Knowledge Intensive Service Activities in the New Zealand Software Industry

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Executive Summary

Why Study KISAs

This report is about Knowledge Intensive Service Activities (KISAs) in the New Zealand software industry.

A KISA is an expert service that firms use to enhance the value of their existing activities. Innovation is one such activity that uses KISAs.

Understanding how firms access and use the variety of innovation-related KISAs, available to them, in different industries, at different times, will help policy makers in the design of targeted policies and programmes to actively stimulate innovation across them.

About this Report

This report on KISAs in the New Zealand software industry will contribute to an OECD study of many nations on KISAs. It is a summary report and uses the results of published studies and surveys, together with focused interviews to address themes agreed upon by the KISA Focus Group of the TIP Working Group.

Main Preliminary Findings

Innovation is very problem-focused and while collaboration across the sector is developing and is desirable, at present, firms innovate without collaboration.

The challenges for innovation are generally symptomatic of the size of the firms: access to capital, costs of regulatory compliance, costs of market intelligence and networking for learning. One major challenge is the shortage of skilled experienced commercialisation agents with international networks, as well as skilled general managers and marketers.

As for future policy to support innovation in the software industry, it's clear that the following actions - some already in progress - could help lessen some of the barriers to innovation:

- building learning networks across the sector;
- supporting platforms that utilise public and private research skills and efforts;
- supporting clustering activity to build critical mass of firms to encourage suppliers of specialist services for software firms; and
- facilitating links between software firms and large scale firms.

Contents

Chapter 1   Introduction

1.1   What is a KISA

This report is about Knowledge Intensive Services Activities (KISA) in the New Zealand software industry.

A KISA is an expert service that firms use to enhance the value of their existing activities[1]. Being an expert service, it's "knowledge intensive". We focus here on "activity" that firms "demand" themselves rather than what they "supply" to others. KISAs in a firm are a combination of in-house expertise and external expertise. KISAs include: R&D services, management consulting, human resources management, intellectual property services, accounting and legal services.

While innovation requires a great deal of KISAs it does not consist entirely of KISAs. Conversely, some KISAs are used by firms for non-innovation purposes. Some KISAs relevant to innovation activity are: R&D services, intellectual property protection, market intelligence, and creating knowledge networks.

Understanding how firms access and use the variety of innovation-related KISAs, available to them, in different industries, at different times, will help policy makers in the design of targeted policies and programmes to actively stimulate innovation across them.

Comparing KISAs and innovation-related programmes and policies across nations will create lessons on important nation-specific features of KISAs and of international best practice.

1.2   Interactions, NIS, and Innovation

KISAs are interactions of people, firms and institutions. National innovation systems (NIS) describe the interactions of firms, people and institutions and recognise that these interactions at the firm-level determine the effectiveness of a firm's innovation activity. As policy makers in many countries assess their policies to support innovation, they are increasingly aware of the importance of interactions within innovation systems.

Better understanding of how policies enable firms to access and use KISAs will make for better innovation policy. This will enhance innovation, where these activities are relevant to innovation. Since KISAs are important for innovation, they are also important for a nation's economic growth for which innovation is a key driver.

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[1] More succinctly, KISAs are defined as production and integration of service activities undertaken by firms in manufacturing or service sectors, in combination with manufactured outputs or as stand-alone services, OECD DSTI/STP/TIP(2003)11.

1.3 KISA and Innovation

The experts who provide the KISAs can be "internal" (employed by the firm) or "external" (specifically contracted-in for the KISA).

Many businesses – including legal, accountancy, research and development consultancy, personnel recruitment and training services – are examples of knowledge-intensive business services ("KIBs"). Private sector firms providing these services are called KIBs firms[2] and are recognised as important participants in the innovation.

Firms themselves develop internal KISAs as part of their long-term capabilities.

In New Zealand, the government's policies and programmes assist firms to access external KISAs and to develop their own internal KISAs. New Zealand's publicly-funded crown research institutes (CRIs) and universities provide innovation-related expertise that firms access with private funding, government support and through collaborations.

1.4 About this Report

The report has three parts, as prescribed by the project plan of the KISA Focus Group, plus an introduction and conclusions:

Chapter 1: Introduction

Chapter 2: Overview of the New Zealand software industry.
This illustrates the size and diversity of the software industry – drawing on national statistics:
- the R&D Survey, 2002;
- the Innovation Survey 2002; and
- Statistics on Information Technology in New Zealand, 2003.

Chapter 3: Policies and Programmes that Support Industry Innovation
This outlines the government's policies and programmes – as set out in various government papers.

Chapter 4: Knowledge Intensive Service Activities in the Software Sector
This reports KISAs supporting innovation in software firms – using findings of:
- "The High-tech Sector in Canterbury: A Study of its Potential and Constraints"[3] - called the "Canterbury report" in this paper;

    http://www.nzte.govt.nz/common/files/canterbury-hitech-report.pdf

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[2] See for example Miles et al, 1995, 2001.
[3] Prepared for New Zealand Trade and Enterprise by Caroline Saunders and Paul Dalziel, http://www.nzte.govt.nz/common/files/canterbury-hitech-report.pdf.

