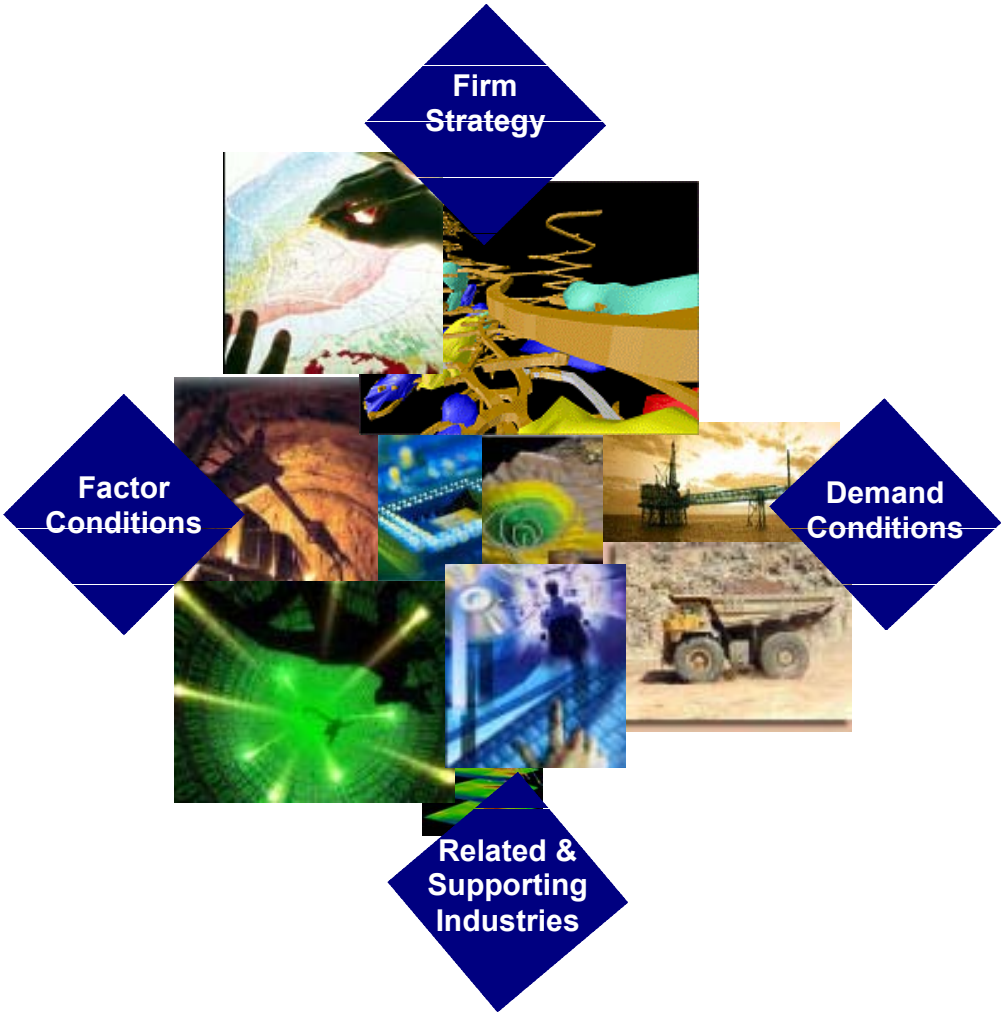
THE UNIVERSITY OF WESTERN AUSTRALIA
THE GRADUATE SCHOOL OF MANAGEMENT

Western Australian ICT – A Rare Diamond?



PAUL GALE 027975X
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EXECUTIVE SUMMARY

Regional competitiveness has been well researched with popular findings centred upon Porters diamond model – the need for favourable demand conditions, strong supporting industries, constructive firm strategies and rivalries, and access to basic and advanced factors. An examination of the Western Australian ICT industry using this framework reveals that these determinants require significant strategic focus for the state to become regionally competitive.

A lack of a critical mass within the industry or even within a sub-sector of the industry precludes the presence of any significant spill-overs. The states most contributory endogenous factors – highly skilled labour and knowledge capital are restricted in their development due to a lack of collaboration, communication and cooperation between the industry's actors. Whilst they are a significant attractor to firms wishing to establish operations in Perth, the extreme protectionism of companies and organisations of these assets prevents the smooth transmission of knowledge within the industry.

