Centre for Innovative Industry Economic Research Inc

The Australian software industry and vertical applications markets: globally competitive and domestically undervalued

Part A

The Australian software industry

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The software industry and market mapping approach

This section presents an outline of the industry and market mapping underpinning this study and lays the foundation for the analysis that follows.

The mapping approach

To map the software industry activities, we developed a framework for analysing the software industry and software value chain and a schema for presenting the actors and activities involved in the software industry, with particular focus on selected vertical applications markets. These *analytical* and *presentational* frameworks are described in turn.

Mapping the software product system (the analytical framework)

There are many possible approaches to mapping software industry activities and markets, ranging from various forms of cluster analysis to value chain/value system, product and innovation systems analysis. Each provides a particular perspective that is more or less suitable to a particular type of study or enquiry.

Within these approaches there are many overlapping and cross-cutting dimensions. One basic distinction is that between those studies using clusters in a statistical sense (i.e. a grouping of entities according to some specific characteristic) and those intending to imply actual relationships between the objects (i.e. networks, value or product systems).

When clustering is studied it can be in terms of any number of characteristics (e.g. location, activity or product field, firm strategy, behaviour, innovative or competitive performance, size, technology or science base) and involve a range of methodological approaches (e.g. factor analysis, cluster analysis, multi-dimensional scaling, etc.).

Network, value chain or product system relationships are typically studied in terms of linkages of various kinds (e.g. supply chain, user–producer relations, supplier–producer relations, innovation linkages, information and/or knowledge flows) and typically involves more qualitative methods (e.g. case studies or representative sampling).[1]

Cross-cutting, or overlaying this basic distinction is that between studies having a geographic dimension and those without. Spielkamp and Vopel (1999) described this distinction as that between ‘milieux or districts’ and ‘clusters, chains or networks’ respectively.[2] Given the focus of this study on software industry activities and vertical applications markets we chose to adopt an approach which focuses on vertical production or value chains, networks or systems in which user–producer relationships (be they mediated or direct) are central.

One such approach, the product system approach, was pioneered by the United Kingdom’s Complex Product Systems Innovation Centre.[3] It is a technique that focuses

on linkages between actors in a complex system that affects the transformation of activities and materials into goods and services through the processes of creation, production and distribution.

Its genesis was in analyses of the building and construction industry, in which learning and innovation are difficult because of the one-off nature of construction projects, with different constructions being produced in different locations, with different teams of architects, engineers, building and construction firms, project managers and trades people in each case.

One reason for wider adoption of the complex product system framework is that building and construction is an example of what is becoming an increasingly common phenomenon—namely, the complexity of putting together a wide range of products and/or services, and integrating them into a solution for a particular client and/or project.

Hobday, Rush and Tidd (2000) suggested that because each new product tends to be different, and because development and production involves feedback loops from later to early stages and other unpredictable, 'emerging' properties, innovative organisational structures are required to coordinate production, particularly where there are uncertain and changing user requirements and technological possibilities.

There is often high production and innovation complexity, not only because a wide variety of distinct components, skills and knowledge inputs are involved, but also because large numbers of firms or different organisations often have to work together in production (e.g. prime contractors and systems integrators, users, buyers, other suppliers, small and medium sized enterprises, government agencies and regulators).[4] Such a characterisation fits the software industry, especially when the focus is on vertical market applications.

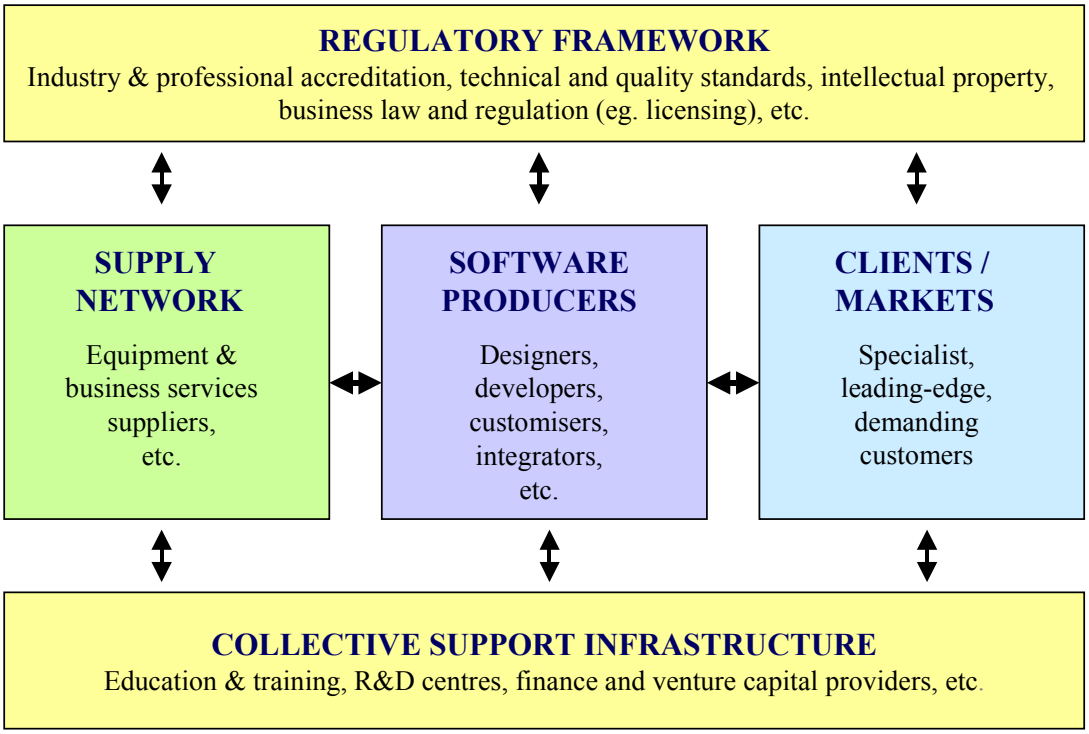
A typical schematic product system includes five major elements, with three groups of key actors and activities forming the core value chain. Figure 1 illustrates a basic schematic product system:

- at the centre are the *software firms* engaged in the development of software and software based solutions;
- to their left, the *supply network*, which includes all the providers of specialist equipment and financial, business and other services to software producers; and
- to their right, the *distribution network*, which includes all the clients of software firms (be they intermediaries or final customers).

Their activities of these groups are supported by a collective support infrastructure and operate within an overarching regulatory framework.

- The *collective support infrastructure* includes R&D centres, education and training institutions, professional associations, specialist consulting firms, finance and venture capital providers, etc.
- The *regulatory framework* includes a wide range of industry and professional accreditation, technical and quality standards, intellectual property, licensing, etc.

Figure 1. A schematic product system



Source: CSES Analysis.

This basic schema was modified to draw out particular insights in the vertical market applications, taking into account the following.

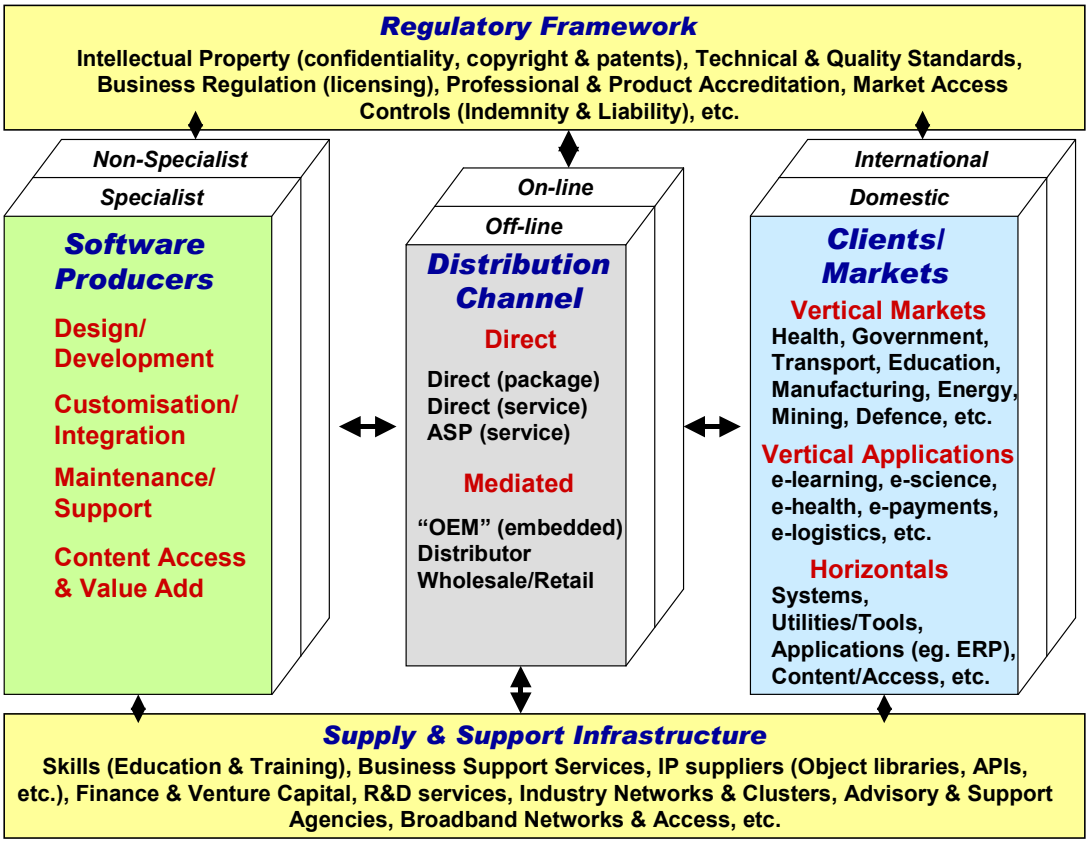
- In the context of production, there is a continuum through which technologies or techniques are translated into applications, and are then built into solutions for a particular client group or market. For example, encryption is a technology that can be applied to security and become a part of a range of vertical market solutions (e.g. protecting health records in e-health, document security in defence and government, etc.).
- Software-related capabilities can cut across applications and markets. For example, digital image manipulation capabilities can be an essential ingredient in the development of computer games, medical scanning and imaging, film and video special effects, production and editing, etc.

In mapping 'software firms and capabilities' we took account of these dimensions, mapping capabilities in terms of the technologies, applications of those technologies and the clients and vertical markets in which they may, or do emerge as solutions.

We also identified the role of key actors in the value chain—as, for example, developers, distributors, integrators and/or value-added services providers. Given the importance of the distribution channel and distribution business models in the software industry, as well as the limited requirements of software firms for specialist inputs, we

modified the traditional schematic product system structure outlined above—with the supply network included within the support infrastructure, and the distribution channel separated from clients/markets. This formulation reflects both the importance of the distribution channel in the software industry, and the focus of this study on particular clients and vertical applications markets.

Figure 2. The software product system



Source: CSES Analysis.

Taking these considerations into account, we developed a software product system map (figure 2) which includes the following.

- *Software producers*, including specialist firms and major non-specialist developers and producers, defined by their main activities—i.e. design, development, customisation, integration, support, etc.
- *The distribution channel*, defined by major channels of direct and mediated software distribution—i.e. direct (package or service) and mediated (embedded, wholesale/retail), be they on-line or off-line, etc.
- *Their clients and markets*, defined by industry/market or application and software industry linkages—i.e. market verticals (e.g. health, government, transport,

education, etc.), application verticals (e.g. e-learning, e-logistics, e-payments, etc.) and horizontals (e.g. systems, utilities, tools, ERP applications, etc.), be they domestic or export

- The collective *supply and support infrastructure*, defined by activity and contribution—i.e. education and training, business support services, R&D centres, finance and venture capital providers, industry networks and clusters, etc.; and
- The overarching *regulatory framework*, defined by scope and area of activity—e.g. intellectual property, business law (e.g. licensing), technical and quality standards, product and professional accreditation, etc.

This map provides a framework for thinking and analysis, which focuses on software production, distribution and vertical market applications.

Mapping vertical markets and applications (the presentational framework)

A less complex mapping structure was developed to provide a picture of software industry activities in vertical applications markets and show key dimensions of activity and capability. The pictorial presentation provides an indicative listing of software producers, defined by their primary activities and what they supply into selected vertical markets.

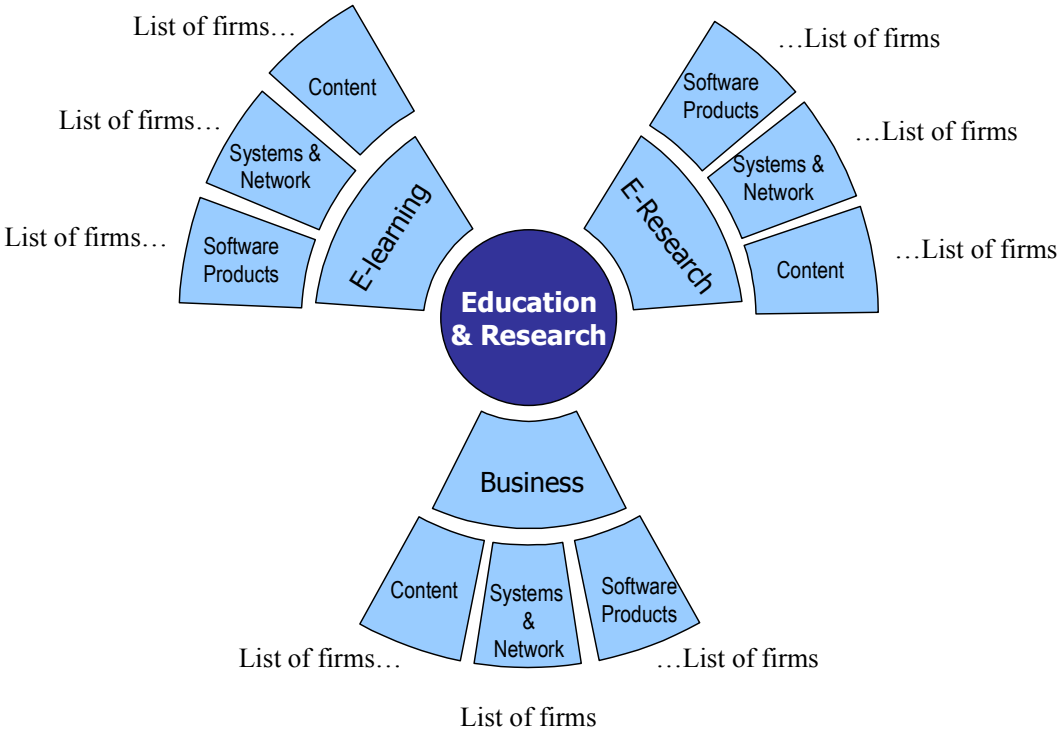
The population of firms represented on the maps cannot be exhaustive, but they are intended to be indicative of actors and significant activities. While multinational corporations (MNCs) are integral to the fabric of the Australian software production, the maps focus on Australian firms and the basis in Australia for sustainable growth of these software firms.

We developed a two-dimensional structure with four layers of branching for the selected target vertical markets (figure 3).

- The *vertical market* (e.g. education) is at the centre.
- The chosen *sub-sector drill-downs within that vertical market* (e.g. e-learning and e-research), along with 'other applications' targeting the vertical market are presented in the next level out.
- The next tier (i.e. branch or concentric circle) identifies the *primary product or service supplied* by the producer/distributor (e.g. 'Software Products', 'Content & Access' and 'Systems, Network and Integration Services', including customisation, integration, maintenance and support services).
- The outermost level *identifies indicative firms* supplying the products and services identified.

This approach is not only practical, but also offers the possibility for strategic focus and drill down while at the same time providing the framework for ongoing data collection and analysis to extend the scope, coverage and depth of the software mapping.

Figure 3. Vertical applications map (education & research example)



Source: CSES Analysis.

Limitations of the vertical market approach

In a study of software for specific vertical markets, there is an inevitable focus on the specialist software producers while non-specialist producers (e.g. multi product and service firms), in-house production (e.g. extensive development of content and tools within the sector for own use and sharing), and non-market production (e.g. freeware and open source/open access) receive less attention.

The focus on vertical software applications markets also tends to lead to a neglect of embedded software—be it embedded in hardware products, services or multimedia content. Given the extent of non-specialist, in-house and non-market software production in sectors like education, health and government, and embedded software

production across a range of industries, these limitations must be borne in mind when reading this report.

As a result, the mapping necessarily involves making a number of generalisations and simplifying assumptions. The categorisation of firms included should be taken as no more than indicative of part of their activities. Importantly, a significant number of key suppliers of software into vertical applications markets will be overlooked as a consequence of the relative neglect of non-specialist, multi-product firms, embedded software, in-house production and other non-market sourcing (e.g. shareware and 'shared ware', freeware, open source, etc).

In some market verticals (e.g. education, health and government) non-market and non-specialist software is likely to account for a significant share, if not the majority of software used (as noted above).

Mapping vertical markets and applications

The product system approach informing this study draws attention to a number of important features of software value or product systems.

Structure of the value or product system

Product or value systems vary in terms of their structure, with some exhibiting a concentration of power and value in specific parts of the system, specific activities and in some cases even specific actors. Because software tends to be deeply embedded in the activities and processes within product/value systems, the ways in which it is designed, developed, distributed and applied are affected by the power and value relationships within the system. As product/value systems become increasingly integrated and coordinated, this becomes an increasingly important aspect of software verticals.

It is common, for example, for the structure of particular product/value systems to influence the nature of software development and purchasing relations, distribution processes and mechanisms. There are cases where a particular type of actor in the product/value system controls a particular resource and/or takes a lead in development which becomes a key driver of the pace and direction of development. For example, in the context of the delivery of travel and tourism services, global reservations systems and global distribution systems, developed originally by airlines (e.g. SABRE, Amadeus, Galileo and Worldspan), form a key part of a system around which all other ICT developments must structure.

Another example common to a number of product/value systems is that of e-commerce and supply chain integration, within which the demands of major customers (e.g. automotive assemblers, major retailers, etc.) drive developments. Smaller users and suppliers along the supply chain (e.g. travel agents, automotive components suppliers, grocery suppliers, etc.) are often encouraged to adopt particular systems and solutions in order to integrate into the existing systems of the major players.

Smaller users and suppliers may even rely upon the major players for the supply of software and operational support services.

In other product/value systems key 'gatekeepers' play a central role, with supplier accreditation and integration crucial to vertical market access. In the government and defence markets, education and health pre-qualification and accreditation play a vital role—with accreditation activities managed by lead customers and/or sometimes official independent regulatory authorities. In some cases, specific regulatory demands and regulated vertical market structures drive and shape development. The types of organisations having the gatekeeper function may vary between national markets, for example regulatory authorities (e.g. the Health Insurance Commission) play a crucial role in the Australian e-health market, while the major private medical benefits funds play that role in the US.

The common theme in all of these examples is that vertical market specific channels and mechanisms may constrain market access by smaller independent software developers, and/or major players may drive and shape developments (sometimes themselves competing as non-specialist suppliers) and act as 'gatekeepers' to vertical market access.