- "No Wires – No Limits", an industry analysis of New Zealand's mobile and fixed wireless sector[4] - called the "NWNL report" in this paper;

http://www.nzte.govt.nz/common/files/nowires-nolimits.pdf

- "A Survey of Software Development Practices in the New Zealand Software Industry"[5]

http://csdl.computer.org/comp/proceedings/aswec/2000/0631/00/0631toc.htm

Chapter 5: Conclusions

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[4] Prepared for New Zealand Trade and Enterprise by MediaLab South Pacific Inc. with Innovation & Systems Limited.

[5] By Lindsay Groves, Ray Nickson, Greg Reeve, Steve Reeves, and Mark Utting.

Chapter 2   Overview of the New Zealand Software Industry

2.1   Introduction

This chapter presents statistical information about the software industry in New Zealand.

It looks at the software industry's:
- production, employment and size;
- innovation activities;
- barriers to innovation;
- information sources; and
- use of intellectual property instruments.

2.2   Overview of Production, Employment and Size

A large number of small-sized firms and a small number of large firms characterise both the software industry and the wider New Zealand ICT industry. The labour productivity within software firms is high as are productivity growth predictions for them. Software firms make an important contribution to the knowledge economy through their development of human capital.

It is estimated[6] that there are currently 7,544 ICT firms with annual sales of less than NZD5 million and 171 with sales above. The industry is highly concentrated; 84 companies with annual sales that exceed $20 million generate approximately 75% of the sector's contribution to GDP and 64% is generated by 16 companies with annual sales that exceed $100 million. New Zealand-based activities of multinationals currently comprise approximately half of the 16 companies that have a turnover exceeding $100 million per annum.

In New Zealand with a nominal GDP for 2002 of NZD122,300 million, software sales in 2002 amounted to NZD822.3 million up 36% from NZD604.6 million in 1998. Exports of software comprised NZD121.2 million of the 2002 figure[7].

There are currently 81,943 people employed in an IT-related occupation[8]. This includes people who are employed in an IT occupation and/or people employed in the IT industry. This represents 4.7% of the working population – up from 59,091, 4.2% in 1991. The annual average growth rate over this period is 3.9%.

The Canterbury study finds that the productivity per employee of the software companies surveyed is about NZD141,000 compared to the New Zealand average of NZD61,280, including NZD41,200 in the retail/wholesale sector, NZD55,900 in agriculture, forestry and fishing, NZD60,750 in manufacturing

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[6] This is an excerpt from the ICT Taskforce Report p11.
[7] Information Technology Survey, 2003, Statistics New Zealand.
[8] Information Technology Statistics in New Zealand, 2003, Ministry of Economic Development.

and NZD148,000 in services. In this study the software firms were asked to predict their annual revenue and employment over the next five years. Their forecasts, perhaps unrealistically, imply a sharp rise in productivity from NZD141,000 per employee in year 1 to NZD369,000 in year 5.

Among the conclusions of the Canterbury study, the authors found that the high tech sector has a significant economic impact both locally and nationally. They contribute to the development of the knowledge economy in New Zealand, particularly through the development of human capital associated with them and their suppliers. This can be illustrated by the number of training days in the firms surveyed, which is currently 21,922 person-days, predicted to rise to 56,376 person-days in five years. Moreover, the authors found that expenditure growth on research and development, which keeps the sector up-to-date in world markets, was reported to be at least 15 percent for the next five years.

2.3   Innovation Activities

Approximately 196 firms in computer and related activities are estimated to have spent NZD62.4 million[9] on R&D in 2002[10]. This is about 7.6% of total ICT sales of NZD822.3 million for firms in New Zealand. Of the 196 firms, 27 firms with 50 or more employees, spend NZD30.8 million. This is consistent with New Zealand having only 171 ICT firms with sales above NZD5 million.

It is estimated that 613 people, including 397 researchers were involved in business R&D for computer and related services in New Zealand, in 2002. These figures comprise 14.8% of the 4,152 total personnel in business R&D, and 15.9% of the 2,490 total researchers in business R&D.

2.4   Barriers to Innovation

As Table 1 indicates, all software firms face difficulties in accessing capital and attracting specialist staff. Innovation for 15 to 25 percent of firms is not seen as a core business activity. For small firms, lack of knowledge about market problems is clearly a barrier, reflecting the critical mass required for firms to sustain continuous innovation.

2.5   Sources of Information

Table 2 shows that the firm owners and competitors are important sources of information for innovation. Books, trade journals conferences and shows are similarly important. These results reflect a style of innovation that adapts existing technologies to provide customised solutions.

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[9] This is approximately equivalent to USD 28 million in 2000 adjusting for purchasing power parity.
[10] Research and Development in New Zealand, 2002, Statistics New Zealand.

2.6   Use of Intellectual Property Instruments

Table 3 shows that supply agreements with customers as well as copyright and trademark are the preferred means of protecting intellectual property. This reflects the nature of the software produced – ad hoc and customer focused.

