clinical and clinical support modules designed for use in a Hospital or medical facility.
Cosmos	Australian developers of software for dispensing and stock management for retail pharmacies.
Amfac	Australian developers of retail and hospital pharmacy dispensing systems.
Centaur Software Development Pty Ltd	Australian developers of dental practice management software.
IntelliRad	Australian developers of tele-radiology, PACS, and medical imaging diagnostic workstation software.
Medseed	Australian developers on clinicians decision support tools and telemedicine applications.
Integrated Medical Systems (IMS)	Developers of medical records, patient billing, laboratory management, occupational health and safety systems.
Verdant Health	Developers of health applications for the community health sector.

Source: CIIER Analysis.

There are a number of Australian firms operating in this space. Our analysis suggests that there is competition from the likes of McKesson in more established areas (e.g. pathology and imaging) where companies such as GE and Agfa are significant players, but less competition in such areas as community and allied health systems, which may be viewed by software developers as lower value markets.

Box 2. Repatriation General Hospital

Infection Control Enterprise (ICE) is an innovative health software package that collects information from other health systems, analyses it, and then provides decision support to the hospital to control infection. It offers cost-benefit savings to hospitals, and reduces risk and improves quality at the same time.

The Repatriation General Hospital in South Australia in which ICE was developed, is a 250 bed hospital for veterans and the general public, with a reputation for commitment to patient care. During the last ten years the Repatriation General Hospital has developed many products, including ICE.

The team at Repatriation General Hospital is in the process of commercialising the software to ensure that its benefits can be enjoyed internationally, and to apply the rewards back to the hospital community.

The team want to achieve a benchmark for infection control internationally and, to do so, ICE can provide the information to determine if a hospital is safe. This is a community service that adds value to patients and reduces hospital risk at the same time.

Source: DCITA (2005) *Secrets of Australian IT Innovation*, Department of Communications, Information Technology and the Arts, Canberra.

Medical Devices

Medical devices can cover anything from simple tongue depressors and bedpans to complex programmable pacemakers with micro-chip technology and laser surgical devices.¹¹¹ The Australian medical devices market is worth more than USD 100 billion and is growing by 9% pa.¹¹² The US is the largest world market, and Europe the second largest. Asian markets for medical devices are growing rapidly. Australia manufactures medical devices worth approximately AUD 720 million, and exports approximately AUD 600 million. Of the total domestic medical device market, Australia manufactures 36% and imports 64%.¹¹³

Table 14. Australian firms in the medical devices market segment (non-exhaustive)

<i>Medical Devices</i>	
IM Medical Limited	An Australian investment vehicle for health sector technological investments, currently developing a web enabled heart function monitoring device.
Compumedics	An Australian manufacturer of computer based patient monitoring and diagnostic systems with a focus of sleep diagnostics and neurology.
Resmed	An Australian manufacturer of devices focused on the treatment of sleep disorders.
Cochlear Ltd	Well known developer of the 'bionic ear' hearing implant. Although not strictly a software developer, their speech processor technology uses sophisticated embedded software within their devices.
Ventracor	Australian manufactures of implantable heart device, with some associated remote device monitoring software.

Source: CIER Analysis.

An examination of the membership list of the Medical Industry Association of Australia (MIAA), the peak body for medial device manufacturers,¹¹⁴ suggests that there are few Australian owned IT/software companies participating in the medical devices industry. Most companies using sophisticated software within their product are foreign owned, and most Australian companies manufacture items that do not contain a significant software component (e.g. artificial hips and non-stick syringes). Therefore, we have identified no more than a handful of Australian companies that have software development capability in this area.

Despite the overall attractiveness of the medical devices market, it does not seem to be providing a large opportunity for Australian software companies. However, industry, with support from the Department of Industry, Tourism and Resources, is currently developing an Action Agenda to support the Australian Medical Device Industry, which may uncover further opportunities for Australian software developers.¹¹⁵

Box 3. Cochlear Limited

Twenty years ago Professor Graeme Clark launched the world's first commercial multichannel cochlear implant. Since the first commercial implant, Cochlear's Nucleus range has been implanted in nearly 62,000 people worldwide. Cochlear is now the world leader in cochlear implants that have enabled tens of thousands of hearing-impaired people to hear.

Cochlear operates in a global niche market with 80% share of the market in Asia-Pacific, 60% share in the Americas and approximately 60% share in Europe. Cochlear markets into 80 countries across the Americas, Europe and Asia, and continues to expand its export base throughout these regions and the Middle East. Cochlear employs over 800 people, 450 of them in Australia where the head office, manufacturing and the majority of R&D are located.

Dedication to innovation means Cochlear is a significant investor in R&D, with \$44.5 million spent on R&D in 2004 – a 7% increase from the previous year. The research program provides significant opportunity for Cochlear to leverage the latest technology research for future products. Collaboration is also a critical part of the developing relationship between major implant professionals and Cochlear. Cochlear's research efforts are closely linked to those of the Bionic Ear Institute, University of Melbourne and the Cooperative Research Centre for Cochlear Implants and Hearing Innovation.

Cochlear has been one of the major success stories on the Australian share market over the last five years, experiencing enormous growth in revenue and operating profits and providing substantial share returns. Sales revenue for the year ending June 2004 was \$282 million. Cochlear Limited is just outside Australia's top 100 companies, with a market capitalisation of over \$1.5 billion.

Source: PMSEIC (2005) *Growing Technology-Based SMEs*, Final Report March 2005, Canberra.

Patient administration systems

Patient Administration Systems (PAS) are commonly used in medium to large hospitals as stand alone systems. The role of these systems is to make patient bookings, allocate resources such as beds and equipment, schedule theatre bookings and manage patient service data. These systems also coordinate the delivery of services to the patient, including meals, linen, equipment and disposable items. They are typically linked to finance, supply and administration systems to fully integrate the operation of the hospital and related community services. Hence, PAS systems play a pivotal role in delivering e-health benefits, as they maintain the full patient demographic information vital for completing the basic record data in a shared EHR.

In Australia, there are several new initiatives to upgrade and integrate PAS across states and territories. PAS are a first priority for government funding, and contracts have already been let in NSW, Western Australia, South Australia, Tasmania and Northern Territory, with other jurisdictions expected to follow shortly.¹¹⁶ Integration of hospital PAS with GP and specialists and private sector health services (e.g. pathology, imaging, physiotherapy, etc.) for activities such as e-booking and e-prescribing, and mobile and wireless services for outpatients will be

future steps on the development path for PAS. NEHTA is facilitating the development of a nationally agreed record standard and a privacy protocol that will be used by all Australian jurisdictions. Pilot programs are being completed, and the solutions developed will be incorporated into PAS implementations.¹¹⁷

Table 15. Australian firms in the patient administration market segment (non-exhaustive)

<i>Patient Administration</i>	
Promedicus	Developers a range of health related products including practice management software, secure messaging and digital image handling (PACS).
IBA Technologies	A local health care information systems provider with a comprehensive suite of clinical and administrative products. It will soon deliver its managed services technology to the South Manchester University NHS Trust and the Kettering NHS Trust (north of London).
Health Communications Network (HCN)	An Australian firm with over 80% share of the GP market for patient management software. They also develop complementary GP practice management software.
Integrated Medical Systems (IMS)	Developers of medical records, patient billing, laboratory management, occupational health and safety systems.
Global Health	Developers of e-PAS a web based patient management system.
Track Health	Australian developers of a suite of patient administration, clinical and clinical support modules designed for use in a Hospital or medical facility.

Source: CIIER Analysis.

Growth prospects in the PAS market remain good, as many legacy systems are not capable of supporting e-health developments. However, competition for the major public sector contracts in the Australian market has been strong. International firms have often won the major contracts, sometimes leading a consortium.¹¹⁸ Large foreign owned competitors in this market include McKesson (US), iSoft (UK), and Capula (UK). New foreign entrants include UK based H2Hcare, with a web based PAS system. Recent newspaper reports indicate that at least one Australian company, TrackHealth, is a serious contender for selection in Victoria's HealthSmart project, along with iSoft, to provide Patient Administration Systems software.¹¹⁹

HCN has achieved more than 80% penetration of the Australian GP marketplace by pursuing a business model that provided the software to the GP for free or at very low cost. As a result, their product, Medical Director, has become a *de facto*

standard among Australian GPs, and companies wishing to provide services to GPs often integrate their offerings with Medical Director.

Finance, supply and administration

Software applications in this segment relate to patient invoicing, general ledger, procurement, stock control, casemix coding, coordination of outsourced services, etc. Products are commonly used by public and private sector service providers on a stand-alone basis. As with PAS, the installed base in many health care providers needs to be upgraded to provide an integrated system. In addition, new products are being added to handle linkages for health insurance claims processing and pharmacy services.¹²⁰

Table 16. Australian firms in the finance, supply and administration market segment (non-exhaustive)

<i>Finance, Supply and Administration</i>	
Pacific Commerce	An Australian firm specializing in improving the B2B procurement and supply chain within the health sector. They host electronic catalogues for suppliers such as Baxter, and the NSW government's SmartBuy procurement initiative and are currently operating this procurement solution in New Zealand, with 7 District Health Boards and 28 health suppliers.
ICS Global and Thelma	Thelma is an electronic transaction clearing house focused principally on the tracking, routing and monitoring of payments and claims between private hospital and health insurance firms. It is operated by ICS Global Pty Ltd.
Centrex Technologies Pty Ltd	Operators and developers of web based linen inventory management and tracking service for hospitals.
Jamsoft	Australian developers of billing software for health professionals.
TC Health Admin	Developers of casemix medical records administration software.

Source: CIIER Analysis.

Australian states have encouraged the implementation of a common ERP platform to ensure rapid reporting of financial information back to government. Contracts are typically let to large multinational ERP suppliers. Both Victoria and NSW have chosen Oracle, while Queensland Health and Mayne Health also implemented SAP.

Recently, various governments have sought to improve the efficiency of the procurement process. AHMAC created the Supply Chain Report Task Force, and NSW has implemented health procurement through its SmartBuy system. Such projects are likely to have implications within health care providers, and may, over

time, force systems upgrades to enable participation. However, success with these programs seems to be constrained by the enormous complexity and effort involved in standards, implementation and subsequent integration (See Trade and Commerce chapter).

As the segment is dominated by foreign owned multinationals (e.g. Oracle, SAP, 3M, etc.) the opportunities for Australian companies lie in exploiting niches. A case in point is Centrex Technologies, which has developed a web based linen tracking and management system, which they appear to be successfully selling as a service in the US market.

Infrastructure

Products in the infrastructure market segment include such things as middleware capable of translating messages between various health message exchange standards and proprietary protocols, secure environments for sharing patient data or requesting clinical support services, and products for managing digital patient data including Electronic Health Records.

Aspects of this segment can be considered to overlap with the Enterprise Application Integration (EAI) or middleware market and some multinational middleware providers, such as SeeBeyond, Oracle and Microsoft's Biztalk platform, incorporate HL7 messaging capability. In Australia, SeeBeyond is understood to have secured contracts with HealthConnect, which gives it an important advantage in competing for future HL7 integration projects that may arise.

Table 17. Selection of Australian firms in the infrastructure market segment

<i>Infrastructure</i>	
Smart Health	Australian developers and proponents of shared electronic health record technologies and supporting software.
Medical Objects	An Australian firm involved in the development of HL7 messaging technology.
Kestral Computing	An Australian firm developing HL7 health message interchange software as well as offering radiology and pathology management systems.
Promedicus	Developers a range of health related products including practice management software, secure messaging and digital image handling (PACS).

Source: CIIER Analysis.

In discussions with one local provider of HL7 middleware, a comment was made that their product could do all that the foreign product could do, at one quarter the

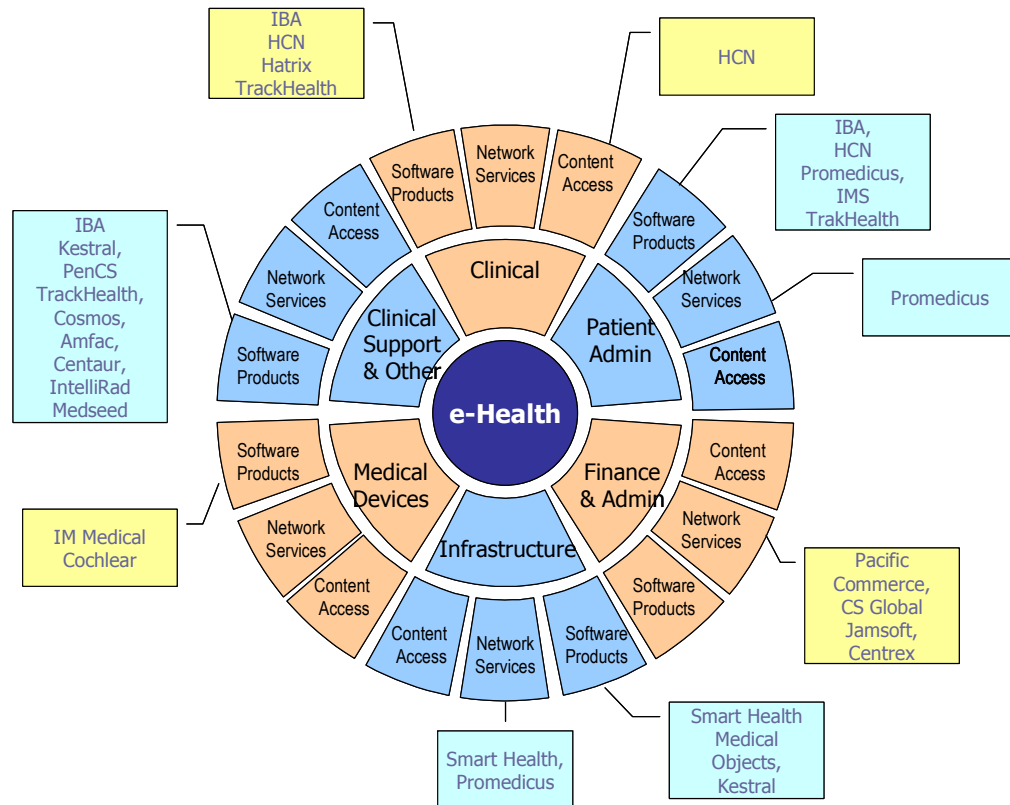
price, but governments and hospitals needed the security of buying the ‘name brand’. Australian middleware producers wishing to compete against MNCs in the area of the newly emerging health standards will face a difficult road unless they can offer something unique.