Nature of the value or product system

The nature of the system in terms of established and conventional practices, national customs and mores can influence several market verticals within individual countries.

Conventional practices in relation to arms-length purchasing and contracting, versus in-house development and provision (i.e. the conventions regarding the trade-off between markets and hierarchies) can influence vertical market opportunities. In some product/value systems the use of subcontracting and purchasing from specialist producers is a long standing practice, for example in the building and construction and the ICT industries (both software and services and electronics). In other industries it is more common for would-be customers to rely on internal resources and non-market sources to supply their needs, such as in the education and research and oil and gas industries.

Conventions and established practices are also important in cooperative/collaborative practices and mechanisms. In some product or value systems and related vertical markets cooperative and collaborative practices have been relatively rare and collaborative mechanism remain under-developed. In others, cooperative activities are widespread, collaboration common and there are well established mechanisms to support collaborative activities. These characteristics may reinforce or potentially distort purely market-based supply decisions.

The ICT and building and construction sectors are characterised by market based collaboration while collaboration is more often characteristically non-market in education and research. In some areas, such as health and logistics, cooperation and collaboration appears to be less developed despite extensive mechanisms for communication.

Stage of innovation and development

There is often high production and innovation complexity in the software product system, not only because a wide variety of distinct components, skills and knowledge inputs are involved, but also because large numbers of firms or different organisations often have to work together in production (e.g. prime contractors and systems integrators, users, buyers, other suppliers, small and medium sized enterprises, government agencies and regulators). *In such systems, there tends to be two phases and forms of innovation:*.

- *the development of new systems architectures* prior to, and during the early phases of commercialisation, wherein architectural designs are powerfully influenced by system suppliers, regulators, standards-making bodies and large users; and
- *a phase of new product generation,* wherein the rate of component and systemic innovation increases and successive new products and components are introduced, without fundamentally altering the established architectural design.[5]

Product or value systems, and related vertical applications markets, vary in terms of the stage of innovation reached. In such areas as e-health, e-learning and e-research, many of the standards and 'systems architectures' are still being worked through. Whereas, in such areas as e-government, there is a more established base upon which to build. The nature and pace of innovation will be different in such cases, as will the key innovation linkages.

Innovation linkages

Software product systems and related vertical markets exhibit a range of key innovation linkages, including:

- *user-producer linkages*, with innovation driven from the demand-side by leading and demanding customers (e.g. large systems integrators in ICTs, national and state governments in health or education);
- *producer-producer linkages*, with innovation driven by cross-fertilisation and demands for the integration of systems components (e.g. defence, e-learning and e-research content and access systems);
- *supplier-producer linkages*, with innovation driven by the emergence of new technical possibilities and price points (e.g. rapid development of hardware or systems software); and
- *regulator-producer linkages*, with innovation driven by the emergence of new standards and standards agreements, or by the demand to meet new, more stringent accreditation criteria.

There are also some linkages to research actors and activities.

The locus and concentration of power, conventional practices and mechanisms, and stage of innovation development will largely determine which of these forms of innovation linkages predominates at particular times and/or within particular vertical markets. A small survey of Australian firms indicated that there is generally a heavy

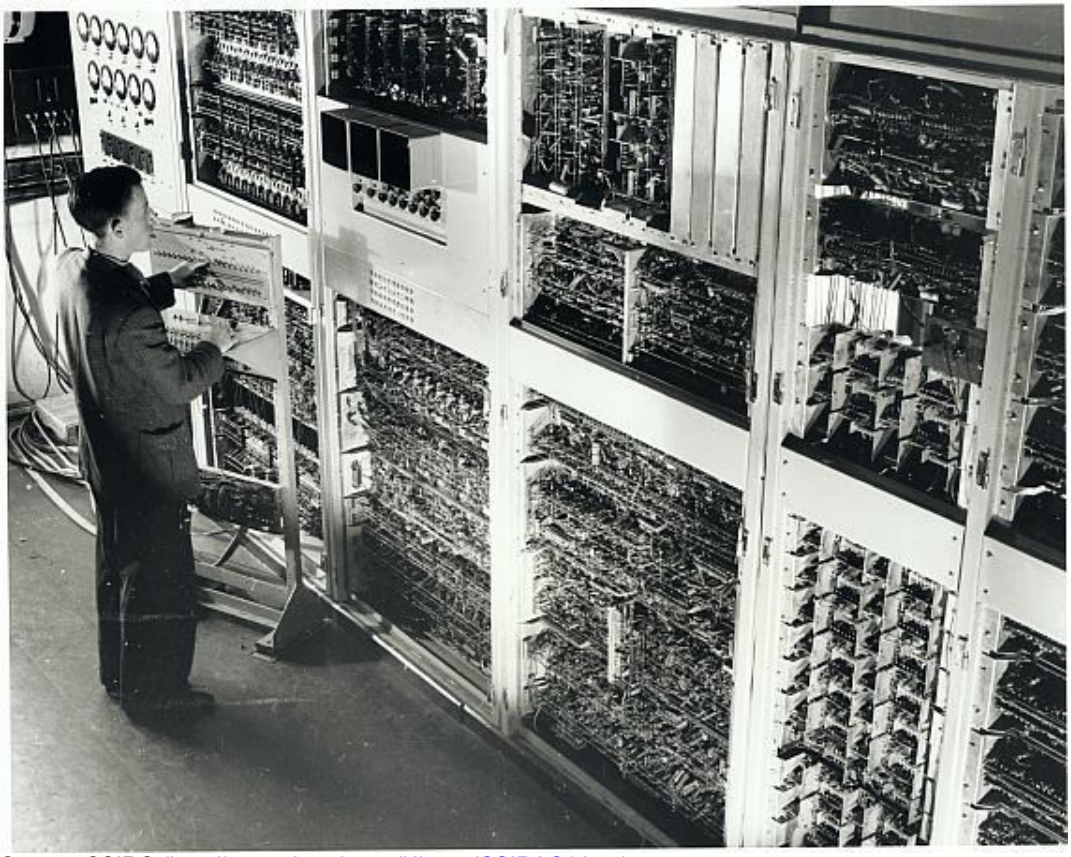
dependency on major clients for both innovation and as a channel to market. Almost 50% of the software firms surveyed nominated marketing as the capability most needed for the future, ahead of skills (29%) and R&D and new product development (9.5%).[6]

Map of the software industry

Evolution of the software industry in Australia

Australia has been involved in the provision of information technology services since the invention of the computer, and was a pioneer user of early telephone and telegraph systems. Australia's first electronic computer, CSIRAC, was designed and built in Australia in 1949, the same year as the first IBM. This computer, the oldest intact digital computer in the world, can now be seen at Museum Victoria.

Figure 4. CSIRAC: Australia's first computer



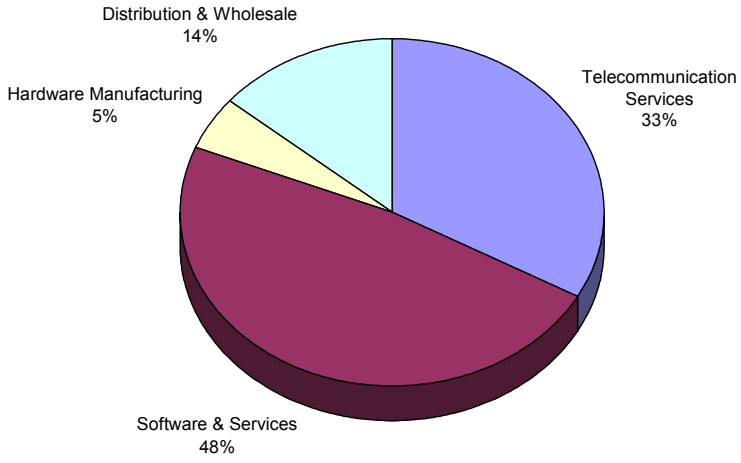
Source: CSIRO (http://www.cip.csiro.au/History/CSIRAC1.htm).

Software and services firms emerged in Australia, as they did elsewhere, in the late 1950s and early 1960s, with an explosion of growth in the 1970s. IT services bureaux have been operating in Australia since that time, and a number of software and services firms in Australia have a 30–40 year history and a track record of satisfied customers, both Australian and international. Therefore, unlike many other parts of the world,

Australia can truly claim to have more than 100 years experience in telecommunications, more than 50 years experience in information technology, and more than 40 years experience in commercial software development.

When they developed Australia's first computers in the late 1940s and early 1950s, scientists such as Trevor Pearcey and John Bennett were just as much software programmers as they were engineers. However, software was not distinguished commercially from the hardware that carried it until the early 1970s. In the 1969 industry 'bible', there are 76 pages concerning hardware in the index but only one mention of software.[7] Today, Australia's ICT industry is dominated by computer and communications services firms, rather than by hardware developers and manufacturers. Almost half of ICT industry employment is found in the software and services sector.[8]

Figure 5. Australian ICT industry structure (employment shares)



Source: Whitehorse Strategic Group industry model 2004 derived from survey data and ABS.

Software is an integral and strategic part of all modern industry and commerce. The Framework for the Future report, *Enabling our future,*[9] concluded that development of the ICT industry needs to be "set in the broader context of ICT as an enabling technology which underpins Australia's development as an 'information' or 'knowledge economy'".

Software enhances the broad information capability in industry, government and many human activities. It increases the productivity of all industries and is increasingly embedded in goods and services and it is critical to the achievement of Australia's economic goals, to national security, to dealing with demographic change,

environmental management, education and health. It is also integral to Australia's capacity to innovate and to the performance of research itself.

Australia also needs domestic software capability to remain competitive and to address our national challenges. Some recent research into the impact of ICT on productivity provides an indication of the importance of software to the competitiveness of Australian industry.

The Productivity Commission concluded in a 2004 paper[10] 'There is sufficient circumstantial and formal evidence to conclude that an increase in ICT use has lifted Australia's multi-factor productivity growth'. The report went on to say:

> The same industries have shown the combination of higher ICT use and productivity acceleration in both the United States and Australia. US industries that have been high on the uptake of ICT and that have also shown strong productivity improvements include financial intermediation, distribution (wholesale and retail trade) and business services.
>
> In Australia, the positive association between higher ICT use and productivity acceleration is most evident in Finance & insurance and, to a lesser degree, in Wholesale trade.

While the commission assumed that the impact of ICT hardware on productivity was due to imported product, it did not examine the impact of Australian software.

The Howard Partner's 2005 *Digital factories* report[11] included an exploration of this issue in the context of the Australian manufacturing sector. It found that some software used was derived from Australia, and suggested that much of the competitive advantage in Australia's manufacturing sector can be attributed to business acumen in being able to use ICT strategically and to Australia's software capability.

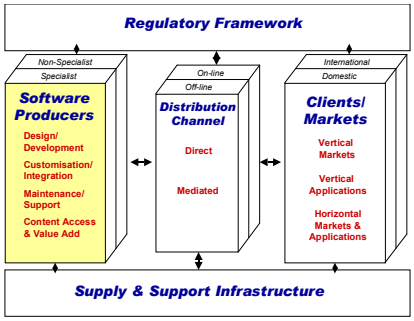
The report concluded that 'software underlies every aspect of productivity and performance improvement. Australian manufacturing businesses need access to software that reflects the research and development (R&D) input of globally oriented software firms but is relevant and applicable to local conditions. This requires a strong Australian software development sector that is attuned to Australian manufacturing needs and a services sector that has both national and international linkages'.

As stated in *Enabling our future*:

> Having an ICT development and production capability creates a symbiotic relationship between users and producers with the level of sophistication of users enhanced by the presence of producers of ICT goods and services. Software contributes to Australia's ability to buy goods and services in the global market – software provides a significant source of export revenue, and many other exported goods and services contain embedded software components. A domestic ICT capability is also more likely to develop ICT goods and services targeted at Australia's specific needs and challenges.[12]

Software producers

This section maps the software industry. It begins with a statistical overview of the Australian software industry and then presents a brief software production analysis. It corresponds to the left-hand box of the software product system map (i.e. software producers).



Statistical overview of the software industry

There are few extensive data sources of the software industry per se and this report relies primarily on the survey of ICT specialist firms undertaken at two year intervals by the Australian Bureau of Statistics (ABS)[13], and the six-monthly ICT industry survey and industry model by Whitehorse Strategic Group Limited, referred to as the Whitehorse 'top 250' (T250). The limited data available on the software industry has necessitated the use, in some cases, of data that is not as up-to-date as we would have liked.

The ABS and other analysts divide the Australian ICT industries into a number of industry sectors, based upon the primary role of the firm (or in a limited number of cases a major business unit of a larger firm). ABS applies four primary groupings to the ICT industry (hardware manufacturers, telecommunications service providers, computer service providers and wholesalers), while Whitehorse[14] and CIIER apply five, which in turn are subcategorised into 14 subsectors. Nine of these subsectors, including software producers, are within the ABS category of computer service providers, whilst many software distributors are grouped within the wholesalers industry category.

Table 1 Statistical model

ABS ICT Industry Sector	*CIIER/Whitehorse ICT Industry Sector*	*CIIER/Whitehorse ICT Industry Sub-Sector*
Computer services	Consulting	IT Education and Training. Strategy and planning. Personnel and contract staff. Other services.
	Software	Software support and maintenance. Software product (package) development. Facilities management and outsourcing. Content and Web-based services. Systems and network engineering and integration.
Manufacturing	Hardware	ICT Hardware and components.
Wholesale trade	Distribution	Wholesale Distribution of Hardware or Software. Retail Distribution of Hardware or Software.
Telecommunication services	Telecommunications	Telecomms infrastructure and basic services. Content and value add.

Source: CIIER Analysis.

The Whitehorse survey and modelling process

The Whitehorse Top 250 database contains detailed longitudinal data on more than 700 firms employing 131 000 staff, earning $61 billion in revenue and spending $597 million on R&D, (as at June 2005)..

Software and services survey base

There are 405 firms in the Whitehorse T250 database categorised as predominately in the software and services sector. This survey sample (June 2005), represents around 40 000 to 45 000 employees and around $12 billion revenue. According to ABS data (2002–03), the employment in the Australian computer services was around 107,000 in 2002–03 and the industry revenue was $17 billion.

On the basis of the ABS data, the Whitehorse database and model represents a detailed sample of nearly half of all employment in this sector, and close to 70% of revenue. Whitehorse maintains consistency of the sampling of firms with the ABS and updated its 2003–04 models to reflect the ABS's new survey frame which was introduced for the 2002–03 ICT industry survey.[15]

The Australian software and services industry—key statistics

World software market

The major categories of software have historically been categorised as customised software, systems infrastructure software, applications tools software and applications software.

Increasingly, however, such distinctions have been extended to more meaningful categories, and the most recent, industry accepted, global evaluation[16] defines software as 'the total value of purchased or leased operating systems, programming tools, utilities, applications, and games, and the total value of outsourced software development such as computer programming, web development, and application development'.

Operating systems and utilities consist of proprietary and some generic (open) software to operate computers and the networks connecting them. This market is dominated globally by the equipment suppliers (IBM, HP, Cisco, etc) and specialist multinational players (Microsoft etc). Some of the companies with significant global market shares are listed below.

- System-level: Microsoft (Windows), IBM and HP
- System management: Computer Assoc, IBM, HP and Candle
- Network management: Bellcare, IBM, Cisco and Network Associates
- Middleware: BEA, WebMethods and IBM
- Serverware: Netscape, EMC and Sterling
- Security software: Network Associates, Symantec and Verisign.

Programming tools provide information access tools and programmer development tools to assist developers in writing software. Some of the major international suppliers are listed below.

- Database management systems (DBMs): Oracle, IBM and BMC
- Information access tools: Microsoft, IBM and SAS
- Programming development tools: Microsoft, Computer Associates and Oracle
- Development lifecycle management: Compuware IBM

Applications are software products that manage organisation tasks offering productivity-enhancing benefits to end-users through either horizontal or vertical industry applications.

Horizontal industry applications have historically offered greater sales volumes than vertical industry ones. They are mostly supplied as branded products by large multinational companies, some of which operate in more than one of the software subcategories.

- ERP (Enterprise Resource Planning): SAP, Peoplesoft, Oracle and JDE

- CRM (customer relationship management): Siebel, Peoplesoft and Oracle
- Supply chain and workforce productivity: SAP, i2 technologies and manugistics
- Consumer: microsoft and electronic arts (Games).

Vertical industry applications - provide solutions to the unique needs of different industry sectors, eg Finance, Telecommunications, Health and Medical.

Software, defined this way, represents 32.4% of the total ICT world spend, allocated 68% to products and 32% to services.

Table 2 ICT world market 2004–08

ICT Market Category	2004	2005*	2006*	2007*	2008*
		$US	Billion		
Communications services	$1,404.50	$1,514.05	$1,632.15	$1,759.45	$1,896.69
Software	$583.00	$633.72	$688.85	$748.79	$813.93
Hardware	$424.00	$451.56	$480.91	$512.17	$545.46
ICT services	$238.50	$263.30	$290.69	$320.92	$354.29

* Projected market size

Source: WITSA Digital Planet 2004

WITSA projects the computer services and software sectors will have the greatest increases over the next four years within the global ICT market, with 10.4% and 8.7% compound average growth rate respectively. This indicates a strengthening and growing software global market.

The Australian software market

Market quantification changes rapidly, and is defined in a number of different ways. WITSA estimated the Australian software spend in 2004 at USD 5.9 billion for products, and a further USD 3 billion for services, (approximately AUD 13 billion in total), having grown more from USD 5.1 billion for products and USD 2.4 billion for services in 2001. Growth to 2007 is projected to deliver a market approaching $US6.6 billion for products and USD 3.9 billion for services.

ABS has estimated that the total revenue earned by the computer services industry during 2002–03 was AUD17 billion, with AUD 736 million (4.3%) of this derived from packaged software (including licence fees).[17] The computer service industry earns other types of revenue as well, so AUD 736 million represents around 8% of revenue from the identifiable software and services revenue items for the computer services sector. For

purposes of comparison, this is equivalent to around 28% of the AUD 2.6 billion revenue earned by wholesale traders for the sale of packaged and customised software.

ABS also estimate a further AUD 3.96 billion industry earnings for customised software and services. The choice to purchase products or services is often determined by the client, so a portion of this expenditure may also be relevant to the market for software developers.