Table 1
Barriers to Innovation by Size of Business
(% respondents)

	Business Size (Employees)		
	6 to 19	**20 to 49**	**50+**
lack of access to capital	44.12	57.69	31.25
market too small or unknown	23.53	c	c
economic climate	23.53	19.23	25
competition activity in the same market	11.76	c	c
outside core business activity	20.59	15.38	25
lack of, or unable to obtain, skilled staff	32.35	30.77	31.25
government policy	5.88	c	c
none of the above	8.82	23.08	18.75

Note "c" denotes confidential data
Source: Innovation Survey 2002, Statistics New Zealand

Table 2

Sources of Information (% respondents)	not important	somewhat important	very important	somewhat or very important	don't know	non-response
competitors	11.29	53.94	29.23	83.17	1.31	4.23
NZ owners and associate companies	28.02	29.82	31.96	61.78	3.43	6.77
overseas owners and associate companies	31.43	24.82	26.92	51.74	7.05	9.78
industry or employer associations	50.99	28.85	10.57	39.42	1.31	8.28
other research institutes, associations or consultants	46.85	31.39	11.29	42.68	2.12	8.36
universities or polytechnics	63.56	24.12	0	24.12	2.73	9.59
books, trade journals, conferences or shows	14.51	52.12	23.5	75.62	2.12	7.75
banks, accountants or consultants	70.35	13.71	4.23	17.94	2.73	8.98
Trade New Zealand (now NZTE)	72.29	13.9	0.7	14.6	4.13	8.98
Technology New Zealand	61.29	17.85	5.63	23.48	4.13	11.1
Industry New Zealand (now NZTE)	73.27	7.99	2.82	10.81	4.83	11.1
Government Departments	78	7.47	0	7.47	3.43	11.1

Note "c" denotes confidential data
Source: Innovation Survey 2002, Statistics New Zealand

Table 3
Use of IP Instruments by Innovators
(% respondents)

copyright or trademark	44.91
registration of design	c
secrecy	22.76
supply agreement	41.43
reaching the market first	28.85
complexity	15.49
patents	9.48
none of the above	27.65

Note "c" denotes confidential data
Source: Innovation Survey 2002, Statistics New Zealand

Chapter 3   Policies and Programmes that Support Industry innovation

3.1   Introduction

This chapter is about policies and programmes in New Zealand that support the Information and Communication Technologies (ICT) sector generally, including the software industry.

Further details can be found from the following agencies that are responsible for administering the programs.

- Ministry of Economic Development http://www.med.govt.nz
- New Zealand Trade and Enterprise http://www.nzte.govt.nz
- Ministry of Research, Science and Technology
  http://www.morst.govt.nz
- Foundation for Research, Science and Technology
  http://www.frst.govt.nz
- Ministry of Education http://www.minedu.govt.nz

In general the Growth and Innovation Framework provides a focus for government policies and programs for the ICT sector. The ICT Taskforce (see below) has provided useful advice to develop new initiatives. This builds on existing major initiatives that are specifically for ICT. It is supplemented by generic programs for which ICT R&D and business support is available.

The chapter is set out as follows:

3.2   The Growth and Innovation Framework
3.3   R&D programmes
3.4   Infrastructure underpinning Innovation Capability
3.5   Innovation Capability in Firms
3.6   Knowledge and Mobility of Human Resources
3.7   Standards and Regulation
3.8   Global Marketing and Exporting
3.9   Intellectual Property Protection
3.10   SMEs: Entrepreneurship and Development
3.11   Commercialisation of New Products

3.2   The Growth and Innovation Framework
http://www.beehive.govt.nz/innovate/innovative.pdf

The New Zealand Government has set out a "Growth and Innovation Framework" (GIF) for innovation to achieve its economic and social goals. The Government is proactive in supporting growth, will work co-operatively with other sectors to achieve that, and will emphasise the importance of sustainability.

There are two key aspects to building an economy capable of sustaining the higher growth rates needed:

- Strengthening the Foundations[11]; and
- Building Effective Innovation.

For Building Effective Innovation, the government is concentrating its policies and resources in four areas:

- Enhancing the existing innovation framework.
- Developing, attracting and retaining people with exceptional skills and talents who are able to innovate and so contribute to increasing our overall productivity;
- Increasing our global connectedness.
- Focusing innovation initiatives in areas which can have maximum impact.

The government has identified three areas[12] that have both the potential to grow in their own right and, because of their horizontal nature, positively improve productivity across the economy. These areas are:

- Biotechnology;
- Information and Communications Technology; and
- Creative Industries (design and screen production).

Four taskforces were set up to look into how best to develop these three sectors. They highlighted bottlenecks and identified ways to remove them. New Zealand Trade and Enterprise co-ordinated the taskforces, with support from other government agencies. The government has set aside $110 million[13] over four years to respond to the recommendations from the four sector taskforces.