This lack of critical mass also influences the contribution of the supporting industries. Whilst Perth possesses a large range of firms engaged in various ICT activities there is insufficient specialisation by groups of firms to create the intense rivalry and competition to stimulate innovation. However, this is not to say innovation does not occur. Perth has been recognised as possessing a number of firms who are leaders in their respective fields.

However this is more a result of an advancement in capabilities due to logical incrementalism, rather than pulled by demand. Whilst the lack of scale in domestic markets prevents firms from responding to local demand, so does the fragmented character of the demand. Both the state government and our large industries such as mining continue to procure ICT products and services with a lack of coordination which if reversed, may create a scale sufficient to stimulate local capabilities.

A significant precursor to the fragmented nature of the industry and a lack of critical mass is government policy disengaged with the needs of the industry and an industry reluctant to work cohesively to promote the industry. Government policy has focused on its resource sector cash cow, whilst neglecting a potential rising star. The growing needs of the global knowledge economy will require the knowledge infrastructure produced by the ICT industry. Western Australia can continue to import this infrastructure or capitalise on its regional advantages to become a world leader in various ICT subsectors.

This will require a whole of government approach, with significant leadership and capital investment. Government initiatives in the way of asset building, establishment and facilitation of knowledge networks and a fostering of an enabling culture are required. As is active industry participation at all levels. Members must be willing to engage in partnerships, mentoring and collaborative knowledge building initiatives with a focus on developing the industry, not just their own organisations.

Whilst cluster development is certainly achievable, it will not be a achieved in the short term, contrary to the views of some sectors. A comprehensive program should be established to investigate, diagnose, formulate and implement constructive strategies which will promote endogenous growth whilst stimulating external investment.

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INTRODUCTION

Western Australia has developed a robust economy over the past 100 years. A combination of a pioneering spirit and being blessed with an abundance of natural resources has permitted WA to enjoy a quality of life barely equalled throughout the world. The rapid development of technology world wide has refocussed government attention on the development of a knowledge infrastructure, with WA being no exception.

As discussed in Part 1 of this report, regional clusters are unique to the country they evolve in. No one model can be used to replicate the development in WA. However the commonalities between the clusters (as discussed in Part 1) can be used as a reference point.

The development of a knowledge economy has been featured in the international literature as a basis of future economic development and at the heart of a knowledge economy is Information and Communications Technology (ICT). The WA ICT industry contributed $2.85 billion in 1999-2000, up from $1.1 billion in 1998-1999.

Whilst impressive in terms of growth, WA's ICT industry is small by world standards. This, coupled with an ICT trade deficit of $450 million and increasing global competition will force WA to continue to seek to improve and innovate to continue this growth.

Therefore the question exists of how is WA to promote this growth. As discussed in Part 1 of this paper, many regions have developed industry clusters based on high levels of interaction and collaboration between the industry's actors. This paper seeks to explore the WA ICT industry to examine the nature of its interaction and collaborative efforts with a view to exploring the concept of a local ICT cluster development.

The first section discusses the current state of the industry in economic terms to outline its relative scale. An examination of the industries actors follows with a focus on their relative positioning. This is then placed in the context of Porters Diamond

Model for Regional Effectiveness to determine where the strengths and weaknesses lie in the states ability to compete globally. Finally, recommendations are given as to possible strategic initiatives which may promote the state's competitiveness in ICT.

METHODOLOGY

This study was performed by way if interviews with over 40 ICT industry participants The range of sectors represented is shown below.