Software exports

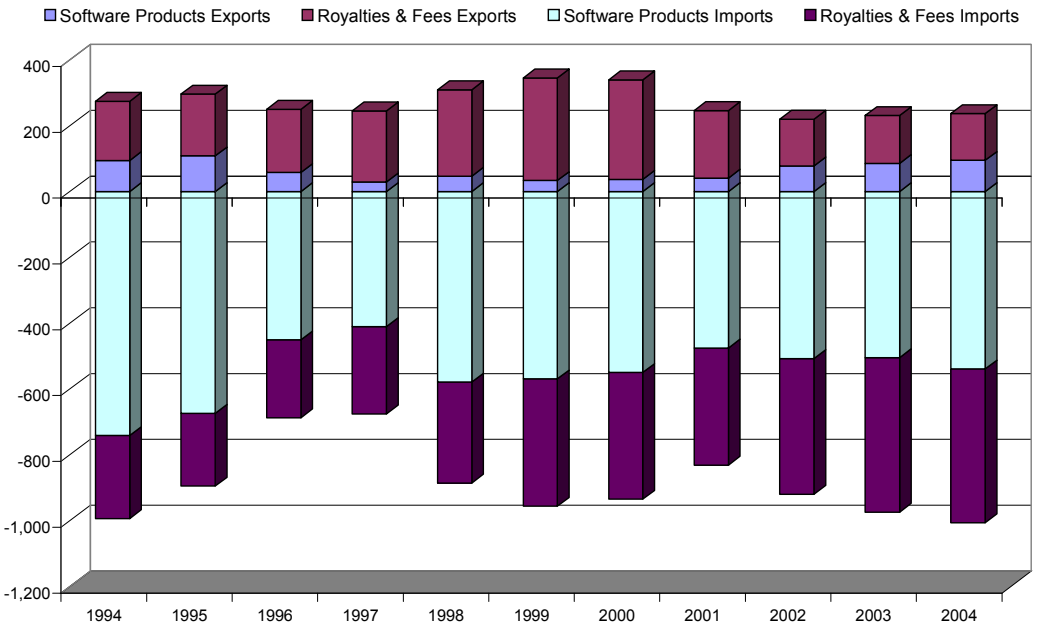
There are many problems associated with tracking software imports and exports in trade in national statistics. The approach used in this analysis is to track trade in the physical supports for software (e.g. magnetic discs, tapes and other recorded media) and in the payments made in respect of software related royalties and licence fees.

Tracking the physical supports for software (i.e. software products) has significant limitations. First, as border valuations are based on the physical support media, the value of the software traded is likely to be significantly understated. Second, the bundling of software with hardware leads to significant mismeasurement (likely overstating equipment trade and understating software trade). Third, trade statistics do not measure the value of copyright works sold in foreign markets. Fourth, trade statistics do not measure the value of software electronically transmitted across borders —an emerging business model for software delivery and accounts for a rapidly increasing share of cross-border trade. Nor do the statistics capture software delivered as a service by applications services providers (ASPs).[18]

Tracking software related royalty and licence fee payments complements software products trade statistics, as some of the elements of the trade missed in trade statistics will be captured in royalty and license fee payments (e.g. embedded software). Nevertheless, taken together, the measured trade in software products and payments of software related royalties and license fees provide an indicative window on Australia's software trade.

Whilst software product exports have risen slightly over the last few years, there has been a decline in the software related royalty fee and license payments to Australian firms (i.e. exports). This contrasts with recent increases in outgoing software related royalty fee and license payments (i.e. imports). The apparent trend decline in total trade in software products over recent years may also reflect the use of online software delivery alternatives and increased embedding of software within other exported products and services.

Figure 6. Software imports and exports, 1994 to 2004 (AUDm)



Notes: Software products include recorded and recordable media of the types suitable for software. Software royalties & fees for 2003–04 are estimated, based on software share of total royalties and license fees in previous year. All data are current prices.
Sources: ABS (various years) *Balance of payments and international investment positions, Australia,* Cat No 5363.0, Canberra; ABS (various years) *International trade in goods and services, Australia,* Cat No 5368.0, Canberra; ABS (various years) *Balance of payments and international investment positions, Australia,* Cat No 5320.0, Canberra; DFAT (various years) *Trade in services Australia*, Department of Foreign Affairs and Trade, Canberra; and ABS unpublished data. CSES Analysis.

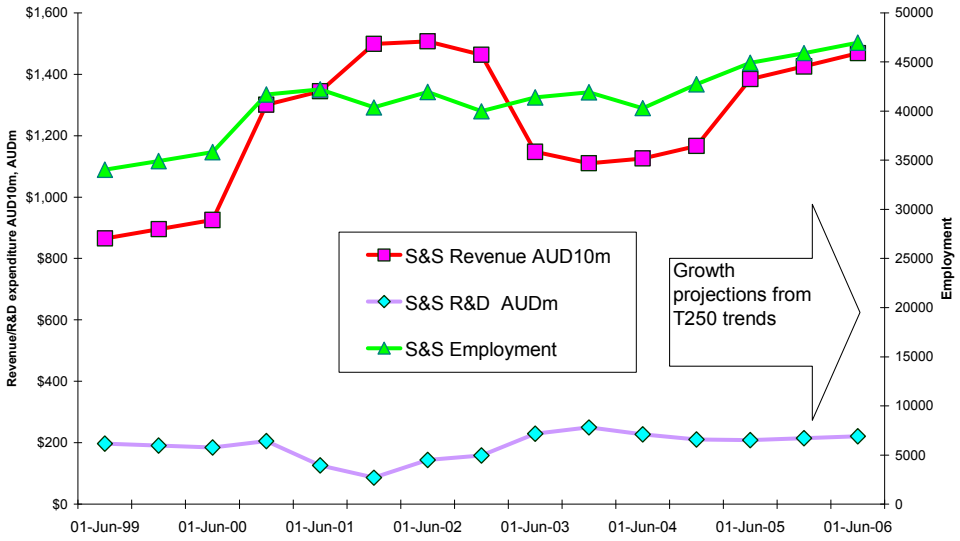
Software and services employment, revenue and research expenditure

Whilst the bulk of the employment is within larger software and services companies, there is a significant number of smaller and micro firms operating in the industry. Various estimates[19] suggest between 18 000 and 22 000 smaller ICT firms exist, although some of these are simply registered entities providing single person contracted services. According to the 2002–03 ABS ICT industry survey, 85% of firms had fewer than 5 employees and around 550 computer services companies had 20 or more staff.[20]

Figure 7 tracks employment, revenue and research expenditure of the software firms within the Whitehorse survey group.

Research expenditure provide an indication of industry's forward intentions for new products. According to the Whitehorse T250 data, software and services R&D spend has been relatively static in real dollar terms since June 1999, and appears unlikely to grow unless some major change occurs that would cause a surge in research activity. This does not bode well for expansion of software product offerings, since they naturally follow behind software research.

Figure 7. Trends in software and services employment, revenue and R&D, 1999 to 2004



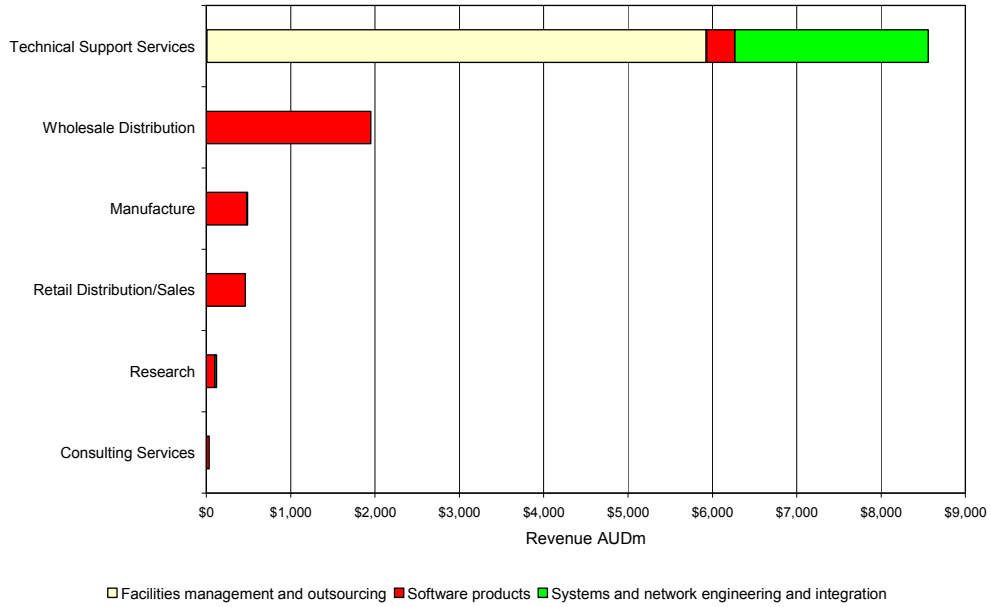
Source: Whitehorse T250 Survey group Dec 2004

A detailed examination of the revenue of firms in the T250 survey, analysed by each firm's major product or service (excluding telecommunications and hardware distribution) reveals several changes that have taken place in the industry's revenue structure. Since July 2003, systems integration service revenue within this group has diminished as a revenue stream from nearly 25% of the total market revenue to just over 19%, while strategy and planning has increased from under 4% to over 5%.

This may indicate a move away from the commissioning of large, in-house projects to a more strategic approach and increased software product sourcing. Facilities management and outsourcing, while retaining its significant 45% of revenue, has hardly changed since June 2003.

Software products revenue within this group has increased from 21% to nearly 26% over the same period, and is the only segment that has increased for three surveys in a row. This may indicate that the Australian software products market will continue to improve, as more software solutions are supplied through a product rather than a service business model.

Figure 8. Indicative revenues of software and services firms by major product/service, 2004



Source: Whitehorse T250 survey group.

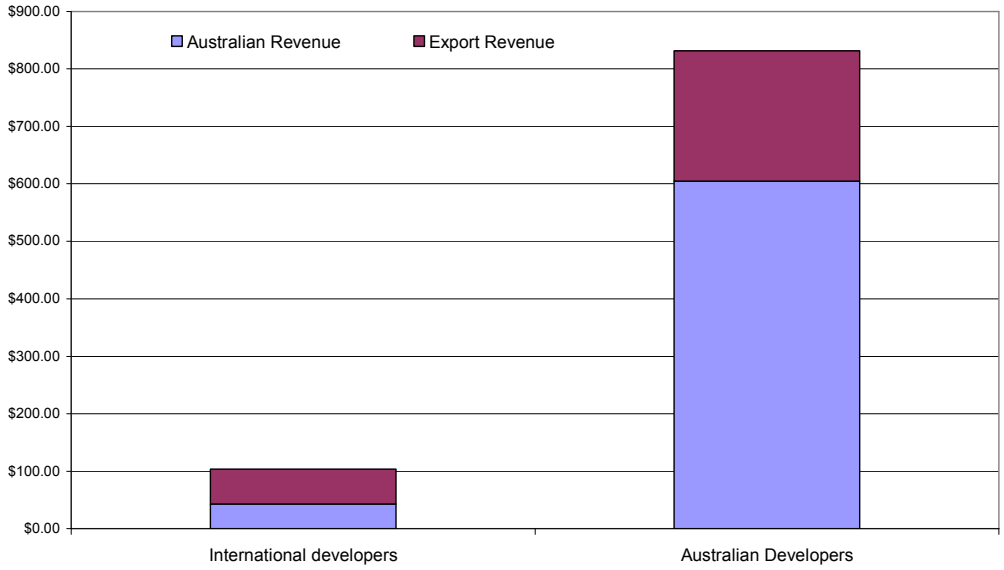
However, a more detailed analysis of the revenue of firms in the December 2004 Whitehorse survey indicates that the businesses operating primarily in technical support services (large, multinational, outsourcers, integrators, and a number of smaller software support firms) gained nearly AUD 8.6 billion of the AUD 11.6 billion revenue in this survey group, and most came from the provision of facilities management and outsourcing or systems integration. The next largest revenue group was wholesale distributors, who mostly handle imported products.

True software manufacturers and researchers in the survey group gained a very small part of the Australian revenue in this sector, and appear to be operating in a domestic submarket of under AUD 700 million per annum (for the survey group).

Implications for the software market model

Taking the detailed Whitehorse December 2004 survey sample data above, and extrapolating this to the software industry model, CIIER estimates that the total domestic and export software product market supported from Australia is approximately AUD 934 million, with international firms currently responsible for AUD 103 million, leaving AUD 831 million of the combined domestic and export market divided among the domestic software producers (see figure 9). Some AUD 605 million of the Australian domestic market is supplied by locally owned domestic software product developers.

Figure 9. Revenue from software products, 2004 (AUDm)



Source: Whitehorse T250 model, IDC, CSES, TradeData and ABS.

Box 1 How many firms can be 'grown' from Australia?

On the basis of a domestic software product market served by Australian producers of about $800 million annually and ignoring export revenue, a simplistic equation shows that Australia could support a maximum of 400 specialist firms with an average annual domestic revenue base of $2 million.

Clearly the export market is the key to growth for Australian firms. However firms seeking to export usually require a higher level of domestic revenue to maintain necessary levels of staff and export development activities. A more realistic evaluation is that the current domestic market, as currently structured, could support up to 80 specialist software firms, with an average $10 million per annum revenue. This revenue would sustain some capacity to supply international market growth.

Most of the Australian $5.9 billion software product market is supplied by imported product and Australian owned distributors earn a significant proportion of revenue by distributing imported products within Australia. If these distributors were to shift to a more significant focus on Australian products, some of this market share may be unlocked for Australian producers.

The current limited domestic market for software producers reinforces the need for export market growth to sustain the growth of a larger software products industry.

Market role of multinational software suppliers

As structural statistics show, the Australian domestic software market is dominated by sales of imported packaged software with the major multinational corporations (MNCs)

operating either through wholly owned subsidiaries or through distributors and systems integrators. Smaller multinationals tend to use distributors more often than the larger companies, however some operate their own branches in Australia, which may also act as regional headquarters for the Asia Pacific, for example Front Range, Bentley and Citrix.

According to Whitehorse21, fifteen MNC software vendors alone accounted for 16.5% (AUD 2 billion) of the estimated AUD 12.6 billion Australian domestic software product and services sales in 2005. Some of the major software multinationals operating in Australia are listed here.

ADC Software Systems Aust	NCR Australia
Citrix Systems Australia	Nortel Networks
Cognos Pty Ltd	Oracle Corporation Australia Pty Ltd
Computer Associates Pty Ltd	SAP Australia Pty Ltd
Compuware Asia Pacific Pty Ltd	SAS Institute Australia Pty Ltd
Microsoft	Symantec Australia Pty Ltd

In addition to these pure software vendors, a number of MNCs operating in Australia are multi-product suppliers selling particular mixes of software, hardware, and services. Some of them have significant software product revenues as part of this mix. CIIER estimates, based upon the 'normal' revenue mix of software and hardware, that these vendors provide at least a further AUD 2.4 billion in software/hardware products and AUD1 billion in services. A non- exhaustive list of these multi-product multinationals includes:

Acer Computer Australia Pty Ltd	Intel Australia Pty Ltd
Digiland P/L	LogicaCMG
Dimension Data Australia Pty Ltd	Nokia Networks Australia
EDS (Australia) Pty Ltd	Satyam Computer Services
EMC Corporation	Sun Microsystems Australia Pty Ltd
Hewlett-Packard Australia	Synnex Australia Pty Ltd
IBM Australia Ltd	Tech Pacific

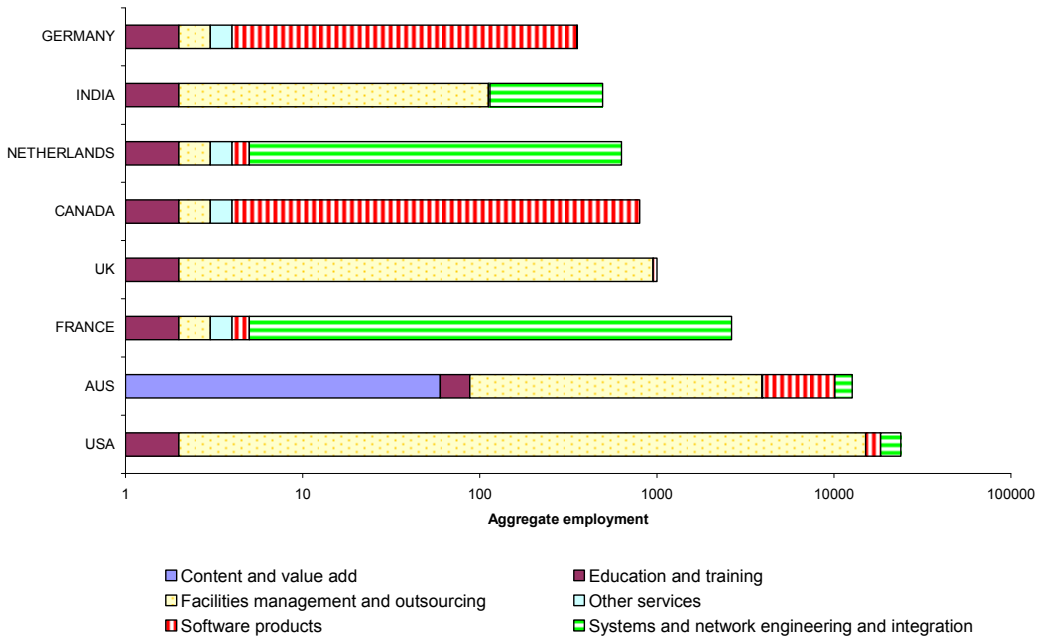
A further grouping of MNCs operate in the systems integration and development field, and account for a further AUD 2.6 billion software and services revenue in 2005. They include such companies as the following.

Accenture Australia Ltd	GFK Marketing Services Australia Pty Ltd
ADI Limited	Infosys Technologies (Australia) Pty Ltd

AMS Management Systems Australia	Kanbay Pty Ltd
Cap Gemini Ernst & Young	Oxygen Business Solutions
CSC Australia	Ripple Systems Pty Ltd
Getronics Australia Pty Ltd	Unisys Australia Limited

The aggregate Australian software and services revenue, just of the 45 MNCs listed above, is therefore estimated at nearly 65% (AUD 8 billion) of the total Australian software and services spend.

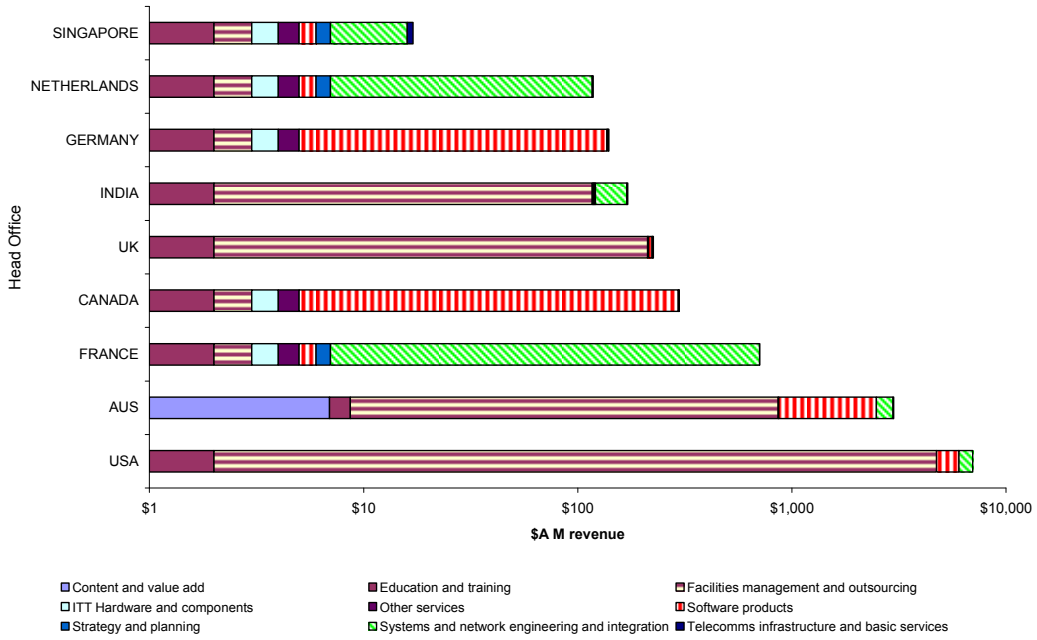
Figure 10. Australian software and services employment by head Office location, December 2004



Source: Whitehorse T250.