An example is Australian company Promedicus, which has developed a secure e-mail system for internet delivery of diagnostic results. This is akin to an EDI VAN for diagnostic results. Promedicus claims that two thirds of GPs in Australia use their system, thus creating a *de facto* standard. Promedicus is an example of a company that has stepped into a niche that is not completely standards dominated and quickly secured a relatively large market share.

E-health software suppliers

The e-health vertical software market map shows how these firms are distributed across the various market segments. This map does not identify all firms in the e-health vertical software market, it is merely indicative. It is intended to demonstrate where Australian activity is concentrated.

Figure 11. E-health vertical software market map



Source: CIER Analysis.

Three firms are particularly noteworthy for their apparent dominance in their respective markets – HCN, Centrex Technologies and Promedius. This seems to have been achieved through exploiting a niche or aggressively entering a market and obtaining market share quickly, so that they become the *de facto* standard. IBA appears to have the resources to undertake a growth strategy by acquisition, purchasing several companies and gaining market entry to the UK and New Zealand, while simultaneously pushing into the GP marketplace in Australia. TrackHealth has also secured contracts in the UK, and has marketing relationships with the likes of Deloitte and Accenture in Brazil and Spain, and technology linkages with IBM, Intersystems Corporation and Symbol Technologies. Electronic health record company SmartHealth has established a relationship with Telstra and with a Kuwaiti technology systems group, WLL.

Innovation base and support infrastructure

Although there are a significant number of formal linkages between universities, CRCs and other research bodies and Australian biotech companies, particularly those involved in genetic and drug research, our analysis suggests that most Australian software companies rely on their own resources to undertake R&D and product development (See Part A).

Box 4. Diagnostics CRC

The Diagnostics CRC research program discovers novel diagnostic targets and develops both high affinity reagents and high-sensitivity reporter systems. This is achieved through 5 integrated and collaborative projects: protein profiling (for novel Biomarker identification), genome diagnostics (for SNP biomarkers), high-affinity reagents (both protein and peptide libraries) and a core focus on infectious diseases and high-sensitivity Reporter Systems.

The participants provide collaborative platform technologies (e.g. the discovery of novel biomarkers) through analysis of molecular interactions, genomics and proteomics together with selection of complementary high-affinity diagnostic reagents.

The Centre's outputs include the development of diagnostic platform technologies, with particular emphasis on innovation in 'point-of-care' diagnosis, molecular arrays and novel opportunities for flow cytometry and high-sensitivity signal generation and capture for rapid quantitative assays.

Source: CRC Website (<http://diagnosticscrc.org>).

There appear to be limited direct linkages between government funded research bodies and Australian health IT companies. The Centre for Health Informatics at UNSW, for example, lists no Australian health IT companies among its partners.¹²¹ Of the nine organisations involved with the ARC Centre for BioInformatics at the University of Queensland, there are no Australian software companies – although two of its partner organisations, Nucleics and Proteome Systems, offer software as an adjunct to their equipment for analysis of DNA and proteins. However, the University of Wollongong's Health Informatics Research Centre does have a

linkage with Pen Computer Systems, and the Distributed Systems Technology Centre (DSTC) has been involved in developing an Open Electronic Health Record, although the DSTC is now closing and the intended future of its Intellectual property is not yet clear.¹²² The majority of external linkages with publicly funded research bodies and universities, that are documented and available in the public domain seem to be with multinationals. There are few apparent linkages with companies like IBA, TrakHealth and most of the other companies listed in this section.

However, there are software development activities and capabilities with application to health among players in the research support and innovation base. For example, the CRC for Sensor Signal & Information Processing's (CSSIP) recent project initiatives have included research on statistical pattern recognition techniques for identifying molecular panel assays for the purpose of classifying lung cancers, and the development of a virtual microscope.¹²³ CSSIP is scheduled to close at the end of 2005-6.

The Cooperative Research Centre for Cochlear Implant and Hearing Aid Innovation (CRC HEAR) is dedicated to developing new hearing prostheses and procedures to improve communication for hearing-impaired adults and children. A CRC HEAR research team was the inaugural winner of the University of Melbourne Business School e-challenge in 2001, an achievement that has led to the establishment of Dynamic Hearing Pty Limited, a venture-capital backed spin-off company. Dynamic Hearing's first product, the ADRO processing strategy, is hearing aid software that utilises the power of digital signal processors to automatically place output levels of a hearing aid into the audible and comfortable range of a hearing-impaired listener. CRC HEAR has also commercialised a number of products through HearWorks, including:

- SPEAR3 – a body-worn digital speech processor with software and development tools suitable for unilateral or bilateral cochlear implant and/or hearing aid research;
- SoundShield – an acoustic shock protection device for users of telephone headsets, which is manufactured by Polaris Communications;
- NAL-NL1 –software for prescription fitting of hearing aids that maximises speech intelligibility for hearing aid users; and
- CView –software for position analysis of cochlear implants using radiography.¹²⁴

Such examples demonstrate the existence of highly specialised health related software development capabilities and proven commercialisation pathways, although direct linkages to the Australian software industry and health IT firms seem limited.

Health market conclusions

A key opportunity for Australian health IT firms lies in taking advantage of rapid change and the growing sophistication in e-health in Australia. The Australian and State/Territory government initiatives to reduce health costs provide Australian firms with an opportunity to participate in this emerging area in the most supportive marketplace they could have. This is reinforced by the study of Frost and Sullivan on behalf of Intellect UK, which identified Australia as a priority target for UK firms.

The fundamental drivers of change will be the level of adoption by the Australian health sector of the emerging interoperability standards being promoted by the government (e.g. HL7) and the level of commitment to engaging in health informatics standards bodies around the world. The greater the involvement by Australia in these bodies, the greater will be the profile and level of respect in which Australian health software will be held in foreign markets, and the greater will be the opportunities created by networking.

Table 18. Overall SWOT analysis for Australian health IT firms

Strengths	<ul style="list-style-type: none"> • A good concentration of clinical support system firms. • Several firms with large market share and demonstrated excellence in GP practice management systems and clinical systems. • Health messaging firms that can take advantage of interoperability opportunities.
Weaknesses	<ul style="list-style-type: none"> • Australian presence in health IT bodies in South East Asia appears to be limited. • Linkages with publicly funded research institutions appear to be relatively few.
Opportunities	<ul style="list-style-type: none"> • Excellent opportunities presented by the Australian government interoperability initiatives to develop world's best practice interoperable health IT. • Canadian and New Zealand markets present similar characteristics and growth potential to Australian market.
Threats	<ul style="list-style-type: none"> • Strong competition exists from foreign firms in the Australian market (e.g. iSoft, Cerner, etc.). • Growth by acquisition is a strategy being adopted by foreign rivals (e.g. iSoft). • Australian firms may soon find themselves under pressure from large rivals.

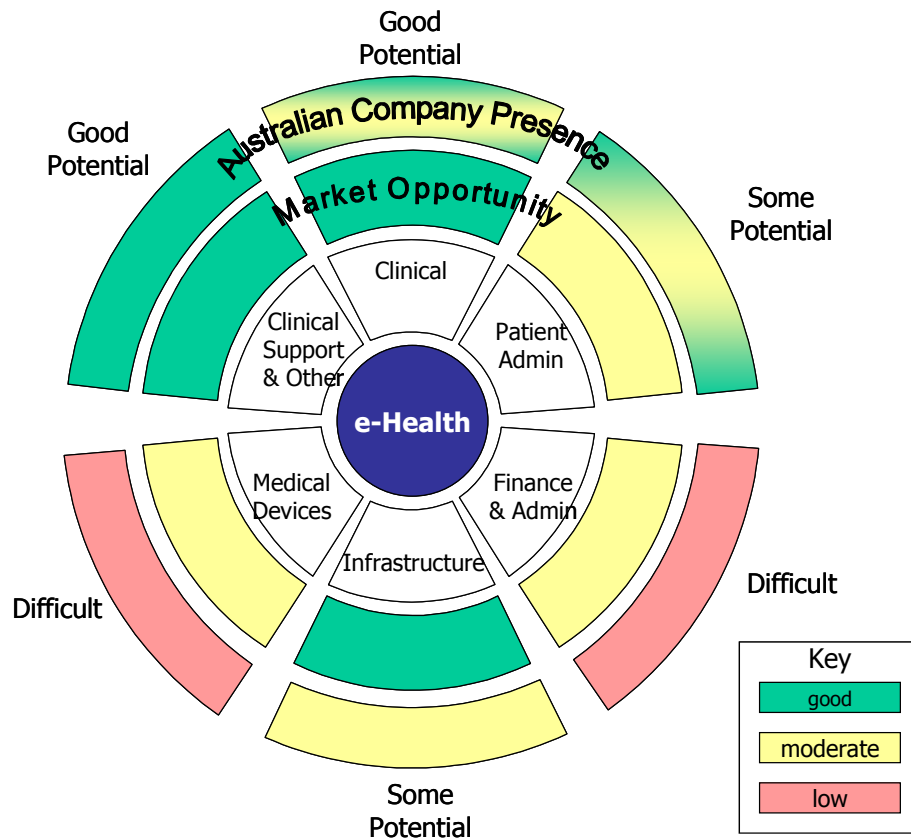
Source: CIIER Analysis.

The recent moves in the US to reduce its health care costs through federally coordinated programs, suggests that the health IT models being promoted in Australia will have applicability in that market too, provided that standards are compatible. The US market is large and the competition fierce. The Australian

government, or AHMAC, might usefully develop linkages with the US Department of Human Services to explore what opportunities for exchanges of ideas and mutual assistance in the area of interoperability could occur. This could prove to have downstream benefits for Australian firms, through enhancing the Australian health IT reputation in that market.

The Canadian and New Zealand markets are experiencing similar changes and developments to the Australian market. Australian firms that can demonstrate a successful product in their local market may find opportunities in the Canadian and New Zealand markets because of their similarity. Competition is at equivalent levels to Australia in both markets. Some aspects of India’s health sector appear attractive, including the relatively well financed private hospital chains and the private health insurance market. It is likely, however, that the Indian market will be appealing to a relatively small number of Australian health IT firms. The UK is a highly desirable market, but with significant competition. Successful entry requires substantial financial resources, and perhaps relationships with some of the prime contractors on the key projects.

Figure 12. Potential for Australian software in the e-health market



Source: CIER Analysis.

From the perspective of the various market segments, the Australian software industry appears best placed to make its greatest gains in the areas of clinical support systems and clinical systems, with potential in patient administration and infrastructure. Those concentrating on the GP market in Australia appear to have established barriers to entry for foreign competitors by obtaining large market share, thereby becoming the *de facto* standard. The situation in sophisticated hospital systems is quite different, with foreign MNCs proving to be tough competition, even in the domestic market.

It is likely that the level of sophistication of Australian producers will increase, driven by the intense focus by the Australian government on improving the interoperability of IT across the health sector. Those companies able to meet the demanding requirements of the current suite of e-health projects, as well as securing contracts ahead of tough foreign competition, will be in a good position to compete in sophisticated overseas markets.