- Multinationals (MNC)
- small to medium size businesses (SME)
- Start-ups
- State Government Departments
- Commonwealth Government Departments
- Angel Investors
- Venture Capital Funds
- Corporate Venture Capital Departments
- Public Research & Development Organisations
- Private Research & Development Organisations
- Tertiary Institutions – Research Academics
  Business Academics
  Commercialisation Departments

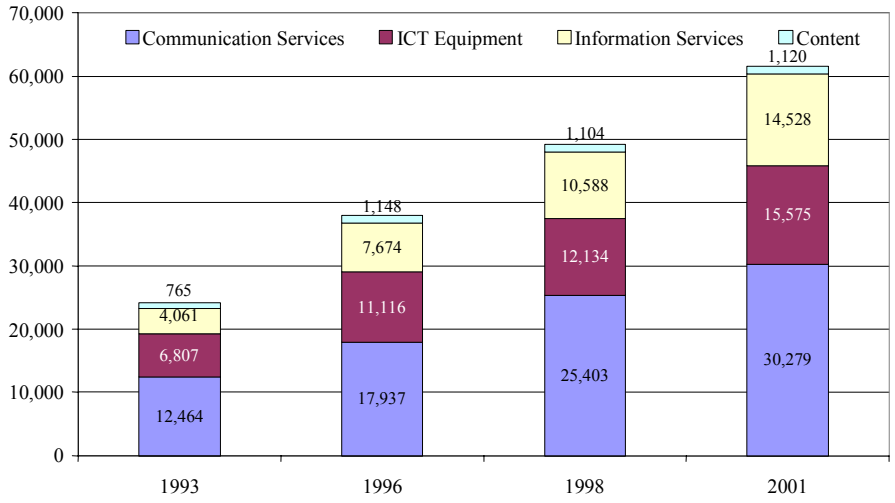
The section focusing on the state of the industry was drawn from material prepared by John Houghton, of the Centre for Strategic Economic Studies (unless otherwise referenced. As the ICT industry can be classified in many different ways, it was decided to use the figures from just one source, for ease of comparison. A map of ICT products and services included can be found in Appendix 1.

As will become evident in the paper, the industry contains much uncertainty and hesitation. As a result of this, many of the participants were happy to participate but requested anonymity. Therefore most companies who participated are not identified.

STATE OF THE INDUSTRY

In 2000, Australia ranked 25 amongst OECD countries in terms of contribution of the ICT industry to the national economy. Australia's ICT contribution to the economy was 8.1% less than half of the contribution Ireland's ICT industry makes to their national economy. Nationally, the ICT sector contributes 5.4% to employment compared to an OECD average of 6.4%. The domestic ICT industry ranks 25th in terms of exports. ICT products and service account for just 3.3% of the countries exports compared to an OECD country average of 17.2%. As shown in Figure 1, the local ICT market is estimated at $61.5b.

Figure 1 Domestic ICT Demand



Trade

Australia runs a trade deficit in ICT goods and services. This deficit increased from $6.6 billion in 1996-97 to $11.3 billion in 2000-01. This contracted slightly in 2001-2002 due to a fall in imports to $10 billion For this same period ICT exports from WA was valued at $75.4 million. Imports were valued at $526 million, leaving a trade deficit of $450.6 million

ICT in Western Australia

As of 2001, Western Australia contained 8% of the nations ICT businesses. By sector, WA was the location for 12% of the nation's communication companies, 7% of information services companies, 9% of ICT equipment manufacturers and 10% of ICT wholesalers. The breakdown of ICT firms in Australia is shown in Table 1.