Figure 10 shows employment in the survey sample of software and services firms operating in Australia (T250 data) and indicates the multinational nature of the industry. Total Australian employment in the software and services sector is understated in this sample, due to the many smaller Australian owned firms. Many of the major segments of the Australian software market are dominated by multinational suppliers. Figure 11 shows the revenue distribution for the same survey sample, with MNCs earning over two-thirds of software and services revenue in Australia. Data for figures 10 and 11 is in the annex to part A.

Figure 11. Australian software and services revenue by product / service, and head office location, December 2004



Source: Whitehorse T250.

While there is some potential for some of the MNCs to expand activities in Australia and to engage strategically with the Australian industry and innovation base, their primary driver is commercial exploitation of the Australian market within the context of their global operations. Firms fund expansion from capital and retained profits and with the control over the foreign-owned MNC's destiny not held locally, CIIER considers that expansion, research commitment and training may be less likely to occur than in Australian-owned companies.

In more difficult times, experience shows that overseas companies can rationalise their activities by reducing or closing operations overseas, particularly those that are less strategic in nature. For example, over 40% of a sample of 120 ICT business closures in Australia following the 'dot-bomb' ICT stock market decline in 2001–02 were overseas owned companies, mostly engaged in software distribution.[22]

Innovation as a basis for growth

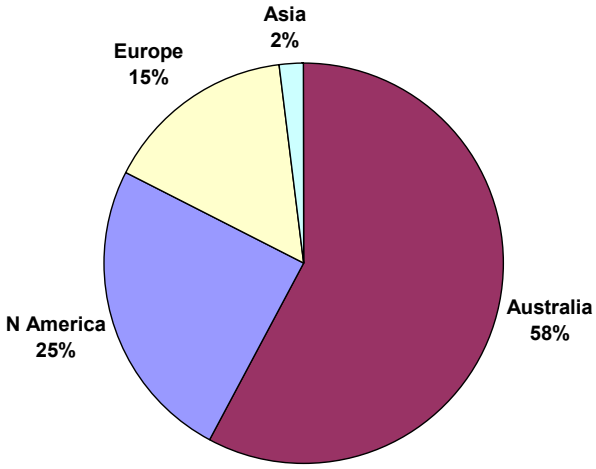
In their report, *Australia—winning in the global ICT industry*, McKinsey & Company commented on the importance of undertaking world-class innovation in Australia.

> Australia will only be successful in the (global) ICT industry to the extent that it drives world-class innovation. ICT R&D is typically carried out over a medium-term timeframe and usually has uncertain commercial outcomes. Collaboration across adjacent sectors to build scale, and even collaboration among competitors, is sometimes required.

Australian domestic software and services firms invest relatively heavily on R&D. The chart below may understate the relative size of the Australian proportion, since it is derived from survey respondents only and is focussed on larger companies. Nevertheless, even on this limited data, MNCs committed around 1.8% of their revenue to R&D, compared to 8.6% for the Australian owned companies in the same sample group.

This would suggest that MNCs, while still contributing a useful amount of software research, commit a lower proportion of their Australian revenue to developing and exporting software products from Australia than do Australian owned firms.

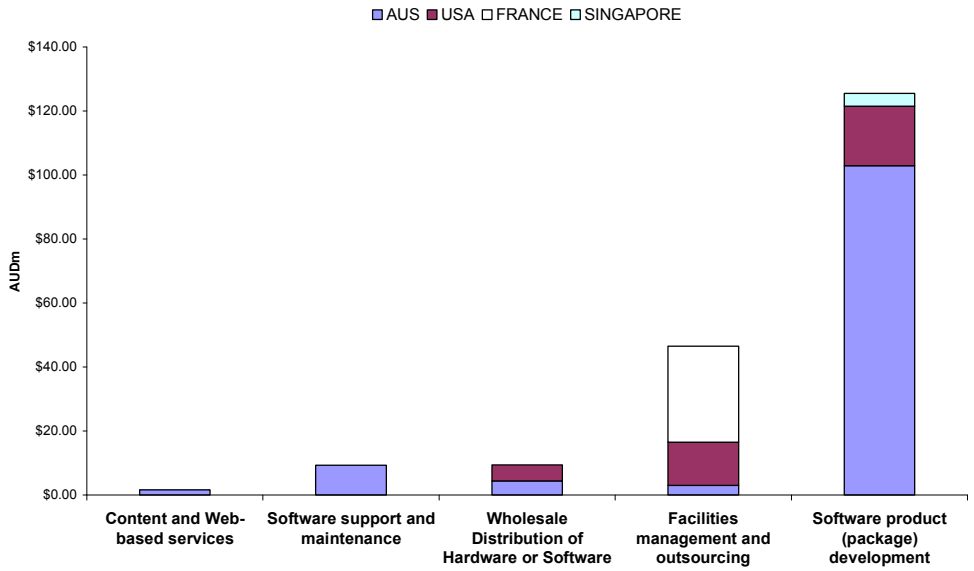
Figure 12. R&D expenditure by software and services firms in Australia, by country and region of origin, 2004



Source: Whitehorse T250.

This difference is further reinforced by analysis of the T250 database with respect to R&D performance in the industry subsectors.

Figure 13. R&D by primary software activity of software and services firms by selected countries of origin



Source: Whitehorse T250 survey Dec 2004.

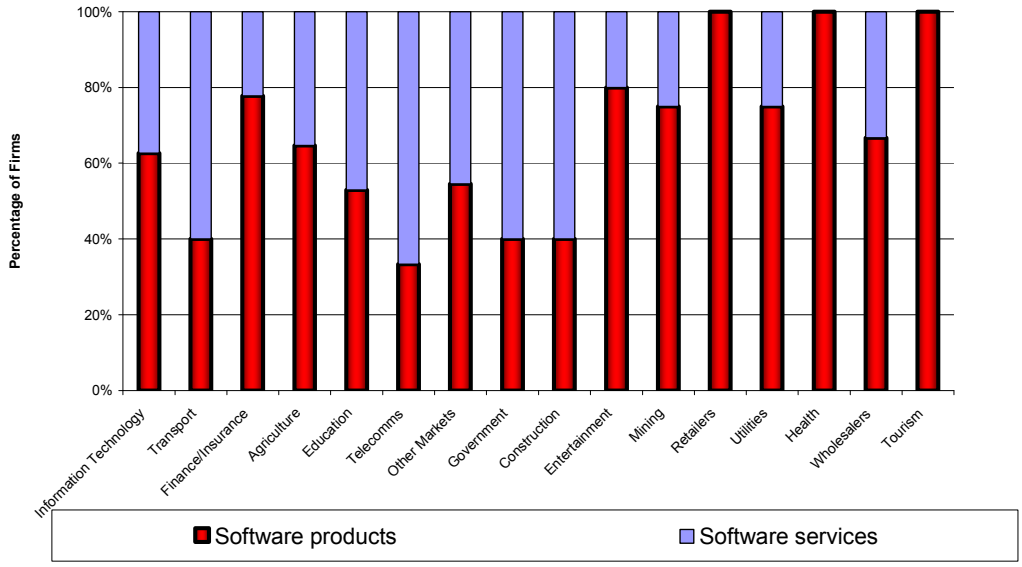
The T250 data show that software products firms (predominately Australian owned) perform the majority of software R&D. The firms providing facilities management and outsourcing (predominately internationally owned MNCs) while earning the majority of software and services sector revenue, perform relatively little R&D on software products or services. Nevertheless, a number of MNCs contribute significantly to Australian R&D and this contribution is explored further in the 'Software markets' chapter later in this report.

Client markets

The Whitehorse T250 survey collects data on all the client markets for the sample firms, with firms able to specify up to 16 markets. Figure 14 shows prime client market selection by the software and services firms, and indicates strong differences between the software product/service balance in the client markets.

The analysis shows that the retail, health and tourism sectors are serviced almost entirely by product-focused firms. All other markets are supplied by both software product and services firms, with companies that select telecommunications, transport, construction and government being predominantly orientated towards services rather than products. (The survey vehicle did not include manufacturing in the list of markets.)

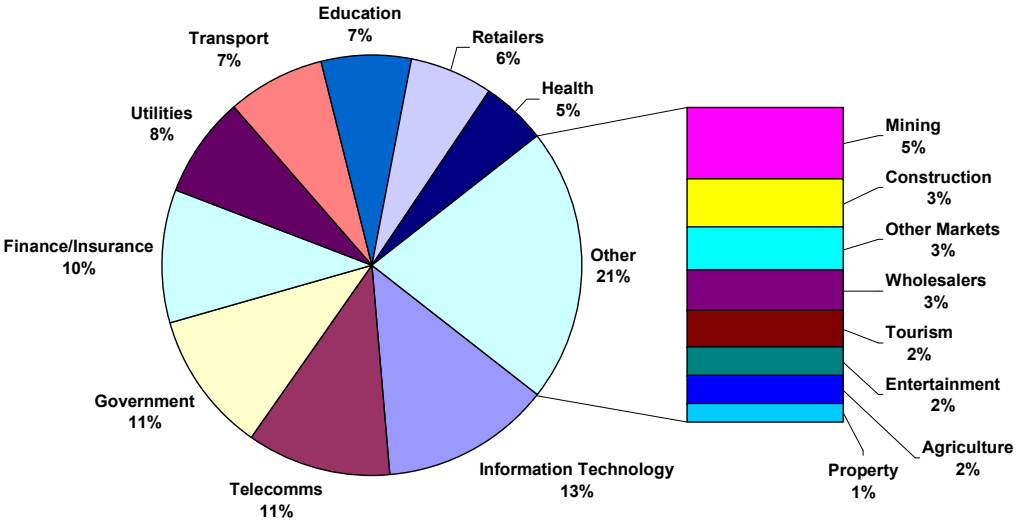
Figure 14. Primary markets of software and services firms in T250



Source: Whitehorse T250.

The subsequent chart shows all of the markets that were individually selected by software and services firms. It reveals that many of the firms selected multiple markets, and that a number of key markets are in second or third place.

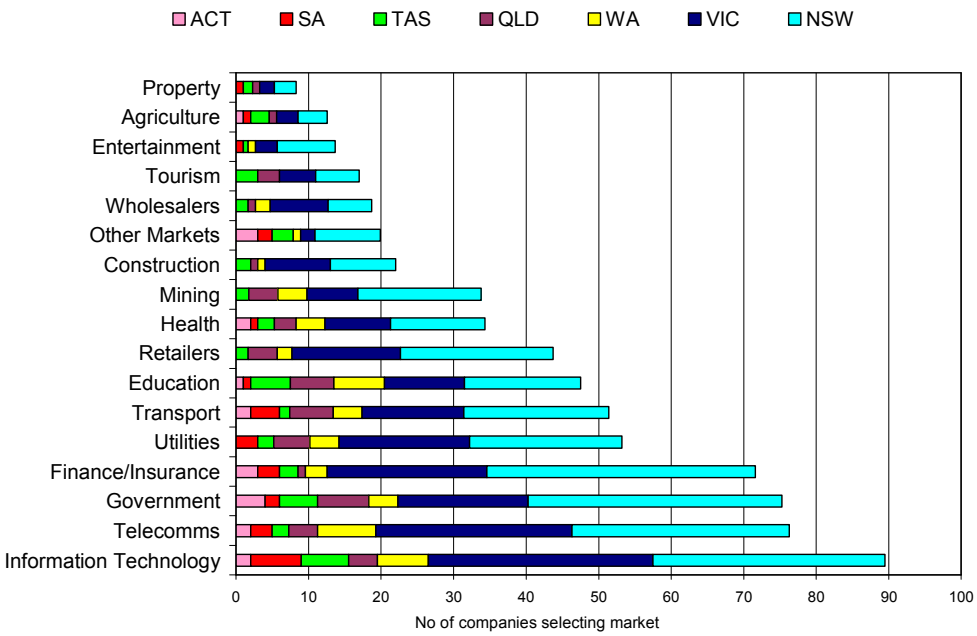
Figure 15. All markets selected by software and services firms in T250, 2004



Source: Whitehorse T250.

It has been suggested during the consultation process that some states have advantages in terms of particular markets. Our analysis supports this, as the ratio for various market selections indexed by the location of head office of the firm concerned, shows a variable distribution pattern in which states other than Victoria and NSW clearly have some significant focus on particular markets.

Figure 16. Market by head office location of software and services firms in T250, 2004



Source: Whitehorse T250.

The chart above shows target markets selected by companies headquartered in the various states. Whilst this does not, of course, equate to market share, as one or two large companies in a particular market may have a disproportionate impact upon the total market, it shows the relative concentration of company effort on particular markets in each of the states. Markets that are targeted by companies from the widest range of states and territories include: information technology (including telecommunications), finance/insurance, transport, government, education and health. The markets that are serviced by firms from a smaller number of States are mining, retail, wholesalers, tourism and construction. The data table is presented in the annex to part A of this report.

Summary of software industry statistics

Both in revenue and employment terms, dedicated specialist software developers, while generating a significant contribution to Australia's ICT export revenue, are a small proportion of the total ICT industry.

Based upon a number of the previously identified sources and models, we estimate that the software product (software product developers and distributors) industry sector in 2004 employed around 17 000 staff, out of a total software and services workforce of 106 500**.** We estimate that it is supported by some 6800 development staff and earns

$2.7 billion a year, of which $831 million per year goes to Australian-owned developers.

Export markets account for $286 million of this product revenue with $226 million going back to the Australian owned software developers, and the software product industry sector spends $66 million a year on R&D.[23]

Domestically developed software captures just 17% of the AUD3.6 billion domestic market revenue for all software products, and less than 5% of the total software and services domestic revenue in Australia of AUD 12.6 billion. The vast majority of the balance remains with the computer services firms (i.e. integrators and outsourcers) or is absorbed at the wholesale and retail level by distributors, many of which are the branch offices of international firms.

This data is explored more fully in the following sections.

Table 3 Software employment, revenues & R&D expenditures (AUDm)

	Employment	Australian revenue (AUDm)	Product export revenue (AUDm)	Total revenue (AUDm)	R&D (AUDm)
International developer	650	43	60	103	10
Australian developer	6,200	605	226	831	38
Subtotal developers	***6850***	***648***	***286***	***934***	***48***
International distributor	7,300	1,355		1,355	13
Australian distributor	3,000	433		433	5
Subtotal developers and distributors of software products	***17,150***	***2,436***	***286***	***2,722***	***66***
Internationally owned software services	66,550	7,962	NA		
Australian-owned software services	22,800	2,227	NA		
Subtotal software services	***89,350***	***10,189***			
International software products retail market share		1,873			
Australian-owned software products retail market share		1,753			
Software products & royalties net revenue		***3,627***	***286***	***3,913***	
International software and services total	74,500	9,360			89
Australian owned software and services total	32,000	3,265			121
Software & services total	***106,500***	***12,625***	***1,223***	***13,848***	***210***

Source: Model derived from Whitehorse/CSES TradeData/IDC/ABS.

WITSA estimated a $534 billion world market for software and $238.5 billion market for IT services, and predicted strong market growth for software. If the Australian and international markets were to increase their focus on software product, CIIER considers

that this could potentially lead to faster growth of the Australian software product sector. Australia appears to have an adequate pool of skills to accommodate such growth, for example through changing in the job focus of some of the more than 100 000 people employed in the software and services sector, or of the many ICT professionals employed as software developers in other industries.

Software production analysis

This section explores Australia's software production capacity, strengths and weaknesses, examining capabilities and areas of focus.

Software product development outside mainstream ICT

The analysis above has concentrated on dedicated ICT industry participants. However, in a recent report Sensis has estimated that 11% of SMEs producing ICT were specialist ICT firms—many more firms were producing ICT outside the industry than in it.[24] Only 26% of the total value of ICT produced by SMEs was from the ICT sector.

We considered the findings of this report, in particular, whether there may be a significant amount of 'hidden' software product, embedded within software development, that could, if marketed, provide additional revenue for the Australian software industry, or there could be a possible additional domestic market, if the software requirement was supplied as domestic product instead of being developed to specific requirement.

The Sensis analysis, however, focused on whether firms produced ICT goods and services, rather than specifically identifying software products. (In the survey, the software category among the ICT goods and services was for 'packaged and customised software'.)

The Sensis report also explored the tasks performed by employees dedicated to ICT tasks within the ICT producers, and found that less than 10% listed 'software installation/preparing/writing' as the main task of such staff (which also includes maintenance tasks). For comparison, 'looking after server/systems' was listed as the primary task by 25% of the firms with dedicated ICT staff, 10% listed 'offering advice/consultancy' and 11% 'designing and updating websites', all of which are mainly maintenance functions.

We consider that the software development activity found by the Sensis survey does not represent a substantial 'hidden' pool of software developers.

Regardless of the specific levels of software development outside the mainstream, while it is true that some software development may be translated into marketable software product, a significant amount of software development will not. The reasons for this relate to the design and structure of software developed for different purposes and to different paradigms, and to constraints upon the exploitation of intellectual property.

There are inherent differences between the requirements for internal use of software, and marketable, supportable, cost-effective, software product. There is almost a continuum extending from a client and purpose specific, locally supported solutions, to the opposite extreme of general-purpose, mass-market, easily implemented and minimally supported software products. Not all software product needs to be mass marketed and minimally supported and there are many examples of complex, higher cost, software products that require significant levels of support.

But such products also require sufficient flexibility in both their operational settings (operating system and hardware configurations) and client structures (location,

management, fiscal, etc.). In the majority of cases, such flexibility is far easier to achieve if it is part of the design brief of the software development, rather then developed as a later addition in order to fit the development to the requirements of software product.

Where the client provides the design brief with detailed specifications, it is far less likely to incorporate product-level design flexibility, as this might result in a higher cost. Developments structured in terms of the time and material employment of external developers, are even less likely to provide such opportunities in the design brief.

The significant reorientation in the provision of software and services to a more exclusive services relationship, epitomised by the growth of outsourcing, also mitigates against the likelihood of opportunities for product development in Australia, as, from our analysis, many of the major organisations now providing such services have much less history in the development of software products, or where they do have such experience, have tended to develop such products outside Australia.[25]

When the design brief has sufficient flexibility for a software product to be developed, constraints on the intellectual property embedded in it makes software product development in many cases, non-commercial, or the development contract prevents further exploitation of the product.

