Knowledge Intensive Service Activities

in the

Software Industry

in Australia

A report prepared for the OECD KISA project

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Dr Lyndal Thorburn of Innovation Dynamics Pty Ltd undertook the research on the firm level case studies. The report is indebted to Professor Jane Marceau, Dr Mike Hales and Dr Kevin Bryant as originators of the concept of KISA.

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ABBREVIATIONS

ABS	Australian Bureau of Statistics
BITS	Building on IT Strengths (program)
CRC	Co-operative Research Centre
DCITA	Department of Communications, Information Technology and the Arts
DITR	Department of Industry, Tourism and Resources
GDP	Gross domestic product
ICT	Information and communications technology
KIS	Knowledge intensive service
KISA	Knowledge intensive service activity
KIBS	Knowledge intensive business service
MIIP	Most important innovative product
MNC	Multinational corporation
NICTA	National ICT Australia
R&D	Research and development
RTO	Research and technology organisation
SMEs	Small and medium enterprises

Summary

Note: all currency in this paper is expressed in Australian dollars. At time of writing, AU$1 was equal to approximately US$0.75.

This paper explores the knowledge intensive service activities (KISA) which Australian software firms use in innovation. It is part of an OECD project which is studying the role of KISA in the innovation systems of different industries. It looks at software firms' choices among providers of innovation expertise, reports insights into the reasons for the choices made, and indicates how firms mix and match and internalise the knowledge-intensive services used.

The study consists of an overview from secondary sources of the software industry, an online survey of software firms with follow-up interviews, and six case studies of software firms. The study has significant limitations. First, defining the industry is difficult, as much software production occurs in firms which do not describe themselves as software specialist. In some cases statistics are collected for the information and communications (ICT) industry, not for the software sector specifically, and sole traders are omitted from some of the data collections. The response rate for the survey was such that the data cannot be claimed as representative. Nor are the case study firms representative, as firms were selected on the basis that they were innovative. Nevertheless the analysis provides valuable information for understanding the role of KISA in innovation in the software industry.

Specialist software firms in Australia generate about $10 billion a year in income, or about 1.3 per cent of Australia's GDP. This is in line with estimates from other OECD countries. Very small businesses make up nearly 80 per cent of ICT specialist businesses, but account for only 15 per cent of employment and 5 per cent of total income of the industry.

Australia's industry policy is relatively non-interventionist. It emphasises innovation as a source of continuing competitive advantage, and focuses on stimulating research and development and encouraging its commercialisation. An important recent initiative has been the establishment of National ICT Australia, a flagship research organisation funded by the Australian and State governments. The ICT Incubator Program has established incubators which supply not only seed capital but also a variety of knowledge intensive services including management advice, mentoring and channels to markets. Among generic industry programs, the R&D Start program, which provides matching grants for R&D, and the Commercialising Emerging Technologies (COMET) program have been important for software firms.

The survey asked firms about a range of knowledge intensive services, both those like intellectual property consulting and technical advice that are obviously linked to innovation, and those like management advice which can be crucial in the successful implementation of innovation. In general, the survey showed that most firms found most services internally. The exceptions were employment agency services, which most firms used for recruitment, and legal advice, especially on aspects of intellectual property

management. Some firms sought some strategic development advice from outside because an independent view could add value, and R&D was obtained externally for specific purposes and projects, as well as being performed in-house. Firms kept in-house those services which they thought were important for maintaining their technical edge, especially those which developed their own skills. They also did some things in-house because the cost was lower. They outsourced compliance-related services, and functions where they did not have the expertise in-house.

Most externally sourced services were obtained from commercial providers. The role of industry associations and government as a direct provider of services seemed not to be significant. About a quarter of the firms had some interaction with universities and public sector research organisations.

Apart from internal resources (particularly the owner-founder), the most important sources of knowledge and ideas for innovation were not formal service providers, but from the people and organisations with whom firms worked: customers, suppliers, and other firms in the industry – including competitors. Firms also used ideas from publicly available sources such as the web, conferences and journals, and occasionally patent data.

All of the case study firms had built on a radical innovation, the initial concept developed by the company, and were actively modifying and expanding their products and services in response to customer demand and changing technologies. Of the services the firms were asked about, most were provided in-house. Use of external services ranged from 19 per cent to 45 per cent. Most firms used externally provided legal advice; and many used external strategic advice when they sought to raise capital externally. Few firms outsourced aspects of technology scanning, product development or project management as their technical staff provided these services in-house. All but one had in-house R&D programs, and while they did not have formal relationships with research institutions they kept up informal contacts with them. Industry associations did not appear to be important providers of services.

In the six innovation case studies, many firms had long term relationships with their service providers. All firms had excellent and active external networks on which they relied to assess market trends and to find services. The firms were aware of the need to build capabilities. They learned from their customers particularly, and also from reports and other written materials supplied by contractors. Several had benefited from government programs, particularly seed funding and advice from incubator programs and assistance with business planning from the COMET program.

Both the survey and the case studies show a lack of reliance on external services; and when external services were used they were often provided by informal contacts and networks. Customers were particularly important sources of ideas for innovation. The services that were consistently sought externally were legal advice, especially advice on intellectual property management, and compliance functions such as auditing. The case study firms' readiness to take advantage of government programs suggested that they were not averse to using external services, so it may be that external services were not available or that they did not see the need for them. Neither in the survey nor in the case studies did firms complain of the lack of availability of services.

1. Innovation and the Importance of KISA

1.1 Introduction

The international research literature explores many dimensions of innovation and innovative activity by firms. Initially the focus was on product innovation in manufacturing, but there is now an understanding that innovation also involves not only product development but also new production methods and new organisational forms taken up by enterprises, that it can be radical or incremental, and that it is as important in service industries as in manufacturing (see for example Miles 2001). It has become clear that all these aspects of change characterise innovative firms and influence competitive success.

Innovation, defined here as novel activities of economic value to an enterprise, is a complex mix of factors and occurs differently in different industries, in relation to different products, in firms of different ages and size and at different stages of an industry or product cycle. Many of the processes involved in innovation - the ways in which firms go about changing their products, processes, markets, organisational shape and skill levels - are still not well understood.

It appears that an important input to innovation may be the range of knowledge intensive service activities (KISA) carried out by firms. As well as being a direct input to innovation, such activities enable firms to develop knowledge based capabilities and skills. These may be as important as R&D itself in the overall success of innovation. Policies designed to assist enterprises to innovate need to rest on an understanding of these processes. In particular, past policies may have been designed with too little understanding of exactly how businesses, especially small and medium enterprises (SMEs), mix and match the knowledge-intensive services provided by public and private sources. This study seeks to explore and understand the ways in which innovative activities occur in different industries so that future programs meet the needs of particular firms and industries.

The present report is an element of a broader project which aims to improve understanding of how firms in different industries engage in knowledge intensive service activities in their innovation processes. It is part of an OECD research project that will ultimately provide policy makers with analytical and empirical insights to underpin the design and implementation of more effective industrial development strategies.

1.2 Services in the innovation system

Research on innovation has focused attention on patterns of innovative activity in an economy as a function of the characteristics of the major players (institutions and organisations public and private), and the ways in which the public and private sectors are linked. The players may link in different ways at different spatial levels (national, regional or local), through activities such as R&D provided by public or private enterprises, through the development and use of management and other business-related skills and expertise – seen in the rise of knowledge-intensive business service firms (KIBS) – and/or through their activities as suppliers and customers.

Recent decades have seen a vast amount of investigative work, both theoretical and empirical, on the players and their interactions. Many studies have developed understanding of the *systemic* nature of innovation and the importance of all elements of a nation's innovation system – legal, scientific, training, business programs, for example – working well together. The recent work is summarised in OECD 1999, 2000, 2001a. (See also Edquist, 1997). The notion of *national* systems of innovation was complemented by recognition of the similar importance of regional and local innovation systems (eg Cooke, 2001). Work has also progressed on sectoral or technological systems of innovation in specific industrial fields (Malerba, 2002; Marceau et al., 2002; and Marceau and Martinez, 2002) and more recently on the need to integrate the spatial elements of these systems (OECD, 2001b). There has also been important work on the growth of the services sector and the separate systems of innovation operating there (see eg Anderson et al., 2000; Howells, 1999; Metcalfe and Miles, 2000) and on linkages between manufacturing and services in firms' competitive strategies (Marceau et al., 2002). More recent work is bringing together theories about firms, institutions and organisations to provide a 'systemic' theory of innovation at firm level (Coriat and Weinstein, 2002).

Over the same period, the shift towards the 'knowledge economy' has seen the creation of KIBS as important private sector players in the innovation game (see eg Miles et al., 1994; Gallouj and Weinstein, 1997; also Muller, 2001 for interactions between KIBS and SMEs and Muller and Zenker, 2001) and public organisations, notably universities, have been more strongly encouraged to make their expertise widely available to business and the community. The production and diffusion of knowledge via KIBS firms has become central to innovation systems in many countries. KIBS typically include legal and accounting but also, and more relevantly here, design and computer-related services, R&D consultancy, recruitment of skilled personnel, environmental services and technical and training services (Windrum and Tomlinson, 1999:393). KIBS play a twofold role in a country's innovation system – as providers of knowledge services to other firms and as a means of introducing internal innovations by way of internal consultancy.

Innovation expertise and support are also provided to firms by public sector research organisations and by a range of government programs aimed at encouraging innovation in the private sector. Driving firms and organisations towards ever greater innovation effectiveness through the science and technology system and related policy instruments has become a major aim of government in Australia (see, for example, the package of measures gathered into 'Backing Australia's Ability' (DITR 2001), as elsewhere in the OECD (OECD, 2002a).

An important aspect of the national innovation effort remains understudied. It concerns how firms use the variety of sources of expertise available; how they choose among several providers of similar services; how they combine information from different sources; and how they seek different sources of assistance at different times and for different innovation project purposes.

Nonaka and Takeuchi (1995) have shown that innovating firms indeed draw on a range of providers of expertise. Services available and used include R&D, testing, prototyping and other technical and engineering services, ICT, legal (especially IP-related), financial, marketing and training. However, critical questions remain about *how*, *when* or *why* firms

choose to use *particular* different kinds of publicly and privately provided innovation programs or services among the variety available - why they choose x and not y or x and y but not z - and how and why these choices vary. Even less is known about how firms transform the innovation services they receive from outside to build capability which could support sustained innovation at firm level.

Two projects funded by the European Union in recent years have focused on innovation in services and services for innovation. The first of these, the IS4S project, focused on innovation in service industries and specifically the development of services to support innovation by others. The second, the RISE project, focused on mapping the transformation of Research and Technology Organisations (RTOs) as they began to reach out more to private sector clients and to depend more on private sources of income (Hales, 2001). The RISE project also began the investigation of how firms engage with external providers of innovation services, both public and private, at different stages of the innovation process and in different clusters (Hales, 2001; Hauknes, 2000; Preissl, 2001). In Australia, Marceau and Hyland, through their Australian Research Council Large Grant project, ARISE, are currently seeking to elucidate the shifting landscape of RTOs, with a particular focus on the public-private hybridisation of major scientific organisations, including universities.

Against this background the Knowledge Intensive Service Activities (KISA) project, of which this report is a part, focuses on KISA as a generic function that plays an important role in innovation processes throughout the economy and society. It is an attempt to shed light on the increasing role of knowledge intensive service activities through examining how they operate in a range of industries. Each study in the series comprises statistical description of the size and 'shape' of the industrial sector selected, description of government policies and the programs available for firms in the sector, and an empirical study of innovation at the firm level. The results of this analysis for the software industry in Australia are presented in this report. It is intended to show software firms' choices among providers of innovation expertise, to report insights into the reasons for the choices made, and to indicate how firms mix and match and internalise the knowledge-intensive services used.

1.3 Knowledge-Intensive Service Activities (KISA)

1.3.1 Kinds of KISA

KISA are the knowledge intensive service *activities* that firms undertake, usually in conjunction with external or internal experts. They may be grouped according to their purpose and function. One group of services has to do with the internal management of the firm, for example accounting services, management consultancy, training, and employment services. Another has to do with product development. The latter includes research and development, technical consultancies, industry strategy advice, and marketing. A third set of services concerns the firm's relationships with the outside world, including legal advice, compliance advice, and intellectual property consultancies.

1.3.2 Sources of KISA

Knowledge Intensive Business Services (KIBS) are important external providers of knowledge. So are research and technology organisations (RTOs), who increasingly compete with KIBS as a result of changes in funding systems (Hales, 2001). Competitors, customers and other organisations from the same or different industry sectors also provide knowledge intensive services, sometimes through networks and clusters via informal cooperation agreements.

The experts concerned may be from public or private sector or research organisations; they may have been developed inside the firm, perhaps as part of a strategic package of actions designed to build long-term capabilities; or they may become involved in the course of a joint venture.

In past research the formal providers of external knowledge, KIBS and RTOs, have been emphasised. However, informal transactions for the co-production of knowledge are also important. Thus there are three sets of external knowledge providers: KIBS, RTOs, and other organisations in the firm's network. KISA may take place as formal transactions (for example contracts) or informal transactions (for example sharing information) or as internal to the firm.

1.3.3 Knowledge, learning and capabilities

Learning by the firm is important in building innovation capability (Malerba and Orsenigo, 2000). The importance of KISA is to a great extent bound up with learning processes: the ways in which a firm accesses, acquires, produces and integrates knowledge. Knowledge may be built within the firm (Penrose, 1959; Loasby, 2002), or it may come from outside. When a firm acquires knowledge from outside, internalises it and builds on it, and when it uses external consultants to build on knowledge it has developed, it makes sense to talk about the 'co-production' of knowledge.

Engaging in KISA builds a firm's innovative capability. The processes themselves of seeking, evaluating and comparing services offered by various providers build knowledge of the marketplace and additional competences within the firm. The new service adds functionality, and the processes of integrating it provide new knowledge and learning abilities, and ideas for new services and relationships. At the same time, the provider of services also learns from the interaction (Muller and Zenker, 2001).