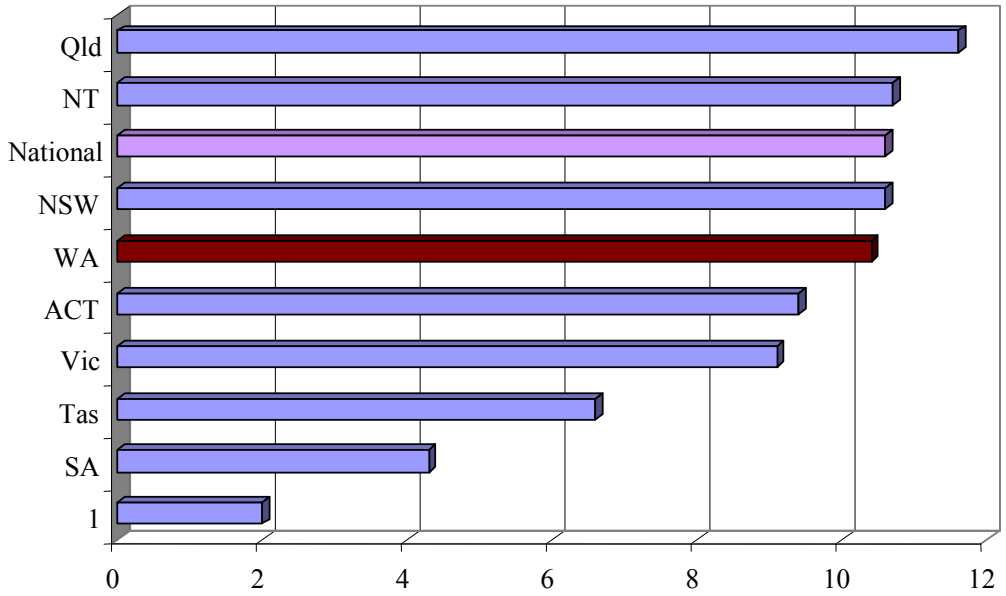
	Commun -ications	Information Services	Equipment Manufacture	Wholesale	Content	Total
NSW	358	8,001	226	1,248	1,138	10,971
Victoria	253	5,916	153	885	540	7,747
Queensland	155	2,141	88	567	129	3,080
Western Australia	120	1,340	56	336	91	1,943
South Australia	45	669	76	253	90	1,133
ACT	35	788	18	81	24	946
Tasmania	41	138	7	59	11	256
Northern Territory	7	49	4	43	9	112
Total	**814**	**18,361**	**497**	**2,803**	**2,009**	**24,484**

NB. Content - (TV & Film Production)

Table 1 ICT Firms in Australia

Whilst the growth in the number of ICT firms between 1996 – 2001 was 10.6% nationally the growth in the number of ICT firms in Western Australia was 10.1%. Comparison of the growth rates in other states is shown in Figure 2.

Figure 2 ICT Firm Growth % (1996-2001)



ICT Employment

In 2001, Western Australia possessed 6.3 % of all ICT jobs in Australia.

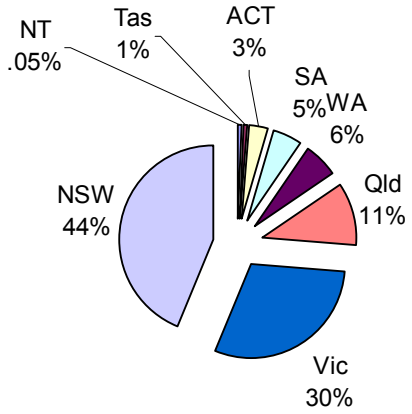
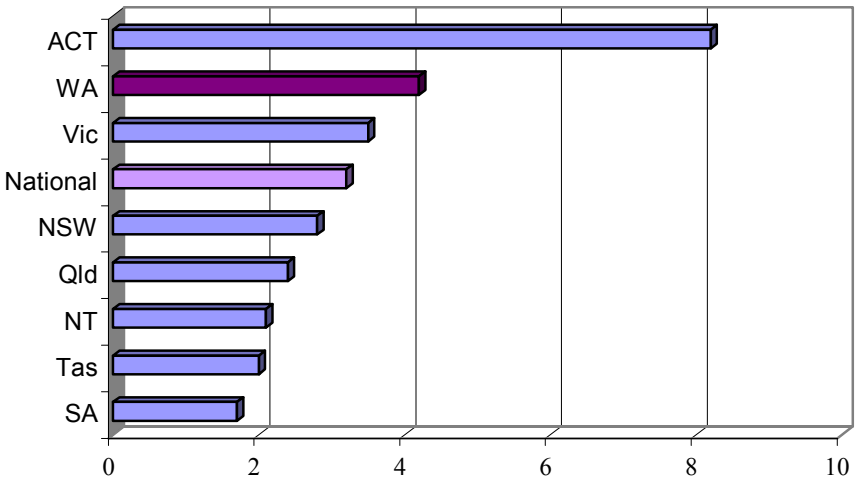


Figure 3 Percentage of ICT Employment in WA (2001)