Information and communication technology

The Information and Communication Technology (ICT) industry, as the core of the software industry, produces a wide range of software products. These fall broadly into three groups:

- enterprise products which have wide application and may also be addressed in a number of verticals
- custom products that are designed for specific purposes that relate to specific vertical markets e.g. mine optimisation software

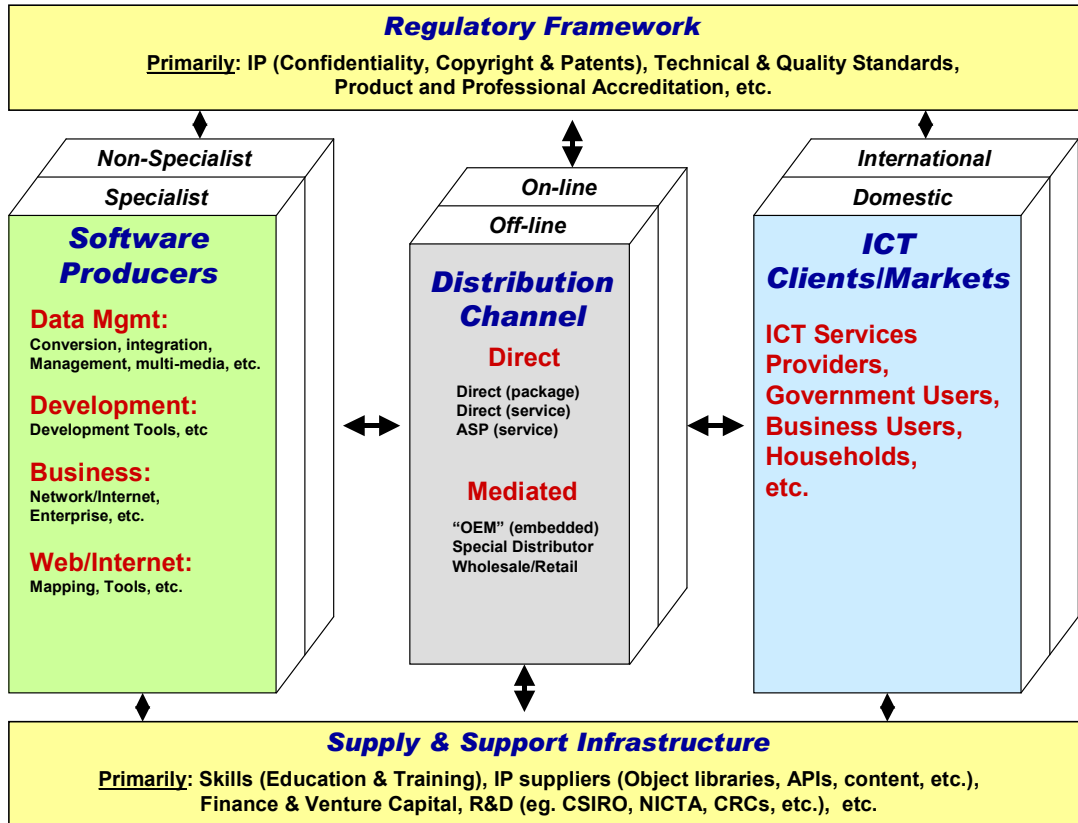
IT systems ‘glue’ products: middleware, networking, generic processing (e.g. data management), security and generic interface software etc.

The products identified in this vertical are used in all industries and are not specific to just the ICT industry, but, since many of them are used by ICT professionals, relate strongly to ICT professional services. Vertical ICT software products and services include ICT business products (e.g. network management), web/internet management products (e.g. web tools and search engines), data management tools (e.g. data recovery and data integration), and software development products (e.g. languages, development engines and design tools). Whilst operating systems and operating environment tools are also included in these products, that segment is dominated by international suppliers and hardware vendors operating systems and operating environment tools.

The ICT software product system

The overall ICT product system, regardless of product, is characterised by the dominance of the marketing power of global players in the ICT products and services sector, e.g. IBM, who act as the major clients and the primary channel through which many software developers reach the market. As a result, the leading ICT services multinationals and, to a lesser extent, network equipment and communications services providers, are key gatekeepers to markets. In more specialised segments (e.g. Document Management) of this vertical market there are greater opportunities to deal directly with end-users, and thereby create a more direct path to market. In such segments, collaboration with clients and producer-client linkages are crucial for innovation and development.

As elsewhere, adherence to international standards and interoperability are crucial – especially in such areas as software e-security, content management, and Web tools where the need to be platform (operating environment) independent is crucial. Product accreditation is also important, and a reference site can be an extremely useful way to gain credibility and instil confidence among would-be purchasers. As one industry representative said: “In selling to overseas governments it is imperative to have a local government site as a reference, otherwise the product will not be considered.”¹²⁵



Source: CSES Analysis.

All software developers depend upon their own skills and access to skilled workers. It is important to recognise that there is a requirement for an ongoing stream of qualified people to ensure development of new products is not hindered. The skill mix varies, with developers targeting the ICT vertical market likely to focus more upon the pure technical capabilities, while those in other verticals likely to seek a mix of vertical market-related business skills and technical skills.

For some time the anecdotal evidence has indicated that ICT employers believe that the higher education sector has a critical role to play in developing the technical and business skills required for ICT industries but this training is typically not embedded in the science/technology degree, with students being required to make the connections between the technology and its commercial application and prospects. However some Business IT degrees have inserted one year into the three year course to ensure that graduates have some direct work experience in business.

Software markets

The following statistical data and analysis is offered as an indicative view of the global software spends, accounting for all software except that developed in-house. Information on the latter is not readily available nor is there specific reliable

statistical data available on individual vertical market segments. However the projected data does give some idea of where there may be market opportunities. Total ICT spending underpins ICT market vertical spending, since all ICT environments need and use ICT products and tools.

Global IT software spending in 2004 was USD 241 billion. Asia-Pacific region spending on software was USD 29.4 billion, 12% of the world total. Australia ranked 10th in the world as a market, with spending of USD 3.1 billion, and 3rd in the region behind Japan (USD 15 billion) and China (USD 3.9 billion). The US software market was worth USD 119 billion in 2004, almost 50% of the world total. The second largest world market was Germany with USD 18 billion.¹²⁶

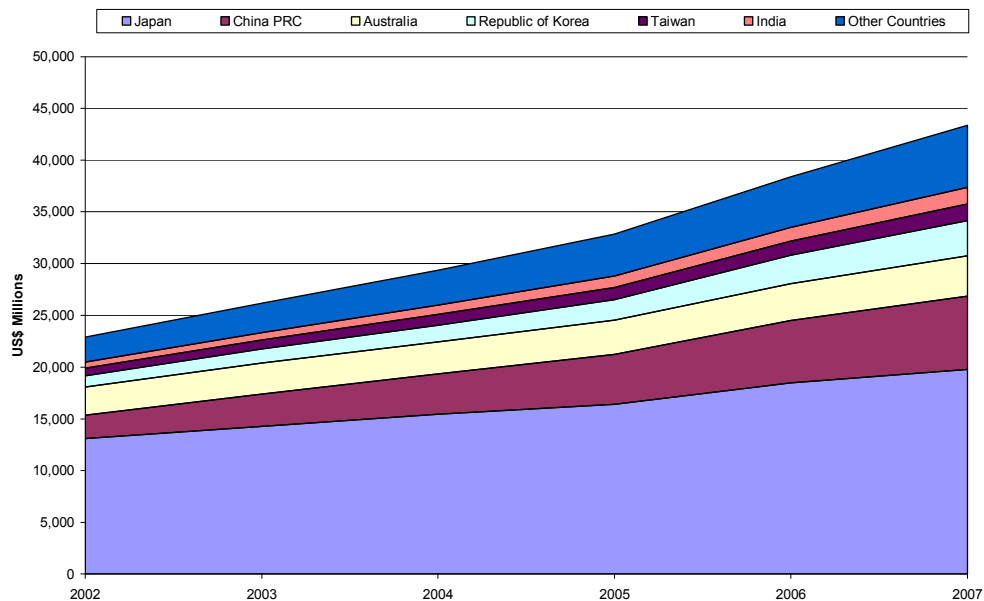
Growth projections suggest that the gap between the US and the other leading markets (Germany in software and Japan in services) is widening. Forecasts for 2007 show US spending of USD 148 billion, compared to Germany's USD 24 billion for software, and USD 335 billion, compared to Japan's USD 88 billion for services.¹²⁷ By 2007, Australia is expected to rank 13th in software spending and 11th in services. In both software and services, China is expected to be the biggest mover, rising from 15th to 8th in software spending, and from 22nd to 9th in services.¹²⁸

In 2004, Germany, United Kingdom, France, Italy and the Netherlands were the major markets in Western Europe, with software spending ranging from USD 18 billion to just over USD 5 billion.

Nevertheless, total spending of the five leading European countries was only USD 59 billion, compared to the US spending of USD 119 billion.¹²⁹ Projections for 2007 suggest that the same countries will continue to dominate Western European spending on both software and services.¹³⁰ In Eastern Europe, recent growth in software spending has been steady rather than spectacular, and figures released recently show spending in 2004 at USD 2.4 billion, rising to USD 3.5 billion in 2007.¹³¹

In the Asia-Pacific region there has been strong growth in software spending in a number of countries. Between 2000 and 2004, India's spending on software rose from USD 358 to USD 902 million, and it is projected to reach USD 1.6 billion in 2007.¹³² Despite the fact that offshoring to India is high on corporate agendas around the world, opportunities exist in India's ICT sector for Australian software firms focusing on vertical markets, such as health, transport, insurance, finance, chemicals and engineering. In other countries in the region the opportunities are varied. In China, there are many opportunities for supply and cooperation, due to the rapid development of the ICT industry. Key areas include supply chain management (SCM), enterprise resource planning (ERP), and customer relationship management (CRM).¹³³

Figure 13. Asia-Pacific software spending, 2002-07



Source: WITSA. Digital Planet2004, The Global Information Economy

Korea has developed a sophisticated manufacturing base for computer and telecommunications hardware and, with the rapid adoption of broadband, it has become one of the leading information economies in Asia. This has created opportunities for foreign firms that have internationally recognised technology and for services in a range of areas, including: Internet-related services, e-commerce applications, including payment solutions, network and systems integration services and smartcard and intelligent traffic systems. Taiwan also presents opportunities for Australian exporters in such areas as e-commerce and digital content for e-commerce, e-security, e-government, e-learning, and intelligent transport systems.

Austrade’s Global IT Team in their website has also identified opportunities for IT solutions in such areas as: advanced traffic management applications for urban networks; electronic tolling systems; smartcard systems for public transport; road and rail route planning and systems management; air traffic management; and advanced traveller information systems.

In Japan, there has been “a rush for firms to plug security leaks” with “technology solutions emerging as law takes effect” and the “public demands data safety”.¹³⁴ This has created a business opportunity for ICT firms to help their clients prevent data loss. Another sector of the Japanese market that has grown rapidly is authentication of online transactions. This market is driven by rapid growth of business-to-business e-commerce.¹³⁵ The big question facing Australian security

software providers is, can they get access to this still growing market and do they have the financial infrastructure to support a foray into Japan?

Whilst the comments above relate to other market "verticals" each of them also indicates a potential need for the "tools of trade" (i.e. ICT software products), to assist in the building, monitoring and management of ICT environments.

A graphical representation of the Asia-Pacific region shows the relative size and position of Australia vis-à-vis other countries. Although Japan is the biggest market, its growth is slower; whereas the growth curves for India and China are steeper. So, although Indian software spending is relatively small compared with the top four countries, it may represent one of the best opportunities for Australian software suppliers. However, China is the biggest mover, and notwithstanding cultural and language difficulties, there is export potential for Australian software developers.

The challenge for Australian software providers is to gain access to the rapidly expanding markets of the Asia-Pacific region as well as global markets. Whilst a range of factors will clearly influence their opportunity, the proportion of SMEs, and thus the capacity to maintain an export effort, is seen as a significant hurdle. In response to the question "Your corporate weakness?" one Case Study respondent replied: "If we have a weakness it is size. At times we have noticed that the size of our firm has affected decision making by potential customers. There is, at times, the syndrome of: 'if it is big it must be good' and if not 'they are big enough to sue.' Our biggest impediment to growth is the growing number of competitors and the size of some of our competitors. This requires our firm to become more innovative and clever."¹³⁶

The rising use of open source software is providing some niche opportunities for smaller firms to bring new products to market, and the Internet is also giving rise to new product opportunities.

Medium sized businesses and many smaller businesses are increasing the sophistication of their IT systems. The increasing use of Internet for commerce is driving the demand for integrated, robust and secure software systems on which to operate the trade and commerce products. There is also greater scope and demand for SMEs to integrate their operational and back-room activities.

In larger firms the use of web services and the move toward service-oriented architecture may also provide opportunities for smaller software suppliers.

Australian ICT software suppliers

The ICT industry is made up of a wide range of organisations and vertical streams which sit across both vertical and horizontal business markets. A large portion of organisations in a vertical business market are serviced by multinational firms supplying overseas developed software (e.g. IBM and EDS). This is often done in

conjunction with local service firms specialising in systems implementation and integration.

One of the more significant differences between the US and Australian ICT sectors is that of funding for product development. “In the US, angel funding is greater than venture capital funding, making start-up and research dollars more accessible. As a result, ICT firms in the US are able to get their product to market quicker and without the pressures venture capitalists place on the entrepreneur,” said one Melbourne Focus Group participant.¹³⁷ Another Melbourne Focus Group participant said: “Australia is seen to be competitive in price, even cheaper than Singapore and the US. Nevertheless, there are impediments to successfully entering the US market. Capital and lack of local market size prevent local firms obtaining critical mass and a revenue base locally that can support a US market attack”.

One of the outcomes of these differences is that Australian SMEs developing software products similar to US SMEs, find it difficult to succeed at this level of the market because they lack critical mass and capital. While they are successful in the local marketplace, in many cases they do not have a scaleable product or sufficient capital to step into overseas markets. As a consequence, the products are often not readily marketable overseas, nor is there a desire to go offshore. Hence, their growth is aligned with the growth of the business sector in which they operate.