KISA are likely to vary among firms, and may be a source of competitive advantage. Superior search skills, ways of interacting with providers, and ability to integrate new knowledge will lift productivity. At the same time through the learning involved these functions will contribute to increased capacity which may lead to further gains in productivity.

1.4 The KISA Study

Understanding these innovation-related knowledge intensive service activities – KISA – is important in relation to development and use of public policy instruments to promote sustained innovation in all areas of the economy. It is also important that organisations providing innovation services gain a better understanding of how their services work in

practice, how the services may be accessed and used and how they can improve service provision.

The KISA project attempt to focus from a firm level view on how expertise is accessed, adapted, incorporated, refined, added to and transformed to create innovative products, services, processes and organisational forms and innovation capability for the future. Further, through the analysis of what firms do in different industries some understanding of differences in relation to KISA in sector innovation may be identified. This focus on the firm, the industry level and the role of KISA in the innovation system distinguishes the KISA project from work on KIBS and innovation in service industries themselves.

The Australian KISA study focuses on three industries – software, mining technology services and tourism. The industries selected provide a contrast in scale and spread while one, software, is highly relevant to the others, especially mining technology services. The firms in each sector are mostly small, and so may illustrate some elements of the innovation system which particularly affect SMEs.

2. Methodology for the Software Study

2.1 Introduction

This chapter summarises the material used in the study of the Australian software industry.

The first element of the study of the software industry is an overview from secondary sources. General data on the industry are presented in Chapter 3. In Chapter 4, there is a description of government programs and policies directed to the sector.

An online survey commissioned by the Department of Industry Tourism and Resources and carried out by AEGIS was followed up with semi-structured interviews with survey respondents. Simple statistical analysis and tabulation of the results of the survey and qualitative analysis of the interview material are reported together in Chapter 5.

Case studies of six software firms were undertaken to explore the issues in more depth. They are reported in a separate chapter (Chapter 6).

Finally, in Chapter 7 some conclusions are drawn about the role of KISA in innovation in the software industry.

The software industry was selected for close study because it is not only an important producer of innovative products but also a critical enabling technology for innovation in both products and processes in almost all sectors and the focus of policy interest by several government departments. Thus, while software in Australia is a relatively small industry in terms of numbers of specialist firms, it reaches into almost all industries as a core technology, and is crucial to those sectors' continued development and capacity for innovation.

One issue that arises in studying the software industry is that it is both a user and a provider of knowledge intensive services. Occasionally it is difficult to maintain the focus on the software firm's use of KISA specifically for innovation, when it has a constant involvement with them as product and input.

2.2 The survey

While it was intended that the survey would generate sufficient responses for meaningful statistical analysis, a poor response rate meant that the results were not reliable as a sample, and it was necessary to interview the respondents to get richer responses. Thus the survey responses, while they are presented numerically, should be treated as interesting qualitative data rather than as a statistically significant result.

In order to focus responses, each firm was asked about the introduction of its most important innovative product (MIIP) rather than about their innovation processes in general. The MIIP could, for example, be the product that the firm feels is the most radical or likely to constitute the signature product for the business in the future.

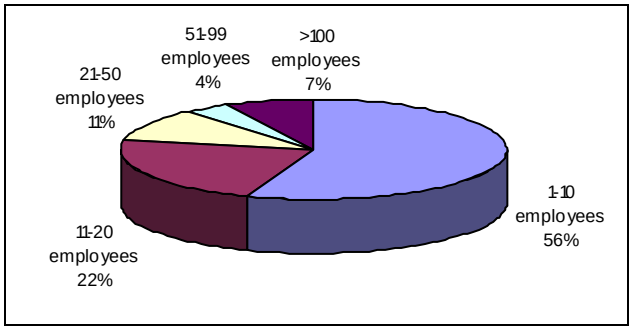
Invitations to participate in the online survey were sent to companies through ICT industry associations.[1] In total, about 10 000 invitations were sent (but some of these would have been to firms that were contacted by more than one association). The survey included questions concerning:

- Background data on firms such as size, ownership, principal products;
- Information on the development of their most important innovative product (MIP) and the capabilities associated with that development;
- Use of services provided internally by specialist divisions in the firm;
- Use of services provided externally by government and private sector agencies;
- Incorporation of KISs into the product for sale;
- Minimal internal capabilities required to receive external expertise;
- Difficulties and challenges in the innovation process.

The survey instrument is at Attachment 1.

Fifty-four firms responded. The majority had 10 or fewer employees, and almost 80 per cent employed twenty or less people, while only four had more than 100 employees. The distribution is shown in Figure 1.

Figure 1: Size of surveyed Companies (n=54)



Source: AEGIS KISA Online survey, 2003

Table 1 below illustrates a number of important ways in which companies with from one to ten employees differed from companies with more than ten employees.

Government grants were used more by the larger companies than the smaller companies, while the smaller firms were more likely to have business angels funding their company. Another important aspect of smaller companies was that they were more likely to use competitors as partners.

Predictably, lack of funds was an important challenge to innovation for smaller companies. The challenges experienced by larger companies were organisation of management resources, and lack of market information which was felt more by them than by the smaller companies.

[1]Industry Associations were; Australian Electrical and Electronic Manufacturers' Association, Australian Interactive Multimedia Industry Association, Internet Industry Association (IIA), The Biometrics Institute, Australian Microelectronic Network and Software Engineering Australia National (SEA).

Table 1: Characteristics of the companies by size

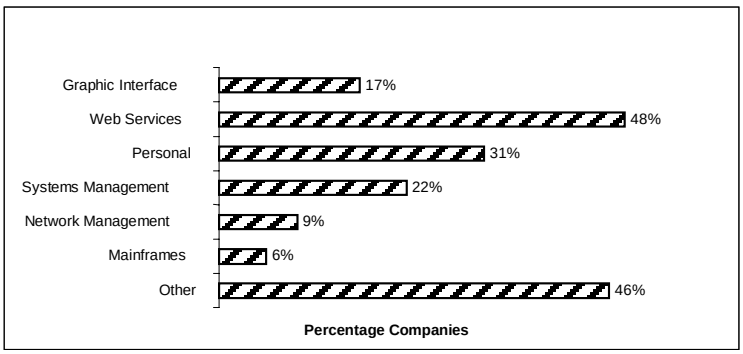
Distinctive Characteristics	Firms with 1-20 staff n=42	Firms with > 20 staff n=12	Total n=54	Total (%)
Funding MIIP through business angels	5	1	6	11.1
Access to Government grants	7	4	11	20.4
Use of commercially provided training services	30	10	40	74.1
Use of competitors as partners	1	4	5	9.3
Lack of appropriate financing	29	5	34	63.3
Organisational management resources	10	6	16	29.6
Lack of market information	17	7	24	44.4

Source: AEGIS KISA Online Survey (2003)

Because of these differences according to size, it is important to note that the composition of the sample is consistent with the pattern of the ICT specialist industry shown in Table 5 in the next section, which is even more dominated (numerically) by very small businesses.

Figure 2 below shows the main product lines of the firms sampled. The majority of firms were engaged in web services, personal services, systems management and graphic interface. The data are not available to compare this with the product composition of the software sector as a whole.

Figure 2: The main product lines of the firms



Note: The total is greater than the number of companies surveyed as some had more than one main product line, and, for example, ticked one of the main categories and also 'other'.

Source: AEGIS KISA Online Survey (2003)

Of the 54 respondents to the online survey, 41 were subsequently interviewed to collect more detail on KISA and their innovation processes. The interview protocol is at Attachment 2. A profile of the firms interviewed is at Attachment 3.

2.3 The case studies

Six software case studies were undertaken, using firms identified as innovative, to find out what happens inside the firm, how the firm organises itself to obtain ideas and how it puts them into practice. Firms were chosen on the basis of:

- coverage of a range of target markets (in these cases, education, health, business services, environment and planning, mining exploration and tourism)
- type of innovation (new product or service, management innovation, training and staff innovation or facilities)
- size (small, medium, large)
- age.

Case studies are reported separately from the survey. The interview guide as at Attachment 4.

The characteristics of the case study firms are presented in Table 2 below.

Table 2: Characteristics of Software Case Study Firms

Name	Location (State)	Market that is being serviced	Size (a)	Age (Yrs)
Callista	Victoria	Education	Large	5
Gecoz	Northern Territory	Environment and planning	Small	3
Hatrix	Australian Capital Territory	Health	Small	3
Maxamine	South Australia	Business services	Medium	5
Prophecy International	South Australia	Business services	Medium	24
YourAmigo	South Australia	Business services	Medium	5

(a) Micro businesses have four or fewer employees, small businesses have between 5 and 19 employees, and medium to large businesses have 20 or more employees

Source: Thorburn, L.J., Sectoral Case Studies in Innovation

2.4 Limitations of the study

The following are limitations to the analysis presented in this report:

- The number of respondents to the survey was not a representative sample of the Australian software industry.
- The firms in the case studies are highly innovative – one of the methods of selection was to look at firms that had achieved some award or recognition by professional bodies in the industry.

Thus the methods of innovating of the firms in the survey and case studies, and the use of KISA, is not representative, so it is not possible to draw conclusions about innovation across the software sector as a whole. Nevertheless the analysis of these firms has provided valuable information for the understanding of the role of KISA in innovation.

3. The Software Industry in Australia

3.1 Introduction

The software industry's importance in the Australian economy is twofold, like that of other aspects of the information and communications (ICT) industry.

- There is a significant volume of production of software for sale as final products to consumers and businesses, both in domestic and international markets.
- Software is an important input to production in other industries, improving scope, efficiency and quality in production and in the provision of services.

Software can be described as comprising four broad areas: systems infrastructure, applications development, mobile and embedded software; and applications solutions. Within these four areas there are nine sub-sectors. These subsectors encompass a range of tools and activities, including client-server operating systems, application programs and programming languages, interoperability software, operating systems for mobile devices, enterprise resource planning and personal productivity tools.

In this study the software industry is defined in terms of production of software for sale as stand-alone software and not embodied in other non-ICT products. That is, software which is embedded in other applications – controls of motor car engines, for example – is not included. But no distinctions are made as to the kinds of software applications produced.

The available statistics and descriptive material do not allow precise analysis of the software industry in Australia. The Australian Bureau of Statistics (ABS) publishes figures on information and communications technology, and includes data on software production and services in the category 'ICT Specialists: Computer Services' (ABS 2004a Cat. No. 8126.0). However, this category also includes other businesses such as computer maintenance, and separating the numbers is partly by inference.

Perhaps a greater difficulty is that ICT has become integrated into all aspects of the economy (DCITA 2003). Companies in most industry sectors are producing ICT. Recognising this, the Department of Communications, Information Technology and the Arts commissioned two studies to identify elements of ICT production outside the specialist sector, one by Sensis and one by Howard Partners. The Sensis report found that in a sample of 1800 small and medium enterprises across the economy, 7 per cent were producing ICT for sale. Some 30 per cent of these firms were producing packaged and customised software and 20 per cent were providing computer and data processing services. Sensis estimated that the greater proportion of software production by SMEs was occurring outside the specialist ICT sector. Non-ICT sectors with significant software sales included finance and insurance, construction, health and community services and cultural, recreational and personal services. Case studies by Howard Partners reported ICT production by manufacturing firms which were not specialised ICT manufacturers. Indeed, several of the firms studied in other Australian industries – in tourism and mining technology services - for the KISA project are in fact software

producers. These companies in other industries would not identify themselves as software producers for statistical purposes and so would not be represented in some collections.

The following analysis, therefore, both underestimates the amount of software production in Australia and presents a simpler picture of the industry than is actually the case.

3.2 The structure of the specialist software industry

The following analysis is derived primarily from ABS Cat. No. 8126.0 *Information and Communication Technology: Australia* (2004), and *Enabling Our Future*, the report of the Framework for the Future Steering Committee to the Minister for Communications, Information Technology and the Arts (DCITA, 2003a).

The Australian ICT industry is a small part of the world industry. It contributes roughly $50 billion to the Australian economy. There are about 24 000 specialist ICT firms employing nearly a quarter of a million people. These constitute about half of the industry, the rest being other businesses which describe themselves as producing ICT. In addition, individual contractors may not be captured in these figures.

It is difficult to discern how many specialist software firms there are, as many companies have more than one activity, but it may be about 8000 to 10 000. An absolute lower bound for the number of Australian specialist software firms is given by the 1,654 software providers who have registered on the self-reporting Kompass database in 2002. The best data is from the Australian Bureau of Statistics, which surveys firms who report that more than 50 per cent of their business is ICT. The main concentration of software producing firms is in computer services. Wholesale packaged services are also included in Table 3.

The annual income from specialist software activities is about $10 billion, of which about $4 billion is customised software services and solutions, $1.7 billion is software maintenance services, and $1.2 billion is data processing and retrieval services. This is likely to be an underestimate, but on these figures, the specialist software industry would contribute about 1.3 per cent of Australia's GDP, which is in line with estimates for other OECD countries.

Table 3: Income from software activities: specialist firms

Industry Group	Number of Businesses (a)	Income $m
ICT wholesalers packaged software	948	2571.0
Customised software services and solutions	9720	3959.3
Software maintenance services	6663	1764.2
Data processing services	889	1190.6
Information storage and retrieval services	569	190.5
Sales of packaged software incl. licence fees	2698	735.7
TOTAL	**19307**	**10411.3**

(a) *Note:* Some businesses are in several categories

Source: ABS 8126.0 2002-03

Very small businesses (employing 1-4 persons) make up nearly 80 per cent of the ICT specialist businesses. However, these businesses account for only 15 per cent of employment and 5 per cent of total income in the industry. Most of these are very small computer services businesses. Fewer than 1 per cent of ICT specialist businesses employ 100 persons or more, but they account for 55 per cent of employment and 72 per cent of total income. It is likely that this pattern is reflected in the narrower software industry.