The ICT Taskforce[14] has produced a report with a number of recommendations for the government to consider. It identified two main barriers to growth in the ICT sector in New Zealand. These are: (i) access to capital and (ii) retention of key people. It discussed a number of relevant regulatory issues, including taxation and security issues, and compliance costs, and considered whether any adjustment in these areas would be desirable.

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[11] Policies will be aimed at sustaining: (i) macroeconomic settings; (ii) openness; (iii) social cohesiveness; (iv) healthy people; (v) high skill levels; (vi) sound environments; (vii) global connectedness; solid R&D framework.
[12] http://www.nzte.govt.nz/industry
[13] $1 = USD0.64 approximately.
[14] http://www.industrytaskforces.govt.nz/ict/documents

3.3 Research and Development Programs and Service Technologies

3.3.1 Research and Development Programs

The main programs for the Government (non-university) investment in R&D relevant to the ICT sector are:

- "Technology New Zealand" ($44.056m): to increase the ability of firms to adopt new technology and to apply technological learning and technological innovation for business growth;
- "New Economy Research Fund" ($63.884m): to support researcher-led innovation in areas of new emerging industries; and
- "Research for Industry" ($185.035m): to increase the competitiveness of industry and sectors

In these and other programs, the Government invests about $32m for the ICT sector and co-investment by the private sector is actively encouraged.

As part of Research for Industry" the Government invests in "Research Consortia" ($8.55m) to facilitate public/private research partnerships that provide early user engagement and increase private investment in New Zealand. The investment is made through user-led Research Consortia in partnership with private sector providers, public research institutes and universities. Proposals for two ICT research consortia with funding of about $2.4m are being assessed.

3.3.2 Access to New Technology

The following initiatives aim to assist the service sector with technology for services.

The **E-commerce Action Team (ECAT)**, was made up of industry and business leaders and experienced e-commerce individuals. It worked on raising awareness of e-commerce issues across the broader community represented by its members and identified ways of meeting specific sector needs.

. A key objective of ECAT was to promote the establishment of additional regional or sector based E-commerce Action Teams and to support existing groups.

While ECAT concluded in June 2003, it led to specific initiatives for SMEs[15] and in supporting the ICT sector generally.

The **ECAT website** (www.ecat.govt.nz) was developed as a key

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[15] Refer section 3.10

instrument to support business and the wider community to build their e-commerce capability and develop support networks.

The **ECAT Network** was launched in June 2001 and provided a channel for businesses, non-profit organisations and individuals to share their experience and interest in e-commerce.

ECAT has been involved in the development of a comprehensive e-capability program in partnership with New Zealand Trade and Enterprise.

Among many activities, ECAT:

- commissioned research and statistics on ICT in New Zealand;
- supported the development of the regional broadband forum;
- held a Sector Leaders Forum; and
- developed an "e-farming" initiative for New Zealand farmers.

3.4   Infrastructure underpinning Innovation Capability

3.4.1 ICT Innovation

The **E-government Strategy** was released in April 2001 with the mission that by 2004 the Internet will be the dominant means of enabling ready access to government information, services and processes.

Work continues on a comprehensive range of projects including:
- implementation of secure email,
- development of a new government portal,
- the e-procurement pilot and
- work on establishing interoperability and standards.

See www.e-government.govt.nz for details.

3.4.2 Foresight

The Information and Communications Technology (ICT) Taskforce was established in response to the Government's Growth and Innovation Framework (GIF). GIF has four related goals:
- enhancing the existing innovation framework;
- developing skills and talent;
- increasing global connectedness; and
- focusing effort for maximum gain.

The Taskforce was convened as a tightly focused group of ICT business leaders with relevant commercial experience to report on its insights into the growth potential of New Zealand ICT and to identify the collective private sector and Government contributions needed to achieve this potential.

The ICT Taskforce Report assumes that the issues should be approached from a partnership perspective between industry and Government, and with the active commitment of the education, investment and research communities.

3.4.3 Knowledge and Technology Diffusion

refer section 3.10 for many initiatives that support knowledge and technology diffusion.

3.4.4 Digital Strategy

The Government has drafted a "Digital Strategy" to provide an integrated framework for existing initiatives, as outlined in this paper, as well as future ones. The purpose is to encourage the uptake and effective use of ICT for economic, social and cultural gain. In producing this strategy the Government recognises that, in addition to innovation in ICT infrastructure, changes in society's systems, and in institutions, businesses and people themselves are required, in order to exploit the benefits of ICT.

http://www.med.govt.nz/pbt/infotech/digital-strategy/index.html

3.5   Innovation Capability in Firms

The Government provides a range of services (Foundation Services) targeted at a wide business audience with a particular focus on smaller firms, entrepreneurs, start-ups and new exporters. The services are largely focused on building and supporting the development of management skills and capabilities through the provision of

- business assistance and information and mentoring services where appropriate ($9,870,000); and
- training services ($10,568,000)

New Zealand Trade and Enterprise through a business information program (BIZ) has developed an eight module e-commerce training program aimed at small and medium businesses. This program is now available through the BIZ provider network. See www.bizinfo.co.nz for details.