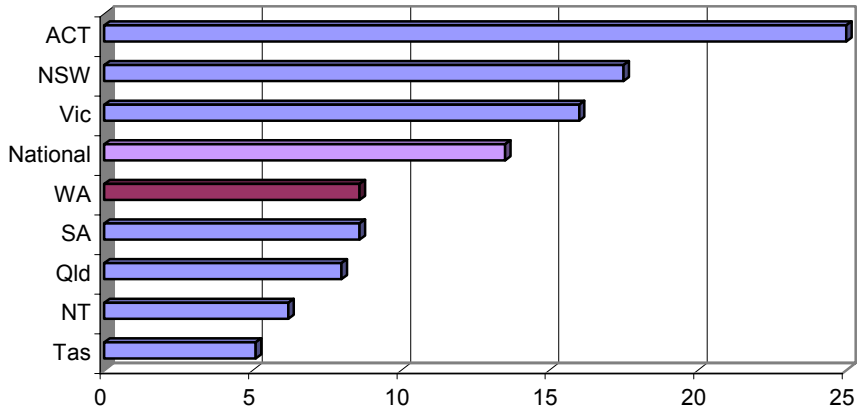
Between 1996 and 2001, this rate increased by an average of 4.2% per annum which was above the national average of 3.2%.

Figure 4 ICT Employment Growth (1996-2001)



Despite this growth, WA's ICT sector employment intensity (Figure 5) was below the national average of 13.5 jobs per 1000 people with a rate of 8.6.

Figure 5 ICT Sector Employment Intensity by State (2001)



A study by Mazzaroll (2002) reported nine sub-clusters in the WA ICT industry, and the percentage of local firms within the subsector. (See Table 2.)

Subsector	% of Industry
Wireless Technologies	24.7
Mining Software Technologies	19.2
Spatial Science Technologies	13.7
Defence Software Technologies	15.4
Security Technologies	17.8
Marine ICT Technologies	13.7
Multimedia & Games	13.7
Medical ICT	5.5
Environmental Management	4.1
Other	37

N.B. n=73. Some firms categorised in more than one subsector.

Table 2 ICT Subsectors in WA (Source: Mazzarol 2002)

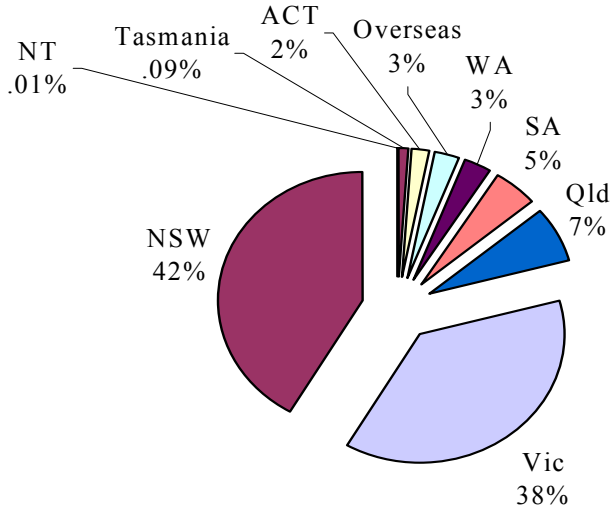
RESEARCH & DEVELOPMENT SPENDING

Research and development activities which lead to innovation and commercialisation have been estimated to account for 40% of GDP growth amongst OECD countries (Larkins 2002). This emphasises the importance of the sector on Australia's future.

Nationally between 1999 and 2001, there was a 5.8% increase in the number of businesses undertaking R&D activities. However there was a 4% decline in the number of people employed in these activities and a 1% decrease in business expenditure. Compared to R&D activity within all industries this is alarming. R&D expenditure across all industries increased by 8.6%, the number of businesses undertaking R&D increased by 3.9% and the number of people employed in R&D increased by 5.3%.