Recognising that software products may be derived from the development at the design and contract point may enhance the opportunities for Australian firms to grow. It would also be advantageous if distinctions were made between confidential data, derived intellectual property ownership and IP exploitation rights within development contracts.

EU research and development projects that include both public and private sector participants can incorporate IP exploitation plans and agreements, developed either prior to the commencement of the research or during the research process.[26]

In contrast, some governments and major commercial entities in Australia have, historically, reserved ownership of intellectual property within their software development contracts.[27] The *Commonwealth IT IP guidelines* (2001) were developed to encourage Commonwealth government departments to have regard to industry development opportunities and the capacity for governments to make savings by not acquiring all the IP. The guidelines are scheduled for review in 2005–06.

The development of mechanisms for shared exploitation of intellectual property, and the consideration of product oriented design briefs as part of this process, would require significant changes to many current public and private ICT procurement processes, but could, in the opinion of the consultants, act as a major stimulus to software product development. The potential benefit to the Australian software industry of such changes would also depend, in the first instance, upon the domestic industry's market share of such projects.

Shared software development

There have been a number of initiatives in various markets in which groups of customers, often via industry bodies or other associations, have developed sets of

common standards, shared requirements, or minimum paradigms for software products and services to address their needs.

These have then led to expressions of interest, or to the formation of 'panels' of approved suppliers. In some cases, such processes have led to the development of new software products, or, they have provided a marketing platform for successful applicants. In other cases the processes are still under development. Examples include:

- E-government—Municipal Association Victoria (Federal Government funded) Local Government Online Services Project. Projects/products included online payments, GIS systems, e-procurement, and web enablement.
- Health—Australian Health Ministers Advisory Council (AHMAC) has sponsored the National Supply Chain Reform Task Force (NSCTF) since early 2003. This has focussed on analysing the needs of the health supply chain, creating standards and encouraging pilots.
- Trade and commerce—Australian Retailers Association e-Commerce Committee is developing a functional template for point-of-sale (POS) vendors to create more conformity between the various POS systems.

Australia's software industry strengths

Australia's main strengths in the development of software products are long-term experience in the field, compared to many other countries, and the quality of software personnel. As one focus group participant put it; 'We write … good software'. This is a generic strength, however, and needs to be directed to particular markets. Some of these markets, and our relative strengths and weaknesses in each of them, are explored in Part B of this report.

A number of other software industry strengths were identified during the focus groups, including:

- relatively low costs for software development (compared to US and Europe);
- strong Unix and open source skills;
- multicultural work-force and language skills;
- well educated and open society;
- well established and representative industry bodies;
- competitive and discerning domestic market;
- technological leadership in a number of vertical markets;
- technological leadership in some software niches; and
- higher quality finished software products than world norms.

There was, however, a strong feeling expressed during the focus groups by a number of software industry leaders that, in comparison to perceptions of the significance of the telecommunications and computer equipment industry sectors, and of international software product distributors, they felt that the relative quality, dynamism, and

economic significance of Australian software development was under-appreciated and undervalued by other industries and by many in the various levels of government.

While the US is generally considered by those outside the software industry as pre-eminent in ICT, it was noted by some that the popular wisdom that the US invented the computer, the worldwide web, and software programming is false.

- First computer: Manchester, UK, 1948
- World-wide web: Theorised by Trevor Pearcey, Australia, 1949, developed by Tim Berners-Lee, UK
- Programming: popularly attributed to Charles Babbage and Ada Lovelace, UK, 1835 [28]

Other opinions on the US market included that the US has a very fragmented market with a myriad variations in taxes and local laws, a legacy of very old applications in key markets, arguably lower software productivity than Australia, and lower telecommunications infrastructure standards than Australia's. Nevertheless, the US has undoubted strengths in sales and marketing and many globally competitive companies.

Australia's software industry weaknesses

A number of significant weaknesses and barriers to growth, and areas upon which the software industry needs to focus, were also identified by the focus groups. These included the tendency for software producers to invest more heavily in presentation and marketing and innovation issues—the availability of investment capital, skills development, the disconnect between public research and industry. The presentation and marketing issue is discussed below and the other issues are discussed in the section on the innovation base, infrastructure and framework conditions.

Presentation and marketing

It is generally agreed that many Australian firms prefer to put their effort into producing better products, rather than presenting and marketing them. Some commentators felt that this was, in some cases, due to a lack of regard for profits—that some software developers are driven more by the wish to solve a problem than by a desire to have a profitable return. A number of measures were discussed that might help address this weakness. They included better business mentoring programs and the establishment of software marketing consortia or specific representation agencies.

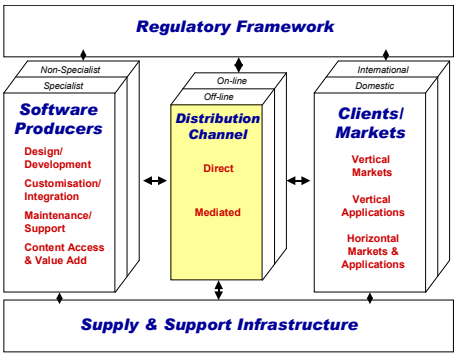
Conclusions to software production analysis

Australia's software production capacity is contained within a large number of small firms, and a relatively small number of medium sized companies. Much of the market is dominated by a relatively small number of global suppliers, providing software products via subsidiaries or domestic distributors, but performing relatively little R&D in Australia themselves. Whilst the market is growing, it is currently structured more to services than to software products. However, this balance is shifting as outsourcing processes are reviewed and adjusted.

While software exports are almost certainly understated, the gap between the value of software product imports and exports is declining. The trade deficit in royalties and licence fees continues to grow.

Australia's relative strengths in software production are not sustainable indefinitely, as other countries improve their software productivity and quality. We discuss issues that impact on the ability of Australian firms to be internationally competitive in the 'Innovation base' chapter, in particular capital and R&D links, and the availability of skilled labour.

Distribution of software



This section examines software distribution models and market entry techniques. It corresponds to the central box of the software product system map (i.e. the distribution channel).

Software distribution models

Software distribution can be defined in two ways: physical distribution models (i.e. how to get the physical product to the client); and financial distribution models (i.e. how to organise payment for the product).

Physical distribution channels

Table 4 lists the major physical distribution methods used, both domestically and for export markets, and some of the pros and cons for each. These have been derived from the focus groups and our consultations. Each method has its adherents, and each is pertinent to particular products and markets.

It was noted that, in some specialist markets, an existing user of the software product can become the distributor, or may be responsive to a joint-venture proposal. A further, usually short-term, process can involve a 'mate' system, where another Australian firm, whether in ICT or not, offers, the use of offices, staff contacts, etc. to assist on either low-cost, deferred, or long-term shared terms. A number of successful Australian ICT exporting firms in the focus groups indicated that, in the right circumstances, they may be responsive to approaches of this nature from other companies.

Forum participants also noted that there have been experiments in the past with software export consortia, export representative offices and other support mechanisms to provide an alternative to physical representation offices. These have included the Austrade supported European Software Export Centre, the Paxus US software centre, and two Victorian Government supported software consortia (CPX and ITC). All arrangements involve risks and the outcomes of the initiatives were variable. Some resulted in enhanced marketing for Australian firms, some eventuated in mergers. The tech-wreck related collapse of market funding had adverse consequences on some of these initiatives, as did the uncertain continuation of government funding

Table 4 Physical distribution models: pros and cons

Method	*Pro*	*Con*
Online Download	Minimal cost No middleman	Piracy problems Difficult for providing support
Branch Office	High control Direct customer contact	Most expensive
Sole Distributor	Needed in some markets Useful as a mechanism for providing local market knowledge	Training costs, Potential revenue loss, Difficult to provide service quality control
Shared distributor	Needed in some markets Useful as a mechanism for providing local market knowledge May have broader coverage	Competing with other suppliers, Less visibility
Wholesaler	Good for shrink-wrap products, May be only route to retail market	Worst for revenue, visibility and marketing
Publisher	Good for shrink-wrap products, May be only route to retail market	
Bundled product with manufacturer	Strong channel to market	May restrict product to one manufacturer, Difficult for contract enforcement
Badged product with manufacturer	Strong channel, Guaranteed return (royalty only)	No visibility for software developer, Dependant on others

Source: CIIER Analysis.

Financial distribution channels

Traditionally, financial distribution models have split between the 'single sale', e.g. outright sale or one time licence fee, and 'multiple sale', e.g. various combinations of periodic fee involving licences and/or maintenance/upgrades. These distinctions have generally been based upon the preferred model for the company, rather than being segmented on the type of product. Multiple fee systems have normally required a higher level of capitalisation for the companies concerned, in order to balance delayed cash-flows with expenditure.

Several US analysts have recently commented on the strong growth in the emerging Software as a Service (SaaS) market.[29] SaaS is the process of providing software products as a download or process at runtime (i.e. at the time that the software product

is required to be used) on a fee-for-service basis for each usage. IDC recently suggested that worldwide spending on software as a service (SaaS) reached $4.2 billion in 2004, an increase of 39% over 2003. This reinforces the results of a survey conducted by US based Saugatuck Research earlier in 2005, which found that North American CIOs plan to use up to 14% of new IT infrastructure spending on 'pay as you go' IT services, and 13.8% of new IT application spending on software as a service in 2005.

Table 5 Financial distribution models: pros and cons

Method	*Pro*	*Con*
Outright IP sale	Upfront revenue	No further revenue Potential loss of access to future IP development
Territory sale (right to IP in geographical region)	Upfront revenue	Often hard to sell Can easily underestimate potential market
One time licence fee (OTLF)	Industry standard	Ongoing service cost long after revenue
OTLF + annual service fee	Industry standard	Sometimes hard to maintain service fee revenue Administration overhead
Annual fee for service	Industry standard	Effectively a resell each year Amortisation of initial costs needs careful consideration
Run time licence fee	Ongoing lag revenue	Ongoing service expectation/cost
Seat based licence (based on the number of users)	Variable pricing to suit market	Complex to administer and police
Web -enabled/usage (SaaS)	Attractive to users, emerging model	High capital cost to set-up May involve security issues
Shareware donation	Very user-friendly	Limited suitability May be difficult to make a profit Unattractive to investors

Source: CIIER Analysis.

A number of attendees at the consultation forums indicated that the incidence of more complex market models, and, in particular, the use of various service based deliverables, such as the SaaS approach, were part of their forward planning or were already in place for particular products.

One respondent, in particular, indicated that their very major US sales position could only have been achieved through this model. However, a note of caution was also

sounded by software industry specialists, as SaaS is not suitable for all products and markets. The consensus was that, while SaaS has definite attractions, as with ASP and other market models in the past, the enthusiasm of the industry watchers does not always translate into commercial reality.

Selecting physical and financial models

The choice of a particular physical or financial model for either the domestic or selected international markets is neither a trivial nor simple exercise. Some markets may require direct representation, others may benefit from a distributor with local knowledge, some may be sophisticated enough for electronic delivery methods, depending upon various indicators, including market size, competition, client expectations, the complexity of the software product, the relationship between the software product and associated services, and cultural and business mores.

Decreasing costs associated with electronic distribution and 'fee-for-usage' financial models such as SaaS, is expanding the range of options available to smaller firms to develop their international client base, and may be shifting the balance from products to services. For many smaller companies, especially, the same considerations may apply to the selection of appropriate models for interstate operations in Australia.

Market entry techniques

The following table outlines a range of market entry techniques with positive and negative comments on each derived from industry participants in focus groups.

Table 6. Market entry techniques

Entry technique	*Positive comments*	*Negative comments*
Country Visit	Almost essential	Rarely do business first time
IT Trade Show	Gives 'flavour' of IT in the market.	Expensive If you exhibit you will get stuck on a stand and see very little of the competition or the market
IT Trade delegation	High level contacts, high visibility	Can involve significant participation in time-consuming 'social' events for local dignitaries
Vertical market trade show	Best way to assess market potential	Need to get invited
Advertising for a distributor	Could get lucky	Creates vulnerability
Local IT trade Association	Very helpful in some markets	Need to make commitment to the local industry
IT Conference	Contacts can be good Getting speaker status is very useful	Often held at expensive hotels Involves mandatory social scene
Austrade local office	'On our side' Has local market knowledge	Some far better than others Involves some fees - often costs unrelated to value
State govt offices in markets	As Austrade, but some even offer a loan desk	Few and far between
Export advisory services/consultants	Can save you a lot of time and money if they know their stuff	Variable quality Some know export market but do not understand software

Source: CIIER Analysis.

We did not rank these market entry techniques, as they vary in significance considerably for both products and markets. In general, however, it was felt that the more government influence applies to a market, the more useful techniques like IT trade delegations become.

Free trade agreements

Free trade agreements (FTAs) can assist in reducing barriers to trade between nations, but their impact can vary depending upon the terms of the agreement and the market status of the two nations.[30] In the case of software products in particular, an FTA can be of most value to the Australian producer where the target country market is growing

quickly and there are fewer dominant suppliers. This category would include: Thailand, Malaysia, and parts of Peoples Republic of China (PRC), and the Baltic States.

An FTA may open fewer opportunities in countries/regions with mature commercial markets, such as the US and UK where there are significant and established suppliers. However, the private sector markets in such countries have generally presented few non-commercial barriers to entry for good software products.

Significant barriers to access to the government purchasing market may remain, regardless of FTAs. For example, Australian SMEs cannot access the SME set-aside portions within US federal government contracts. Access to the other parts of the US government market, can be difficult for all small firms, regardless of the country of origin.

> Few small tech outfits ever get close enough to the Pentagon to talk to someone about their technology. For all the buzz about private industry cashing in on spending by the Defence Department and federal intelligence agencies, the little guys hardly ever land those contracts. Indeed, it's usually tech giants like IBM, Perot Systems, or the half-dozen or so Washington-centric consulting firms that industry insiders like to call the 'Beltway Bandits'.[31]

Success and failure

A study by Software Engineering Australia also identified a series of generic business success factors derived from other industries, and mapped these against the Australian software industry.[32] SEA concluded that the Australian software industry is under-developed, but that many of the requirements and precursors are already in place.

Box 2. The nature of success factors

Intrinsic attributes of the industry: Some industries in Australia seem inherently suitable to become vibrant and successful by virtue of geography, climate, space, character and aptitude of people, language, etc. There is little than can be done about altering these intrinsic attributes, but it is important to recognise whether they exist or are absent.

Actions that foster and sustain: Even if the intrinsic attributes exist, it is necessary for specific, identifiable actions to be taken by some individuals or organisations for the industry to prosper.

Attributes of the resulting ecosystem: Other success factors are observable features of mature, successful industry ecosystems. Their development and proper functioning seem to be prerequisite to success.

Source: SEA. CIIER Analysis.

Focus group participants identified a number of success and failure factors for software exports. They include:

Success	**Failure**
Understanding the market	Committing cultural faux pas
'Wanting it enough': the desire to succeed	Failing to understand commercial operating practice differences
Necessary funding: 'it always costs more'	Overselling our ability to deliver
Having the right product at the right time	Them overselling their ability to deliver
Competitive pricing: 'cheap is not the best'	Not allowing enough negotiation time
Good trustworthy staff	Being too direct and forthright (e.g. talking like an Australian)
Competitive intelligence: 'knowing the enemy'	Poor language skills leading to misunderstanding (e.g. assuming that people speak English)
Contractual protection	Underestimating travel and accommodation costs
Competent technical support network and	Not having the 'elevator pitch' tuned and ready
'Getting close to your customers'.	Underestimating service time and cost
	Being too greedy, or too generous
	Trusting too much, or too little
	Not allowing for currency variations
	Not allowing for freight costs and delays
	Not allowing for government regulations, taxes, and charges
	Forgetting that 'it's their country—it's their legal system'
	Making it difficult to get yourself out of a bad contract
	Making it too easy for them to get out of a good one
	Failing to protect IP

These success and failure factors presume that the company concerned has already put into place its capital requirements, has established its track record, reference sites, and credentials, has created appropriate relationships with platform vendors and other stakeholders, has developed effective marketing material, and has a sustainable revenue stream to allow it to meet its operational outgoings.

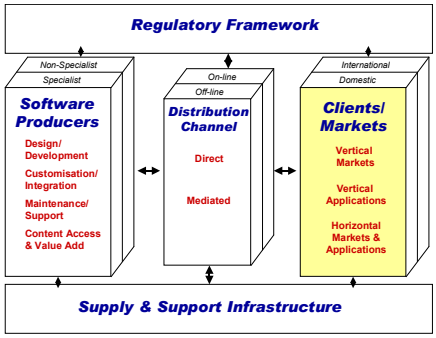
Conclusions on software distribution

There are a multitude of different physical and financial distribution models for software products. The choice of the appropriate model will vary for companies, products, and markets. The growth of the internet has opened up new opportunities for lower cost distribution models that may assist some producers.

Market entry models also vary considerably, and the choice of the appropriate mix is not an easy one for companies to make. Recent developments in free trade agreements may assist in some countries, but success or failure in markets has more to do with market intelligence and understanding by the company concerned, than any external factor.

Software markets

This section examines software market dynamics, domestic and international markets for software. This section corresponds with the right-hand box of The software product system map (i.e. clients and markets). The approach here is generic, with issues relating to specific vertical market applications dealt with in the second part of the report.



Market dynamics

One of the interesting aspects of vertical software markets is their volatility and variability, and how these are impacted by technological change. *Changes in technology can help to create new or enhance existing vertical software markets.* In the games software market, for example, significant technology breakthroughs in graphics, processing power and storage created low cost platforms capable of supporting multiple complex games systems and engendered the mass-market for games software. *But just as technology can create markets, it can also constrain them.*

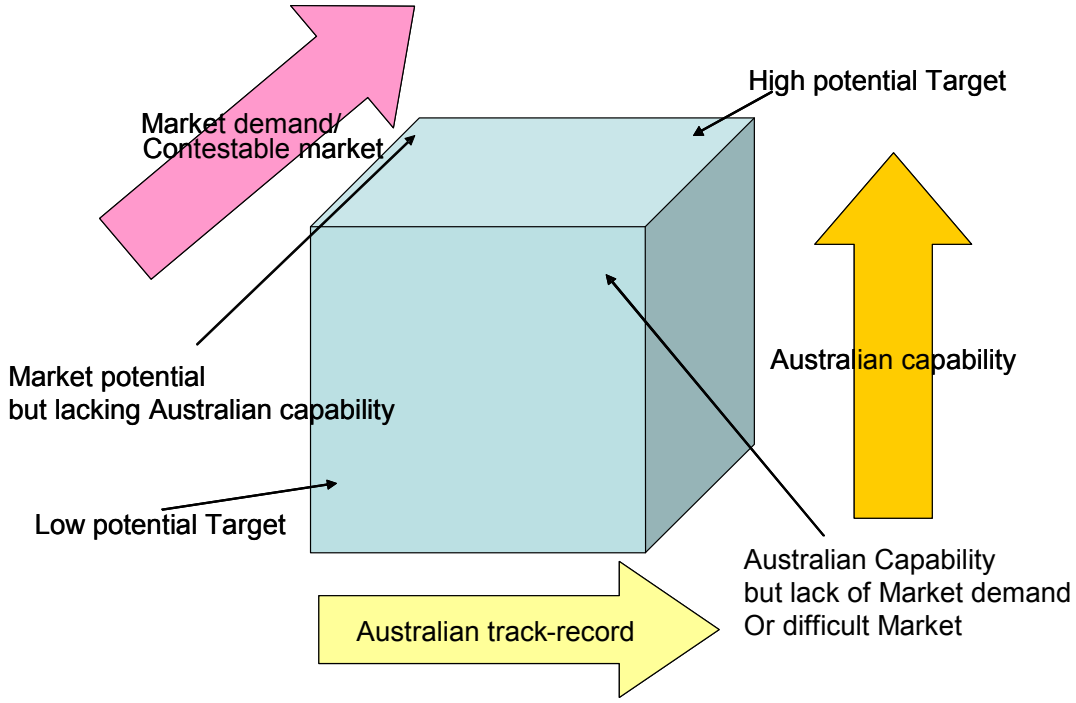
In the same games software market, for example, the key platform suppliers are now engaged in a struggle for market share and, as one of their weapons in this, are using the constriction of what were previously more open software platforms, so that only developers within the platform supplier's specific sphere of influence can produce saleable products for that platform.