Table 4: Business size in the ICT industry

Business size	Number of businesses	Proportion of businesses (%)	Share of employment (%)	Share of income (%)
1-4 persons	18,924	79	15	5
>100 persons	188	1	55	72

Source: ABS Cat No 8126 (2004a)

Australia has a substantial trade deficit overall in ICT, with imports of $15 billion against exports of $4.5 billion. However, in the category of packaged software and associated licensing, local production exceeds imports, and 30 per cent of production is exported. This suggests a specialisation in the highly skilled software sector rather than the commodified hardware manufacturing sector (DCITA 2003a).

Wages are considerably higher in the software sector than in manufacturing of ICT. Employment growth also appears to have been more rapid. It should be noted, however, that the following figures are for the economy as a whole, not for the ICT sector. In the period 1998 to 2002, while there was a small decline in the number of electronics and communications engineers and technicians, there was a 43 per cent rise in the number of computing professionals and technicians (ABS 2004b). The proportion of highly skilled workers grew form 50 per cent of the total ICT work force in 1996-97 to over 60 per cent in 2001-02.

The share of R&D inputs in the turnover of the enterprises in the industry and the share of research staff in total personnel is higher than in the business sector as a whole. In 2000-01 total gross expenditure on R&D in Australia was around $10.25 billion, of which expenditure on ICT R&D accounted for about $2.4 billion. Of the ICT R&D expenditure, business expenditure accounted for $2.0 billion (83 per cent) and tended to be concentrated at the ‘development’ end. The rest, about $0.4 billion, was shared by the higher education and public sector research agencies and tended to be directed to the longer term. Although business expenditure was high compared with other Australian industries, and grew by 50 per cent between 1996-97 and 2001-02, the ratio of R&D expenditure to value added by the Australian ICT industry, at 4.6 per cent, was well below the OECD average of nearly 10 per cent for the industry. This may be partly because the activity of multinational corporations, which are among the largest players in the Australian industry, tends to be somewhat less research intensive in Australia (DCITA 2003a, 2003b).

4. Government policies and programs for the industry

The OECD report, *The New Economy: Beyond the Hype* (OECD 2001) emphasised the importance of information and communications technology to productivity. It also made clear the complexity of ICT's contribution to the economy, as an industry, an input to industry, and an enabler of communication.

Australia's industry policy is relatively non-interventionist and rests first and foremost on providing general economic settings which foster efficiency. Recent policy has emphasised innovation as the basis for continuing competitive advantage, including a focus on commercialisation of Australian research. Important in this context is an appreciation of the joint role of the ICT industry and its contribution to the broad economy and other national goals.

Action Agendas are a central element of industry policy. They build a partnership between industry and Government to realise opportunities and overcome impediments to growth. There is a particular emphasis on identifying the actions that an industry itself will take to realise its full potential. The Information Industries Action Agenda was undertaken by the Department of Communications, Information Technology and the Arts with industry and was aimed specifically at fostering the development of the information industries and increasing their contribution to the Australian economy. The Action Agenda contributed to the development of the *Strategic Framework for the Information Economy* released by the Government in December 1998. The key priorities for industry were: access to capital; formation of intellectual property; commitment to quality; developing global scale; orientation towards global markets; and fostering a domestic environment conducive to competitiveness, employment and growth.

Key elements of the Government's approach to the ICT industry (DCITA 2003a) are:

- leadership by governments, industry and researchers to highlight the central importance of ICT by setting and reviewing strategies and priorities and by driving change
- creating a world class ICT research and development base with a consistent focus on commercial outcomes and collaboration
- developing technical and business skills necessary to develop and maintain leading applications and widespread community ICT fluency
- creating a secure communications infrastructure with broadband connectivity to support industry development and other applications
- providing a supportive environment for innovative ICT businesses, including appropriate intellectual property and standards frameworks and attracting and retaining investment in high value added capabilities
- developing a culture of risk taking and innovation
- encouraging the development of small and medium ICT enterprises.

Government industry policy is attempting to produce an enhanced and more focused public sector research effort. Importantly, ICT has been designated a key component of several of the newly defined national research priorities (DEST 2002). The Government is encouraging the building of critical mass, particularly where the interface between ICT

and other areas of technology and application, or where Australia's characteristics or commercial structure create potential strengths.

The Australian Government is contributing $318 million over 10 years to the establishment of Australia's new Centre of Excellence in Information and Communications Technology, National ICT Australia (NICTA). NICTA's founding members are the Australian National University, the University of New South Wales, the New South Wales Government and the Australian Capital Territory Government. NICTA will focus on ICT research at the highest international standard and scale, facilitate the commercialisation of research, conduct research training through an enhanced PhD program, and forge mutually beneficial linkages with public and private sector research organisations, major corporations, SMEs and public sector agencies. It will employ more than 300 researchers and create around 500 new PhD places over the next ten years.

Other significant concentrations of ICT research are organisations including, the Defence Science and Technology Organisation, and the Commonwealth Scientific and Industrial Research Organisation; the Australian Research Council Centres of Excellence program; those funded through the Co-operative Research Centres program; and the major national research facilities program. There is also a strong emphasis on commercialisation of Australian research by improving links between researchers and business and using the challenge of solving the problems of leading edge users as a framework for research programs.

The Government's main generic program to stimulate private sector investment in R&D is the R&D tax concession which enables companies to deduct up to 125 per cent of R&D expenditures from taxable income, and 175 per cent of additional R&D expenditure. The new Commercial Ready program, which commenced on 1 October 2004, will provide competitive matched grants for R&D, proof of concept and early stage commercialisation.

Skills development is provided by Australia's system of universities and Vocational Education and Training colleges. Traditionally they had offered degree and diploma courses, but there is now pressure for more flexible courses, often directed to specific competences, and for more involvement of the industry in curriculum development. There is also a new emphasis on business management courses along with ICT training.

ICT companies are increasingly focused on delivering services and applications: providing and operating business solutions software, educational software, health monitoring equipment and so on, and web based services which mix and match distributed applications. Such services increasingly depend on access to advanced communications infrastructure such as broadband networks. This need is being addressed through the government funded Advanced Networks Program, which has enabled the development of new applications such as the Virtual Critical Care Unit now under trial in NSW and support for innovative third generation (3G) mobile wireless services. AARNet - Australia's Research and Education Network - provides high-capacity, cost-effective Internet services to the education and research communities and their research partners. In the next two years the next generation Australian Research and Education Network (AREN) will be developed to provide very high bandwidth links resulting in an education

and training infrastructure comparable to the most advanced available in North America, Europe and Japan. This is of particular importance to regional universities in Australia.

In terms of standard setting in the ICT industry, the Australian government and business come together in the joint Australian and New Zealand Communications, IT and eCommerce Sector Board to address a range of standards issues. In addition, a joint industry-research-government working group is examining the significance of accreditation in the national and international software market.

Australia maintains a strong system of intellectual property legislation, and is participating in the international debate on the balance of rights between creators and users. The Government is conscious that the way it uses its statutory rights can benefit or stifle innovation (DCITA 2003a), and has released guidelines for the management of intellectual property assets developed in the course of delivering services to government. The Australian Information Industry Association has published a Software legal guide to provide practical legal advice to companies.

SMEs are important for the commercialisation of new ideas in ICT, but it is a long, risky and difficult process. SMEs in the industry generally need assistance in building management skills and funding R&D in their early stages; they also need patient early stage capital, access to markets, and access to government and big business contracts.

The **ICT Incubator Program** aims to improve the rate of commercialisation of ICT ideas and R&D by establishing incubators to increase the success rate of new business information in the Australian ICT sector. The incubators have varied business models, but all incorporate a structured business growth program which includes access to early stage finance, access to a management team and advisory panels, coaching and mentoring, and channels to markets and to international partnerships.

In addition, software firms can take advantage of a number of programs offered by the Department of Industry, Tourism and Resources:

- The **Small Business Assistance Program** is a competitive grants program made up of three components: Small Business Incubators, Small Business Enterprise Culture and Small Business Answers. These initiatives are available to fund projects that help small businesses grow and develop.
- **Commercial Ready** is a competitive merit-based program offering industry a single entry point to grants for early stage commercialisation activities, R&D with high commercial potential, and proof-of-concept activities.
- **Commercialising Emerging Technologies (COMET)** is a grants program that targets management skills of businesses and individuals to increase the commercialisation of innovative products, processes and services (COMET is particularly relevant to KISA and is discussed further in later sections of this report.)
- The **Pooled Development Fund (PDF) Program** is designed to increase the supply of equity capital for growing Australian small and medium-sized enterprises (SMEs). PDFs raise capital from investors and use it to invest in Australian companies.

- The **Innovation Investment Fund (IIF) Program** is designed to promote the commercialisation of Australian R&D, through the provision of venture capital to small, high-tech companies at the seed, start up or early expansion stages of their development.
- **Industry Techlink** gives companies looking for technology solutions access to technology consultants who can help them diagnose their problem and provide a suggested way forward.
- **Invest Australia**, in the course of attracting direct foreign investment, builds capacity by creating leading edge customers for the industry.
- The **InnovationXchange**, which is a joint effort between government and industry, is a web based data exchange between business, government and research organisations designed to provide a trusted intermediary to assist businesses, especially SMEs, to gain access to new technologies, research and patents, education and training, financial and business services, government programs and networks.

Government programs also attempt more directly to improve the customer base of the industry. **Information Technology Online** accelerates the national adoption of business to business electronic commerce solutions across key industry sectors, especially by SMEs.

The Government's **Information Technology Infrastructure Outsourcing** policy places a strong emphasis on promoting strategic ICT industry development through alliance building and creating business opportunities in both Australian and overseas markets.

Software Engineering Australia aims to improve the competitiveness of software developing companies via its education services and SoftwareMark® program. SEA operates as a self funding not-for-profit industry organisation, having been initially established with limited funding by the Government.

The **Australian Technology Park** offers a business incubator program providing consulting advice and administrative support for emerging and promising small companies. (There are also many similar but smaller programs.)

The recently announced **Digital Content Industry Action Agenda** will assist in bringing together the disparate but related industries that deal with content in order to deal with common issues and build critical mass and scale. It is likely to focus on:

- the development and dissemination of industry standards;
- education, training and mentoring, in particular the development of business skills;
- cross-sectoral research and development, and its relation to innovation;
- exports and market access and the role of niche markets; and
- facilitating investment

State Governments provide a variety of programs to assist SMEs. Most States are involved with the Australian Government in the co-operative **Australian Technology Showcase** program, which is designed to promote innovative Australian technologies nationally and internationally, and to attract foreign and local capital for technology

development and commercialisation. Most also have a range of **business mentoring and advice** services, and subsidies designed to **attract high technology businesses**, but they do not single out ICT. The exception is Tasmania, which operates the **ICT Enterprise Ready** Program which provides training for ICT businesses which are entering the national and global markets. This is funded under the Australian Government's Intelligent Island initiative.

Alliances with multinational corporations can deliver substantial benefits to Australian companies seeking global markets. For example, Tower Software signed a contract to supply their document management system to the US Navy, in a deal worth up to $200 million, in the largest electronic document management software implementation ever. The software will be installed on over 350 000 desktops. This contract came about through an alliance with the American firm EDS. A particular challenge that has been identified is how to embed the R&D effort of multinational corporations in the local economy through closer engagement with local research institutions.

Two particular areas of opportunity have been identified for the Australian ICT industry by McKinsey & Company, as part of the research behind *Enabling Our Future* (DCITA 2003a). First, there are likely to be opportunities in 'vertical' applications (that is, specialised application is sectors such as mining that have unique needs and a sophisticated customer base); 'horizontal' applications (which apply widely across industry sectors, for example security systems); and consumer applications (such as computer games and specialised operating systems for embedded microchip applications). Second, there will be opportunities to provide specialist support for multinational corporations, for example undertaking high-end software R&D, providing regional hubs for technical support services (for example virus response) and professional services (such as systems design and architecture, and maintenance support.

5. Key Findings from the Survey and Follow-up Interviews

5.1 Sources of KISs

5.1.1 Internal and formal external service providers

The availability of knowledge intensive services is an important element of an innovation system. It is obvious that software firms need access to technical skills and first rate advice on how to protect their intellectual property if they are to innovate successfully. It is less obvious, perhaps, that they also need access to management services to support innovation. Indeed, a change in management which results in improved product or productivity is an innovation worth study in itself; and management change in response to other innovation does not take place automatically. One of the questions of interest in mapping the innovation system is where firms find these functions, and whether they buy them on the market or develop them in-house. Investigation of this question should also make apparent any difficulties in availability of the necessary services.

The survey asked about the following KISA:

- Strategic development advice
- Employment agency consultancy;
- IT-related training;
- Engineering consultancy;
- Management consultancy;
- IP and legal consulting;
- Research and development;
- Software marketing consulting;
- IT technical consulting;
- IT development advice.

Most firms provided most of the listed services internally. The exceptions were employment agency services, which most firms used for recruitment and also for staffing software (while presumably doing the bulk of their personnel management in-house), and legal advice, especially on matters of intellectual property, where firms felt the need for external expertise. Some firms sought some strategic development advice from outside because an independent view could add value, and R&D was obtained externally for specific purposes and projects, as well as being performed in-house. These results are presented in Table 5.

The survey of software firms shows that most knowledge service providers were KIBS (see Table 6). Services obtained in the private sector were IT training, employment consulting, intellectual property advice, and strategic planning consulting. The role of industry associations seems not to be significant apart from the area of engineering consultancy. Some firms also sought the advice of State government agencies in developing software. About a quarter of the firms surveyed had some interaction with universities and public sector research organisations.