3.6   Knowledge and Mobility of Human Resources

3.6.1 Training Subsidies, Tax Breaks for Training and Other Resources

refer http://www.minedu.govt.nz

The first **ICT Strategy for Schools** was released in 1998. The goals of this strategy were to build infrastructure and school capability. It was followed in June 2002 by the new strategy "Digital Horizons: Learning through ICT". This strategy focuses on the challenge of integrating ICT more fully into curriculum practice.

Project PROBE (Provincial Broadband Extension) has been developed jointly by the Ministry of Education and the Ministry of Economic Development to rollout high speed Internet access to all schools and provincial communities. The project's key objective is to roll out high speed Internet access to all schools and communities that do not have access to these through commercial providers and secondly to encourage competition in provision of high speed Internet access telecommunications outside the metropolitan centres.

On-Line Learning Centre (http://www.tki.org.nz)
A virtual centre has been developed for on-line learning. Its prime audience is teachers, and new curriculum materials designed to support and improve teachers professional practice are added regularly.

Software in Schools
The Government has agreed to a licensing deal with Microsoft New Zealand to provide all state and integrated schools with computer software. The agreement includes the installation and use of the software at home by all school staff.

3.6.2   Inwards Mobility of Human Resources

refer www.immigration.govt.nz

The New Zealand Immigration Service has developed a co-ordinated international marketing approach to attract people with e-commerce and ICT skills to New Zealand.

The New Zealand Immigration Service is currently undertaking a "first principles" review of work visa and permit policy. As part of this, ways to further facilitate the entry of talented migrants are being examined.

Current policy initiatives to address skills shortages in the e-commerce and ICT areas are as follows:

- The New Zealand Immigration Service has ICT occupations on its
  skills shortages lists so that a labour market test is not required
  for employers wishing to recruit ICT specialists from overseas;

- Industry groups experiencing significant difficulty recruiting highly skilled specialist employees from overseas may request special provisions allowing the employment of such specialists.
- ICT specialists, supported by the Information Technology Association of New Zealand (ITANZ), may be given preference for residence.

3.7 Standards and Regulation

The Electronic Transactions Act (2003) enables statutory requirements for writing, signature and the retention and production of information to be met using electronic methods.

The Telecommunications Act (2001) is designed to create a more efficient and competitive telecommunications market in New Zealand for the benefit of both business and domestic consumers.

The New Zealand Model Code for Consumer Protection in Electronic Commerce is designed to assist business to develop self-regulatory mechanisms.

The Government has supported the development of the e-Marketing Standards Authority (eMSA) and provided advice to business associations considering their own codes of practice.

A National Infrastructure Protection Strategy report was prepared and the Government approved the establishment of a Centre for Critical Infrastructure Protection.

3.8 Global Marketing and Exporting

The Government provides services (*Growth Services – Facilitation of New Business Opportunities* $27,359,000) customised to support and assist business with medium to high growth potential and objectives to achieve that potential. It is largely focused on international market opportunities.

New Zealand Trade and Enterprise has:
- an education program aimed at lifting exporter awareness of global e-commerce opportunities;
- commenced e-business education for its staff through three online learning modules and staff briefings;
- commenced client e-business education – including three training modules as well as awareness building seminars around the country;
- worked with their e-business partner consortium members to develop affordable e-business products/services for exporters, following the development of an e-business education "Road Map";
- delivered an increasing range of export information services on-line through the utilisation of a new information management strategy;
- developed and implemented an online database to profile all NZ

exporters (NZ Exporters Online);
- redeveloped the Corporate Website, including implementation of an online content management system;
- begun developing an online Newsroom to provide exporters with news and analysis on topical trade and investment issues;
- worked on development and delivery of "off the shelf" services online;
- entered into partnership with Emarketservices.com to provide a research database of digital marketplaces to New Zealand Trade and Enterprise staff and clients and is developing a service line to advise exporters on selection and integration of digital marketplaces. www.nzre.co.nz; and
- established a "marketnewzealand.com" website. This portal brings together New Zealand exporters and potential buyers to aid international trade matching.

3.9   Intellectual Property Protection

New Zealand's IP regime is generally compatible with that of other countries. It complies with the TRIPS Agreement and Paris Convention on Intellectual Property[16].

The Patents Act and the Trade Marks Act are being amended.

The main issues for the Patents Act are:
- the definition of invention and possible exclusions to patentability;
- the strictness of the tests applied in determining whether or not to grant a patent;
- the patentability of methods of medical treatment of humans;
- the patentability of business methods and software;
- Māori concerns regarding the granting of patents for inventions involving traditional knowledge and indigenous plants and animals;
- concerns surrounding the patenting of biotechological inventions, including plants and animals, and genetic material; and
- pharmaceutical patent term extension.

The new Trade Marks Act:
- defines the scope of rights protected by trade marks more clearly;
- simplifies and streamlines processes for registering a trade mark;
- introduces some measures to address concerns of Māori over inappropriate registration of Māori text and imagery as trade marks;

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[16] New Zealand is a party to the Paris Convention for the Protection of Industrial Property and, as a member of the WTO, the Agreement on Trade-Related Aspects of Intellectual Property Rights ("TRIPS"). These treaties require New Zealand to have a patent system that provides certain minimum levels of patent protection and to provide the same level of patent protection to residents of other countries as New Zealand provides to our own residents.