On the other hand, the universal acceptance of ICT on the desktop, and the expansion of the Web and the Internet, has created new and diverse markets for specialist software developers. The expectation of the desktop user that all his/her data will be somehow managed and manageable is a key driver of growth of new product in the areas of data integration, security, document management, content management and search. These products can be classified under the heading of ‘productivity tools’. They include:

- integration programs, which allow data from disparate systems to be integrated into one database or a single report. These are key to the presentation of ‘legacy systems’ data combined with the current applications’ information;
- IT project and portfolio management for guiding the management of IT product and systems development and maintaining and upgrading installed IT systems. Products manage a range of functions from scheduling and tracking, resource profiling and allocation, risk management, quality management, time reporting and governance;
- security systems, which manage user activity and accessibility on in-house networks, while detecting outside or illegal intrusion;
- document management, which manages electronic documents and records from creation, to archiving, to destruction across local or geographically dispersed operations and locations;
- enterprise content management, software solutions for the management of unstructured data;

- corporate compliance, which manages all aspects relating to a board of directors and addresses Sarbanes-Oxley legislation, CLERP9, BASEL II, etc. compliance issues;
- intelligent mapping applications, provides analytic capability between mapping and business dashboards (e.g. highly specialised software that analyses data between mapping applications and interactive business dashboards without the user having to write any further code);
- development tools, including business process analysis tools, object-oriented analysis and design tools, business activity monitoring tools, business rule engines, business process management workflow engines, integrated, model-driven code generators, fourth-generation languages, Java 2 Platform, Enterprise Edition (@JEE) and .NET integrated service environments;
- data mining, which provides the ability to retrieve and analyse large amounts of data from large databases / data warehouses without impacting the performance of the systems creating the data;
- multimedia and games, which can be seen as productivity and development tools for the entertainment sector; and
- data and resource tracking, which includes tools that allow comprehensive track and trace capability.

Australia has a number of organisations developing leading-edge software that fall into these categories.

MNCs have the capability to develop the type of product discussed above and frequently do (e.g. Microsoft) however there appears to be a growing tendency for these companies to buy specialist developers and incorporate their product or services into their portfolio.

However, the market for some ICT products (operating systems) is totally dominated by MNCs and while the MNCs primarily focussed on large companies in the past they are now increasingly looking to sell to smaller businesses.

The proportion of Australian businesses using information technology continues to increase. Computer use has grown steadily, from 49% of employing businesses in 1993-94 to 85% in 2003-04. Internet use has grown more rapidly, from 29% of employing businesses in 1997-98 to 74% in 2003-04.¹³⁸

As new businesses are created, either by takeover, amalgamation or start-ups, software developers may expect a corresponding growth in their market as the business imperative is to use productivity tools in order to compete. For example a new company of, say, 50 people would need 50 copies of one product (Eracom security) and a lesser number of, say, a network management tool (Dtex).

Those firms developing 'productivity tools' (e.g. Data management, web/internet tools) have significant opportunities. Data integration tools are essential for the

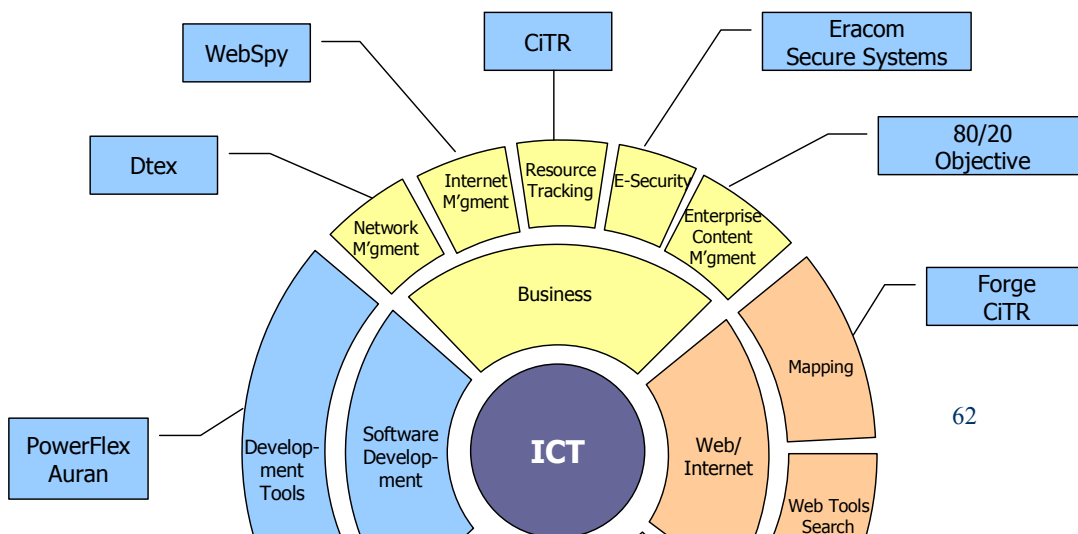
management of greater volumes of, and more disparate, data. The cost of replacing several older databases is considerable, thus a program that allows data from different sources to be gathered and reported is a cost effective alternative. A common focus for data integration is the integration of all data related to customers. These software products are sometimes called customer data integration hubs. The products support the global identification, linking and synchronisation of customer information from several sources, create and manage a central data base and enable the delivery of a single customer view.

Whilst web-based products are sometimes treated separately, Data management encompasses:

- Document management
- Web content management
- Records management
- Document capture and document imaging
- Document-centric collaboration
- Workflow to support business processes and routing content, assigning work tasks and creating audit trails.

As the majority of the products being discussed are in the hands of the end-user, whilst some sectors are more driven by networking and the internet (eg media, logistics and finance) than other sectors, in the main the market (for these data tools) is driven by the overall growth of the economy. There is little research data available to quantify this potential growth in sales volume for an SME with a leading-edge product. The product life-cycles for all software tools (due to the competitive nature of the ICT industry) can be short and this presents both dangers and opportunities. A market leader can be overtaken by the competition very quickly. For example, one Melbourne based firm developed a document management product in 1997, took it to the local market (successfully) and then to the US, where it was an immediate success. Today, eight years later, the product is still being enhanced, but that marketplace is now full of competitors and the firm has developed a new product that has enabled it to move its primary focus to another vertical market.

Figure 14. ICT vertical software market map



Source: CIIER Analysis

With the rapid growth of Internet based sales new products are being developed to provide, for example, search and retrieval capability, content management, online ordering and information dissemination that are effective, efficient and easy to use given that the end-user is the public. This type of product has great potential early to market developers. A Sydney based online search engine developer has launched a contextual advertising solution, which enables online publishers to provide targeted advertising aligned with their content.

It is interesting to note that of the 84,000 businesses estimated to be receiving income from sales via the Internet in 2003-04, 28% generated less than 1% of their total income in this manner. A further 28% generated between 1% and 5% of their total income via the Internet, while 44% of businesses generated at least 5% of their total income via the Internet. Only 6-7% of these businesses generated 50% or more of their total income from sales via the Internet.¹³⁹ As business usage of Internet services increases it is not hard to see from this data that a large number of businesses are potential client users of products that support and improve these facilities.¹⁴⁰

Multimedia is another growing market sector that covers many different industries, ranging from broadcasting through games, music, film production to advertising. It covers both content and delivery mechanisms. The Australian multimedia industry is recognised for its technical strength in multimedia production. Within the "multimedia" segment, the local games sector has been highly regarded for a decade, and attracts some of the most talented ICT people. A number of local firms are already actively exporting in these market segments.

E-Security is another area where Australian firms figure prominently. E-Security encompasses protection of data, data sources and data transport. Australian firms working in this arena have considerable expertise in access control systems, data encryption, virus protection, disaster management and data recovery. Due to the pioneering efforts of local firms in the areas of defence and intelligence networks, the Australian industry is rated highly around the world.

Some Australian firms operating in each of these market segments are listed in the accompanying table. Of these, the ones marked with ‘**’ are already exporting their products to markets that include the US, Eastern Europe and the Asia-Pacific region. This list is indicative, but by no means complete.

Table 20. Some ICT vertical market firms and products

<i>E-Security</i>	
Biometix	Develops automated border control systems, and has integrated Cognitec's biometric facial recognition system into 'Smart Gate' a best-of-breed application. The system has been deployed by the Australian Customs Service, is under evaluation by the US government and is being used as a test case by the International Civil Aviation Organisation.
Eracom Technologies	A key player in the IT security industry for more than twenty years, Eracom Technologies has been a leading developer and global supplier of cryptographic based IT security products and solutions. As an industry pioneer, Eracom has developed cryptographic technologies which are internationally recognised.
Rocksoft	Develops high-performance, scalable, mission-critical data integrity, data management and security infrastructure software.
Secure Systems Ltd	Established in 2000, Secure Systems is engaged in the research and development of data security technology and applications for computer based data security. The Company develops security solutions to ensure confidentiality, data integrity and user authentication. Secure Systems has a wholly owned subsidiary in the USA which was established in November 2001.
Tenix Datagate	Develops and produces cutting edge network separation security used worldwide.

Content Management (including Compliance)

80-20 Software Pty Ltd **	Founded in 1997 and with Offices in the US and Europe, 80-20 Software specialises in solutions that empower corporations with effective governance through solutions that deliver real-time compliance, control and transparency. In 2000, 80-20 delivered its first solutions for use by boards of directors in delivering sound corporate governance.
Objective Corporation **	Founded in Australia in 1987, Objective has provided Government and Top 1000 Corporations with solutions that deliver maximum return on their information assets. Objective is now a global company delivering solutions throughout Asia Pacific, Europe and the Americas.

Mapping

Integeo	Integeo, a Forge Group company, develops and markets Map Intelligence, a spatial Business Intelligence product that creates information-rich, interactive maps "on the fly" from the contents of digital dashboards or spreadsheets with no programming required. Seamless switching between location and data views enables new insights into knowledge that is hidden behind your data. Map Intelligence facilitates state of the art decision-making; thus lowering risk, enabling better governance, improving productivity and lowering costs across your organization. Map Intelligence currently interfaces to mapping applications from the leading GIS vendors.
CiTR Pty Ltd **	CiTR accesspoint is a platform for the creation of service directories and information & knowledge management portals providing electronic business solutions for the Internet, telecommunications, enterprise and government markets.

Web Tools (including Search Engines)

Mooter	Mooter Search is the leading provider of intelligent clustering, search and media personalisation software. Mooter has pioneered search result clustering and now provides a visually intuitive way to navigate through confusing amounts of data.
ISYS Search Software	ISYS Search Software is a global supplier of enterprise search solutions for desktops, networks, websites and intranets. The company's award-winning software has been implemented by organisations operating in a variety of industries, including government, legal and law enforcement. On display will be the brand new release of the ISYS Suite -- Version 7. Come see how we've made ISYS even more powerful and easier to use.
P@noptic	P@noptic is a highly effective search engine for the intranet, portal, websites or shared file systems. The search engine is oriented towards corporate and government intranets and portals but can be used in almost any search application. It supports all common metadata formats and can be customised to meet the needs of an organisation. The engine is used in major organisation is Australia and overseas.

Multimedia

Auran Pty Ltd	Established in 1995, Auran is one of Australia's oldest and largest game studios. Auran first came to prominence with the hit RTS 'Dark Reign: The Future of War', which won Strategy Game of the Year in 1997.
Krome Studios	Australia's largest developer, Krome Studios, has created a game that is uniquely Australian. <i>TY the Tasmanian Tiger</i> is a highly successful title selling over a million copies

internationally. After this success, the publisher, Electronic Arts, is asking for more TY and the third TY game is currently in production.

Micro Forté

Micro Forté is one of the world's oldest development studios and emerging publisher of wireless interactive entertainment products. Micro Forté enjoys a strong leadership position in the Australian games industry, having founded the [Academy of Interactive Entertainment Ltd.](#) Through its two studios Micro Forté develops innovative, quality technology and computer games.

Torus

Torus has demonstrated the prowess of their Southpaw first-person shooter (FPS) Game Boy Advance engine when they developed *Duke Nukem Advance*, *Doom II* and *The Recruit* for Take Two, Activision and BAM! Nokia recently published the Torus developed *Ashen*, the first multiplayer first person shooter for the N-gage system. These games have gained international recognition for Torus as world-leaders in the genre.