Table 5: Sources of knowledge-intensive services in Australian software firms

KISA	Majority internal sources	Majority external sources	Comment
Strategic Development advice	■	■	Most prefer in-house, but some value external expert advice
Employment agency services		■	Recruitment and consultancy support, also management software
IT training services	■		Need to maintain highest level of skills in-house to operate in the industry
Engineering consultancy services	■		Some believe external input helps them remain competitive
Management consultancy services	■		Part of routine management, but some note that comprehensive process outsourcing is becoming available
IP-related services		■	Need the expertise from outside
R&D services	■	■	Response to specific research challenges, often customer driven
Software marketing services	■		One firm had outsourced successfully
IT technical consulting services	■		Keep this, including training, at highest level in-house
IT development advice	■		Is available in the market, but most prefer to do it themselves

Source: AEGIS KISA Online Survey (2003)

Table 6: External providers for KISA

External Inputs	State Govt	Federal Govt	Universities/ PSR	Private Sector (KIBS)	Industry Associations
Strategic Development advice				■	
Employment agency services				■	
IT training services				■	■
Engineering consultancy services				■	■
Management consultancy services				■	
IP-related services				■	
R&D services			■		
Software marketing services				■	
IT technical consulting services				■	
IT development advice	■			■	■

Source: AEGIS KISA Online Survey (2003)

If the KISA inputs required were not available in-house the companies principally sourced the expertise in their local area, especially services related to intellectual property and the services of employment agencies. It may have been more important to have these specific services locally available, because they were used more frequently (see Table 7 below).

Table 7: Location of external providers

External Inputs	Local (within city)	Regional (within state)	National	International
Strategic Development advice	14	1	0	1
Employment agency services	15	1	0	0
IT training services	12	1	0	0
Engineering consultancy services	8	2	0	2
Management consultancy services	11	0	1	0
IP-related services	28	0	1	1
R&D services	3	2	3	2
Software marketing services	6	2	1	1
IT technical consulting services	9	3	0	5
IT development advice	11	2	1	3

Source: AEGIS KISA Online Survey (2003)

Most firms kept in-house the services that maintained their technical advantage. They felt that they had to be at the cutting edge in terms of ICT training, technical issues, and industry developments. They performed these activities in-house both to develop their own skills and because they could not get better elsewhere. Services described as engineering functions crossed over from internal management – securing optimal operations – to product design and outside the firm to compliance activities. Most firms kept these in-house, but believed that external advice or stimulation could be helpful.

It is important to note that these results are not clear cut. Indeed, most firms used a mixture of internal and external sources for many of their knowledge intensive activities.

5.1.2 Informal sources of KISs

A more complex picture emerges from other items on the survey. Firms were asked about their sources of ideas and information for their innovative products. Their responses are presented in Table 8.

It is clear that in most firms innovation is an in-house matter, possibly because many of these firms are small, and still dominated by the innovator founder. The ideas come from staff, or from customers. This is reinforced by responses to questions about where firms get their information about the industry and innovative opportunities.

Table 8: Important sources of innovative ideas for firms

Sources	No of firms (n=54)
Within the firm	**47**
Customers	**47**
Databased information networks such as the Internet	32
Competitors	22
Conferences, meetings or professional literature	20
Other firms within the same industrial group	17
Suppliers of equipment, materials or components	17
Fairs and exhibitions	15
Industry associations	9
Universities and colleges	6
Public/private non-profit research centers	6
Consultancy firms	5
Public patent documents	2

Source: AEGIS KISA Online Survey (2003) N=54 (multiple answers)

The most important sources of knowledge and ideas for innovation are not formal service providers, but the people and organisations the firm works with day by day: in addition to the internal debate, there are customers, suppliers, and other firms in the industry. Competitors, too, are important sources, whether by intentional communication or competitive industrial intelligence gathering. Other external inputs come from publicly available sources, such as the web, conferences and journals and occasionally patent information.

A similar picture comes from firms' nomination of their partners in the innovation process, which are shown in Table 9.

Table 9: Innovation partners for software firms

Partners	No of firms (n=54)
Customers	**42**
Suppliers of equipment, material, components or data programs	**19**
Consultancy firms	15
Other firms within the same industrial group	14
Industry associations	11
Universities and colleges	9
Competitors	5
Public or private non-profit research institutes	5
Other	2

Source: AEGIS KISA Online Survey (2003). N=54 (multiple answers)

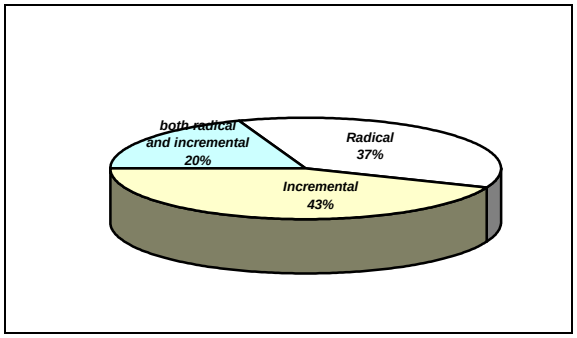
The most important difference between initiating and carrying out the innovation is that external consultancies do feature as partners in innovation processes, after the innovative

idea has been initiated. Competitors, of course, are less often partners than sources of ideas, but it is interesting that 10 per cent of firms named them as partners. Interestingly, universities are more likely to be the source of assistance as partners in the process rather than to supply the original idea or information for the innovation.

The importance of customers and suppliers in the innovation process is elucidated by the picture of incremental and radical innovation that comes from the survey. As is illustrated in Figure 3, about 40 per cent of those surveyed regarded their most important innovation as an incremental change, 40 per cent claimed a radical innovation and 20 per cent regarded it as both. Many of those interviewed said that even with a radical innovation the firm continued to build on it incrementally, in response to feedback from users.

Some firms described the very process of innovation as a continual enhancement of the product in response to customers' requirements and following technical feasibility contributed by suppliers. Some even lowered their prices to certain customers because the partnership allowed them to reduce risk by working with the customer, whose experience in working with the product provided insights which were incorporated before general release. In some cases, too, the sale to the partner-customer worked as a marketing showcase. In such cases, long term relationships are especially important.

Figure 3: Types of innovation in the software industry



Source: AEGIS KISA Interview data, May 2003

The story here corresponds to early descriptions of innovation systems, which emphasised the importance of user-producer relationships in product innovation (Lundvall, 1992). Those learning relationships can be characterised as knowledge intensive activities, and they provide a service to the firm; so they can be characterised as KISA.

5.2 Reasons for internal provision versus outsourcing

5.2.1 To make or to buy?

The theory of transaction costs (Williamson, 1985) suggests that a firm will develop resources internally or buy them on the market depending on costs. An input might be produced externally more cheaply than the firm could make it, but the costs of acquiring it could still make it cheaper to produce it internally. Non-production costs may be obvious costs, like transport and accounting. They may be the time spent finding a suitable contractor and comparing bids; the cost of drawing up a contract; or the time and

effort of supervising an external contractor. Or they may be due to various kinds of uncertainty. For example, because it is impossible to specify every detail in a contract, it may be that what is supplied is not what is wanted; and there is no way of knowing if the supplier will deliver as promised.

A widely held analysis of the functioning of firms argues that lasting competitive advantage for a firm depends on its possession of resources that are scarce, non-transferable and inimitable (Barney, 1991). These may be physical resources like land or access to minerals; they may be knowledge resources, such as patents; or they may be dynamic capabilities: for example, the skills and difficult to trade knowledge of individual workers and the processes of the team which is formed by their interactions (Teece *et al*, 1997). A firm will keep in-house those knowledge intensive activities which it regards as essential to its core functions, which depend on scarce skills, which rely on tacit knowledge (which cannot be explicitly traded or taught), or which are its secrets.

To buy a service requires some knowledge: which service to buy, where to look for the service, how to judge quality, what is the going price, and how to use the service once it is acquired both for its basic purpose and in integrating it into the firm's knowledge base. The more knowledge intensive the service, the more sophisticated is the set of knowledge and skills required within the firm in order for it to buy in the market. So a firm cannot simply choose to outsource the whole of a specific area of KISA. It has to keep enough knowledge in-house to retain the capacity to be a discerning buyer; and it has to retain the capacity to learn from the services acquired (Cohen and Levinthal, 1990).

The decision to make or buy knowledge intensive services depends on a number of transient factors. A firm may be too small to have the resources to develop a particular knowledge intensive capability, even though it would prefer to provide it in-house. Conversely, it may not have the cash to buy it and so must provide it in-house even though it would prefer to find it externally. The service may not be available in the market, but this may not be a permanent state of affairs: witness the growth of management consultancy in the last 20 years. So the firm's decision to make or buy can change over time and depending on circumstances. Its choices may say a lot about the innovation system it is in and the resources it has available.

5.2.2 Results from the survey and interviews

4.2.2.1 Reasons for using internal provision

Most of the firms surveyed relied on internal provision of most of the knowledge intensive services most of the time (see Table 5 above). There was some consistency in the reasons given in follow up interviews.

Cost factors

The most common reason for using internal services was cost: about half the firms interviewed gave this as one of the main reasons they would rather use in-house services than outsource them. This was largely because many of the firms are small and self-funded, but some interviewees commented that current economic conditions dictate withdrawal from external sourcing.

Experience and expertise

Approximately half the firms interviewed indicated that they possessed the skills, personnel and experience required for an internalisation strategy. These firms had consciously built up the internal expertise they needed and found no necessity to source externally. One firm has a strategy of increasing in-house specialisation, in which outsourced expertise will be incorporated into the in-house capability through training, the hiring of new employees, and the drawing of external consultants into more long-term roles in the firm.

Knowledge Retention

A few firms interviewed did not want to contract out any part of their innovation development because they specifically wanted to maintain the core of intellectual capital within the organisation. Operating in a knowledge-based industry, they felt that they needed to retain their knowledge and build it further. One firm preserved knowledge through staying in-house or by hiring people with specific expertise to train the employees.

Unreliable, bad experience

A few organisations mentioned previously experiencing poor, unreliable services from external experts. This led them to keep services in-house.

Time constraints

For a small proportion of firms time was the determining factor. Delays caused by the schedule of an external supplier could be critical. One manager related an experience of using a multinational corporation to provide consultancy in the design of a particular piece of software. The MNC was undertaking numerous projects at the time, meaning that his organisation had not received sufficient priority. This resulted in a delay in the overall innovation process and implementation of the new product, and hence in introduction in the market.

Control and ownership of the innovation process

Another motive for internalising is risk aversion. Some interviewees perceived outsourcing as risky because innovation was considered a critical activity. Several firms also indicated that their decisions not to outsource were influenced by issues of ownership and of control of the strategic development of the firm.

Maintaining relationships with customers

One manager indicated that it would not be feasible to outsource too much of the innovation process because the firm risked losing some customers who might feel that the product supplied came from somewhere else. Also, in order to stay in touch with the market and its current trends the firm kept as much of the innovation process in-house as possible.

However, maintaining internal KISA was not simply a default option. It required active management and inputs of resources as well as use of existing resources, capabilities and competences. Table 10 illustrates some of the inputs to KISA within the firm in the innovative process.

Table 10: Inputs to internal KISA undertaken by firms for development of products

Internal KISA	No of firms (n=54)
R&D	49
Acquisition of software and other external technology linked to technological innovations	44
Preparations to introduce new or improved services or method to produce/deliver them	44
Training directly linked to technological innovations	40
Market introduction of technological innovations	39
Acquisition of hardware and equipment linked to technological innovations	34
Commissioned R&D	22
Other innovation related activities	6

Source: AEGIS KISA Online Survey (2003)

5.2.2.2 Experiences with using external provision

The interviews conducted for this study suggested that a lot of the firms viewed each innovation project as distinct. They were primarily small firms who lacked the resources to develop standard operating procedures. Besides, each innovation project is a one-off occasion for many firms which innovate in response to customer demand. The development process among projects differs so much that they feel that there can be no standardised list of services required. So relations with external sources of expertise tend to change with each new project.

In the light of the discussion above, it is not surprising that the reasons firms gave for seeking external KISA included the following:

- They lacked the expertise in-house and sought access to current external software capabilities or technologies and avoid technology obsolescence;
- They wanted to keep in-house resources free for mission-critical purposes and allow the company to focus on its core business, and saw external services as a way to leverage scarce resource;
- Using external resources allowed them to maintain flexibility and responsiveness;
- An external stimulus would accelerate process improvement or re-engineering benefits;
- Outsourcing enabled them to reduce and control operating costs;
- Outsourcing enabled them to reduce cycle times and improve customer service;
- Some service required extensive capital outlay, and this was avoided by buying them in.

Initial selection of an external provider of KISA is itself a demanding process. It may be difficult for the purchaser to specify in detail what is wanted, given that innovation by definition involves new circumstances. There are information asymmetries in the market for KISs: it is hard for a firm to know the quality of the service that will be provided. The service may be bundled with other products of unknown value to the purchaser. It is

difficult to find out if the provider is viable, and will stay in business for the duration of the contract. Perhaps most important, the firm may be contemplating a long term relationship, in which case the particular price and quality of one service will not be the only consideration. Good communication would be a significant factor in the decision.

Firms indicated in the survey that they dealt with these difficulties sometimes by using a formal benefit: cost analysis. They also looked at the reputation of the provider, and sought recommendations from industry partners, their networks, industry associations, and government agencies. Occasionally they formally sought advice from consultancy firms.

Firms were asked how they evaluated external KISA. Most responded in terms of whether the service met their needs at the time, rather than by reference to industry standards or benchmarks. They also compared the particular experience with their experiences with other providers. About a third of those who were currently outsourcing intended to continue to do so, usually because they were satisfied with the service they had received but sometimes because it was not feasible to develop the expertise in-house. Some felt that outsourcing would be easier in the future, because they had identified a reliable supplier.

A few firms had had negative experiences with external providers. One manager described an unpleasant experience because of an unclear position on legal rights and intellectual property rights. Others merely commented that in future they would try to provide the service in-house.