- introduces new measures to deter pirating of copyright works and counterfeiting of trade marks; and
- strengthens protection for well-known trade marks.

3.10   SMEs: Entrepreneurship and Development

See also http://www.industrynz.govt.nz

The government has established a special policy unit (Policy Advice – Small Business) to provide advice to the Minister of Small Businesses on a series of measures designed to strengthen the government's support for, and communication with, small and medium enterprises.

3.10.1 Entrepreneurship

The Government provides customised information and advice (*Growth Services – Customised Information and Advice* $25,516,000*)* to businesses that meet criteria for more tailored assistance. The services are aimed at assisting companies to identify and respond to opportunities for growth and/or address constraints to growth.

The Government provides assistance (*Enterprise Development Fund* $8,613,000) to entrepreneurs and businesses to:
- engage the services of a business mentor for a period of time;
- undertake more advanced management and technology-based training;
- employ specific external advice and expertise in a management area (eg, feasibility studies, e-commerce, e-business, market research, enhancement and uptake of new technologies, human resources, intellectual property, strategic planning, environmental management, production management), and
- undertake international market development activities, including new market investigation, trade fair participation, trade/business missions, business exchanges and visiting buyers.

E-commerce and e-business strategies have been included as a qualifying category in the Enterprise Award Scheme administered by New Zealand Trade and Enterprise[17].

The Growth Services Fund ($10,125,000) provides support for high growth potential firms to purchase external advice and expertise, and marketing intelligence and development services. Funding is available to both firms and groups of firms to facilitate access to the following enablers of business growth – specifically including e-commerce initiatives:
- new business opportunities;
- skills and expertise;

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[17] See www.nzte.nz/sme/sec03_overview.shtml for details.

- innovation and new technologies; and
- finance.

The Sector Strategies and Facilitation Fund ($5,100,000) provides assistance for specific sector related initiatives, particularly in the areas of major events and development and growth of successful business incubators.

The Regional Partnerships and Facilitation Fund ($20,818,000) provides assistance for the support and development of business incubators, regional clusters and supporting programs for the development and implementation of regional economic initiatives.

The Regional Initiatives Fund ($2,000,000) provides funding support for regional projects that are consistent with the Government's economic, social and environmental objectives but cannot be funded through other Government assistance programs – specifically including e-commerce initiatives.

3.10.2 SME Development

New Zealand Trade and Enterprise is supporting initiatives to enable SMEs to exploit collective opportunities to extract economies of scale with respect to technology and e-commerce applications by:

- assisting in dissemination of key e-commerce and ECAT messages through its publications and website;
- funding regional studies of ICT needs in Northland and Southland and is contributing to the Broadband pilots; and
- the Industrial Supplies Office (ISO) will continue to provide information to NZ business and will extend this to provide coverage of e-procurement opportunities.

3.11 Commercialisation of New Products

The Government has appropriated $100 million of capital that is administered by New Zealand Venture Investment Fund Limited[18]. This investment has four goals:
- to accelerate development of the New Zealand venture-capital industry by increasing the level of seed, start-up and early expansion investment activity in the New Zealand market;
- to develop a larger pool of people in New Zealand's venture capital market with skills and expertise in seed and start-up investment;
- to facilitate the commercialisation of innovations from public research institutes, universities and the private sector.

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[18] http://nzvif.com

- to get more New Zealand businesses on paths to global success by increasing their access to international experts, networks and market knowledge.

The "Pre-Seed Accelerator Fund" ($4.8m per year) aims to increase the rate of commercialisation of innovations from publicly funded research by publicly-owned research institutes and universities.

The Government has appropriated $12 million of capital to provide for targeted equity investments into publicly-owned research institutes that have the capability to develop commercial prospects but are unable to find suitable commercial partners or to borrow the necessary funds. This will assist with the acceleration of activities that increase the rate of commercialization of innovations from publicly-owned research providers.

Chapter 4   Knowledge Intensive Service Activities in the Software Industry

4.1   Introduction

This chapter discusses survey information from:
- the Canterbury report;
- the NWNL report; and
- the Reeve paper

for the following set of themes – that the KISA Focus Group agreed upon:

Together with the national statistical information in chapter 2, these help characterise KISAs in software innovation in New Zealand.

4.2   Overview of the Firms

A large number of small-sized firms and a small number of large firms characterise the software industry in New Zealand. Activities include application and development of proprietary software, with low infrastructure requirements, for niche market consumers. This coupled with the diverse range of cellular frequency technology platforms produces useful "test-bed" conditions for solution-focused software innovation. Relationships with large scale firms – such as telecommunication companies and major commodity producers - are important for product development and building international customer and knowledge networks.