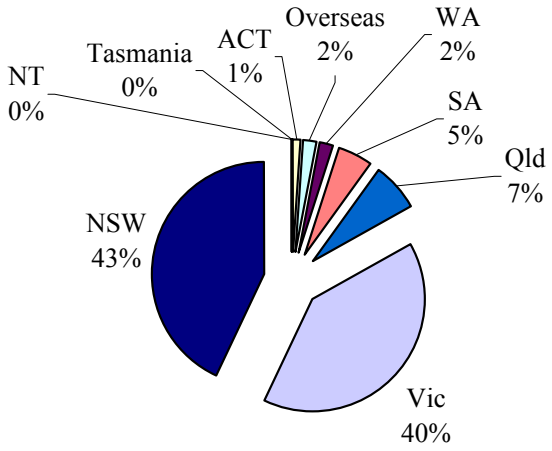
Total ICT R&D (Public & Private) spending for 2000-2001 was $1,898.6m. As shown in Figure 6 only 3% ($52.9m) of the national total was expended in Western Australia. This represented 10% of total R&D expenditure in Western Australia (all industries).

Figure 6 R&D Spending by State (2000-2001)



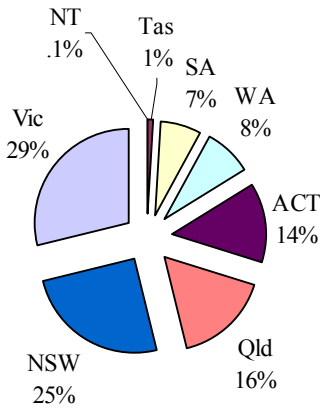
Of the $52.9m spent on ICT R&D in Western Australia, $45.9m (87%) was spent on software development. Western Australian ICT R&D spending included $38m by the private sector. This represents only 2% of the total expenditure by private firms on ICT R&D nationally (Figure 7).

Figure 7 R&D spending on ICT.



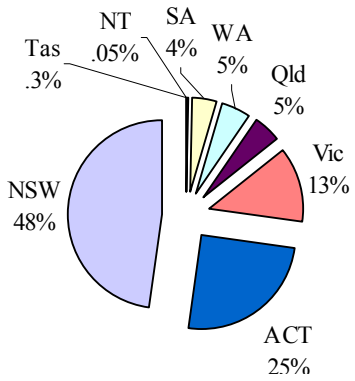
Spending by higher education on ICT R&D in WA was $11.7m which represented 8% of the national Higher Education ICT R&D spending (Figure 8). Whilst significantly lower than Queensland, Victoria and New South Wales, the larger number of tertiary institutions in these states would explain the increased spending.

Figure 8 Higher Education Spending on ICT R&D by State.



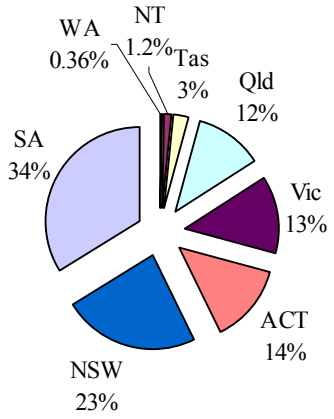
The Commonwealth Government expenditure on ICT R&D for 2000-2001 was $60.4m. Of this WA received $3.01m which represents 5% of the total (Figure 9).

Figure 9 Commonwealth Government Spending on ICT R&D by State.



In 2000-2001, Australian State governments collectively invested just $2.5m on ICT R&D. The Western Australian government reportedly spent only $9,000 on ICT R&D. This represents only 0.36% of the total and only 1.07% of the investment made by the SA government (Figure 10).

Figure 10 State Government Spending on ICT R&D by State.



WESTERN AUSTRALIAN RESOURCES INDUSTRY

Western Australia is an established mining community which in 2000-2001 contributed $27.5 billion or 23% of Gross State Product. The sector reported the highest growth rate (10.7%) of all state industries (1995-2001) and outgrew the national mining industry by 3.1%. Employment in the mining sector has increased by only 2.7% from 1997 – 2000. However revenues have increased by 51.7% in the same period. The revenue per employee in 1997 was $427, 575 whilst in 2002 it was $631,643, a 47.7% increase. Whilst these changes may be accounted in some part by the fluctuation of commodity prices, an increased utilisation of technology could be considered a significant factor. Overall national ICT employment increased by an average of 4.2% during the same period (See Figure 4). Whilst not conclusive, one may argue that many of the newly created jobs in ICT are related to the mining & resources industry.

The estimated spending of selected industries on ICT is shown in Figure 11.