Many had developed, or thought they would develop, a long term relationship with the supplier. One manager, for example, indicated that, since the company was relatively new and the product just recently launched, the firms wants to develop long-term relationships with the people providing marketing expertise and advice. Another manager planned to use an industrial relations contractor on a continuous basis so as to add his expertise to the intellectual capital of the company. However, one firm rejected the notion of long term relationships because each innovation project was different and had different demands for knowledge intensive service inputs.

The majority of firms interviewed had some form of interaction with ***multinational corporations***. Many are able to leverage their activities on the skills and expertise of the multinationals through partnerships and coordination of resources. The benefits of these alliances with large partners included greater market scope, increased trade links and networks, access to technical resources and solutions for their products and sourcing new clients and projects through the reputation of and referral from such organisations. One manager mentioned that the multinationals bundle their software into their products and so market the small firm's products, especially when they supply to overseas markets through their subsidiaries.

Some firms enter into a consortium, whilst some partnerships are organised through the relevant ***industry association***. One respondent, for example, mentioned that the Australian Information Industry Association (AIIA) offers assistance in such matters by organising networks, sessions and seminars between MNCs and smaller organisations. The Australian Technology Park also offers a business incubator program providing

consulting advice and administrative support for emerging and promising small companies.

About 25 percent of the firms surveyed and interviewed had some interaction with ***universities and public sector research organisations*.** Some of them maintained long-term relationships for developing software and finding out the latest developments and research in their niche areas. One firm responded that they had worked alongside researchers from a particular university, where the researchers undertook the data collection and analysis, whilst the firm created a product from the data to address the project. Other forms of interaction with research institutes include discussions with researchers to produce ideas and feedback on the development of a new product. One organisation has constant advice and consultancy from universities and Cooperative Research Centres (CRC). A few of the firms indicated short-term relationships on a project basis only. They generally agreed that these collaborations facilitated innovation in some form or another, and contributed to the firms' capabilities.

Companies elect to outsource for many reasons. For instance, outsourcing may be used as a rapid and often short-term solution to a particular need or problem. This does not form part of the overall business strategy. Or a source may engage in strategic outsourcing, working with one or more suppliers, in order to effect a significant improvement in overall business performance.

Despite their generally positive experiences with outsourced services, when asked if they were planning to develop internally the expertise currently outsourced almost half (46 per cent) of firms answered in the affirmative. Many of these small organisations envisage growth and expansion in the future. As part of this, they hoped to develop or hire the skills in their own organisation.

5.3 KISA and Firm Capabilities

5.3.1 Capturing the learning

In technologically advanced industries the core capabilities of firms are knowledge seeking and knowledge creation (Powell, 1998). Engaging in KISA can build knowledge, and the ability to acquire and create knowledge. This learning will happen more or less automatically, but the process can be enhanced by specific attention.

Some of the firms surveyed were conscious of this. The decision to provide a KISA in-house was often based on the need to build and maintain leading edge skills in the firm's area of technology. For example, in one firm that conducted training internally, the trainer is able to keep up to date with the applications and developments of the software market. He carries out his own research, and learns from other organisations or industry sources in order to upgrade himself before training the new employees. In this case, as the firm conducts the training internally, the trainer builds up internal competencies in the firm. This is a direct contribution to the innovative capability of the firm.

More generally, firms were aware that service activities built capabilities. One manager highlighted his belief that employees could improve their skills and gain more experience through 'learning by doing.' Another firm indicated that in team approaches to software

marketing services, the members interact and share ideas, and as a result come up with new ideas. A lot of the innovation that occurred was incremental in nature. Employees gained new knowledge from conducting the services themselves.

Several also explicitly used externally provided KISA to enhance the firm's capabilities, either by learning by watching the contractor, or by making the contractor a part of the firm's resource base, like the firm employing the industrial relations consultant mentioned above. One manager gave an example of learning a new technique of business forecasting from an overseas trip. He implemented the new ideas within the firm. Ideas or knowledge may come from external sources, but competences are built within the firm.

In the interviews, firms were asked how the internal and external inputs to KISA were managed and coordinated. The majority of firms handled this mix and match of activities internally rather than using external consultants. Some appointed an internal project manager to handle the mixing of KISA, whilst other firms involved the owner or director managing the whole process single-handedly. About half of the firms interviewed indicated using a team approach of managers working in a group to handle the mix and match of KISA. They believed teamwork resulted in better decisions and a diversity of ideas and reinforced the capabilities of the firm.

Two very small firms indicated that they used an informal process of management, without formal structures in the firm. Some managers also avoided the use of task forces or similar top-down approaches, favouring instead more informal knowledge sharing. Some of these respondents seemed confident that they themselves possessed the necessary project management capabilities, skills and experience to coordinate the use of KISA inputs from various sources.

Firms were asked about their innovation capabilities. More than half appeared to be confident that they had within the firm the abilities required for product development, namely their R&D capability, their skills in and knowledge of the technology, and their expertise in commercialisation issues such as management of intellectual property.

They were also asked about the capabilities they would require for the future. Probably because of their confidence in their product development capability, they highlighted marketing as the one they would most need. This is shown in Table 11.

Table 11: Capabilities firms wish to possess for future innovation

Capability	No of firms (n=41)
Marketing	19
Competent skills and knowledge inherent in employees	12
Business and management skills	4
Research and development	4
New product development	4
Financial capital	4
Keeping abreast with technology	2
Intellectual property management	2
Processes and systems in place	1
Strategic relations and contacts	1
Growth and expansion	1

Source: AEGIS KISA Interview data (2003).

One way in which firms captured the learning from KISA was in their networks. The survey shows that companies obtain information and ideas from their customers, and when they seek expertise they look to local providers of KIBS to a greater extent than to national or international sources. Since the local providers also learn from the experience of providing the service, the firms are also strengthening the local innovation system where they are embedded. The particular interaction of the firms and the KIS supplier impacts on the innovation capability of both firms resulting in a co-production of knowledge. The analysis of Muller & Zenker (2001) shows how important it is for SMEs to access local KIBS. They found higher levels of reported innovation and expenditures on innovation-related activities among manufacturing SMEs who interacted with KIBS than among those who did not. The same applies to those KIBS - they were more innovative than those who do not engage in such interactions. Such interactions are more likely when the KIBS are local.

5.3.4 Managing and integrating the knowledge

The capacity to harness and capitalise on the new knowledge acquired by or generated in the firm depends on the strategic management and coordination of resources. Knowledge management is a process that deals with the development, storage, retrieval and dissemination of information and expertise within the organisation to support and improve its business performance (Gupta et al, 2000). Organisations need to tie together the knowledge not only to stay competitive, but also to become innovative. They need to make sure that knowledge is captured, stored, and transmitted, so that it can be used and acted on by others.

The interviews with managers investigated the use of various methods for retaining and diffusing knowledge or intellectual capital within the firm. Almost 40 per cent of firms interviewed used documents as a method of knowledge diffusion. This is because documents are easily transferred to other employees across the organisation, and the information is systemised. Other firms indicated that information is collated into reports or stored in a database for future retrieval. Some organisations adopted ISO 9001 guidelines requiring them to document all components of the process so that they can be catalogued, stored and become a resource for future projects. About a third of the firms interviewed used informal methods for the transmission and assimilation of knowledge. Social events, informal communication and meetings are considered reliable methods of information diffusion. Some examples include after-work drinks, lunch meetings, and company outings.

Most surveyed companies comprised very few people, so constant communication, brainstorming, and informal sessions were effective ways to transfer information.

Firms were also asked to identify the challenges they faced in obtaining external knowledge for innovation. The findings indicate that some firms faced refusals to license by other firms. There are also many requirements to enter into cross-licensing agreements with other firms which were considered difficult to fulfil. In addition, ten firms indicated that some external providers were very protective of the knowledge and were cautious

about sharing the knowledge. They refused to transfer the technical know-how in order to protect their capabilities.

5.4 Use of government programs

Government programs for industry in Australia are generally in the form of assistance for R&D, the major programs being the R&D Tax Concession and the R&D component of the Commercial Ready program. There are also programs, like the New Exporter Development Program administered by Austrade, which assist firms to become export ready.

Even in the best of climates, SMEs in the software industry are highly vulnerable and can be considered 'high risk', particularly in the early phase of commercialising ideas and implementing business plans. Little initial investment may be required, but once they are successful, start-up companies producing innovative technology-based products need a significant injection of funding and management skills to help them take advantage of fleeting market opportunities. Continuing market failure in early stage investment in the ICT sector has been a major barrier to growth.

In the Building on IT Strengths (BITS) Incubator program, a total of $122 million is being provided through 11 incubator centres. The incubators invest seed funding in start-up firms which that have passed through a due diligence phase and meet specific criteria. In return the incubators claim a small proportion of equity in the firm. The incubators incorporate a structured business growth program-including access to various types of early stage finance, make use of an experienced board, management team and advisory panels, provide business coaching and mentoring and channels to markets and international partnerships. Among the six case study firms discussed later in this report, Gecoz, Maxamine, and YourAmigo received assistance under the BITS Incubator program.

Another program which has been valuable to the sector is the COMET (Commercialising Emerging Technologies) program. COMET has engaged private sector business advisers across Australia to assist successful applicants to become ready for commercialisation activities and provides financial assistance and access to business advice.

The program’s origin demonstrates that it was introduced as a direct support to KISA in young firms. In 1997 the Australian Government introduced the Innovation Investment Fund program to build early stage venture capital investment in recognition of the poor capital availability following completion of the R&D phase of activity in Australia.

After some 12 months operation, the five fund managers advised government that the majority of deals coming forward were ill prepared for investor financing. This was largely due to the poor state of financial planning, knowledge of potential market, IP management of applicants. Given this the government decided to introduce a new program to assist new technology based firms to become investor ready. This eventually resulted in COMET in late 1999.

COMET assistance is available to early-growth stage companies - companies in the early stages of commercialising an innovation; spin-off companies – from public or private research institutions; and individuals. Assistance is available for up to two years.

Firms are required to work with a COMET business adviser to develop and implement an Assistance Plan through third party specialist service providers. This might involve:

- strategic and business planning, including an export strategy if appropriate
- market research
- management development including participation in approved management skills development courses
- intellectual property strategy
- engagement of mentors
- proving technology (including working prototype)
- establishing market validity by focussing on building a credible business position.

COMET financial assistance for companies is available through a two tier funding structure. Tier 1 offers grants of up to $64,000 (exclusive of GST). The rate of assistance is available at 80 per cent of the eligible expenditure. Tier 2 offers grants of up to an additional $56,000 (exclusive of GST). Assistance is available at 50 per cent of eligible expenditure. Individuals may be assisted to develop management skills required to progress their innovation to commercialisation. Grants to individuals are up to $5,000.

Most respondents to the survey focused on grants programs and were not asked about their use of COMET. Of the case study firms, Gecoz had been assisted under COMET.

5.5 Challenges in the innovation process

Firms were asked what challenges they faced in innovation. Access to KISA was not seen as a pressing problem, although shortages of knowledge workers and lack of organisational management resources were identified. The majority of firms indicated that what hindered successful innovation was economic factors such as lack of finance, high innovation costs and great economic risk. Other important factors were inadequate market information, lack of organisational management resources and insufficient market information (see Table 12).

Table 12: Factors that impeded the innovation process

Factors	No of firms (n=54)
Economic risk	35
High innovation costs	34
Lack of appropriate financing opportunities	34
Lack of market transactions	24
Lack of interest for new products and processes	20
Organisational management resources	16
Lack of skilled personnel	16
Competitors	15
Management structure	14
Lack of technological information	13
Strict standards	5

Source: AEGIS KISA Online Survey (2003)

6. Key Findings from the Case Studies

6.1 Innovation in the case study firms

A useful framework for the analysis of how changes occur in the way the firm organizes itself to obtain ideas and put them into practice has been developed by Koberg *et al* (2003):

> '…procedural (management-determined innovation in rules and procedures); personnel-related (innovations in selection and training policies, and in human resource management practices); process (new methods of production or manufacturing); and structural (modifications to equipment and facilities and new ways in which work units are structured).'

The case study firms had usually built on a radical innovation, the initial concept developed by the company. All except Callista and Gecoz were focused on international markets and so saw themselves as competing in global industries.

Table 13: Radical innovation in software case studies

Case study	Key idea
Callista	Student enrolment management software for tertiary institutions
Gecoz	Salinity maps from radar data
Hatrix	Software to reduce adverse drug events
Maxamine	Analysing websites so all content is visible to search engines
Prophecy	Software combining logistics, billing and back office management
YourAmigo	Internet search engine software using novel architecture

Sources: Thorburn, L.J., Sectoral Case Studies in Innovation; AEGIS KISA Report

All firms were actively modifying and growing their products and services to meet changing customer demand, and to take advantage of new ideas and technologies which would enable them to deliver a more consistent service or to do so at a lower cost.

In the IT industry the custom is to release product upgrades and all IT case study firms were involved in this. Most were also planning, or had introduced, more significant product changes. These were responses to changing market opportunities and were often enabled by changes in technologies (for example, the advent of XML, the ability to service customers over the internet and rising market sophistication about their internet strategies). All six case study firms were very conscious of the role of intellectual property and the need to protect it in these circumstances.

All the firms could point to some changes in each of the four categories identified by Koberg *et al*.