These examples show how client demand together with advances in technology can create or enhance software markets. Software producers respond to this demand by producing software products, but controllers of distribution channels can use technological change to constrain or control those markets.

In a number of vertical software markets a key problem for Australian firms is establishing or maintaining its distribution. Firms that directly distribute (e.g. Mincom, IBA, Computershare, etc.) tend to have strong position in a niche market, a direct interface with leading edge clients in a specialist environment, and little exposure to mass market retail distribution of their products. The health, energy and minerals verticals tended to have more firms of this nature.

Another aspect to selecting appropriate software markets to focus on is that a globally expanding and contestable market is insufficient if one cannot demonstrate Australian track record and capability in that market. The ICT vertical is one in which we have both established track record and excellent linkages to global players, and we have an emerging track record in trade and commerce, and some established strengths in manufacturing.

Figure 17. Three dimensions of software markets



Source: CIIER Analysis.

Conversely, it is often not enough to have excellent Australian capabilities or track record in a software market, if the global market is too thin or too difficult to contest. The government market is one in which the domestic market may be more significant than export markets, but Australia's relatively strong position in e-government implementation means that Australian companies are often positioned at the leading edge of this market.

Education is another market in which our comparatively strong domestic stage of usage creates a potential export platform. As illustrated in the figure above, the optimum position is in markets that exhibit all three dimensions (or at least two of the three with the potential for the third).

Access to Australian markets

A key issue for smaller software producers is access to markets. Singleton (2003) noted:

> If our software firms are to prosper and grow exports, they need to be in partnership with key clients, integrators and services firms— potential prime solutions contractors, as well as associated specialist hardware suppliers and international operators. Australia, however, currently lacks services firms and prime contractor integrators that are not tied to foreign supplier alliances.33

As a major purchaser of ICT goods and services, the Government sees its procurement arrangements as, *inter alia,* a possible mechanism to work in partnership with industry to address these issues. According to a discussion paper from the Australian Government (for a program which was terminated in June 2002):

> Through contract service delivery outcomes, and longer-term strategic initiatives, the procurement environment can encourage SME development, R&D, exports, investment, regionally based activities, skills development and technology transfer.[34]

Most governments and major commercial entities in Australia strictly reserve ownership of intellectual property within their software development contracts[35] and consequently there is limited opportunity for Australian firms to exploit this IP in projects with other customers. In addition, in view of the requirement for value-for-money, projects are narrowly scoped to target the needs of individual clients, without considerations of potential opportunities arising from a more strategic approach. [36]

The 'small and insignificant player' issue

It may be that Australia's market is too small to develop and sustain significant firms in the ICT industry. However, Australia's market significance would tend to disprove this.

- Australia has the twelfth largest economy in the world.
- Australia together with New Zealand has a larger GDP than all of South East Asia combined.
- Australia has the ninth largest ICT market in the world.
- Australia has the second largest ICT market in the Asia-Pacific, although China is swiftly growing and will push Australia back to third position in coming years.

Table 8 Sample of countries with smaller domestic ICT markets

Country	*Firm*	*Relative % to Australian Market*
Finland	Nokia	22.10%
Sweden	Ericsson	57.17%
Norway	NorskData	26.79%
Korea	Samsung	83.18%
Taiwan	Acer	35.74%

Source: WITSA.

The suggestion may also overestimate the domestic market size required to establish world scale ICT firms. Whilst each case is unique, and other factors come into play, the countries listed in the table accompanying have smaller domestic markets than Australia, but each has at least one globally competitive ICT firm.[37]

Other countries, such as Israel and Canada, have significant domestically owned ICT firms, despite significant presence of international MNCs. We consider that Australia has a large enough domestic market for firms to establish and expand, if there are sufficient firms capable of doing so and if they can have fair and reasonable access to that market. There are many examples of successful ICT related firms, (e.g. Computershare) that would support this contention.

The Role of multinational corporations in the Australian market

In the ICT industry, some MNCs , such as Mincom, IBA, and Telstra, are Australian, although most of the MNCs operating in Australia are foreign-owned. Some of these Australian-owned companies are identified and commented upon in this report, particularly in the discussion of the vertical markets.

Creating, building and sustaining these MNCs could be the most important element of any strategy to develop Australia's software industry. However, most discussion on the role of MNCs in Australian industry development focuses on those headquartered outside Australia. In this report we consider foreign MNCs primarily from the viewpoint of their impact upon the Australian software market, and on Australian software suppliers.

Governments maintain non-discriminatory purchasing and business policies, and actively encourage overseas owned companies to establish and maintain operations in Australia. A number of overseas owned ICT companies have extensive operations in Australia, and, in some cases, a history of significant investment and research in Australia.

It is important to understand, however, that, in terms of economic benefit to Australia, attracting an overseas owned company to establish facilities in Australia, while simultaneously losing a similar Australian owned company, is not a simple equivalent.

Attracting ICT MNCs to locate in Australia can increase employment, and often creates investment. It is CIIER's view that the retention of such companies, however, is less certain than in, for example, manufacturing as the infrastructural investment in plant and equipment for software companies is low and financial constraints on relocation are therefore minimal.

Growing and, just as importantly, retaining, domestic ICT companies, can increase exports, reduce the trade deficit in ICT goods and services, and enhance the accumulation of capital and ICT technical and management skills in Australia.

However, overseas owned ICT MNCs do not act in a homogenous way and MNC behaviour can range from an active, participative engagement with the Australian economy through to a short-term focus, aimed purely at selling overseas products and services in the Australian market. This variation in behaviour was commented upon in Thorburn *et al.* (2002):

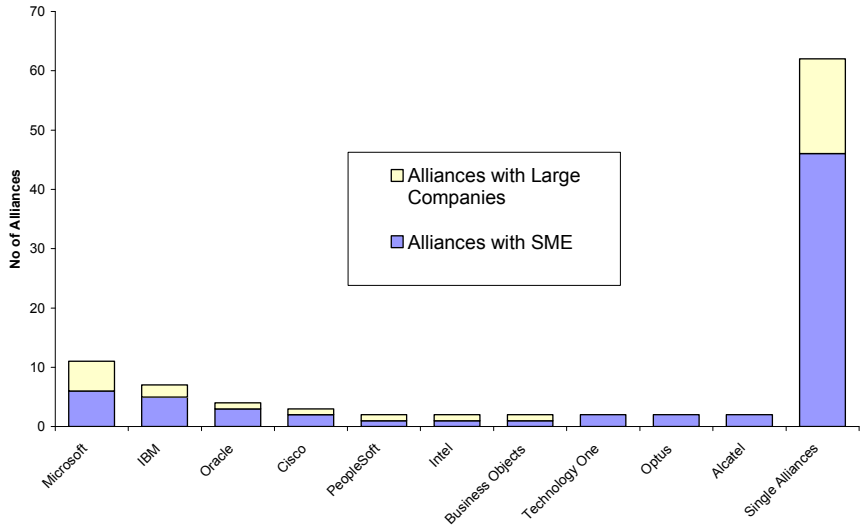
> There were some significant differences between firms by nationality, management type and mode of entry. These variations show that it is dangerous to take a 'one size fits all' approach to promoting inward investment. As a

> group, US respondents were larger, but were less likely to have RHQ structures that gave the local subsidiary autonomy. They were also less likely than UK/European respondents to export and to undertake R&D. Overall it appeared that UK/Europe respondents were more outward looking and their subsidiaries had a greater contribution to make to global operations.
>
> There are also significant differences between MNCs according to their contribution to the regional or global product development of their firm as a whole. Employment was highest in firms that had only a local mandate, but these firms were unlikely to be RHQs and also had less autonomy. MNCs that had a regional or global mandate were much more likely to export, work with customers, transfer technology to customers and be in control of product development than local mandate firms. Thus, they are likely to have a greater positive impact on the economy as a whole. [38]

While all companies have a responsibility to create and sustain profit for their shareholders, individual MNCs perceive strategic value in heightened levels of engagement with local industry and with the local economy. Some overseas owned MNCs have active and supportive relationships with local companies through clusters and networks, some work closely with Australian industry and some with Australian research bodies. Many of these activities are of direct benefit to the Australian ICT companies, many of which are software companies, with which the overseas owned MNCs relate.

In the December 2004 T250 survey, 73 MNCs, mostly overseas owned, were identified, with 99 nominated business alliances between them, of which a significant number were with Australian ICT SMEs.[39] These relationships can, at their best, encourage research synergy, and assist with both domestic and export marketing, and with the management skills of local companies. But such strategic engagement is always predicated upon the benefit for the MNCs concerned, or it could not be encouraged or sustained, and the key benefit that is normally required is enhanced market access and increased market share for the MNCs.

Figure 18. ICT MNCs in alliances with Australian SMEs, December 2004



Source: Whitehorse Strategic Group.

From the perspective of the development of the Australian software industry, we argue that the Australian ICT industry benefits directly where the net economic benefit of MNC investment and employment in, and strategic support for, the software industry exceeds the value of the imported products. (This does not take into account direct impacts in the wider economy such as productivity gains from the use of overseas-developed software and services.)

There are also indirect benefits from the presence of MNCs including skills upgrading, access to technology, domestic research, and overseas market access. Other indirect benefits may include increased productivity and innovation in domestic firms in the same industry and supply linkages between MNCs and domestic firms, leading to increased employment and higher wages.

A report by the Prime Minister's Science, Engineering and Innovation Council in 2000, derived from an analysis of individual corporate data from the Partnerships for Development (PfD) Program, the R&D Scoreboard, the *Business Review Weekly*'s Top 500 List and the Fortune Global 500 List, noted:

> There is a noticeable difference between the R&D performance in Australia of a select group of foreign owned corporations and their global R&D. Although not exhaustive it illustrates that most MNCs perform much less R&D in Australia than their world average.

The report went on to say:

> The dominance of the MNCs in the ICT industry and their relatively weak R&D performance is a major contributing factor to Australia's overall ICT business R&D (BERD) underperformance. If this group of MNCs had an ICT

R&D performance in Australia equal to their world averages, then an additional $1 billion would be spent annually on ICT R&D in Australia, raising total business R&D expenditure to $4.9 billion or around 0.8% of GDP. [40]

Whitehorse analysis suggests that, with some exceptions, there is a discernible difference between the MNC attitudes to Australian R&D from US headquartered companies, compared to those headquartered in Europe and in Asia.

Historically, much of the European owned ICT R&D was focussed on telecommunications and engineering, and this has now declined from its former strength, although companies like Alacatel and ADI continue this tradition.

Companies such as NEC, Fujitsu, Toshiba, and Canon have been joined by companies such as Infosys in a growing Asian corporate research base in Australia. Whilst much of this research may be aimed at equipment outcomes, a significant proportion has a software focus.

Box 3 Canon Information Systems Research Australia

Established in 1990, and owned 51% by Canon Inc. and 49% by Canon Australia, CISRA (Canon Information Systems Research Australia) is the Australian R&D centre for Canon Inc, the world's leading provider of cameras, business machines and imaging and information technologies. CISRA has grown from a small R&D group to one of Canon's largest R&D centres outside Japan, with over 250 engineering and support staff and annual revenue of AUD 40m. Together with Canon R&D centres in Japan, America, Europe and Asia, CISRA is a key part of Canon's future product development.

Despite the significant and integral role played by MNCs, domestically sustainable industries normally include a significant measure of technical and managerial sovereignty. That is, they are capable of controlling their own destiny, both in terms of decisions to invest, conduct research, employ and develop, and in terms of the technical and financial capacity to implement such decisions, within the context of a global industry.

'Branch office syndrome' is a phenomenon common to every industry, in which cutbacks tend to take place as far from head office as possible, and most important and strategic investments are kept close to home.

There are significant benefits to MNC presence in Australia and we consider it important that major MNCs be encouraged to headquarter regional and global operations here, to avoid insularity of the Australian industry and to ensure that Australian firms have access to technology and exposure to market.

However, to sustain a domestic software industry sector, CIIER considers that a significant proportion of software research, development and market share needs to be under Australian control, and in order to sustain a vertical software product development capacity, the industry needs to maintain an innovation base that will

encourage and nurture firms as they grow, and that will reduce relocations, selling off or losing Australian IP.

Overseas market selection

There is a tendency to assume that the largest market is always the best, but chasing the largest potential market can be poor strategy. Selecting the best overall potential market for a particular vertical software product can be a more complex process.[41]

The considerations, other than pure market size, include the cultural and political background of the target country and its 'fit' to Australia (e.g. trade relationships, language differences, proximity to Australia/cost of travel, economic structure and legal system, and demographic relationship to Australia (e.g. migrants, expatriates, students, etc.). These considerations are often expressed in the form of indices, which, when combined with a potential market size index, can assist in the selection of appropriate target markets.

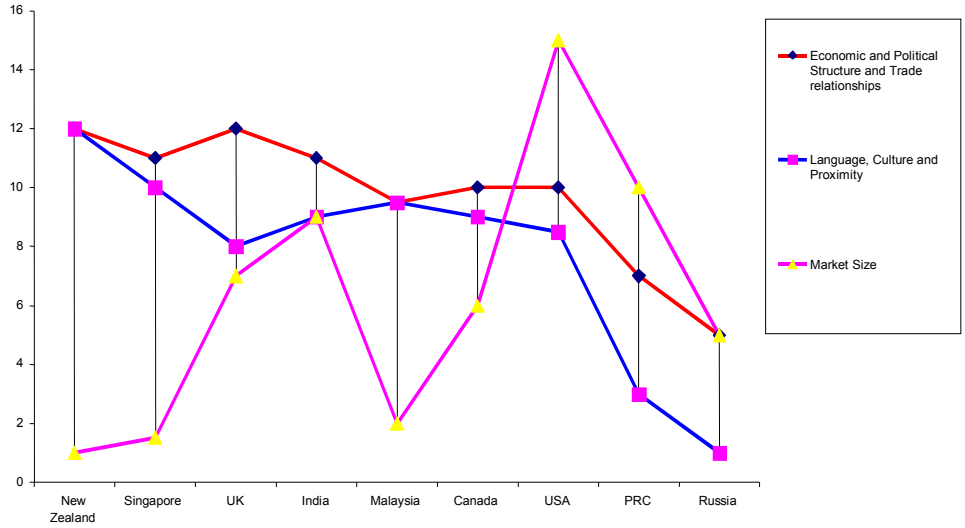
The methodology for the market analysis was developed and refined from a number of similar studies of a more generic nature, and was tailored to reflect the specific factor mix and weightings that are important for ICT.

The approach was to identify the specific factors that relate to the ICT investment decision, to source independent and reputable location based assessments of these factors, to apply a consistent ranking technique to each of the factors, and then to group them into the three basic considerations, of people, environment, and cost.

Weighting was then applied to each factor and the individual and combined rankings analysed by location, so that preferred locations could be selected. A large number of investment factor sources were identified and evaluated.

In most cases data was used from reputable international bodies, in particular those with a specific focus on the factor concerned, e.g. productivity bodies for productivity data, accounting bodies for accounting data. Two or more sources were identified for every factor in order to minimise bias, the most up-to-date information in each case was utilised. Whilst the detailed methodology is proprietary, the data sources included the Australian Bureau of Statistics; Business Software Alliance IPR Global Software Piracy Study; Harvard University Business Competitiveness Index; IDC; IMD World Competitiveness Yearbook 2003; International Monetary Fund; International Software Benchmarking Standards Group Ltd; A.T. Kearney; Nexia International Accounting Group; OECD; Political & Economic Risk Consultancy Ltd; Richard Ellis; Standard & Poors; World Information Technology and Services Alliance.

Figure 19. Market selection indices for selected countries



Source: CIIER Analysis.

The accompanying chart shows a generic summary of such analysis, in which the market size index shown is derived from the size of the general ICT market, as calculated by WITSA. Whilst 'radar' and other chart forms can provide more understanding of particular factors, this form of chart helps to identify the relative significance of the different indicators, shown by the range between the indices for any particular country.

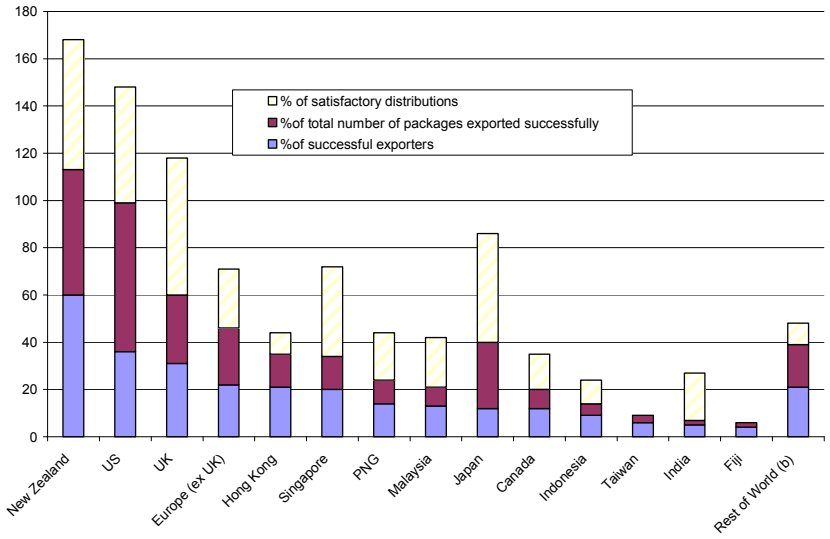
Ideally, a market should have a relatively high market size index, and a small range between that and the two other indices, which suggest 'ease' of market entry, and the cultural and organisational operational "fit" to Australian practice.

On this basis, the easiest market for Australians on cultural, political, demographic and economic indices is New Zealand, but New Zealand also scores a low index for the size of its market.