Document Management	
80-20 Software Pty Ltd **	Founded in 1997 and headquartered in Melbourne 80-20 created their core document and records management technologies. This product is still being sold through their offices in the US and Europe.
DocBank	DocBanq is a standards-compliant electronic document and records management system that is suitable for a wide range of organisations, including those in the biotechnology, public-sector, legal, engineering and financial services areas. DocBanq allows organisations to achieve records management compliance, where required, and to improve operational outcomes by allowing the secure sharing and searching of documents by all personnel.
Redmap Networks Pty Ltd **	Well established in the imaging and Information Management markets for over 12 years, Redmap sells predominantly through a growing network of Business (Channel) Partners throughout Australia, Asia Pacific, the United States and Europe. Redmap is acknowledged as a leading developer of document capture, document management and Information Management software.
Tower Software **	Tower Systems started in 1981 with an accounting system for Newsagents. In 1997, the first EDI (Electronic Data Interchange) trials were conducted linking the software to external supplier systems and in 1998 the first Windows point of sale program was released.
Weblogics	Weblogics has developed award winning web based knowledge management software solution, Intralogic, The product provides intranets, portals, internets and extranet knowledge sites that allow organisations to capture, manage and share their collective information and knowledge assets. The solution is very intuitive, out-of-the-box and requires no development or technical skills. Weblogics has a 14 year track record of success and customer satisfaction.
Data Integration	
Transol Corporation	Transport Solutions Pty Ltd was formed some 10 years ago, to provided a highly specialised transport service with a complete distribution service from receiving imported product through to specialised delivery to customers.
Wizard Information Services Pty Ltd **	Wizard is Australian owned and operated, and has been providing IT solutions and services to both government and the private sector in Australia, Asia, Europe and North America since 1985. It has an outstanding reputation for providing quality products and services.

Data Recovery

GetData Software	GetData Software specialises in data recovery and Windows system utilities. GetData's award winning data recovery software, allows recovery of files lost by accidental deletion, a software crash, virus infection or the accidental format of a hard drive.
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Data Mining

Prometheus Information	<p>Prometheus Information is an organisation focussed on delivering industry-specific Business Intelligence solutions. These solutions are built on our advanced, next-generation Business Intelligence technology. Prometheus BI empowers management to draw business insight from corporate data assets for timely and effective decision making. It has an unparalleled ability to add value to data through its capacity to:</p> <ul style="list-style-type: none"> • express complex business logic • link data from disparate sources • apply algorithms across the full range of data • add information through extensive classification systems • perform meaningful statistical analysis • empower users to explore the data through tables, maps and graphs in an Integrated Analysis Environment.
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Forge data solutions	Forge was established in 1995 and has grown to be a successful, open-standards software development and consulting organisation, specialising in distributed systems (Enterprise Service Management), large-scale data management and security. Forge delivers solutions to major Australian and International clients.
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Development Tools

Powerflex Pty Ltd	POWERflex Corporation is the developer and manufacturer of PFXplus, a high-performance multi-user software product for application development which is used to create commercial-quality network business applications for Windows, Linux, UnixWare, Unix SCO OpenServer and AIX systems.
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Auran Pty Ltd	Auran is currently producing V2.0 of its advanced 3D game development engine, Auran Jet.
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Sparx Systems	Sparx Systems was formed in 1997 and specialises in the development of high quality modelling tools. Enterprise Architect is a UML 2.0 based modeling CASE tool and offers high-end features and performance at a price that the entire team can be outfitted, thus realizing the true potential of a collaborative and shared modelling environment.
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Network Management

Dtex Systems Pty Ltd **	The Dtex Systems Group started in Adelaide in early 2000. Dtex is now a leading authority in internal security and is dedicated to becoming the pre-eminent provider of internal security solutions worldwide, with key strengths in the Asia Pacific market. Dtex officially launched the 'SystemSkan' product set in October 2002. Dtex has now set up its head office in Kuala Lumpur, which will be the centre for sales and marketing coordination throughout the Asia Pacific region, and will also house a new R&D centre.
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Internet Management

WebSpy Pty Ltd	WebSpy Ltd is a leading provider of Internet and e-mail Monitoring, Analysis and Reporting Solutions, all designed to provide meaningful reports and facilitate a transparent view of how network and systems resources are being utilised. Established for 10 years, with product representation in over 50 countries, WebSpy solutions are used by more than 6000 customers worldwide. WebSpy offices are located to provide comprehensive 24x7 support and customer services across Europe, Asia Pacific and United States.
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Resource Tracking

CiTR Pty Ltd	The latest product provides the capability of tracking all of a company's resources via an integrated track and trace system.
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Source: CIIER Analysis.

Innovation base and support infrastructure

The generic ICT industry and its supporting infrastructure is examined in more detail in Part A of this report.

The key elements of innovation for the software industry sector are, as indicated in Part A, access to capital, communications capability and a supportive taxation and business environment (e.g. intellectual property protection). The information industry faces unique problems in relation to gaining access to finance such access to capital has been a perennial problem for software firms. These relate to the high level of R&D spending necessary for firms to stay competitive; and the lack of physical assets in activities such as software development; and the problems of placing a value on the intellectual property contained in the finished product.

The Australian capital market suffers from its small size, despite the extent of deregulation which has taken place. It therefore finds difficulty in dealing with the

unique financing problems of the information industry in particular the software development segment.

Communications capability, especially high levels of band-width and reliability, is very important to software developers however low levels of adoption of broadband in Australia can adversely affect local software industry development

In the private sector, those SMEs that do significant R&D often spend up to 20% of their annual revenues. This group tends to be at the top end of the SME scale in terms of personnel size and revenues.¹⁴¹

Developers might benefit from greater engagement with and access to Australia's underlying R&D infrastructure, drawing on NICTA, CSIRO and various CRCs that focus their work on the relevant technologies, applications and vertical market. For example the CSIRO Business intelligence Group has excellent expertise in data mining and the Smart Internet CRC in Internet related technologies and applications.

In addition to the issues raised above there are a range of other regulatory issues affecting software firms addressing the ICT market. These include:

- rivacy legislation and the need to build compliance mechanisms into development;
- rofessional indemnity and liability, an area in which recent developments have adversely affected SMEs in many industries;
- echnical and professional accreditation, including a range of compliance and accreditation issues; and
- echnical and quality standards

ICT Market Conclusions

We consider that the ICT sector offers good opportunities to organisations that have developed software products able to fill a niche market – particularly for tools. Unlike the application software market, where the large multinationals play a dominant role, the software tools market is more accessible to smaller firms – as the large multinationals tend to focus on the high cost, high profile projects for large corporates (using overseas developed software products). There are a number of leading-edge software products that have the capability to position their Australian developer at the top end of the global market niche. In fact, a number of firms have already achieved this status. Nevertheless, we consider that there is still an untapped local market within smaller firms for software that operates across the spectrum of business requirements, and at the same time is independent of hardware platform and operating environment.

Very small businesses (those with fewer than five employees) had much lower adoption of information technology at June 2004, with 80% using a computer, 67% having Internet access, but only 16% having a web site or home page.¹⁴²

If the potential of the Internet was first seen and exploited by the developed world, the period between 2002 and 2004 marked the emergence of the developing world into the policies and politics of the Internet, driven both by their firms and governments. The growth of the Internet provides the means for a new competitive opportunity for developers of niche software products, through the use of internet based marketing and distribution. This opportunity enables new and existing products to be available to a wider market in a shorter timeframe. The alternative is a locally based branch office which has its own set of problems.¹⁴³ The relative ease of bringing a product to market and the ability to gain penetration (using technology to deliver the product) means that high cost distribution channels are not always necessary. However, it is also recognised that major players (e.g. Microsoft) use highly developed distribution channels very effectively.

Focus group attendees have suggested that almost all Australian ICT firms planning to export view the US as the ultimate marketplace. One view is that being a niche player in a large field can be more rewarding than being a big player in a niche field. As one participant at the Sydney Focus Group meeting said: “The US (marketplace) is huge, so any niche is okay.”

The experience of firms that have been successful in the export arena, however, shows how difficult it can be to break into, and gain a foothold in overseas markets where significant competition already exists. For this reason, the developing countries of the world may provide an environment where opportunities still exist and are open to all comers. The WITSA report *Digital Planet 2004* predicts that the services and software segments of the ICT market in developing countries will grow fastest over the next four years and thus offer the best opportunities, because of the lower investment required for equipment and infrastructure.

However, one needs to look at these markets carefully. In Africa, for example, while current spending on software is low, there are enormous economic issues facing individual countries which are likely to constrain the growth of ICT markets. The Middle East has some areas of greater wealth and market potential, but we consider that economic and other issues appear to be weighted against this region becoming a major export market for ICT products in the short term. Opportunities do exist in these areas, but probably not in sufficient volume to warrant an aggressive marketing campaign from Australia in this particular vertical market. Similarly Eastern Europe is a region showing growth and some potential, but there are language and cultural issues facing an exporter. Nevertheless, some Eastern European countries are becoming active in ICT manufacturing and in areas such as offshoring, which would suggest that the language barrier is not insurmountable. Moreover, some Eastern European countries have high levels of e-commerce and Internet use, which suggests that there may be some scope for Australian software exports of ICT development and management products.

We believe that there would seem to be good opportunities for ICT software products in the regions closer to home (i.e. the Asia-Pacific), especially in growing

economies. This potential applies to most ICT vertical market software products, except software development languages, where there is the strongest market presence of MNCs. Other products (e.g. web tools, data integration and data management) would seem to have the capacity to compete alongside other country's products.

Export market opportunities

Export potential was assessed for each of the vertical software market sub-sectors, and a ranking was allocated to each of the major international regions for comparison purposes.

This ranking is indicative and provides an approximate ordering of the regional opportunities for Australian firms, both for the vertical market in particular, and to a lesser degree, for software products in general.

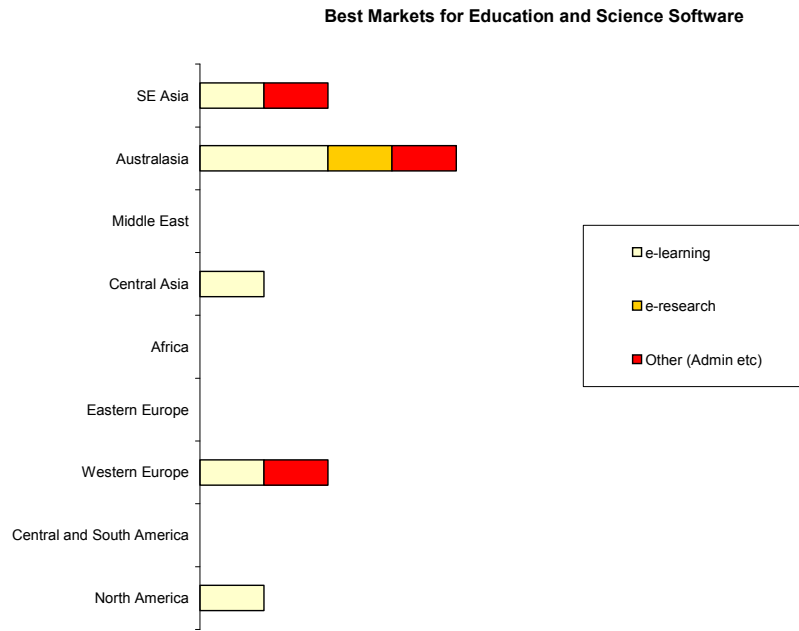
Regions were categorised for Australian software of each sub-sectoral type as being a well established market, a strong potential market, or a less advantageous market, based upon the analysis in this Report.

A ranking value from 0 to 4 was then allocated to this market determination by sub-sector and region, to allow for graphic representation of the export potential. Ranking was allocated to each regional area, with a higher value for established markets, middle value for potential markets, and a zero value for less advantageous markets.

It should be noted that the relative size of the regional market for each vertical sub-sector varies considerably, and this would also need to be considered by individual firms. Nevertheless, the application of this ranking allows some comparison to be made of the relative significance and potential of particular target regions and for particular software sectors.

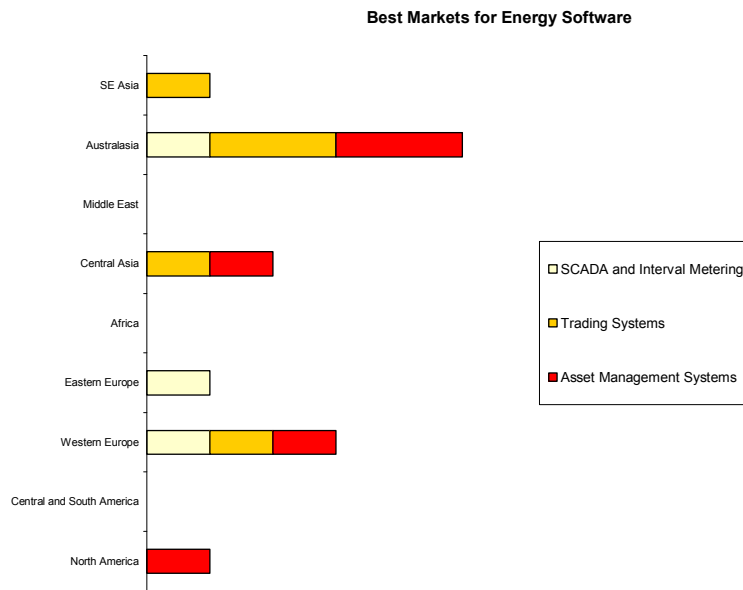
In some cases (e.g. mining software into Canada, rather than US, and educational software into UK, rather than France or Germany), it is also important to note that the significance of a particular region is mainly ascribable to one particular country, rather than necessarily to the region as a whole. In order to maintain consistency between the vertical market sector graphs, and to allow for aggregation, all regions are shown in each vertical market graph, whether that region is referenced or not. Australasia is also included, as it both includes New Zealand, and, in some cases, the vertical market potential may be equal or stronger outside Australia.