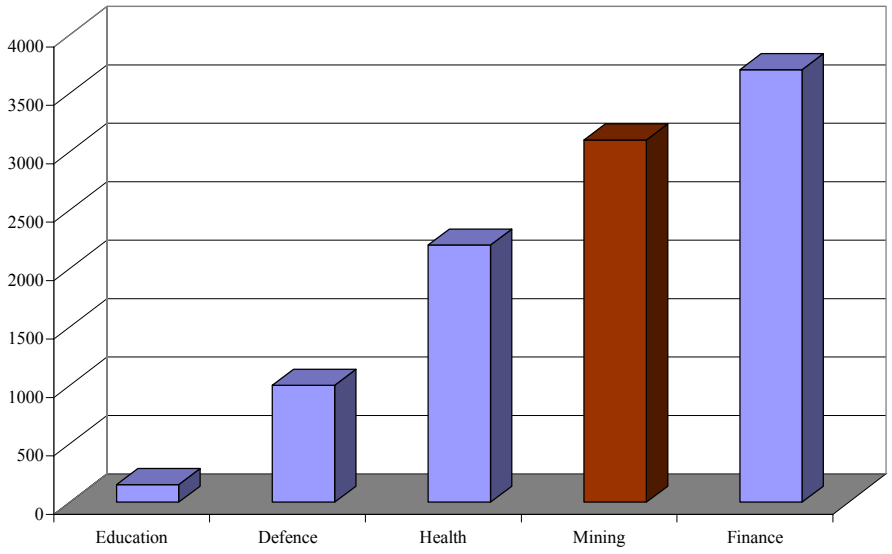


Figure 11 Spending on ICT (000's) (2000-2001)

As shown, the mining industry spent $3 billion on ICT related products and services in 2000-2001. Whilst state by state data is not available, given WA accounts for 50% of the nations mining production, and in 2001 43% of new mining investment was in WA, one could hypothesis a large portion of that expenditure originates in WA (DoIR, 2003).

TERTIARY EDUCATION INSTITUTIONS

It is estimated that R&D activities within the nations higher education sector contribute significantly to the national economy, with spillovers from this sector being responsible for between 9 and 13% of GDP growth per annum (Larkins 2002). A 2000 National Survey of Research Commercialisation revealed that of the 32 start up companies spun off from Australian Universities, 6 came from WA universities (UWA – 4 Companies, Curtin – 2 Companies). UWA was the only WA university to receive royalty payments in 2000 with $62,173 in revenue. This represented less than 0.1% of the national royalty payments of $83.3 million.

However, a lack of a commercialisation culture within our universities is providing a barrier to further innovation. Academics and researchers have long been motivated by the status and recognition they receive from the discovery of a new technology or innovation, as the grants and funding they receive is often dependent on publication of research – not commercialisation of the research. As such many innovations are developed from the capability side with logical incrementalism producing new methods and thinking. However this rarely leads to commercial products. A criticism which originated from within the tertiary sector was that research academics rarely have "real world" experience, and have little understanding of the commercial imperative which has evolved. The recently established Knowledge Commercialisation Australia – an industry association representing the commercialisation departments of Australian universities believes more emphasis should be placed on attracting academics that have both knowledge of the commercialisation process and a desire to pursue it. A US study by Bray & Lee (2000) found that if a university produced a start up company the value held by the university in company equity was on average $700,000USD prior to listing. This obviously provides great financial incentives for producing spin-off companies.

A re-focussing of academics towards commercialisation may help to alleviate a further barrier – that is a lack of collaboration between the commercialisation departments of Universities and the researchers. It has been reported by respondents that some "friction" exists between these departments leading to a loss of opportunities. Academics, in response, stated that their focus must remain on the

development of technology "for the greater good" to ensure the integrity of their projects. However several academics and researchers believed that there was room for more demand side initiation of research. A more cooperative alliance between these two actors may see a smother transition of technology into products.

To assist in the next generation of researchers becoming more commercially orientated, promotion of commercialisation at the undergraduate stage may be beneficial. Including a unit on commercialisation / entrepreneurship in courses such as engineering will educate students that to make a significant contribution to the local economy, their ideas must be commercialised.