The next most 'logical' market, out of this group of indices, is Singapore, followed by UK, India, Malaysia and Canada.

On the 'size of market' index alone, the US is by far the market of choice, but for a number of software producers, providing the market size was not too small for their particular product, it might be a more sensible approach to develop their export skills in easier markets first, providing the market in such countries can provide a viable return.

Figure 20. BIE software export market evaluation, 1989



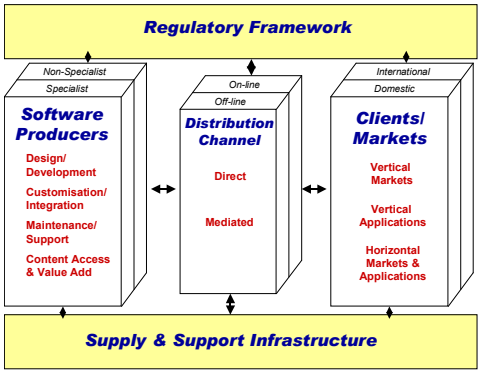
Source: Bureau of Industrial Economics , 1989, "Selling Packaged Software Overseas", Chart reconstructed by CIIER

The Bureau of Industry Economics ranked software export markets in 1989, considering both the then successful overseas markets for software and the most satisfactory distribution arrangements. It indicated that almost twenty years ago countries like New Zealand, UK and Singapore were strongly favoured.[42] This suggests that many of the selection factors are enduring, with changes relating either to variations in growth in particular markets or to market entry difficulties or improvements due to other factors.

Conclusion to software markets

Australia's software markets are both dynamic and volatile, and despite its small size, the domestic market is well able to provide the underpinning support for globally successful Australian companies. Improved access to this domestic market for Australian producers is very important however to sustain operations and growth, and, whilst a number of MNCs are supportive of the Australian software industry, others are mainly concerned with their own market share. The selection of the right countries to target for export markets is a complex issue for many companies, and can be crucial to success.

Innovation base, infrastructure & framework conditions



The innovation base for the software industry includes domestic infrastructure, the public sector R&D base, the skills base and the domestic market. Coverage in this section corresponds with the 'collective support infrastructure' and 'regulatory framework' (i.e. upper and lower boxes of The Software Product System Map outlined above).

Domestic framework and infrastructure

The primary infrastructural elements of innovation for the software industry sector are access to capital, communications capability and a supportive taxation and business environment (e.g. intellectual property protection). The following discussion provides a limited statistical analysis relating to the issues, where the data is available. However, the issues are complex and some of the key concerns identified in the focus groups, or in other sources are presented.

Access to capital

While still small relative to other OECD countries, Australia's venture capital market has been growing. As at June 2004, investors had $9 billion committed with venture capital investment vehicles, compared with $5 billion in 2000. Of the $3.1 billion that had been invested in the 909 investee companies at June 2004, $465 million was invested in new projects during the 2003-04 financial year. As at June 2004, $697 million (23%) was invested in 333 IT, media, electronics and communications firms.[43] Nevertheless, there is currently a reported dearth of capital for start-ups.[44]

A number of studies of the ICT industry in Australia have concluded that the availability of appropriate investment, and especially second-tier, patient capital, is its most significant weakness. While a series of initiatives and programs address the issue, the weakness continues.

The current Australian Information Industry Association (AIIA) submission (June 2005) to the government enquiry into the Venture Capital Industry states:

> A common view within the local ICT industry is that there is a low level of availability of venture capital and later stage private equity funds.
>
> On the other hand, the venture capital sector and business angel networks believe that capital availability is not the problem; rather it is one of quality deals being available.
>
> The Australian venture capital market is immature when compared to the sophisticated market in the US and one of the implications of this is that smaller

> ICT companies often struggle to understand how to best engage potential investors and access the critical pre-revenue funds necessary to fund growth. [45]

This suggests that many of the concerns that industry participants have expressed for some years remain and may well be a systemic aspect of technology investment in Australia.

Communications capability

Communications capability, especially high levels of broadband bandwidth and reliability, is very important to software developers, just as it is to many other industries. While communications capability is generally at an adequate standard in most capital cities, the development of software companies in regional Australia can be adversely affected by either inadequate or expensive communications capability.

Focus group attendees have commented that the relatively low level of adoption of high capacity broadband in Australia, including by many local SMEs, also adversely affects local software industry development, as it diminishes their capacity to provide sophisticated internet based products, and to use internet based distribution methods, for those clients without such capacities.

Taxation and business environment

Taxation and other operational issues that impact upon the software industry are the same as those affecting almost every other industry. Operational issues tend to relate to regulatory compliance requirements (e.g. compliance cost increases from introduction of the GST, impending compliance cost increases from superannuation changes), while taxation issues tend to fall into two categories, GST cash-flow implications and the tax implications of R&D expenditure. Focus group respondents commented that some changes to the R&D tax concession had made it less attractive to invest in R&D.

Intellectual property protection

Australia has sound intellectual property protection for computer software.[46] Indeed, Australia can claim to have led the world in the adoption of specific intellectual property protection for software, including the first definition of software for the purposes of copyright protection, patenting of business methods, and the first criminal sanctions for abuse of software copyright.

This creates a protected environment for software developers, and it is recognised by many international companies as a supporting factor for software development investment. It also creates a situation in which Australia is an attractive market for international software developers to test their new products with a relatively strong sense of security.

Australia's relatively strong position on intellectual property protection for computer software has gradually been translated into an improved position in many other parts of the world, and in particular in South East Asia. Australian representatives within the Asian-Oceanian Computing Industry Organization (ASOCIO)[47] have strongly argued that intellectual property protection is a precursor to successful development of a local

industry. This has been recognised by many of the industry representatives from other countries. International agreements and forums, in particular the World Intellectual Property Organization and the World Trade Organization (through the Trade Related Aspects of Intellectual Property Rights Agreement) have also encouraged many countries to improve software protection. There has been a gradual improvement in legislative frameworks in other countries, including in South East Asia. As the legislative frameworks improve and compliance increases, export markets have become more attractive for Australian software developers.

Some focus group attendees were concerned that the 'harmonisation' provisions embedded within the recently signed Australia-US free trade agreement (AUS-FTA) may have the impact of varying Australia's strong software copyright protection in ways that are a negative for the industry, by requiring Australia to alter its legislation to more closely correlate to that of the US. Other industry sources, however, hold the view that such variations, if required, may act to strengthen Australia's software copyright protection. Concern has also been expressed that some of the potential benefits inherent in an FTA with China may be difficult for Australian software producers to achieve, until intellectual property compliance in that market is stronger.[48]

Other regulatory issues

There are a range of other regulatory issues affecting software firms, as they do firms in other industries. These include:

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

Whilst the scope of this report is insufficient to comment on all of these, standards is an area in which Australian ICT research groups, firms and government agencies have cooperated effectively. Standards Australia has focused on understanding industry needs and delivering services to meet these needs through: rationalising standards; improving communication; managing interfaces; promoting international competitiveness; encouraging innovation; enabling interconnectivity; and reducing competing proprietary standards.

This effort has been supported by many industry players, with overview provided through the Communications IT and e-Commerce (CITEC) board. Current areas of standardisation within IT and e-commerce fields include: health informatics; software and systems engineering; e-learning; geographical information; intelligent transport information systems; records management systems; interactive voice response systems; ict governance and management; e-business architecture and data exchange; biometrics; security and identification technology; computer modelling and simulation; multimedia; data management and interchange; automatic identification and data capture techniques;

financial transaction systems, communications cabling; broadcasting and related services; telecommunications; and electrotechnical.[49] There is also active engagement in international standards forums by many of the ICT industry and professional groups.

The Australian Government established a software quality working party in June 2004 to examine the importance of software quality accreditation to the development of the Australian software sector. The report was released on 18 February 2005 for public comment but the implementation plan was not available at the time of this research

Software Engineering Australia and others have strongly supported the drive to encourage more Australian firms to adopt and apply relevant quality standards certification. AIIA have now taken up the SEA initiative, and are offering support to this process, as is the Victorian Government. Nevertheless, there is scope for Australian software firms to pay greater attention to quality accreditation and standards in order to enhance their capability to address export markets, and there is concern that too few firms adopt achieve certification, and perhaps even fewer achieve heightened software quality.

The ICT research base

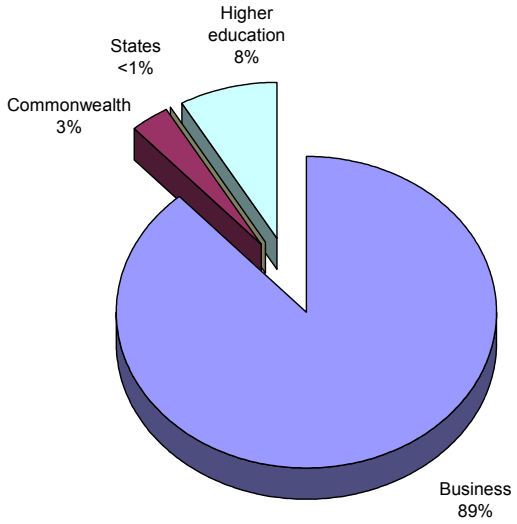
The sections that follow explore ICT related R&D activities, first by socio-economic objective and then by field of research (research fields, disciplines and course). The former tells us about innovations likely to feed into the ICT producing industries, applications and solutions, while the latter tells us about information and communication sciences.[50]

ICT R&D as a socio-economic objective

The Australian ICT Industry Update 2003[51] report showed that a total of $1.55 billion was spent on R&D in information and communication services *as a socio-economic objective* (SEO) in 2000–01: fifteen per cent of all R&D expenditure by socio-economic objective. Some 10 138 person years were devoted to information and communication services R&D activities in 2000–01, more than 10% of all human resources devoted to R&D in that year.

(As expenditure data includes the cost of equipment and services, person data can give a better indication of the true amount of research effort undertaken). The vast majority of the expenditure on information and communication services R&D took place in businesses (88%), less than 8% took place in higher education institutions and less than 3% in Australian Government agencies.[52]

Figure 21. Share of R&D expenditure on information & communication services (SEO), 2000-01 (%)

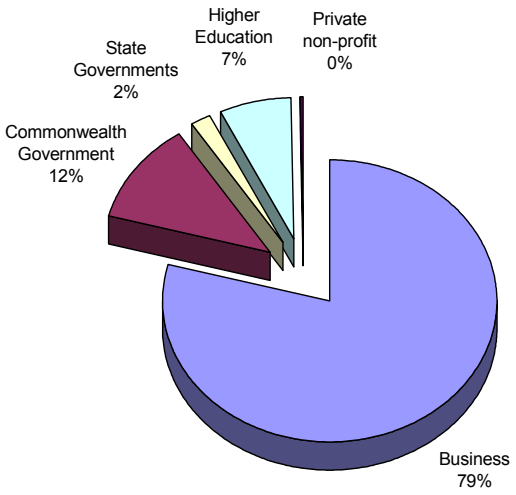


Source: CSES analysis.

ICT sciences R&D as a field of research

The Australian ICT Industry Update 2003[53] reported that, in 2000–01, $1.6 billion was spent on information, computer and communication sciences R&D *as a field of research* (FOR) economy-wide; 5.5% of total R&D expenditure in Australia by field of research. (Note: communications technology is not included.) Business expenditure (all industries) in the same period amounted to $1.26 billion or almost 80% of total ICT related R&D expenditure, Australian Government institutions accounted for $197 million or 12%, and the higher education sector for $113 million or 7%.[54]

Figure 22. Share of R&D expenditure on ICT sciences (FOR), 2000-01



Source: CSES analysis.

A DEST report in 2003[55] suggested that Australia is unusual in the high proportion (29%) of its total research effort that is conducted by firms with fewer than 100 employees. It stated that this proportion is higher than for any other OECD country apart from Iceland, and that SME research in Australia is highly concentrated in computer software (62% of total ICT R&D expenditure in 1998–99), and this may be because it is relatively low cost.

Analysis by DCITA[56] reveals that the Australian ICT industry's expenditure on ICT R&D (including communications technology) was $1.4 billion in 2002-03, 64% of total Australian expenditure ($2.15 billion) on ICT R&D. A DCITA report, '*An overview of the Australian ICTt industry and innovation base*'[57] found that 'R&D expenditures by the ICT industry were highest on software and communications technologies, (about $480 and $470 million respectively in 2000–01). Most of the software R&D (76%) was undertaken by the computer services subsector'.

Public sector R&D base

Public sector ICT-related R&D expenditure for 2002–03 by field of research was $326 million, supported by 3,244 research person/years. This represented just over 18% of total ICT expenditure, and 25% of the research personnel allocated.[58]

Table 9. ICT related R&D expenditure by field of research, 2002-03

	Business	*Commonwealth*	*State & Territory*	*Higher Education*	*Private non-profit*
Research Personnel Person years	9,673	968	108	2,168	32
Research Expenditure AUDm	$1,440	$165	$17	$144	$5

Source: ABS 8104.0, 2003.

Linkages to Industry

In general, linkages between Australian universities and Australian industry are extensive at the individual level,[59] but industry funding of research at universities is relatively limited. In 2000, 4.9% of Australian higher education expenditure on R&D was financed by industry compared with an OECD average of 6.2%, with the largest industry contributions flowing to medical and health sciences, engineering and technology, and biological sciences.

The low level of support is due at least in part to the relatively low level of Australian business expenditure on R&D, (other than in the ICT industry), and when this is taken into account, Australian businesses place a higher priority on funding R&D in the higher education sector than their counterparts in many other OECD countries. About 2.9% of industry financed expenditure on R&D is directed towards higher education, compared to an OECD average of 1.7%.[60]

One characteristic of the software industry is that innovation linkages and sources tend to be limited by concerns over intellectual property and confidentiality, with firms concerned about sharing the knowledge that is their core asset.

One small survey of Australian software firms found that they relied heavily on internal sources for knowledge intensive services inputs, such as R&D and skills. More than 90% reported undertaking internal R&D. In contrast 50% commissioned no external R&D. When nominating their major external innovation partners, 78% of responding software firms nominated their customers, while less than 17% nominated universities and colleges, and 9% nominated public research institutes.[61]

Key public sector ICT related R&D infrastructure

Larger ICT research centres are being encouraged through a number of initiatives, aimed to encourage the development of more critical mass in ICT R&D, and better co-ordination of research teams across Australia. There are a number of cooperative research centres (CRCs) which perform ICT R&D. Some of these have relevance to software development, as do several which are outside the ICT sector definition. Five of the ICT-related CRCs are now facing closure, having failed to win further government funding under the CRC program.

Table 10. ICT related CRCs.

CRC name	*Funded until*
Australian Photonics CRC (*uncertain future*)	2006
Australian Telecommunications CRC (*closing*)	2006
CRC for Enterprise Distributed Systems Technology (*closing*)	2006
CRC for Satellite Systems (*closing*)	2006
CRC for Sensor Signal and Information Processing (*closing*)	2006
CRC for Smart Internet Technology	2008
CRC for Spatial Information	2010
CRC for Technology Enabled Capital Markets	2008
Australasian CRC for Interaction Design	2010
CRC for Integrated Engineering Asset Management	2010

Source: CIIER Analysis.

The commitment to establish an ICT centre of excellence was announced as part of the January 2001 Australian Government Innovation Action Plan, Backing Australia's Ability. National ICT Australia Limited (NICTA) was established in May 2002. NICTA's role is to develop world-class ICT research and research training capabilities.

By early 2005, NICTA had three laboratories (two in Sydney and one in Canberra) and had established its headquarters at the Australian Technology Park in Eveleigh (Sydney). Two additional laboratories have become operational in 2005 in Melbourne and Brisbane, involving contributions and participation by the governments of Victoria and Queensland and four universities.

CSIRO has one of the longest traditions of continuous ICT R&D in the world. The CSIRO ICT Divisions (Telecommunications and Industrial Physics and Mathematics and Information Sciences) contributed to world patents in wireless leading to the successful $600 million Radiata WLAN start-up.

In addition, about 30% of CSIRO's investment in ICT R&D occurs in its other, non-ICT divisions that have deep domain knowledge in such areas as exploration, mining and agribusiness (i.e. vertical markets).

In 2003 CSIRO established an ICT R&D Centre that will provide a whole-of-CSIRO focal point for the organisation's research, bringing focus on a few high impact areas of ICT research and facilitating the integration of CSIRO's core ICT research with the research being undertaken in application domains.

DSTO is focused on works to enhance Australia's defence capabilities. The DSTO spent $28.5 million or 9.5% of its 2003–04 budget sourcing collaborative R&D and technical services from industry and research organisations. DSTO estimates that about 50% of its research is ICT-related, suggesting that at least 33% of Australia's public ICT research is oriented toward defence. In 2002, DSTO established a Technology Transfer & Commercialisation office to achieve greater industry take-up of DSTO's intellectual property, including for non-military applications.

Public sector research focus

Australia has adopted national research priorities which will have a significant impact upon public sector research funding and focus. The priorities, listed in full in annex 2, are aimed primarily at improving the quality of research and its contribution to Australia's future prosperity.

Each of these research priorities has the potential to engender software products as part of their research processes. (e.g. 'An Environmentally Sustainable Australia' will require measuring and monitoring software for water quality, energy usage, waste management etc., 'Promoting and Maintaining Good Health' is supported by health diagnostic and management software, 'Frontier Technologies' will require embedded software of many kinds, including scheduling, operational monitoring etc., and 'Safeguarding Australia' requires security software, recognition and encryption systems).

Whitehorse Strategic Group conducted a detailed study of public sector ICT R&D in June 2002 to provide a snapshot of the composition of the workforce and institutions involved, and the focus of ICT research.

The survey included all higher education institutions, cooperative research centres and other government funded organisations including CSIRO and DSTO. DSTO did not respond in detail, but cooperative research with DSTO was cited by a number of other respondents. An interview process involving 16 heads of university departments allowed for the collection of supplementary qualitative information.

Table 11. Whitehorse ICT R&D database, June 2002

	VIC	*NSW*	*QLD*	*SA*	*WA*	*ACT*	*TAS*	*NT*	*AUS*
Public ICT R&D institutions	9	12	7	5	4	3	1	1	42
Public ICT R&D Researchers (FTE)	766	672	380	326	176	92	26	2	2,440
Public ICT R&D Expenditure (AUDm)	46	40.3	22.8	19.6	10.6	5.5	1.6	0.1	148.1
Top 250 private sector ICT firms' R&D expenditure (AUDm)	226	214	191	0.3	0.0	1.5	0.0	0.0	632.4

Source: Whitehorse Strategic Group.

The table below identifies major ICT research focuses by the number of research centres. It is noticeable that the majority of the research focus areas selected have a generic ICT focus, rather than a focus on a particular vertical market.