Figure 15. Vertical software market analysis: Education



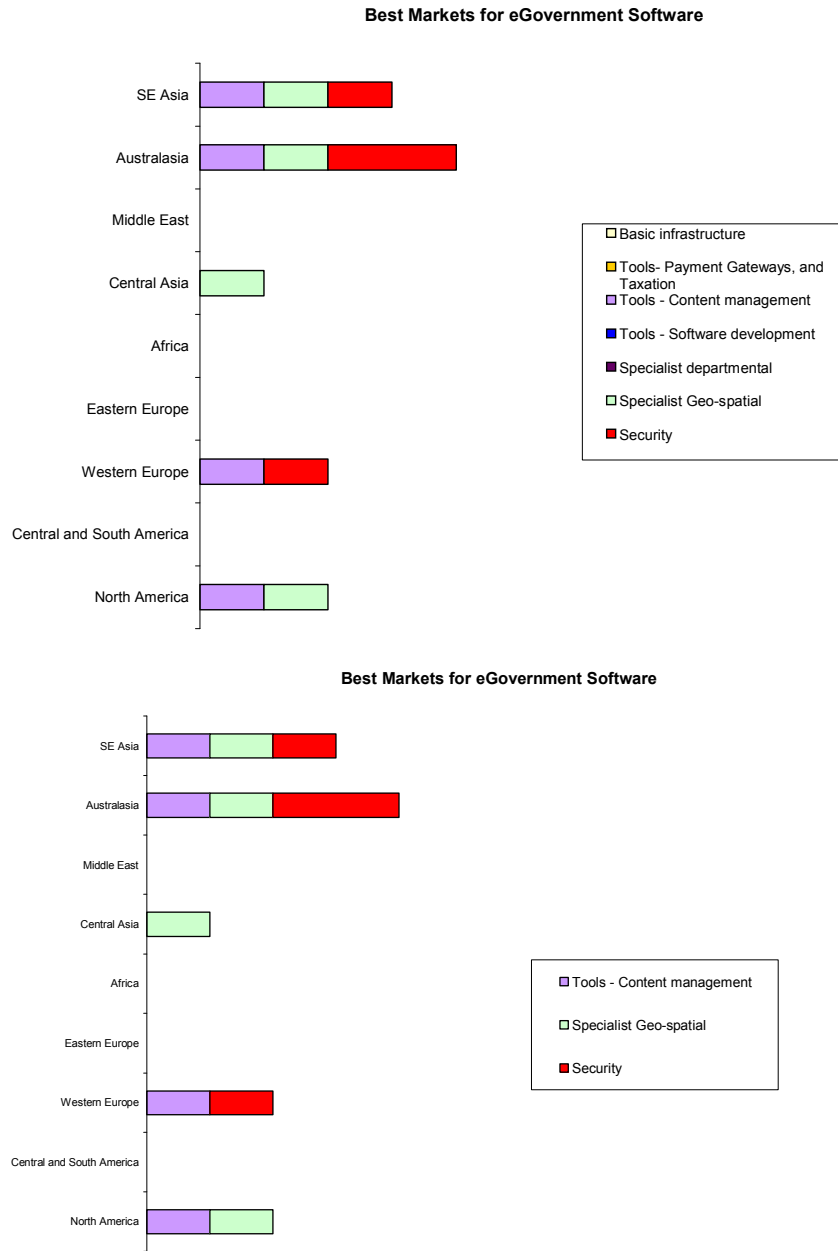
Source: CIIER Analysis.

Figure 16. Vertical software market analysis: Energy



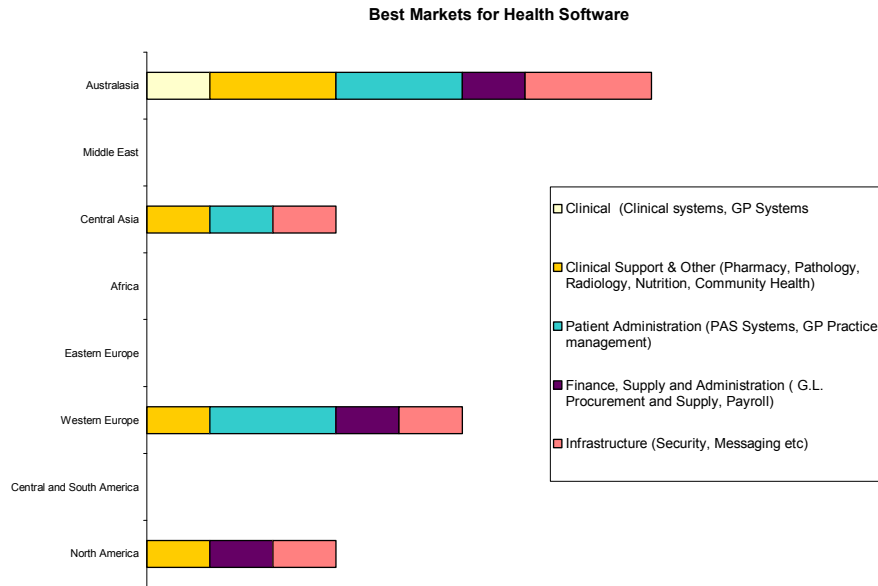
Source: CIIER Analysis.

Figure 17. Vertical software market analysis: Government



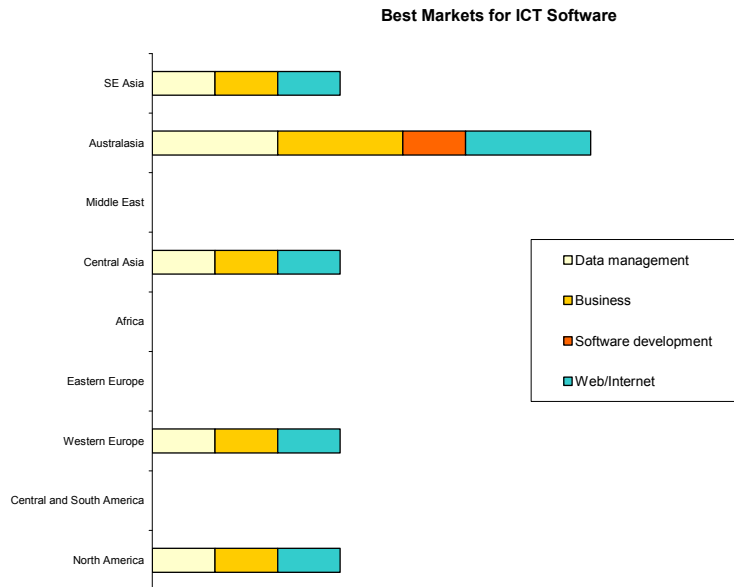
Source: CIIER Analysis.

Figure 18. Vertical software market analysis: Health



Source: CIIER Analysis.

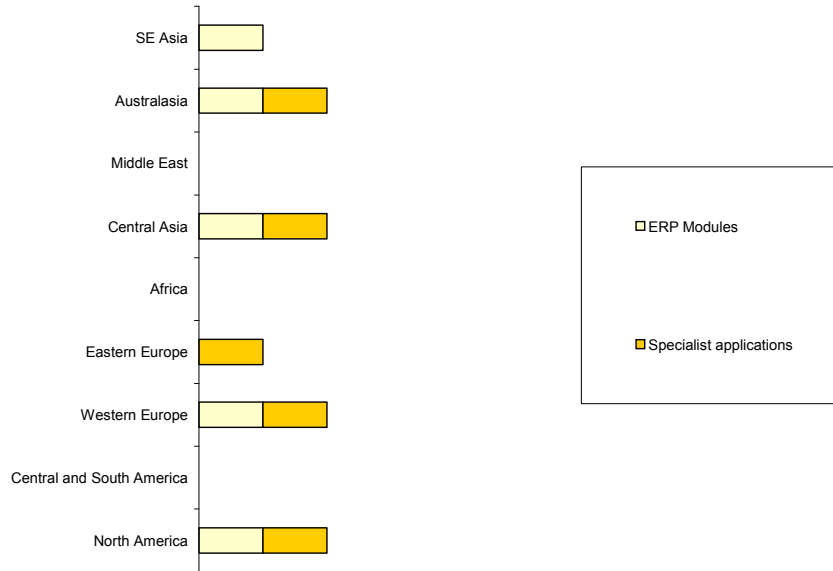
Figure 19. Vertical software market analysis: ICT



Source: CIIER Analysis.

Figure 20. Vertical software market analysis: Manufacturing

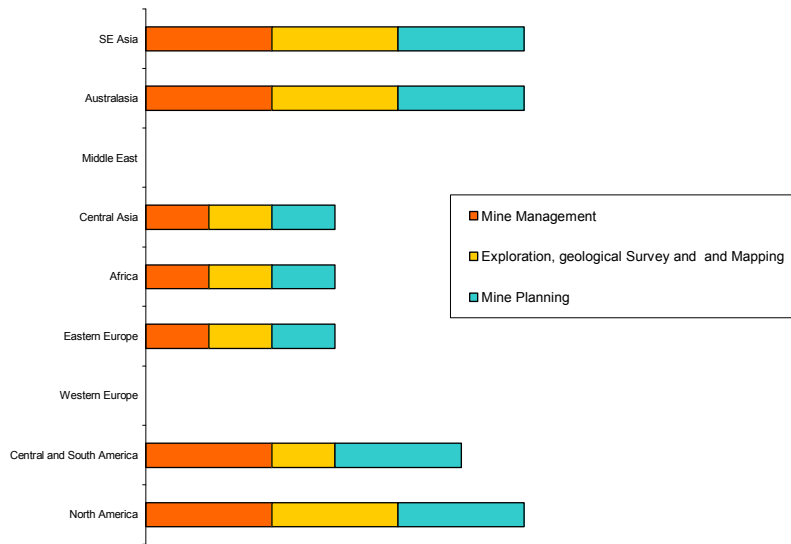
Best Markets for Manufacturing Software



Source: CIER Analysis.

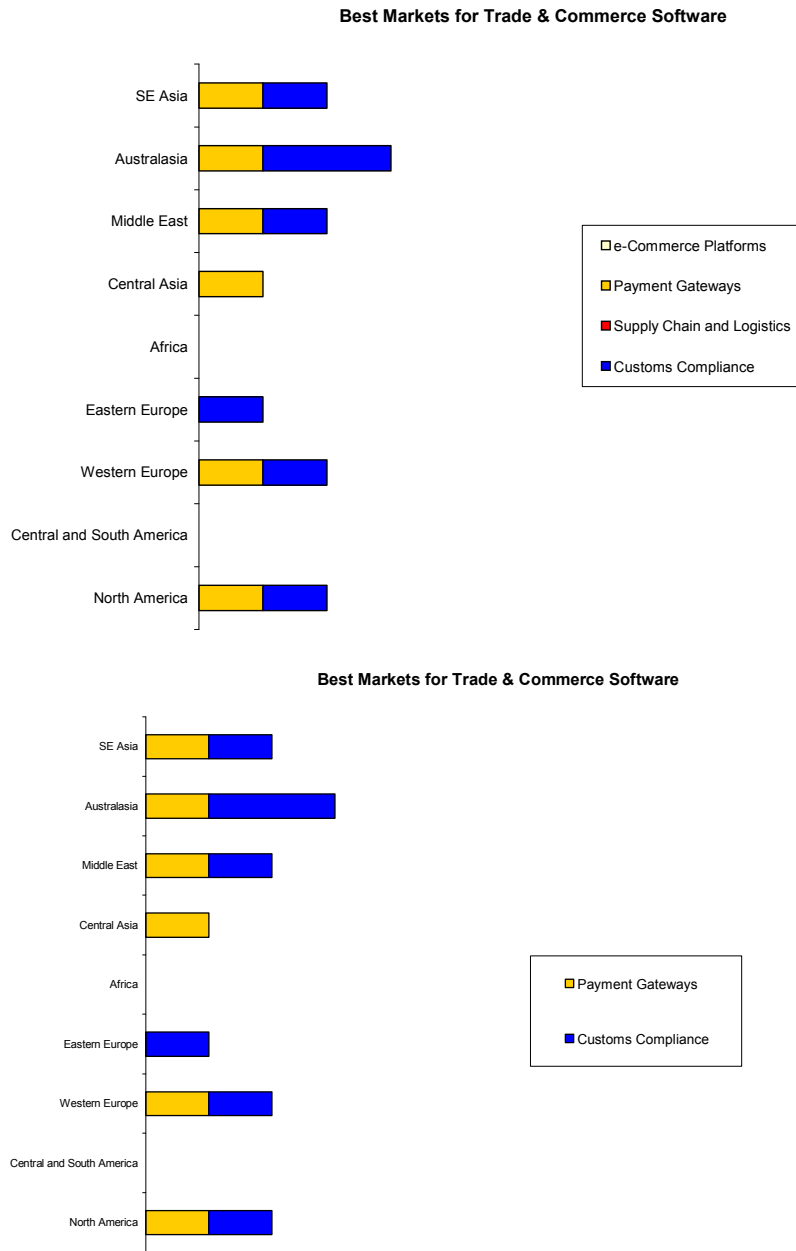
Figure 21. Vertical software market analysis: Minerals

Best Markets for Minerals Software



Source: CIER Analysis.