4.3   Innovation Characteristics

Research and development expenditure is a significant proportion of total expenditure by software companies, but most R&D is carried out by a small number of large firms, that typically have formalised procedures for specifying customer requirements. Research and development tends to be product-focused and ad hoc rather than driven by a research strategy and this is consistent with the inexpensive "solution-focused" approach to software innovation in New Zealand. Innovation is generally self-funded.

In general, the style of innovation in the software industry is based around identifying industry problems and developing clever technical solutions, which are not too expensive and are easily customised. The approach is simple and

effective, as it does not require significant infrastructure and allows new technologies to be commercialised rapidly.

As is perhaps typical of software firms generally, the NWNL study, found that lack of working capital and lack of international venture capital to enable SMEs to access global markets are issues that continue to stall growth in this industry. It found that, generally as with many small businesses, cash reserves are extremely low. Businesses are run from cashflow from sales after an initial angel investment or injection from the founders.

The NWNL study found that once the initial product has been created, further R&D activity is conducted on an ad-hoc basis, if at all. The NWNL study and other evidence suggest that government research and development funding is relatively well-provided for – but that timing difficulties arise. This is due the quickly evolving industry changing faster than the grant application timeframe.

The Reeve study found that the most significant factor in determining the kinds of software development practices, is the size of the software development group. In general, it seems that larger software development groups tend to have more well-defined software development processes – because they tend to perform larger software development projects. In addition, well-defined processes are characteristic of software teams that produce software for customers, rather than for their own in-house purposes.

The Reeve study investigated both (i) formality of process – how well-defined and documented is specification of software, and (ii) formality of notation – how well-defined are the software specification languages. This study found that more well-defined software development processes are characteristic of larger software companies (with greater than 10 personnel), and software teams that produce software for customers, rather than as in-house providers.

4.4　Innovation Cooperation

Formal collaboration for innovations between software firms and with other innovators is low, but is recognised as a way to build the critical mass and essential networks for knowledge transfer and technology diffusion. Relationships with large-scale customers are vital for innovation. Also important are relationships with other firms (eg suppliers and hardware developers) along the value chain for an innovation. Collaboration with government-funded research providers - the Crown Research Institutes and universities is important and growing in specific fields.

In general, innovation cooperation is growing off a small base in the software industry. The NWNL study typifies current practice. Generally, it found that innovation and new ideas mainly resulted from technology adaptation (32 percent) and in-house R&D (48 percent). Very few organisations outsourced or partnered when sourcing new technological developments.

At a more formal level, the NWNL study noted that new formal collaboration platforms such as MediaLab South Pacific are emerging. MediaLab is working

with a range of software developers who are writing applications or standards implementations for use within the wireless sector and are actively seeking partnerships with network operators and international distributors or technology companies to provide an international commercialisation path.

While the Canterbury study noted historically weak links between the high-tech sector and tertiary institutions, there have been a number of recent initiatives to strengthen these links. Recent initiatives include industry advisory groups consulting on curriculum design; promoting consultancy research connections between industry and the universities; and major software companies providing funding for professorial chairs and post-graduate study.

In general though, ICT industry groups in the Canterbury study saw the tertiary sector primarily as educators of future skilled graduates rather than collaborators in innovation.

The Canterbury study identified a voluntary association of software producers and support agencies working together to help innovative software companies commercialise their products and improve service relationships. This association in conjunction with the local regional development organisation operates a mentoring programme, a business resource library and an ICT business directory. It also offers an e-mail forum, workshops, networking opportunities, and information technology resources. Some electronics firms are members of this association, reflecting the importance of 'embedded software' in the electronics industry.

One issue for the mobile sector, identified in the NWNL study is a "power imbalance" - with an impact on innovation - that surrounds the few, large, network-operating companies and many, very small application developers and solution providers. The network operators have infrastructure and resources and are able to pick up and choose new developments and applications for publication, seemingly at whim. Relationships with these big companies rather that capability of the small software developers were found to be the core driver for how applications got picked up and developed.

The NWNL study found that the relationships between the participants along the value chain of innovation and production are powerful forces that affect the dynamics of the wireless and mobile value chain. These relationships can be for knowledge and learning, or for business.

4.5   Sources of information

Software firms mainly draw on in-house knowledge of software solutions they provide for niche markets. Clusters and networks provide an important information source external to the firm.

The NWNL study found clusters help small firms especially, to get information about areas they need in their business, but are too busy to organise for themselves. This is additional to the role of clusters and networks in developing business growth opportunities.

4.6   The Role of KISA in Innovation

The KISAs that firms considered most important were:
- skilled commercialisation agents with international networks internal to the firm;
- provision of training in marketing external to the firm;
- provision of platforms for diverse (cellular) technology standards external to the firm to enable a diversity of innovation; and
- specialist business advice services external to the firm.

The NWNL study observed that New Zealand is a beacon for advanced wireless and mobile internet innovation. It is the world's ideal test bed for trial deployment of global fixed and mobile wireless technologies and applications. Mobile technology standards (TDMA, GSM, CDMA and GPRS) operate alongside numerous fixed wireless networks operating in both the licensed and unlicensed spectrum. The provision of these standards by the large companies represents an important KISA for software innovation.