Table 14: Incremental Innovation in IT Case Studies

Name	Product/ service	Procedural	Personnel related	Structural
Callista	Development of support systems for remote region clients	Project lead staff for scanning environment	Developing creativity of IT staff	Restructuring of company into teams
Gecoz	Development of methods for producing inundation maps	Develop on-line investor-ready documentation	Company director training	Access to new sources of data through alliance
Hatrix	Extension of main product to XML	Quality management ISO9001	Hire in staff with new skills for OTJ training	Move to handheld PC technology
Maxamine	Extension of basic product to search engine strategies	Internal departmental plans and targets	Adaptation of training for US and Australian staff	Advisory Board
Prophecy	New billing product for utilities	Corporate governance systems to comply with changes in listed company rules	Move staff through product development teams; mentoring	Product advisory team co-ordinates input to management
YourAmigo	Extension of product to automatic search and alert	Customer account managers	Training technicians in sales	Advisory Board

Source: Thorburn, L.J., Sectoral Case Studies in Innovation

6.2 Sources of KISs

6.2.1 Internal and formal external service providers

Firms were asked about their use of KISA with reference to a list of 21 knowledge intensive services.

In all case study firms management drove innovation in the softer areas relating to staff development and training, company structure and upgrading of equipment.

In relation to external services, firms were asked whether they used routine, 'off-the-shelf' services or had them tailored specifically for the firm; in particular they were asked if they used services for compliance purposes, such as audit, occupational health and safety and public liability. They were also asked how important it was to obtain the services externally.

Use of external services is shown in Table 21. It ranged from 19 per cent of the named services being outsourced (by YourAmigo) to 45 per cent (by Maxamine). In certain cases, the availability of external services was of high importance because there was no equivalent skill inside the firm. This ranged from 14 per cent (for Hatrix) to 75 per cent (for YourAmigo). That is, YourAmigo outsourced only a few services, and it looked

externally for them mainly because it did not have the skills in-house. Of the services outsourced, the range of services that were tailored for the firm was 13 per cent to 100 per cent. As with the survey firms, most firms used externally provided legal advice (which includes advice on patenting and intellectual property); and the high use of external capital raising (important when entering US markets or seeking venture capital investment in Australia or overseas) corresponds to the high use of external strategic advice in the survey firms.

Table 15: Use of External Services by IT Case Studies

	Callista	Gecoz	Hatrix	Maxamine	Prophecy	YourAmigo
Planning	tailored	TAILORED	tailored			
Legal		TAILORED	tailored	TAILORED	routine	TAILORED
Acctg/Financial	routine	TAILORED	COMPLIANCE	TAILORED	routine	
Capital Raising			tailored	TAILORED	TAILORED	TAILORED
Tech awareness	routine	TAILORED				
Tech trends	routine					
Formal R&D						
Market research		TAILORED		tailored	TAILORED	
Product devt						
Project manag't						
Operations	tailored	routine				
Marketing				routine		tailored
Sales			routine	TAILORED	Tailored	TAILORED
Export strategy			tailored			
Establishing o/s offices		N/A				
Benchmarking	ROUTINE					
IT/Networking				TAILORED	tailored	
Recruitment	tailored			tailored		
Accreditation			tailored			
Standards				N/A		
Training	TAILORED	compliance		TAILORED		
Total Outsourced	**8**	**7**	**7**	**9**	**6**	**4**
% Outsourced	38%	35%	33%	45%	28%	19%
Of those:						
% High	25%	25%	14%	67%	33%	75%
% Tailored	13%	71%	71%	89%	66%	100%

Notes: Words in CAPITALS indicate outsourcing was of high importance; words in lower case indicate outsourcing of medium importance; blanks indicate no outsourcing. N/A indicates not relevant to that firm

Source: Thorburn, L.J., Sectoral Case Studies in Innovation

Several firms had sought external assistance for business planning and tailored legal services, accounting and technology awareness services. Few firms outsourced aspects of technology scanning, product development or project management as their technical staff in-house were used for these functions. Many firms had long term relationships with their service providers.

All case study firms expected their professional staff to keep abreast of technical developments and all but Prophecy had in-house R&D programs. They often obtained information from external sources (trade magazines, conferences) but the search role was played by staff rather than external advisers.

Three of the firms' founders (for Maxamine, YourAmigo and Gecoz) had moved directly from employment with Australian R&D institutions to their new firms and two firms (YourAmigo and Callista) had spun out of research institutions.

Few of these had continuing formal relationships with these institutions but they did maintain informal networks, which were used to keep up with trends. However all R&D was undertaken in-house. Universities' main function was as a source of technical staff. Keeping R&D, and hence intellectual property, within the firm was also a key issue.

Two firms, Hatrix and Prophecy, did not have any contact with research institutions. Hatrix was concerned about expectations that IP arising from research funded at a university would have to be shared, and Prophecy had not considered forming relationships with R&D institutions because it did its R&D in-house.

Companies that sell software traditionally use distributors, termed "resellers", to reach a wide market. This is particularly so if the firms are aiming to sell product in international markets. This was the case for four firms – YourAmigo, Hatrix, Maxamine and Prophecy. All these firms had relationships with resellers who acted on their behalf. As these resellers supplied services to the case study firms, they have been included in discussion of KISA later in this section. Gecoz is currently only selling to organisations in Australia and its service requires a large amount of tailoring so it is working directly with customers. The same is true of Callista, whose market is focused on Australia's higher education institutions. The others have developed mechanisms to interact directly with customers even though their direct line of sale is to a reseller and this is discussed later in this section.

Of the six software companies interviewed only two were active in industry associations, although most were members of the key national association, the Australian Information Industries Association. Gecoz is a founding member of the Spatial Sciences Institute which has been formed to promote standards development and best practice in what is a relatively new field. Prophecy has also joined a new water industry body, relevant to its customers, in its home State. These associations did not provide any particular inputs in relation to innovation although industry newsletters did give some leads in relation to emerging technological trends.

6.2.2 Informal sources of KISs

Senior staff in all companies had excellent and active external networks. All CEOs interviewed relied heavily on their personal networks to assess market trends, to confirm

or test the results of formal market surveys or other sources of quantitative market data and to find people to deliver services when these were not available inside the firm.

Maxamine, YourAmigo and Callista all rely on extensive personal networks of the founders for innovation inputs. In Maxamine and YourAmigo these networks are formalised in an Advisory Board structure. These boards rarely meet together, but were relied on to provide skills and information in particular areas. In some cases, Advisory Board members were rewarded with access to options to buy shares. The Advisory Board members acted as an extension of the eyes and ears of the CEO of these firms. They were often selected for their knowledge of overseas markets, as well as other people that they knew. When they were used, these Advisory Boards provided valuable links through to other sources of expertise, ideas and information.

Callista's current CEO has wide personal networks outside the education sector and uses these to bring in ideas from outside the organisation. Hatrix relies on attending industry conferences and trade shows for some informal networks and ideas. Some firms maintained informal links with R&D institutions.

6.3 Firm Capabilities

6.3.1 Learning by firms

6.3.1.1 Marketing

All IT firms marketed themselves heavily through their website, as well as through the various channel partners/resellers. They all had sophisticated website strategies and were heavy users of the internet. Callista had used a brand consultant to reposition itself in the market but all others had developed their own strategies. Two firms (Callista, Maxamine) purchased pre-packaged market reports from firms which specialise in this area. YourAmigo had been offered pre-packaged research but had decided not to purchase it, and now believes that such reports are of little use.

For those who export (Prophecy, Maxamine, YourAmigo and Hatrix), marketing is heavily focused on those overseas. All except Hatrix had also established overseas offices to support this process. They had often sought advice from patent attorneys, accountants and lawyers in these markets prior to establishing their offices or subsidiaries. Maxamine also contracted a specialist US market analyst who played an important role in environmental scanning.

6.3.1.2 Customer feedback

As noted above, four case study firms relied on resellers so there is an intermediary between the firm and its eventual end customer. These firms had developed a range of methods to obtain feedback from their eventual end customer without potential "filtering" by the reseller. These enabled them to read market needs, as well as get direct feedback from their distributors. Callista had also established customer feedback groups to address key issues of software development.

Table 16: Customer Feedback Methods for Case Study Firms

Case Study	Main Customer Feedback Method
Callista	Customer working groups
Gecoz	Direct feedback from customers
Hatrix	Direct feedback from customers through installation and delivery
Maxamine	Embeds staff in Tier 1 partner firms; provides customer support from Australia & the US as part of its 24x7 coverage
Prophecy	Own offices to support customers in-country
YourAmigo	Customer account managers

Source: Thorburn, L.J., Sectoral Case Studies in Innovation

6.3.1.3 Quality Systems, Customer Service and Intellectual Property

Firms were very aware of the importance of intellectual property and three (Maxamine, Gecoz and YourAmigo) had protected their intellectual property by patenting in Australia, the US and elsewhere. All others, however, protected their IP by ensuring the source code stayed in-house and used trademark and copyright to keep their intellectual property from being stolen.

All firms had quality systems or standard procedures in place. For example:

- Maxamine has formal processes for sales management and written procedures for roll-out of the sales management systems;
- Hatrix is ISO9001 certified, primarily because its hospital customers require this;
- Gecoz's investors appointed a business manager who set up key business systems which are now followed; and
- Prophecy has standard operating procedures covering development methodologies, technical processes and checklists.

6.3.1.4 Staff

Staff contribute significantly to innovation and environmental scanning, primarily because they are more likely to be tertiary-qualified and hence will have their own professional networks. This usually related to information on technology awareness and technology trends, both of which were important to these firms in fast-moving markets. Callista had the most formal of these arrangements, with technical staff assigned to scan the environment for potential improvements to support customer management and product rollout.

6.3.2 Knowledge management

The main reasons IT firms outsourced services were:

- The need to access particular skills not available in-house (for example, both Maxamine and YourAmigo had sought advice from patent attorneys to support patenting and Gecoz had outsourced market research to identify and analyse its market when it was first established).

- The need to access complementary skills on a longer-term basis (for example, the use of channel partners in US markets).
- The need to obtain greater objectivity (for example, software productivity assessment and accreditation/quality auditing).

Firms expected external service providers to provide reports and other written materials in order to retain knowledge gained. Where the relationship was longer term (for example, with channel partners) then interaction with these service providers had been formalised and meetings were held to share information and ideas with the firm's management.

6.4 Government programs

IT firms in general were very aware of the range of services and grant programs offered by the Australian Government. One had been granted funds under COMET and several others had successfully received R&D START grants, which provided up to several million dollars funding for R&D projects, with the company being required to match Government funding. (Grants along similar lines will be available under the new Commercial Ready program.) Three firms had been involved in Government-sponsored incubator programs – Gecoz had been funded by the building on IT strengths incubator in Darwin and YourAmigo and Maxamine were funded by the Playford Centre, a BITS incubator in Adelaide. Maxamine also had private investors. Three case study firms also used Austrade at varying levels:

- Maxamine was selected to participate in the 2002 Austrade Euro High Tech Tour.
- Gecoz was supported by Austrade market assessment in China (and also received State funding for a mission to Singapore).
- Hatrix is a member of the Austrade Tradestart program.

There is no doubt that the funding provided through these programs helped to kick start these companies. Gecoz, in particular, spoke highly of the COMET program, which provided significant support to directors who had little business experience. Gecoz also reported that the firm's business plan, developed by an adviser and with the COMET funding, provided an independent, arms length assessment of the business opportunity and helped to convince investors that the firm had prospects.

7. Conclusion

7.1 Awareness of KISA

The software sector relies on relatively new technology and is likely to be more aware of the need to innovate than other industries. It is not surprising, then, that the firms surveyed or studied as cases all seemed explicitly aware of the knowledge intensive services activities they needed and used. In particular, they were aware of the need to retain and build on in-house capabilities, and they recognised that purchased services were a source of new capabilities. Most firms had explicit mechanisms for absorbing and developing the new knowledge that the services brought them.

7.2 Sources and availability of KISA

Both the survey and the case studies showed a striking lack of reliance on formal externally produced KISA. The only consistent exceptions were the seeking of legal advice, especially advice on intellectual property management, and some necessary compliance functions such as auditing from external experts. Other exceptions were routine management services such as recruitment and accounting, and some strategic (especially international marketing) advice. But in general firms found their knowledge intensive services in-house or in the personal networks of their staff.

While the data are inconclusive, those external services which are widely used tend to be generic, like recruitment, legal and accounting services. The finding that firms used universities more as a source of advice on implementation than of ideas for innovations reinforces this notion. But most firms used a mixture of internal and external sources for many of their knowledge intensive activities. Further, most of the small firms regarded each innovation project as a distinct activity, and relations with external sources of expertise changed with each new project.

Firms can have sound reasons for providing services themselves. There might be a clear strategy to build in-house resources, or nervousness about letting outsiders have a glimpse of trade secrets, or even a decision not to part with cash for services that can be obtained elsewhere. Any of these would be unremarkable. But the readiness of at least one of the case study firms to use the Australian Government's COMET program, and the enthusiasm for it, suggests that there is no unwillingness to use external services if they are there.

It could be that formal services are not easily available. No market for them may have developed. It may be that technical services like R&D, product design and engineering consultancy are simply not there for the software sector. This would have two results: firms would produce their own services to the extent that they saw the need and had the competence to do so; but they would use the services less, because they would not be responding to any marketing push – and indeed, might not even be aware that a particular service activity could be carried out. Firms in the study did not complain of the lack of availability of services. This could be because they preferred to produce them in-house or use their networks, or it could be because they did not even look to the market.

While this might not be an issue for the firms in the study, which are likely to be more innovative than the average for the industry, it could be a problem more broadly. If firms are not innovating, it could be partly because of a lack of supporting knowledge intensive services. The question of availability of services requires more study.

7.3 Policy implications

It is difficult to draw clear conclusions from this study, because the firms in it are not necessarily representative. Few firms pointed to problems in the provision of KISA as obstructions to innovation. To the extent that they saw problems, they were in the perennial area of finding capital for growth.

Comparisons between this study and others in the KISA project may highlight where the Australian innovation system for software differs from others, and where software differs from other industries. The dual nature of software firms as both knowledge intensive service providers and users of knowledge intensive services may make a difference to their use of KISA.