Figure 22. Vertical software market analysis: Trade & Commerce



Source: CIIER Analysis.

Export Market Conclusions

One result of this analysis is to show that the significance of regions for export potential by geographic region varies considerably for particular vertical markets, with minerals having the most divergent profile from other vertical markets, and thus likely requiring significantly different and tailored export programs.

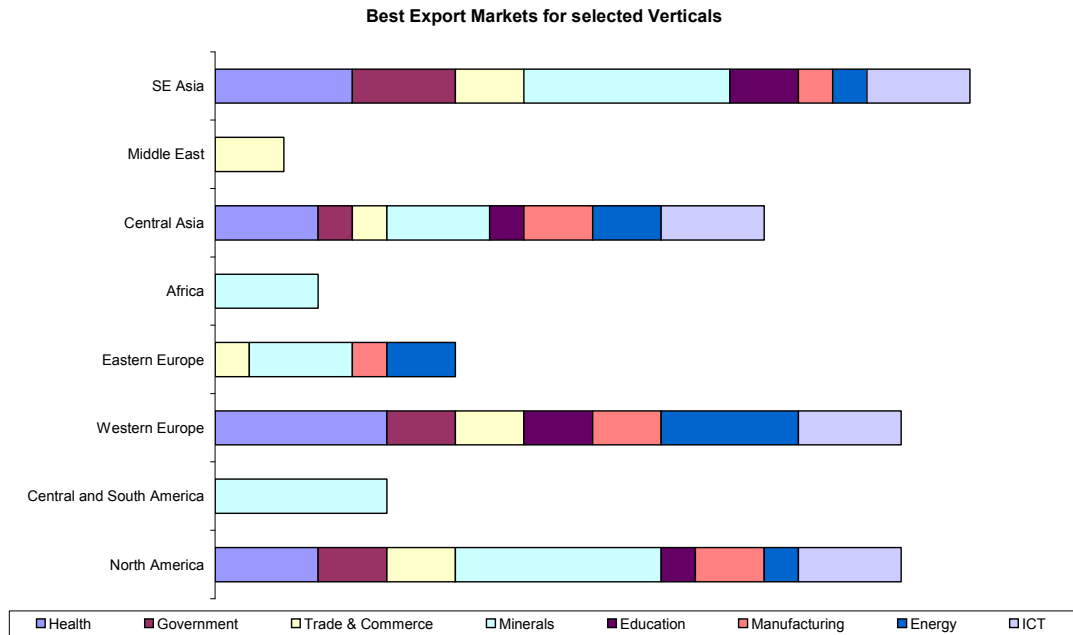
Another result is to show that, despite its relative size, North America may not offer the most responsive target. The ‘common heritage’ of the Commonwealth has resulted in a higher degree of commonality in practices and legislation (in health, education, government, and, to a lesser degree, energy) in regions including those countries within or formerly part of that grouping.

The most significant emerging markets in high growth regions of the world are in South East Asia, Central Asia and Eastern Europe, but the significance of each of these, and the merits of particular countries within the region, varies depending on the vertical market, and can vary considerably for particular sub-sectors within a specified vertical. As a general rule, however, those countries with greater cultural compatibility to Australia offer the easiest potential market entry (e.g. New Zealand, UK, Singapore, India, Canada, Malaysia).

We would recommend consideration by the ICT industry of a sectorally targeted software export strategy, based upon specific vertical market missions to selected regional and country targets. As each Australian state has different strengths and weaknesses in particular vertical sectors, it may be easier for some such missions to be state based, or jointly developed by key states within the vertical sector, rather than being necessarily national in nature.

We would also recommend consideration of more structured links between firms within such sectors being explored, as the limited feed-back derived from the various focus groups and case studies has indicated a commonality of interest and the potential for useful cooperation between Australian software developers who are interested in growing their businesses in the same vertical market.

Figure 23. Summary of export markets for selected verticals



The graph above summarises the results of the individual vertical market graphs, and aggregates the potential market indices for each vertical market within each region. As can be seen, Africa and Central and South America are considered viable targets for minerals software, whilst other regions have a broader potential on this analysis. As sub-sectors of the vertical markets selected can also vary considerably in potential, the following table shows the same data in a colour-coded tabular form.

Figure 24. Detailed summary of vertical software markets



Source: CIIER Analysis.

Annex 2 National Research Priorities

Research Priority 1: An Environmentally Sustainable Australia

- Transforming the way we utilise our land, water, mineral and energy resources through a better understanding of human and environmental systems and the use of new technologies

- Water – a critical resource
- Sustainable ways of improving water productivity, using less water in agriculture and other industries, providing increased protection of rivers and groundwater and the re-use of urban and industrial waste waters.
- Transforming existing industries
- New technologies for resource based industries to deliver substantial increases in national wealth while minimising environmental impacts on land and sea.
- Overcoming soil loss, salinity and acidity
- Identifying causes and solutions to land degradation using a multidisciplinary approach to restore land surfaces.
- Reducing and capturing emissions in transport and energy generation
- Alternative transport technologies and clean combustion and efficient new power generation systems and capture and sequestration of carbon dioxide.
- Sustainable use of Australia’s biodiversity
- Managing and protecting Australia’s terrestrial and marine biodiversity both for its own value and to develop long term use of ecosystem goods and services ranging from fisheries to ecotourism.
- Developing deep earth resources
- Smart high-technology exploration methodologies, including imaging and mapping the deep earth and ocean floors, and novel efficient ways of commodity extraction and processing (examples include minerals, oil and gas) while minimising negative ecological and social impacts.
- Responding to climate change and variability
- Increasing our understanding of the impact of climate change and variability at the regional level across Australia, and addressing the consequences of these factors on the environment and on communities.

Research Priority 2: Promoting and Maintaining Good Health

- Promoting good health and well being for all Australians
- A healthy start to life
- Counteracting the impact of genetic, social and environmental factors which predispose infants and children to ill health and reduce their well being and life potential.
- Ageing well, ageing productively

- Developing better social, medical and population health strategies to improve the mental and physical capacities of ageing people.
- Preventive healthcare
- New ethical, evidence based strategies to promote health and prevent disease through the adoption of healthier lifestyles and diet, and the development of health-promoting products.
- Strengthening Australia's social and economic fabric
- Understanding and strengthening key elements of Australia's social and economic fabric to help families and individuals live healthy, productive, and fulfilling lives.

Research Priority 3: Frontier Technologies

- for Building and Transforming Australian Industries
- Stimulating the growth of world-class Australian industries using innovative technologies developed from cutting-edge research
- Breakthrough science
- Better understanding of the fundamental processes that will advance knowledge and facilitate the development of technological innovations.
- Frontier technologies
- Enhanced capacity in frontier technologies to power world-class industries of the future and build on Australia's strengths in research and innovation (examples include nanotechnology, biotechnology, ICT, photonics, genomics/phonemics, and complex systems).
- Advanced materials
- Advanced materials for applications in construction, communications, transport, agriculture and medicine (examples include ceramics, organics, biomaterials, smart material and fabrics, composites, polymers and light metals).
- Smart information use
- Improved data management for existing and new business applications and creative applications for digital technologies (examples include e-finance, interactive systems, multi-platform media, creative industries, digital media creative design, content generation and imaging).
- Promoting an innovation culture and economy
- Maximising Australia's creative and technological capability by understanding the factors conducive to innovation and its acceptance.

Research Priority 4: Safeguarding Australia

- Safeguarding Australia from terrorism, crime, invasive diseases and pests, strengthening our understanding of Australia's place in the region and the world, and securing our infrastructure, particularly with respect to our digital systems.
- Critical infrastructure
- Protecting Australia's critical infrastructure including our financial, energy, communications, and transport systems
- Understanding our region and the world
- Enhancing Australia's capacity to interpret and engage with its regional and global environment through a greater understanding of languages, societies, politics and cultures.
- Protecting Australia from invasive diseases and pests
- Counteract the impact of invasive species through the application of new technologies and by integrating approaches across agencies and jurisdictions.
- Protecting Australia from terrorism and crime
- By promoting a healthy and diverse research and development system that anticipates threats and supports core competencies in modern and rapid identification techniques.
- Transformational defence technologies
- Transform military operations for the defence of Australia by providing superior technologies, better information and improved ways of operation.

CSIRO Flagship Programs

In 2003, the Commonwealth Scientific and Industry Research Organisation ('CSIRO') established six flagship programs with the objective of achieving some audacious goals over the next ten years.

- Preventative Health - To improve the health and well being of Australians and save \$2 billion in annual direct health costs by 2020 through the prevention and early detection of chronic diseases.
- Light Metals - To lead a global revolution in light metals, doubling export income and generating significant new industries for Australia by the 2020s while reducing environmental impact.
- Food Futures - To transform the international competitiveness and add \$3 billion annually to the Australian agrifood sector by the application of frontier technologies to high-potential industries.

- Energy Transformed - To halve greenhouse gas emissions and double the efficiency of the nation's new energy generation, supply and end use, and to position Australia for a future hydrogen economy.
- Water for a Healthy Country - To achieve a tenfold increase in the social, economic and environmental benefits from water by 2025.
- Wealth from Oceans - To position Australia by 2020 as an international benchmark in the delivery of economic, social and environmental wealth based on leadership in understanding ocean systems and processes.

Cooperative Research Centres

The Cooperative Research Centres ('CRC') Program was established in 1990 to improve the effectiveness of Australia's research and development effort. It links researchers with industry to focus R&D efforts on progress towards utilisation and commercialisation. The close interaction between researchers and the users of research is a key feature of the program.

When all CRCs from the 2004 selection round are established, there will be 72 CRCs operating in 6 sectors: environment, agriculture, information and communications technology, mining, medical science and technology and manufacturing.

Manufacturing Technology

CRC for Advanced Composite Structures
 CRC for Bioproducts
 CRC for CAST Metals Manufacturing
 CRC for Construction Innovation
 CRC for Functional Communication Surfaces
 CRC for Intelligent Manufacturing Systems and Technologies
 CRC for MicroTechnology
 CRC for Polymers
 CRC for Railway Engineering and Technologies
 CRC for Welded Structures
 CRC Wood Innovations
 CRC for Advanced Automotive Technology

Information and Communication Technology

Australasian CRC for Interaction Design
 Australian Photonics CRC
 Australian Telecommunications CRC
 CRC for Enterprise Distributed Systems Technology
 CRC for Integrated Engineering Asset Management
 CRC for Satellite Systems
 CRC for Sensor Signal and Information Processing
 CRC for Smart Internet Technology
 CRC for Spatial Information
 CRC for Technology Enabled Capital Markets

Mining and Energy

Parker CRC for Integrated Hydrometallurgy Solutions
CRC for Clean Power from Lignite
CRC for Coal in Sustainable Development
CRC for Greenhouse Gas Technologies
CRC for Landscape Environments and Mineral Exploration
CRC for Predictive Mineral Discovery
CRC for Sustainable Resource Processing
CRC Mining

Agriculture and Rural Based Manufacturing

Australian Biosecurity CRC for Emerging Infectious Disease
Cotton Catchment Communities CRC
Australian Sheep Industry CRC
CRC for the Australian Poultry Industries
CRC for Beef Genetic Technologies
CRC for Innovative Dairy Products
CRC for Innovative Grain Food Products
CRC for Sugar Industry Innovation through Biotechnology
CRC for Sustainable Aquaculture of Finfish
CRC for Sustainable Forest Landscapes
CRC for Sustainable Rice Production
CRC for Tropical Plant Protection
CRC for Value Added Wheat
CRC for Viticulture
CRC for Molecular Plant Breeding
CRC for an Internationally Competitive Pork Industry
CRC for National Plant Biosecurity

Environment

Bushfire CRC
CRC for Antarctic Climate and Ecosystems
CRC for Australian Weed Management
Australasian Invasive Animal CRC
CRC for Catchment Hydrology
CRC for Coastal Zone, Estuary and Waterway Management
CRC for Freshwater Ecology
CRC for the Great Barrier Reef World Heritage Area
CRC for Greenhouse Accounting
CRC for Irrigation Futures
CRC for Plant based Management of Dryland Salinity
CRC for Sustainable Tourism
CRC for Tropical Rainforest Ecology and Management
CRC for Tropical Savannas Management
e-Water CRC
Desert Knowledge CRC
Environmental Biotechnology CRC
CRC for Contamination Assessment and Remediation of the Environment

Medical Science and Technology

CRC for Aboriginal Health
CRC for Asthma and Airways
CRC for Cellular Growth Factors
CRC for Chronic Inflammatory Diseases
CRC for Cochlear Implant and Hearing Aid Innovation
CRC for Diagnostics
CRC for Discovery of Genes for Common Human Diseases
CRC for Oral Health Science
CRC for Vaccine Technology
The Vision CRC

Completed CRCs

The following CRCs have completed their terms and are not included in the list above (although some have developed into new CRCs):

Australian CRC for Renewable Energy
Australian Petroleum CRC
CRC for Antarctica and the Southern Ocean
CRC for Conservation and Management of Marsupials
CRC for Eye Research and Technology
CRC for International Food Manufacturing and Packaging Science
CRC for Mining Technology and Equipment
CRC for Molecular Plant Breeding
CRC for Sustainable Sugar Production
CRC for Tissue Growth and Repair
CRC for Waste Management and Pollution Control

Parts B and C

Country	Expenditure USD 2004	Expenditure USD 2007	Estimated Growth Rate 2004-07 (per cent change)
South America	\$9,013	\$9,856	9.35%
Malaysia	\$3,592	\$4,066	13.20%
North America	\$108,191	\$125,517	16.01%
Philippines	\$1,032	\$1,217	17.93%
India	\$4,600	\$6,202	34.83%
Indonesia	\$1,509	\$6,202	40.65%
China	\$37,835	\$55,068	45.55%

ANNEXES

Annex 1 Project Team

The project team was formed under the aegis of the Centre for Innovative Industry Economic Research Inc. (CIIER). This newly formed body brings together researchers and industry bodies to further our understanding of the innovative industries – information and communications technology; biotechnology; nanotechnology; and environmental technology. The project team was supported by the Australian Computer Society (ACS), the Australian Information Industry Association (AIIA), and the Pearcey Foundation.