A key feature factor internationally of high-tech sectors, is the growth of specialist companies offering technical and business support to firms in the sector. This was also identified as a critical factor by interviewees in the Canterbury study. This includes the growth of specialist input-suppliers for electronics manufacturing, and specialist web support and graphic design for software developers, but extends perhaps even more importantly to key business services.

The study found that small firms in particular can find it difficult to obtain the specialist advice they need for growth in the sector. This includes intellectual property advice, lawyers, international marketing consultants (for both product promotion and market information), and small business advisors. A factor contributing to this difficulty is the tendency of many Canterbury firms to be specialised in niche markets where experienced expertise may be difficult to obtain. Networking within the sector is also an important source of information about where to find good consultancy services relevant to a particular firm's immediate problems. There is a desire for high-tech oriented business courses on a part-time basis for both employees and managers to enhance their marketing skills. It was suggested that the tertiary education sector should include at least some management and marketing skills in their courses.

4.7   Innovation Challenges

The innovation challenges faced by software firms are symptomatic of their small size and problem-solving focus, coupled with the need for them to develop international connections for knowledge sharing and market intelligence. For small firms, access to capital and costs of regulatory compliance become relatively large to other business needs.

The NWNL study found that most of the software developments are centred on technologists or inventors creating clever solutions to technical problems. This produced a "technology push" rather than a "market-pull" situation. The study concluded that this ultimately constrains the growth of the industry because the skill-sets of this technical group do not include the skills needed to build international companies and relationships in international markets. Overall, while there is no shortage of technically capable people, many firms involved in the NWNL study commented on the serious shortage of skilled experienced commercialisation agents with international networks, as well as skilled general managers and marketers.

It is generally recognised that New Zealand high-tech firms need to focus on overseas markets to grow beyond the constraints of a relatively small domestic market. As stated earlier the large firms in the study are very export focussed. This was seen as a problem for small firms once they reach the stage in their development where to grow they must develop new export markets. This lead to a number of issues, not least of which is accessing overseas market information and distribution.

Many interviewees also raised an ongoing problem of a shortage of skilled business people, particularly in specialist areas such as supply chain management or international niche marketing. Some firms reported that it would be highly desirable for high-tech graduates to have some marketing and business skills. This would make them more effective members of product development teams and provide them with important skills if they created their own start-up company. We were told that there is not only a shortage of new graduates with relevant business skills, but also a shortage of courses and facilities that can be called upon to up-skill existing employees. This is an area where the tertiary education sector could assist industry more effectively than it does at present.

Compliance costs and New Zealand's regulatory regime were raised by some as an issue affecting growth in the high-tech sector. A particular issue was raised by software companies about New Zealand's tax law and its treatment of software development – which is being currently investigated by tax authorities.

4.8   The Role of Government

The government provides a system of grants for research and development and business development activities. These are generally well-regarded by software innovators.

Some concerns lie in the scale and scope of funding – that fewer and larger and more targeted grants might be more effective. To some extent this reflects a call for a greater critical mass in innovation activity. The government's public-private research consortia programme has two ICT consortia, which include elements of wireless technology development,

currently under due diligence. In addition, its venture investment fund is currently supporting software development projects.

The Canterbury study saw a role for the government to act as a facilitator in linking large multinationals with small-firm software developers. The government's support for collaboration platforms where large firms, publicly-funded researchers and small firm innovators can interact, addresses the call for this role in some way.

Chapter 5   Conclusions

The software industry in New Zealand – with some notable exceptions - is dominated by a large number of small firms using ingenuity and strong customer linkages to develop clever customised solutions for industry problems. As a result firms are diverse across many niche markets and produce high value, high productivity outputs. Customer supply agreements generally protect intellectual property.

Innovation is very problem-focused and firms use their own ideas for innovation or learn about new technology through watching competitors and through trade fairs and journals. Collaboration across the sector is developing and is desirable, but at present, firms innovate without collaboration.

The challenges for innovation are generally symptomatic of the size of the firms: access to capital, costs of regulatory compliance, costs of market intelligence and networking for learning. One major challenge is the shortage of skilled experienced commercialisation agents with international networks, as well as skilled general managers and marketers.

Important KISAs for these firms are:

- providing international marketing services;
- providing training in marketing;
- provision of a diversity of technology standards for trialling new technologies; and
- managing relationships with large scale firms.

The government has no specific programmes for the software industry. There are many programmes supporting research and development and supporting growth and entrepreneurship, for example that software firms can and do use.

Two software projects are currently undergoing due diligence for the government's research consortia programme. The government's Venture Investment Fund is supporting software projects. The Technology for Business Growth Fund supports firm-based research and development across many software projects – and is generally well-regarded by firms.

As for future policy to support innovation in the software industry, it's clear that the following actions – some already in progress - could help lessen some of the barriers to innovation:

- building learning networks across the sector;
- supporting platforms that utilise public and private research skills and efforts;
- supporting clustering activity to build critical mass of firms to encourage suppliers of specialist services for software firms; and
- facilitating links between software firms and large scale firms.