It would be useful to undertake further inquiry as to whether less innovative firms are constrained by a lack of access to KISA. This report pointed to some interesting differences between small and large firms which would also be worth exploring. The relationships of Australian software firms with multinational corporations, particularly as a source of KISA, could also be investigated. Some further work on whether the content of network KISA differs in significant ways from formally provided external KISA could be useful. And the popularity and effectiveness of the COMET program in providing knowledge intensive services to very early stage firms suggests that there may be room for more services tailored to later stage firms which are attempting to grow from small local to larger international players.

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Attachment 1

QUESTIONNAIRE PROTOCOL

This study of the software industry in Australia is part of an Australia-led OECD project on innovation in the software industry. The questionnaire below is designed to provide a broad picture of the different sources of expertise used by innovating firms in the software industry in Australia. It is designed to provide information on the broad parameters of organisations' decisions about where and how often in a product innovation process they choose to source particular services. The results of the survey will be used to provide a framework for selecting firms as candidates for a round of interviews to cover in detail how and when firms mix and match expertise from diverse sources at the different stages of the innovation process. We are asking for your contact details only if you are willing to participate in an interview.

The findings from the questionnaire and the results of the study will benefit the Australian software industry by improving its visibility and identifying its current capabilities and the innovation challenges faced. The analysis of the industry in innovation terms and in an international context will provide valuable information on the position of the industry in Australia in comparison with other OECD countries.

The questionnaire first asks for background information related to your firm and then seeks information related to your firm's access to and use of knowledge-intensive services such as research and development, expert advice or software publishing. The results of the research will not include names of individuals or organisations participating in this project. Please contact Dr Cristina Martinez, Senior Research Fellow at AEGIS (The Australian Expert Group in Industry Studies), email: c.martinez@uws.edu.au for further information on the project.

NOTE: This study has been approved by the University of Western Sydney Human Research Ethics Committee or Panel. The Approval Number is …… If you have any complaints or reservations about the ethical conduct of this research, you may contact the Ethics Committee through the Research Ethics Officers (tel: : 02 45 70 1136 or 02 4570 1688). Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.

AEGIS is a Research Centre of the University of Western Sydney. AEGIS can be contacted at:

University of Western Sydney

Level 8, 263 Clarence Street
Sydney NSW 2000
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Web: www.aegis.uws.edu.au

AEGIS AUSTRALIAN EXPERT GROUP IN INDUSTRY STUDIES

I. BACKGROUND

Name of firm/organisation:

Question 1: How many persons are employed by your firm/organisation?

- In house:
- Full Time:
- Part Time:
- As contractors:

Question 2: What is/are your firm/organisation's main product line/s? Please tick as many boxes as you need.

Running mainframes (corporate management software) ❑

Network management software ❑

Systems management software (real time) ❑

Personal user software (desktop) ❑

Web services software ❑

Graphic interface software ❑

Other (please indicate): ❑

Question 3: Is your firm/organisation owned by

Single owner/manager ❑

Partnership ❑

Private company ❑

Listed company ❑

Division or subsidiary of a larger business group ❑

Other (please indicate): ❑

Question 4: Is your firm/organisation:

Foreign owned/controlled ❑

Locally owned/controlled ❑

Question 5: Is your firm/organisation a *user* of:

Proprietary software ❑

Open software ❑

Both ❑

Question 6: Is your firm/organisation a *developer* of:

Proprietary software ❑

Open software ❑

Both ❑

II. INNOVATION ACTIVITY

This study focuses on your **Most Important Innovative Product** (MIIP – the term 'product' includes services). This may be for example, the one that you feel is the most radical or likely to constitute the signature *product* for your business in the future.

Question 7: What is the Most Important Innovative Product (MIIP) developed by your firm in the last 3 years?

Question 8: What distinguishes this product from others? Please tick all or any.

Offers additional functionality

Offers improved functionality

Offers better cost/performance ratio

Targets new markets

Other (please specify):

Question 9: How long did the innovation process for that product take before its sale to the first customer?

Less than 1 year	❑
1-2 years	❑
More than 2 years	❑

Question 10: How did you fund that product (your MIIP innovation)? Please tick all or any boxes.

Self-funding	❑
Family/friends	❑
Business angels	❑
Venture capital	❑
Government grants	❑
Customers (pre-paid funding)	❑

Question 11: If your organisation does not apply for government grants or R&D tax concessions, could you indicate the reasons? Please tick all or any boxes.

No information about relevant grants	❑
Preparation too costly in time and resources	❑
Low level of knowledge of referees	❑
Process takes too long	❑
Other (please specify):	❑

Question 12: Which of the services mentioned below did you use and how often did you access them when developing that product (MIIP). Please tick *one* box only for each line.

SERVICES	**None**	**Once or twice through the period**	**Monthly**	**Weekly**	**Daily**
1. IT industry development advice	❑	❑	❑	❑	❑
2. IT technical consulting services (systems development, customisation and integration)	❑	❑	❑	❑	❑
3. Software marketing services	❑	❑	❑	❑	❑
4. Research and development services	❑	❑	❑	❑	❑
5. IP-related (legal and accounting) services	❑	❑	❑	❑	❑
6. Management consultancy related to organisational aspects of product development (e.g. team creation)	❑	❑	❑	❑	❑
7. Engineering consultancy related to product or process development	❑	❑	❑	❑	❑
8. IT-related training services	❑	❑	❑	❑	❑
9. Employment agency supply of specific personnel	❑	❑	❑	❑	❑
10. Strategic and business plan development advice/service	❑	❑	❑	❑	❑
11. Other:	❑	❑	❑	❑	❑

Question 13: Who provided the following services for that product (MIIP)? Please tick *all boxes* that you need for each line.

SERVICES	**In-house**	**State Government**	**Federal Government**	**Universities /PSR***	**Private Sector Businesses**	**Industry Associations**	**Other**
1. IT industry development advice	❑	❑	❑	❑	❑	❑	❑
2. IT technical consulting services (systems development, customisation and integration)	❑	❑	❑	❑	❑	❑	❑
3. Software marketing services	❑	❑	❑	❑	❑	❑	❑
4. Research and development services	❑	❑	❑	❑	❑	❑	❑
5. IP-related (legal and accounting) services	❑	❑	❑	❑	❑	❑	❑
6. Management consultancy related to organisational aspects of product development (e.g. team creation)	❑	❑	❑	❑	❑	❑	❑
7. Engineering consultancy related to product or process development	❑	❑	❑	❑	❑	❑	❑
8. IT-related training services	❑	❑	❑	❑	❑	❑	❑
9. Employment agency supply of specific personnel	❑	❑	❑	❑	❑	❑	❑
10. Strategic and business plan development advice/service	❑	❑	❑	❑	❑	❑	❑
11. Other:	❑	❑	❑	❑	❑	❑	❑

*PSR = Other Public Sector Research Institutions, e.g. CSIRO.

Question 14: Where were the services providers located for your MIIP? Please tick *one* box only for each line.

SERVICES	**In-house**	**Local (within your City)**	**Regional (within the state)**	**National**	**International**
1. IT industry development advice	❑	❑	❑	❑	❑
2. IT technical consulting services (systems development, customisation and integration)	❑	❑	❑	❑	❑
3. Software marketing services	❑	❑	❑	❑	❑
4. Research and development services	❑	❑	❑	❑	❑
5. IP-related (legal and accounting) services	❑	❑	❑	❑	❑
6. Management consultancy related to organisational aspects of product development (e.g. team creation)	❑	❑	❑	❑	❑
7. Engineering consultancy related to product or process development	❑	❑	❑	❑	❑
8. IT-related training services	❑	❑	❑	❑	❑
9. Employment agency supply of specific personnel	❑	❑	❑	❑	❑
10. Strategic and business plan development advice/service	❑	❑	❑	❑	❑
11. Other:	❑	❑	❑	❑	❑

Question 15: Where does your firm sell any of the following knowledge intensive services to other firms along with this product (MIIP)? Please tick all or any boxes.

SERVICES	**❑Local (within your City)**	**❑Regional (within the state)**	**❑National**	**❑International**
1. IT industry development advice	❑	❑	❑	❑
2. IT technical consulting services (systems development, customisation and integration)	❑	❑	❑	❑
3. Software marketing services	❑	❑	❑	❑
4. Research and development services	❑	❑	❑	❑
5. IP-related (legal and accounting) services	❑	❑	❑	❑
6. Management consultancy related to organisational aspects of product development (e.g. team creation)	❑	❑	❑	❑
7. Engineering consultancy related to product or process development	❑	❑	❑	❑
8. IT-related training services	❑	❑	❑	❑
9. Employment agency supply of specific personnel	❑	❑	❑	❑
10. Strategic and business plan development advice/service	❑	❑	❑	❑
11. Other:	❑	❑	❑	❑

Question 16: Which of the following activities did you undertake within your organisation for your MIIP?

ACTIVITIES	Yes	No
1. Research and development	❑	❑
2. Commissioned research and development	❑	❑
3. Acquisition of hardware and equipment linked to technological innovations	❑	❑
4. Acquisition of software and other external technology linked to technological innovations	❑	❑
5. Preparations* to introduce new or significantly improved services or methods to produce or deliver them	❑	❑
6. Training directly linked to technological innovations	❑	❑
7. Market introduction of technological innovations	❑	❑
8. Other innovation related activities (please indicate):	❑	❑

*Preparations include activities aimed at defining procedures, specifications and operational features (including final tests) for the introduction of innovations.

Question 17: Which types of innovation partners did your firm/organisation have for your MIIP?

INNOVATION COOPERATION	**Yes**	**No**
1. Other firms within the same industrial group	❑	❑
2. Competitors	❑	❑
3. Customers	❑	❑
4. Consultancy firms	❑	❑
5. Suppliers of equipment, material, components or data programs	❑	❑
6. Universities and colleges	❑	❑
7. Public or private non-profit research institutes	❑	❑
8. Industry associations	❑	❑
9. Other:	❑	❑

Please rank the 3 most significant for your MIIP.

Question 18: Please indicate the type of collaboration structure used when developing your MIIP.

More formal structure (eg formal strategic alliances, joint venture, partnerships)

More informal arrangements only

Other (please indicate):

Question 19: Please indicate your principal sources of information or ideas for the innovation process of your MIIP. Please tick only *one* box in any line.

SOURCES OF INFORMATION	Not relevant	Small importance	Medium importance	Great importance
1. Within the firm	❑	❑	❑	❑
2. Other firms within the same industrial group	❑	❑	❑	❑
3. Competitors	❑	❑	❑	❑
4. Customers	❑	❑	❑	❑
5. Consultancy firms	❑	❑	❑	❑
6. Suppliers of equipment, material, components or data programs	❑	❑	❑	❑
7. Universities and colleges	❑	❑	❑	❑
8. Public or private non-profit research institutes	❑	❑	❑	❑
9. Public patent documents	❑	❑	❑	❑
10. Conferences, meetings, professional periodicals or journals	❑	❑	❑	❑
11. Data based information networks as for instance the internet	❑	❑	❑	❑
12. Fairs and exhibitions	❑	❑	❑	❑
13. Industry Associations	❑	❑	❑	❑
14. Other (please indicate):	❑	❑	❑	❑

III. INNOVATION CHALLENGES AND OPPORTUNITIES

Question 20: Please indicate which of the following factors **most commonly** constituted a challenge for your innovation process.

INNOVATION BARRIERS	**Yes**	**No**
1. Great economic risk	❑	❑
2. High innovation costs	❑	❑
3. Lack of appropriate financing possibilities	❑	❑
4. Organisational management resources	❑	❑
5. Lack of skilled personnel	❑	❑
6. Lack of technological information	❑	❑
7. Lack of market information	❑	❑
8. Strict standards and regulations	❑	❑
9. Lack of interest for new products and processes amongst customers	❑	❑
10. Competitors	❑	❑
11. Management structure	❑	❑
12. Other (please indicate):	❑	❑

Question 21: Has your organisation faced major challenges in accessing knowledge developed by others for your innovation activities? Please tick only *one* box in any line.

CHALLENGES	**Never**	**Sometimes**	**Systematically**	**Do not know**
1. Refusal to license (patents, copyrights) by other firms	❑	❑	❑	❑
2. Requirements to enter in cross-licensing agreements to get a license from other firms	❑	❑	❑	❑
3. Refusal to transfer know-how by other firms	❑	❑	❑	❑
4. Other (please indicate):	❑	❑	❑	❑

Comments:

Question 22: Does your organisation make use of any of the following methods to protect knowledge developed in-house? Please tick only *one* box in any line.

METHODS	**Never**	**Sometimes**	**Systematically**	**Do not know**
Formal Methods 1. Registration of design	❑	❑	❑	❑
2. Trademarks	❑	❑	❑	❑
3. Copyright	❑	❑	❑	❑
4. Patents	❑	❑	❑	❑
5. Others, please specify:	❑	❑	❑	❑
Informal methods 6. Secrecy	❑	❑	❑	❑
7. Complexity of design	❑	❑	❑	❑
8. Speed to market	❑	❑	❑	❑
9. Others, please specify:	❑	❑	❑	❑

Is there anything else about your innovation development process you would like to point to?

If you are willing to be contacted for an interview, please give us your name and contact details.

Name of respondent:

Position:

Contact details:

Address:

Telephone:

Email:

THANK YOU FOR YOUR COLLABORATION

Appendix 2

INTERVIEW PROTOCOL

Background

Australia is the lead country in an OECD/TIP project on Knowledge-Intensive Service Activities (KISA) in which AEGIS is the lead organization. KISA is a three year project in which up to 12 countries are involved in different segments of the overall package of studies. At the TIP KISA Focus Group meeting of June and December 2002 countries decided that the studies of each sector involved would have four components: a statistical 'context' which sets the scene for understanding the size and shape of the industries; a presentation of all relevant public polices targeted for the development of the industries or more generic ones that could be used by industry participants. It was further decided that component three would be an empirical study. The fourth is discussion of the implications of the findings of the KISA project for policy development in participating countries.