Table 12. Focus of ICT research in the public sector by number of research centres, 2002

Major focus	*VIC*	*NSW*	*QLD*	*WA*	*SA*	*ACT*	*TAS*	*NT*	*Grand total*
Electronic commerce	4	1	1				1		7
Network modelling and performance	3		1		1	1			6
Signal processing	1	2	1		1				5
Software engineering	3	1		1					5
Telecommunications	2			2	1				5
Intelligent computing	1	1	1		1				4
Software maintenance	2	1		1					4
Web development		2	2						4
Broadband systems		2		1					3
Knowledge management	2	1							3
Mobile communication systems	2			1					3
Multi-media and Internet technologies	1				1			1	3

Source: Whitehorse Strategic Group.

R&D qualitative issues

Survey respondents also provided some qualitative comments, quoted below.

Box 4 Qualitative commentary

During the process of collecting the data in personal interviews numerous qualitative comments were gathered which highlight some of the key issues facing individual researchers.

One day in five is allocated to research and development work, but that doesn't happen as the staff are too busy teaching and managing their current teaching workloads.

'The notable increase in productivity represented through an increase in student to academic ratios, has been to the detriment of research and development effort within the university.'

'Post-graduate fee paying students are not interested in undertaking *research* work, they much prefer to do coursework, and as their student numbers increase, the numbers of suitable candidates to undertake *research* work diminishes.'

'All of my staff in this faculty undertake ICT research in some regard, they have to maintain a minimum quota and to gain advancement within the university.'

'The cross-faculty research work that is undertaken at this university is well coordinated, ensuring that we have the most appropriate people working on the research projects.'

'My division does not do any applied ICT research, it predominantly just supports other R&D areas, although we are often classified as a research area..'

'CRCs were conceived to be revenue positive arrangements, with the public institutions providing the R&D expertise, but as private firms pull out of CRC funding arrangements, the public institutions find themselves not only providing, but also funding the majority of the research work.'

'No research and development work is done any more within the traditional model within this University. All the research and development effort is conducted within the CRCs and the other specialist *research only* ICT areas within the University.'

Source: Whitehorse Strategic Group.

This commentary suggests that, while innovative public sector ICT research and development work is clearly taking place in Australia, there is a concern about the ability of staff to focus on research work.

The focus of university based R&D also seems to be concentrated more heavily on educating students in the conduct of research, and, despite the best intentions of staff to undertake the applied research necessary to explore innovative new developments, these intentions are often frustrated by the balancing act of having to meet their teaching commitments.

Linkages and greater engagement between industry and the public research sector has been a widely discussed issue. While not specifically investigating linkages with the ICT industry, Howard Partners[62] observed that university-industry interactions are generally not out of line with those in other countries, save for the impact of lower R&D intensity of the business sector and the higher rates of overseas ownership and control of Australian industry.

In relation to the CRC program, data in DEST's report[63] found that industry contributed proportionately more funding to ICT CRCs than to any other sector. While some ICT CRCs have actively engaged SMEs as core participants or through an alliance program (eg the Smart Internet CRC), most core industry participants are large companies and many are foreign-owned MNCs.

In general, it was considered by participants in the industry focus groups that Australian universities are not sufficiently competent at developing a commercial focus, or of understanding the commercialisation of software products. Focus group attendees suggested that relationships between university researchers and Australian software firms, while they might exist at the individual level, became 'difficult' as soon as university administrations became involved, and felt that most Australian SME software firms simply did not have the energy or staff resources to survive the process.

CRCs, it was felt, while having a stronger commercial focus, tended to be primarily orientated to relationships with larger, multinational firms and were therefore less likely to provide any significant commercial impetus for Australian products.

Industry participants of the focus groups for CIIER's research provided almost universally negative feedback on Australian Research Council (ARC) linkage grants, particularly in relation to the bureaucracy of the programs, and the inability of Universities to manage them effectively. It was a strongly held view that such grants would be far more effective if they were managed by the 'industry partner', with the universities' role significantly reduced to that of technical resource.

The concerns expressed by the focus groups were consistent with a 1999 survey[64] which noted that public research organisations and SMEs are driven by different imperatives, and their respective goals, strategies and cultures are not in alignment. The same report also included comments from the public researcher perspective - SMEs were considered tactical, with no commitment to long term or deep R&D, and were unable to afford, and don't value, the services of public research organisations.

Although SMEs and public research organisations and researchers clearly have differences in research objectives, timeframes and priorities, it appears that, while there may well be capacity within the research environment, SMEs and researchers are not taking advantage of this potential.

Positive outcomes

DEST (2003) reported that 21 ICT companies have directly spun out of Australian universities: 11 in communications equipment; four in computer software and information services; six in information and communications services. In 2000, of the 47 start-up companies formed as the result of licensing technology from universities, medical research institutes and CSIRO, 12 were ICT firms and another seven were ICT-related.

The CRCs have also been a source for ICT spin-offs, with 16 ICT companies formed between 1992 and 2001 from R&D in the seven ICT CRCs, including: 10 spin-offs from the Australian Photonics CRC, three from the Enterprise Distributed Systems Technology CRC, two from the Australian Telecommunications CRC, and one from the

Centre for Sensor Signal and Information Processing.[65] However, there have also been difficulties, especially in such areas as IP (e.g. Victoria University and IP3 Systems).[66] What this data show is that there have been few pure software firms spun out of public sector research activities to date.[67]

The skills base

ABS estimated that in June 2003 there were 107 094 people employed in computer services, of which 99,574 were employed in computer consultancy, of which 74,434 (75%) were ICT professionals.[68] The Whitehorse T250 for December 2004 shows that of this significant pool of talent only approximately 6850 people are employed by software developers (6200 in domestic companies, and 650 in internationally owned companies), of whom about 5000 are likely to be ICT professionals.

There are two main sources of mature skills for software development, skilled software developers working in other parts of the industry, or skilled migrants, either from overseas or from other industries. The movement of already skilled software people has tracked demand, with skilled people moving out of the software industry, responding to the rise of outsourcing.

Beyond the professional development programs of the Australian Computer Society (ACS), and commercial providers of training, most skills development in the software and services industry is ad hoc or on-the-job. Major vendors with a long history of internal training now seem to prefer recruiting the skills they need. The demise of structures such as the Training Guarantee, and the increased casualisation of the work-force, may have accelerated this trend. Self-funded training, of course, remains an option, but the recent ACS employment survey [69] found that:

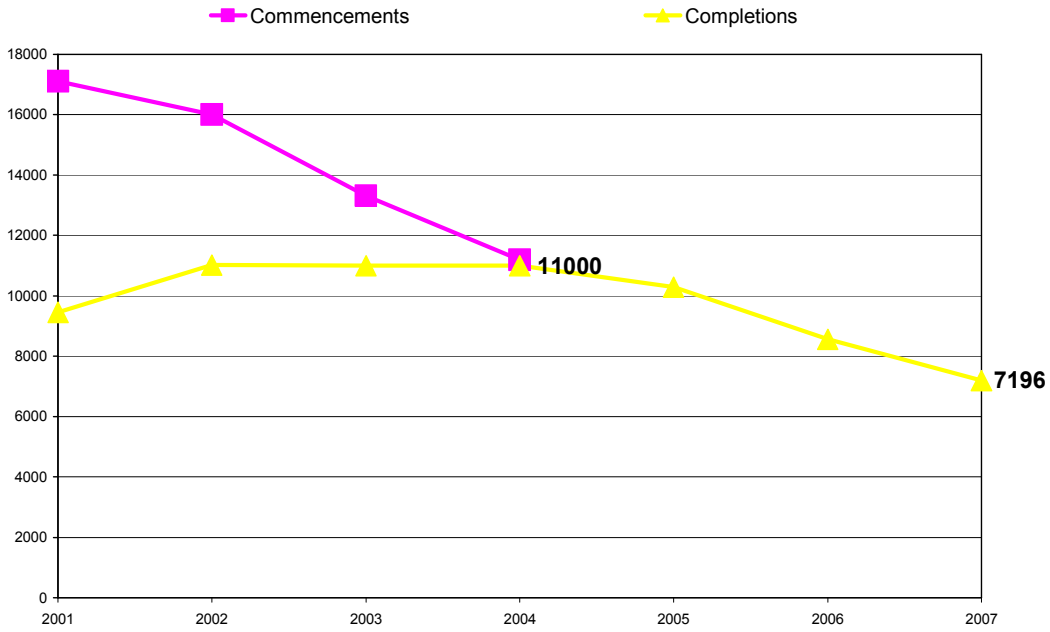
> Nearly 58% of the unemployed gave cost as the major barrier preventing them from doing further training. However, time is not seen as an issue as this was nominated by only 4.4% of unemployed respondents. On the other hand 22.0%, compared with 2.6% for the survey as a whole, stated they had difficulty finding out what courses were available. There was also a marked increase in the number of unemployed respondents who said they had doubts training would boost their employment prospects (33.3% compared to 18.2%).

New inputs to the software skills pool, come either from ‘entry-level’ migrants, some of whom are educated in Australia, or from Australian university graduates. The projections in the charts below extrapolate university ICT commencements into anticipated completions, based on historical completion ratios (i.e. the historical percentage of course commencements who successfully complete the course).

They show that, on current settings, both domestic and international university graduates can supply a diminishing number of entrants to this skill pool over the next three years, and that, unless there are significant increases in commencements in the

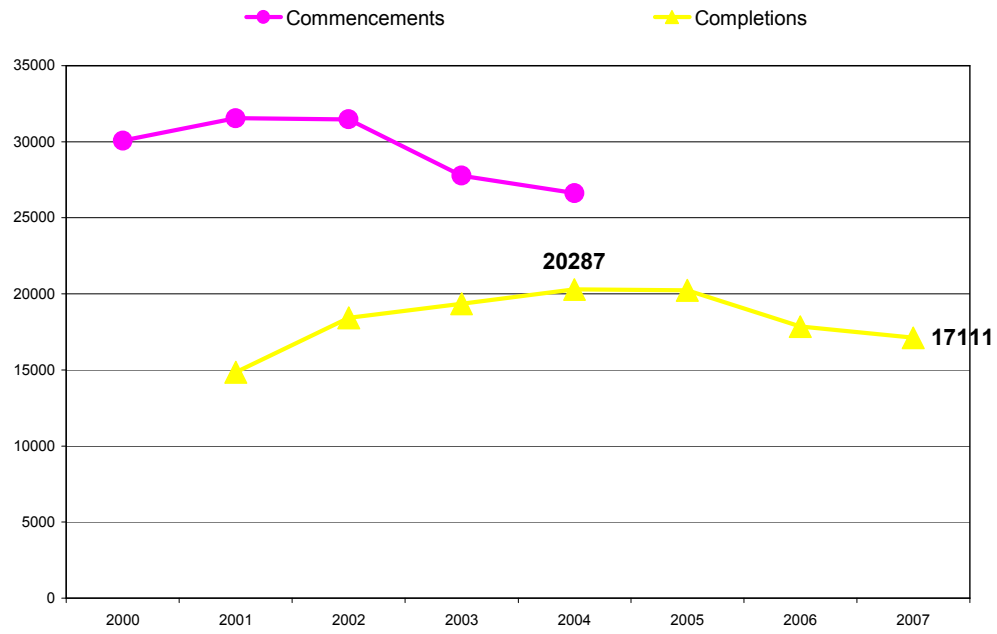
immediate future, this situation will continue, with a declining number of graduates entering the industry.

Figure 23. University ICT intake and graduations (Australian residents), 2001–07



Source: DEST, CIIER Analysis.

Figure 24. University ICT intake and graduations (total), 2001-07



Source: DEST, CIIER Analysis.

The charts above plot the number of new university enrolments in ICT and graduations (with projections to 2007) for Australian resident and all ICT students (international and Australian resident) at Australian universities. While they both indicate that the output of graduates in ICT has been static over the last few years, and, on the basis of current enrolments and commencements, we project that the number of Australian-resident graduates will decline in the future.

This reduction in the flow of graduates has taken place in a climate of cut-backs in educational funding, and consequent financial pressure on Universities to generate fees from overseas students. This reduction in graduates has significant implication for the ready supply of competent entry-level software developers, which can, otherwise, only be supplied through migration.

Conclusions on the innovation base

Whilst the business and operating environment for the Australian software industry is comparable to many other parts of the world, and recent initiatives in R&D are considered likely to improve the situation, the difficulty in gaining access to appropriate capital, concerns about skilled labour supply, and *the lack a of strong relationship between the Australian software industry and the public sector research base*, continue to require attention in order to maximise Australia's potential in this field.

Annex 1. Detailed tables and charts

Table 13. Australian software trade, 1994 to 2004 (AUDm)

	1994	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*
Exports											
Software products	94.3	108.1	57.6	29.2	46.8	33.5	36.6	41.2	77.6	85.6	94.7
Royalties & fees	179.5	187.5	192.5	215.5	262.0	311.5	302.5	204.5	142.0	145.0	142.0
Total exports	273.8	295.6	250.1	244.7	308.8	345.0	339.1	245.7	219.6	230.6	236.7
Imports											
Software products	740.9	673.9	450.9	410.1	578.8	569.4	549.8	475.4	507.7	504.7	539.2
Royalties & fees	252.5	221.0	236.5	266.0	307.0	387.0	385.0	356.0	412.0	469.1	467.0
Total imports	993.4	894.9	687.4	676.1	885.8	956.4	934.8	831.4	919.7	973.9	1,006.2
Balance											
Software products	-646.6	-565.7	-393.3	-381.0	-532.0	-535.9	-513.2	-434.3	-430.1	-419.1	-444.5
Royalties & fees	-73.0	-33.5	-44.0	-50.5	-45.0	-75.5	-82.5	-151.5	-270.0	-324.2	-325.0
Total balance	-719.6	-599.2	-437.3	-431.5	-577.0	-611.4	-595.7	-585.8	-700.1	-743.3	-769.5

Notes: Software products include recorded and recordable media of the types suitable for software. Software royalties & fees for 2003-04 are estimated, based on software share of total royalties and license fees in previous year. All data are current prices.
Sources: ABS (various years) *Balance of Payments and International Investment Positions, Australia,* Cat No 5363.0, Canberra; ABS (various years) *International Trade in Goods and Services, Australia,* Cat No 5368.0, Canberra; ABS (various years) *Balance of Payments and International Investment Positions, Australia,* Cat No 5320.0, Canberra; DFAT (various years) *Trade in Services Australia*, Department of Foreign Affairs and Trade, Canberra; and ABS unpublished data. CSES Analysis.

Data for figure 10—Australian software and services employment by HO location, sample group Dec 2004

Country	Systems and network engineering and integration	Software products	Other services	Facilities mngt and outsourcing	Education and training	Content and value-add
USA	5526	3217		15139		
Australia	2598	6157	42	3831	28	60
France	2635					
Canada		796				
UK		49		950		
India	380			110		
Germany		350				
Netherlands	626					

Data for figure 11—Australian software and services revenue (AUD millions) by HO location, sample group Dec 2004

Country	Teleco Infrast. & basic services	Systems network eng'g & integ'n	Strategy & Planning	Software Products	Other services	ITT h'ware & comp'ts	Facilities mngt & outs'g	Education & Training	Content & value-add
USA		963.00		1294.00			4742.63		
Australia	20.65	489.03		1612.19	7.00	49.00	854.00	1.74	6.94
France		700.00							
Canada				290.30					
UK				8.80			210.00		
India		49.00					115.00		
Germany				132.00					
Netherlands		110.00							
Singapore		9.00							

Data for figure 16: Market selection by software companies—location of head office

	NSW	Vic	WA	Qld	Tas	SA	ACT
IT	32	31	7	4	7	7	2
Communications	30	27	8	4	2	3	2
Government	35	18	4	7	5	2	4
Finance/insurance	37	22	3	1	3	3	3
Utilities	21	18	4	5	2	3	
Transport	20	14	4	6	1	4	2
Education	16	11	7	6	6	1	1
Retailers	21	15	2	4	2		
Health	13	9	4	3	2	1	2
Mining	17	7	4	4	2		
Construction	9	9	1	1	2		
Other markets	9	2	1		3	2	3
Wholesalers	9	2	1		3	2	3
Tourism	6	5		3	3		
Entertainment	8	3	1		1	1	
Agriculture	4	3		1	3	1	1
Property	3	2		1	1	1	

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[13] ABS 8126-0

[14] Whitehorse Strategic Group 'Top 250' industry model. The primary mechanism used to provide the data for the model is a detailed six-monthly survey of ICT firms in Australia, known as the 'Whitehorse Top 250'. The methodology employed includes a questionnaire both mailed and emailed out to respondents and direct verification telephone contact with a significant proportion of the survey base. The survey is supplemented by web-searches, press reports, Annual Reports, and other public sources of data, and the data is used to populate a statistical model of the Australian ICT industry based upon paradigms derived from the most up-to-date ABS evaluations.

[15] In their 2002-03 survey of the ICT industry, the ABS allocated approximately 20,000 sole trader/contractors to the Australian ICT industry for the first time, based upon their inclusion in ATO lists derived from GST registrations. It is likely that they had previously been considered to be casual or contractual workers, and included within ICT professional employment, but not classified to the ICT industry.

[16] Digital Planet 2004, WITSA, Global Insight Inc

[17] ABS 8126-0, 2002-3 Data, September 2004.

[18] OECD (2004) *Information Technology Outlook 2004*, Organisation for Economic Cooperation and Development, Paris, p53.

[19] ABS 8126-0, AIIA reports

[20] ABS 8126.0 2001, 2002-3

[21] Whitehorse Top 250 June 2005

[22] Whitehorse presentation to F3 Mapping Group, July 2002.

[23] Whitehorse Top 250 Dec 2004.

[24] Sensis special report for DCITA, ICT production in Australian SME's Nov 2004.

[25] Whitehorse Study on Outsourcing and Offshoring, ACS, 2003.

[26] European Commission Community Research, Fifth framework, Technological Implementation Plan. The TIP is information that most EU R&D contractors have to submit as a contractual obligation. It describes the results of the project and the plans that the partners have to use those results and to encourage others to use them.

[27] General Information Technology Contract (GITC) Terms and Conditions.

[28] See "The Origins of Modern Computers", Trevor Pearcey, and other sections in "Computing in Australia", Bennett et al, Australian Computer Society 1994

[29] Gartner; IDC; Saugatuk.

[30] "In early February 2004, the Australian Government concluded negotiations for a Free Trade Agreement (FTA) with the United States, the world's largest economy. It is truly a landmark deal, the most important bilateral economic agreement ever undertaken by Australia. When the Agreement comes into force, potentially in early 2005, it will create significant new benefits and opportunities for Australian exporters, including: Elimination of duties on over 97% of US tariff lines for Australia's non-agricultural exports (excluding textiles and clothing); Improved access for Australian agriculture, with 66% of agricultural tariff lines going to zero from day one and a further 9% cut to zero within four years; Full access for the first time for Australian goods and services to the $200 billion market for US federal government procurement; and Enhanced legal protections that guarantee market access and non-discriminatory treatment for Australian service providers in the US market, with only limited exceptions." DFAT website.

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[47] ASOCIO, the Asian Oceania Computing Industry Organisation, the regional body for Asia and Oceania to which industry organisations such as AIIA belong.

[48] Australian Computer Society submission to China FTA Task-Force.

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