Ian Dennis	Project Director / Senior Researcher	Whitehorse Strategic Group/CIIER
John Houghton	Senior Researcher	Centre for Strategic and Economic Studies, Victoria University
Richard Hogg	Senior Researcher / Consultation forums	RGH Consulting
Brett McLean	Senior Analyst	Whitehorse Strategic Group
Tina Xydias	Workshop coordination	Pearcey Foundation/Innovation Events
Robert Eames	Senior Analyst	Fivenines Consulting
Phil Singleton	Consultation Forums	Private consultant

The consultants listed above are experienced in information technology, information engineering, software and services, and ICT strategic matters; have worked in large, medium and small Australian and International firms in the Australian ICT industry; have experience in both importing and exporting software and services; and three of them have played key roles in significant industry bodies and associations, including AIIA, ACS, and the Pearcey Foundation. Collectively, they represent over 250 years of Australian ICT experience.

By necessity, some opinions have been expressed in this report. These are derived from the collective wisdom of the consultants, informed by input from industry sources, and from the many previous government and industry reports addressing this issue and related matters. The opinions expressed in the body of this report are those of members of the consulting team, and do not necessarily represent the opinion of the Commonwealth Government, or of the State governments and industry bodies, which have supported this project.

ACRONYMS AND ABBREVIATIONS

ASP	APPLICATION SERVICE PROVIDER
ABS	AUSTRALIAN BUREAU OF STATISTICS
ACA	AUSTRALIAN COMMUNICATIONS AUTHORITY
ACMA	AUSTRALIAN COMMUNICATIONS AND MEDIA AUTHORITY
ACS	THE AUSTRALIAN COMPUTER SOCIETY
ADP	AUTOMATIC DATA PROCESSING
AGIMO	AUSTRALIAN GOVERNMENT INFORMATION MANAGEMENT OFFICE
AGL	AUSTRALIAN GAS LIGHT
AHIC	AUSTRALIA HEALTH INFORMATION COUNCIL
AHMAC	AUSTRALIAN HEALTH MINISTERS ADVISORY COUNCIL
AHMAC	THE AUSTRALIAN HEALTH MINISTERS ADVISORY COUNCIL
AIIA	AUSTRALIAN INFORMATION INDUSTRIES ASSOCIATION
AMS	ASSET MANAGEMENT SYSTEMS
ANZSIC	AUSTRALIAN AND NEW ZEALAND STANDARD INDUSTRY CLASSIFICATION

ARA	AUSTRALIAN RETAILERS ASSOCIATION
ASOCIO	ASIAN-OCEANIAN COMPUTING INDUSTRY ORGANISATION
ATM	AUTOMATIC TELLER MACHINE
AUD	AUSTRALIAN DOLLAR
BCIS	BILLING AND CUSTOMER INFORMATION SYSTEM
BCS	BASIC CARRIAGE SERVICES
BERD	BUSINESS EXPENDITURE ON R&D
BIE	BUREAU OF INDUSTRY ECONOMICS
CAD	COMPUTER AIDED DESIGN
CAD/CAM	COMPUTER ASSISTED DESIGN AND MANUFACTURE
CAGR	COMPOUND ANNUAL GROWTH RATE
CEO	CHIEF EXECUTIVE OFFICER
CIEAM	CRC FOR INTEGRATED ENGINEERING ASSET MANAGEMENT
CIF	COST INSURANCE FREIGHT
CIER	CENTRE FOR INNOVATION INDUSTRY ECONOMIC RESEARCH
CITEC	COMMUNICATIONS IT & E-COMMERCE BOARD

CLS	COSTING AND LOGISTIC SYSTEMS
CMP	CELLULAR MOBILE TELEPHONE
CNC	COMPUTER NUMERICAL CONTROL
COS	CENTRAL OFFICE SWITCH
CPE	CUSTOMER PREMISES EQUIPMENT
CPFR	COLLABORATIVE PLANNING FORECASTING AND REPLENISHMENT
CPFR	COLLABORATIVE PLANNING FORECASTING AND REPLENISHMENT
CRC	COOPERATIVE RESEARCH CENTRE
CRC-IMST	THE COOPERATIVE RESEARCH CENTRE FOR INTELLIGENT MANUFACTURING SYSTEMS & TECHNOLOGIES
CRM	CUSTOMER RELATIONSHIP MANAGEMENT
CSIRO	COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION
DASD	DIRECT ACCESS STORAGE DEVICE
DCTIA	DEPARTMENT OF COMMUNICATIONS INFORMATION TECHNOLOGY AND THE ARTS
DDSN	DEMAND DRIVEN SUPPLY NETWORK
DSTC	DISTRIBUTED SYSTEMS TECHNOLOGY CENTRE

E.HR	ELECTRONIC HEALTH RECORDS
EAM	ENTERPRISE ASSET MANAGEMENT
EAS2	ELECTRONIC ADVICE OF SALE
ED	ELECTRONIC DATA PROCESSING
EDI	ELECTRONIC DOCUMENT INTERCHANGE
EFT	ELECTRONIC FUNDS TRANSFER
EFTPOS	ELECTRONIC FUNDS TRANSFER AT POINT OF SALE
ELX	ELECTRONIC LABOUR EXCHANGE
EP	ELECTRONIC PROCUREMENT
ERP	ENTERPRISE RESOURCE PLANNING
F3	FUTURE FRAMEWORK
FM	FACILITIES MANAGEMENT
FOB	FREE ON BOARD
FTA'S	FREE TRADE AGREEMENTS
GBP	POUNDS STERLING
GDP	GROSS DOMESTIC PRODUCT
GERD	GROSS EXPENDITURE ON R&D
GFAS	GEOSPATIAL AND FIELD AUTOMATION SOLUTIONS

GIS	GEOGRAPHIC INFORMATION SYSTEMS
GLS	GOVERNMENT LICENSING SYSTEM
GOE	GENERIC OFFICE ENVIRONMENT
GPCG	THE GENERAL PRACTICE COMPUTING GROUP
HCN	HEALTH COMMUNICATIONS NETWORK
HHS	HEALTH AND HUMAN SERVICE
HIPAA	THE HEALTH INSURANCE PORTABILITY AND ACCOUNTABILITY ACT
HLS	HIGHER LEVEL SERVICES
HMO	HEALTH MANAGEMENT ORGANISATIONS
HRMIS	HUMAN RESOURCE MANAGEMENT INFORMATION SYSTEM
IAP	INTERNET ACCESS PROVIDOR
IC	INTEGRATED CIRCUIT
ICT	INFORMATION AND COMMUNICATION TECHNOLOGY
IDA	INFOCOMM DEVELOPMENT AUTHORITY
IDC	INTERNATIONAL DATA CORPORATION
IDD	INTERNATIONAL DIRECT DIALLING
IMSC	THE INFORMATION MANAGEMENT STRATEGY

	COMMITTEE
IO	INPUT-OUTPUT
IP	INTERNET PROTOCOL
IS	INFORMATION SERVICES
ISD	INTERNATIONAL SUBSCRIBER DIALLING
ISDN	INTEGRATED SERVICES DIGITAL NETWORK
ISP	INTERNET SERVICE PROVIDER
IT	INFORMATION TECHNOLOGY
ITOL	INFORMATION TECHNOLOGY ONLINE PROGRAM
IVAN	INTERNATIONAL VALUE-ADDED NETWORK
KTS	KEY TELEPHONE SYSTEM
LAN	LOCAL AREA NETWORKS
LGSS	LOCAL GOVERNMENT SPATIAL SOLUTION
LIS	LAND INFORMATION SYSTEMS
MES	MANUFACTURING EXECUTION SYSTEMS
MIS	MANAGEMENT INFORMATION SYSTEMS
MIT	MASSACHUSETTS INSTITUTE OF TECHNOLOGY
MMUS	MOBILE MANUFACTURING UNITS

MMV	MULTIMEDIA VICTORIA
MNCS	MULTI-NATIONAL COMPANIES
MNE	MULTINATIONAL ENTERPRISE
NEHTA	THE NATIONAL E-HEALTH TRANSITION AUTHORITY
NEMMCO	NATIONAL ELECTRICITY MARKET MANAGEMENT COMPANY
NHIG	NATIONAL HEALTH INFORMATION GROUP
NHS	NATIONAL HEALTH SERVICE
NICTA	NATIONAL ICT AUSTRALIA LIMITED
NOIE	NATIONAL OFFICE FOR THE INFORMATION ECONOMY
NSCTF	NATIONAL SUPPLY CHAIN REFORM TASK FORCE
OECD	ORGANISATION FOR ECONOMIC COOPERATION AND DEVELOPMENT
OEG	OFFICE OF E- GOVERNMENT
OSS	OPERATIONAL SUPPORT SYSTEM
OTLF	ONE TIME LICENCE FEE
PABX	PRIVATE AUTOMATIC BRANCH EXCHANGE
PACS	PICTURE ARCHIVING AND COMMUNICATIONS SYSTEMS
PAS	PATIENT ADMINISTRATION SYSTEM

PC	PERSONAL COMPUTER
PCB	PRINTED CIRCUIT BOARD
PCS	PERSONAL COMMUNICATIONS SYSTEM
PDA	PERSONAL DIGITAL ASSISTANT
PGE'S	PLATINUM GROUP ELEMENTS
PLC	PROGRAMMABLE LOGIC CONTROLLERS
PLMS	PRODUCT LIFECYCLE MANAGEMENT SYSTEMS
POS	POINT OF SALE
POS	POINT OF SALE
PRC	PEOPLES REPUBLIC OF CHINA
PSDN	PACKET SWITCHED DATA NETWORK
PSTN	PUBLIC SWITCHED TELEPHONE NETWORK
QMAS	QUALITY MANAGEMENT APPLICATION SYSTEM
R&D	RESEARCH AND DEVELOPMENT
RAPSIM	RAPID SIMULATION
RFID	RADIO FREQUENCY IDENTIFICATION DEVICE
RIS	RADIOLOGY INFORMATION SYSTEMS
RTAC	REAL TIME AUTOMATION & CONTROL

SAAS	SOFTWARE AS A SERVICE
SCADA	SUPERVISORY CONTROL AND DATA ACQUISITION
SCM	SUPPLY CHAIN MANAGEMENT
SEA	SOFTWARE ENGINEERING AUSTRALIA
SEO	SOCIAL ECONOMIC OBJECTIVE
SI	SYSTEMS INTEGRATION
SKU	STOCK KEEPING UNIT
SLIP	SHARED LAND INFORMATION PLATFORM
SMES	SMALL TO MEDIUM ENTERPRISES
SOHO	SMALL OFFICE/HOME OFFICE
SSQ	SMART SERVICE QUEENSLAND
STD	SUBSCRIBER TRUNK DIALLING
STI	SCIENCE, TECHNOLOGY AND INNOVATION
SUS	SECONDARY USES SERVICE
T&RMS	TRADING AND RISK MANAGEMENT SYSTEMS
TAFE	TECHNICAL AND FURTHER EDUCATION
USD	US DOLLAR
US-FTG	US FREE TRADE AGREEMENT

VAN	VALUE-ADDED NETWORK
VAS	VALUE-ADDED SERVICES
VPN	VIRTUAL PRIVATE NETWORK
WAN	WIDE AREA NETWORK
WITSA	WORLD INFORMATION TECHNOLOGY SERVICES ALLIANCE

ENDNOTES

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- ¹ <http://www.opcfoundation.org>
 - ² Kurt Yeager, past president and CEO of the Electric Power Research Institute.
 - ³ Price Waterhouse Coopers (2005) *Under Pressure – Utilities Global Survey 2005*, PWC.
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 - ⁷ Summary Report of the Independent Panel Electricity Distribution and Service Delivery for the 21st Century Queensland July 2004
 - ⁸ Annual Planning Report - June 2005 : Electricity Supply Industry Planning Council
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 - ¹⁰ Different Worlds: strategic drivers of Australia's new energy industry: PWC 2001.
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 - ¹² Australia - Multi-Utilities Markets: Paul Budde Communication Pty Ltd, July 2005..
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