The empirical study

The empirical study is in two parts. The first part was a study of firms to investigate the extent to which and the ways in which the assistance (e.g. programs and services) potentially available is in fact utilised by firms.

The second part, which is starting now, is a series of interviews with firms in each sector to map the ways in which they weave together knowledge-intensive services provided by the public sector and by different fields of the private sector. This is an essential prerequisite for understanding the ways in which firms mix and match the innovation services available to serve their innovation purposes at any given point of time and to see whether these needs vary according to the kinds of innovation undertaken (process, product or organisational change) and the market shifts associated with the innovation.

The aim of the empirical element of KISA is to use the detail which can be gathered through interviews in conjunction with the results of the broader survey to inform policy and guide new policy choices in different industries. The aim is thus to map major aspects of innovation in firms in the industries selected for study, aspects never before investigated in detail but essential to good innovation policy.

The first industry selected by TIP for the KISA study is software. The first two steps of the study of that industry have been completed and an on-line survey is currently available for companies to complete.

We are interested in how companies mix and match their internal activities with those provided by external organizations to make new products and services. We are also interested in exploring company 'capabilities'. Companies are made up of a set of skills, materials and equipment. They can be developed in-house or brought in to enhance existing capabilities. Companies may, for example, have in-house capabilities for product development but need to purchase research expertise.

Interview Protocol

The focus of the interviews is discussion about how your firm ' does things' relating to innovation and how you would prefer to do them. For example, you could tell us about gaps in your organisation in terms of the knowledge you need or gaps in the suitability of external

assistance in terms of government programs available. We would like to understand what the key issues are in the provision of expertise to facilitate innovation in your firm and in your industry and what, if anything, government programs could do to assist. **Note: The word 'product' includes services.**

INTRODUCTION: These questions relate to your firm and its customers

1. Could you tell me a little bit about your background in the software industry? If you are the founder/owner of the business, when was it created? (If the owner, where were you working before (large /small firm in the industry, public sector eg as a researcher, new graduate)?

2. You have told me that your MIIP is X and that its main differentiating characteristic from other products on the market is. Does this mean that your innovation is mostly making incremental changes? Or was it a radical new innovation? [If yes, ask about these and their genesis].

3. What are your three largest clients? Over the last year what proportion of your sales go to them?

4. Is your relationship with these clients short or long-term? Is your relationship with these clients critical to innovation in your firm eg work closely with you to tell you about what they need, suggest fundamental changes to product; supply you with new knowledge about markets, technical matters, associated products with which you must work and which influence your products?

THEME A: These questions are designed to explore issues concerning the **use that firms made of knowledge-intensive services** in relation to one (or more) of their most important innovations.

5. In relation to your MIIP did you seek out external expertise? If you did not seek out external expertise, why not? What sources of external expertise did you use?

    - IP advisors
    - R&D agencies such as universities
    - Venture capital partners
    - Large firms, eg multinationals

6. Why did you look externally rather than internally? If yes or no, was this part of a strategic plan or decision about the way the firm does business?

    Are you planning to develop expertise internally that is currently sourced externally?

7. Did you receive from the external service providers what you expected/needed? If not, what could the provider have done to improve the services actually received?

8. Thinking about the innovation process from development to sales, does your company have a standard list of external services that are utilized at different stages of the innovation process? In other words, is the use of external services part of a standard operational procedure in the development of innovative products? Please provide examples from your MIIP.

9. In developing your MIIP did you apply for assistance from any government programme such as R&D tax concessions or technology diffusion programme? If not, why not?

    Did you have any difficulties identifying or accessing these programs? Did these programs meet your expectations of them say in reducing costs, cutting development time; improving your capabilities? If not, why not? How can these programs be improved?

THEME B: These questions explore **how firms integrate** different sources of expertise, such as the management and coordination of the resources needed for product development or other forms of innovation – design, production, marketing/sales, R&D, skills, capital, IP protection.

10. When your company requires different types of innovation-related expertise how do you 'mix' this expertise received from different sources to obtain the required results? Do you, for example, use a consultant to put it together?
11. Do you try to develop a long-term relationship with your external sources of expertise by using them on more than one project or sharing technology and staff? Or do you use different external sources on each project?

THEME C: These questions explore how firms **build capability** through the use and integration of expertise to improve their capability for future innovations

12. Which of the following do you consider to be your organization's most important innovation-related strengths/capabilities? eg R&D, Intellectual Property (IP) management, marketing
13. Which **new** capabilities do you feel you should have in-house for the future for:
    - New product development
    - New market development
    - Other innovation, for example organizational change & skill base

    Why these?
14. Do you build capability through interaction with major clients or large multinational companies (MNCs)? Are you part of a network or do you collaborate with MNCs or is your relationship driven by one-off projects?
15. Regarding your interaction with universities and research institutes, what kinds of activities did you undertake with them in developing the MIIP? Is that interaction short or long term?
16. What structures does your company use to transform the new knowledge gained from product/service development into your firm's long-term capabilities. In other words, how do you ensure that knowledge and experience gained from one project is used on later projects. How is this experience and knowledge retained and diffused across your organisation? For example do you use:
    - Committees
    - Working groups
    - Task forces
    - Mailing lists
    - Circulation of reports
    - Weekly meetings/seminars
    - Company newsletter
    - Specific training
    - Take on new staff
    - Buy new equipment
    - Other?
17. Is there any other informal way that is used to transfer knowledge in your company?
18. Finally we would like to know what you think are the most innovative aspects about your MIIP?

THANK YOU VERY MUCH FOR YOUR HELP WITH THIS STUDY

Attachment 3

Profile of firms interviewed

	Firm Life cycle	Main product line	HQ
Micro businesses (4 or less persons)			
Firm 5	Professional Management (5 yrs)	Personal user software (desktop)	VIC
Firm 21	Professional Management (3 yrs)	Systems management software	NSW
Firm 17	Professional Management (4 yrs)	Business information processing development	NSW
Firm 19	Professional Management (4 yrs)	Systems management software (real time)	NSW
Firm 20	Professional Management (6 yrs)	Web services software	NSW
Firm 35	Entrepreneurial (2 yrs)	Personal user software	ACT
Firm 38	Professional Management (3 yrs)	Personal user software	NSW
Firm 26	Professional Management (9 yrs)	Personal user software (desktop)	VIC
Firm 40	Expansion (17 yrs)	Personal user software	SA
Firm 10	Professional Management (5 yrs)	Web services software	VIC
Firm 22	Professional Management (5 yrs)	Systems management software, personal user software, graphic interface software	SA
Firm 32	Professional Management (6 yrs)	Web services software	NSW
Firm 28	Expansion (12 yrs)	Network and systems management software	VIC
Firm 25	Expansion (18 yrs)	Personal user software	NSW
Small businesses (5 to 19 persons)			
Firm 36	Professional Management (8 yrs)	Wireless & Database	NSW
Firm 37	Professional Management (4 yrs)	Personal user, web services and graphic interface software	NSW
Firm 27	Expansion (22 yrs)	Running mainframes (corporate management software)	NSW
Firm 1	Professional Management (5 yrs)	Transaction Capture Appliances and BackOffice Management	VIC
Firm 41	Professional Management (5 yrs)	Search engine software	SA
Firm 33	Expansion (16 yrs)	Systems management, personal user, web services, graphic interface.	VIC
Firm 13	Professional Management (5 yrs)	Web services and graphic interface software	NSW
Firm 7	Professional Management (3 yrs)	Embedded systems and bluetooth	VIC
Firm 8	Professional Management (4 yrs)	Personal user software	NSW

	Firm Life cycle	Main product line	HQ
Firm 2	Professional Management (5 yrs)	Web services software	VIC
Firm 9	Entrepreneurial(2 yrs)	Personal user software	NSW
Firm 29	Professional Management (3 yrs)	Web services software, application templates	SA
Firm 14	Expansion (22 yrs)	Financial modelling software	NSW
Firm 11	Expansion (23 yrs)	Web services software	NSW
Firm 23	Professional Management (8 yrs)	Web services software	NSW
Firm 3	Professional Management (3 yrs)	Education and Delivery	VIC
Firm 34	Professional Management (9 yrs)	Systems management and web services software	NSW
Medium and large companies (20 or more persons)			
Firm 31	Expansion (13 yrs)	Personal user and web services software	NSW
Firm 4	Professional Management (7 yrs)	Visual communications within the healthcare and education industries	NSW
Firm 18	Professional Management (6 yrs)	Web services software	NSW
Firm 24	Professional Management (6 yrs)	Systems management and web services software	NSW
Firm 15	Professional Management (8 yrs)	Personal user software	QLD
Firm 30	Professional Management (7 yrs)	Enterprise Chargeback Applications	VIC
Firm 6	Expansion (34 yrs)	Web services and graphic interface software	VIC
Firm 39	Professional Management (4 yrs)	Integrated Governance tools	NSW
Firm 16	Professional Management (8 yrs)	Professional services	NSW
Firm 12	Professional Management (4 yrs)	Running mainframes (corporate management software) Network management software Systems management software (real time) Personal user software (desktop) Web services software Graphic interface software Security, Storage, Web/Portal	VIC

Source: AEGIS KISA Interview data, 2003

Attachment 4: Interview Guide

BACKGROUND

This is an interview guide which contains some set questions and some starting points for discussion of issues. The depth of discussion on the issues raised in the guide will depend to some extent on the company that is being surveyed. However, during the interview it is expected that the majority of factual questions will be answered. The first section of the guide seeks answers to factual questions about the company while the next section analyses use of KIBS in a range of areas within the firm.

BACKGROUND INFORMATION ON THE FIRM (MOSTLY OBTAINED PRE-INTERVIEW)

1. Date firm established/registered

2. Ownership (name of parent)

3. Location of owner

4. No. staff (FTE)

6. Describe the most recent product/service launched in the past 2 years

_____

7. Describe any management-determined changes in rules/procedures or business processes intended to improve production systems or service delivery in the past 2 years?

_____

8. Describe and changes in selection and training policies or HR management practices intended to improve production systems or service delivery in the past 2 years?

_____

9. Describe any modifications to equipment/facilities or work units which have been intended to improve production/service delivery in the past 2 years

_____

In general, what barriers were faced in implementing these changes?

_____

10. What is the firm's primary competitive strategy? (for example...)

a) Introduce new products/services ahead of competitors
b) Offer higher quality products/services than competitors
c) Offer customised products/services for customers
d) Offer quick service/turn-around
e) Offer lower prices on comparable products/services cf competitors
f) Stick to a small market were there is little competition
g) Other

USE OF KNOWLEDGE INTENSIVE BUSINESS SERVICES

11. From where does the firm obtain its services on each of the following items? (Identify High medium and low importance, or N/A)

Activity	External firm	R&D Instn	Other Extnl orgn (F/I)**	In-house (staff)	Board	Is service tailored, routine, compliance or other?
Business planning						
Legal services						
Acctg/Financial services						
Capital Raising						
Technology awareness						
Technology trends						
Formal R&D						
Market research						
Product/service development services						
Project management						
Outsourced operations						
Marketing/promotion*						
Sales & distribution						
Export strategy						
Establishing offices overseas						
Performance benchmarking						
Networking services						
Recruitment services						
Accreditation/quality management						
Standards						
Training services						

* incl. e-commerce

** incl. government organisations such as business enterprise centres, government grants

For <u>each</u> of those above that are outsourced (KIBS, R&D, other), why is this? Discuss

Impediments to use of outside providers
Importance of outsourced providers
Impact of external providers on learning
Types of providers
Impact on innovation capacity
Impact on innovation performance
Is the service simply outsourced or is it a collaborative arrangement?
How is the knowledge shared?

DRIVERS FOR INNOVATION

12. How frequently do you need to bring out new products/services? What determines the timing?
13. What are the main drivers for innovation (for example, customers, suppliers, new regulations, competitors, staff, management...)
14. Of those listed in Q12, which is the most sophisticated innovation driver and what demands does it make on the firm?
15. If the main innovation driver is within the firm, what is the reason for this?
16. Describe the main customer base for the firm (e.g. large number of end-consumers, mix of firms and consumers, small number of government clients)
17. What proportion of your customers are
    a) From your local region?
    b) From other areas within your State?
    c) From other areas of Australia?
    d) From overseas?
18. Do customers from different regions have different needs/characteristics which require you to modify your products/services for these groups? (if yes, how to you meet this challenge)?
19. What other stakeholders do you need to work with (or at least be aware of) to ensure your business is successful? (e.g. govt for regulatory issues)
20. What is the balance of small (incremental) and step-change (radical) innovations in the firm?
21. Have small (minor) business changes led to significant competitive advantages over competitors? (if yes, expand)

KNOWLEDGE ACQUISITION

22. What continuing arrangements or procedures are there for seeking new ideas or business improvement information from external sources?
23. How does the firm develop a balance between choosing to acquire new technologies to support innovation and choosing to introduce new management practices or training to support innovation?
24. How has the firm structured itself to be able to respond to external opportunities?
25. What is the balance (by value) of all <u>services</u> sourced from outside the firm vs internal costs? (is easily available)

TRANSFORMING INTERNAL PROCESSES

26. How have the changes identified in affected the business? (e.g. productivity improvements, new markets, exports, lower costs)
27. What management practices help to support the process of innovation within the firm?

28. How important are existing vs new personal contacts in deciding to implement an innovation?
29. How does the firm establish internal procedures to ensure that knowledge brought in from external service providers is maintained within the firm?

IMPACTS ON STAFF OF INNOVATION

30. Where do you look to find employees that you most rely on for business changes and improvements (vs KISA)?
31. How do you ensure employees are trained to deliver new innovations in product and services to your customers?
32. Do you maintain company practices or procedures that enable you to benefit from ideas brought forward by other employees?
33. What are the relative roles of staff skills and knowledge, and formal procedures in each of the above questions?