There is evidence of universities becoming more proactive in the commercialisation process. The recent establishment of the "Pathfinder" fund by the University of Western Australia is an example. Funding of up to $40,000 is available to university staff for early stage development. However what has been said is of equal importance is the provision of management expertise to help guide the project. There are currently five projects under management.

INNOVATION FINANCE

Many start-up companies or SME's require significant external funding to progress along the commercialisation pathway. Sources of funding include :

- State Government Funding
- Commonwealth Funding
- Venture Capitalists
- Angel Investors
- IPO's or back door listing.

Angel Investors

Angel Investors (high net worth individuals) are seen as an integral part of the innovation process in other parts of the world. In Western Australia there is currently a fragmented network of these individuals who are seeking ventures to invest in. In a recent study by Callahan (2003), it was found that these Perth Angel investors generally took a hands off approach to their investments, preferring to leave strategic and planning decisions to the incumbent management. They rarely had any relevant industry experience in the area of their investment, were not interested in being involved with the strategic management of the company and therefore did not spend any significant time providing advice.

However one criticism raised by several sectors including government and the private sector is that often the companies targeted for pre seed funding also need managerial support. What is required is the implementation of an augmented angel model. Whilst pure capital only support does have its place, involvement where financial support is given accompanied by management advice and / or mentorship would provide young company managers with a sounding board for ideas and also provide encouragement and moral support.

A recent initiative has been launched by several local business people to leverage the experience of interstate angel investor network "Founders Forum". This group is seeking to formalise the angel network in Western Australia by coordinating networking events with members and providing "pitch sessions" where companies seeking financial assistance are invited to give a presentation of their project/technology with a view to being funded by an angel member. This method of capital raising has enjoyed considerable success both interstate and overseas.

The Entrepreneur 2 Business (E2B) network is another informal association seeking to facilitate interaction between start-ups and investors. An initiative by the Software Engineering Association of Western Australia (SEAWA), the E2B network had planned to host a "pitch fest" with the support of DoIR. However the event was cancelled due to "unresolved logistical issues", which is an indication of the conflict present within the industry, preventing collaboration.

Venture Capitalists

Venture capitalists are an integral part of the resource network layer, the horizontal layer which exists to provide services which facilitate the production process. There are only two venture capital funds based in Perth although several other national funds have representation here. A recent reform to the tax treatment of institutions investing in venture capital funds (where they are now capital gains tax exempt on funds invested in VC Limited Partnerships) should see an increase in the level of funding available.

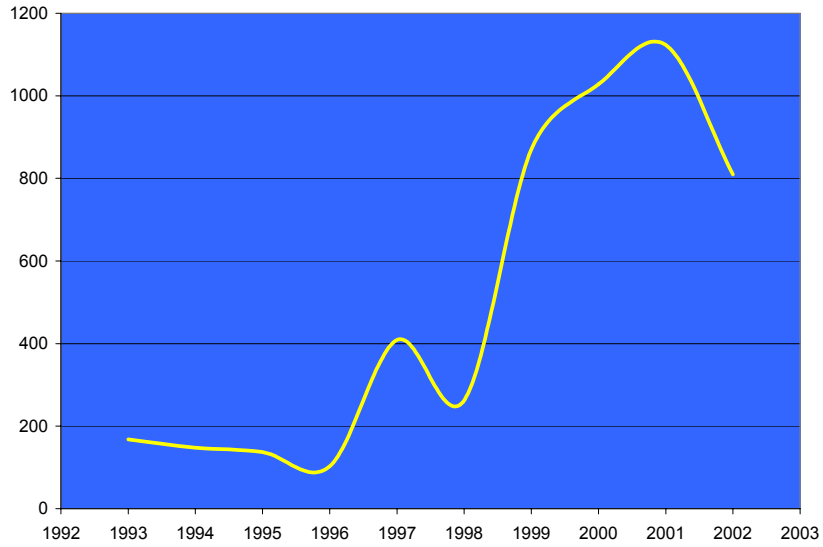
A common comment from companies seeking funding was that it was difficult to access these funds and that these funds required the companies to give up too much equity or charged management fees beyond their affordability.

The response from the venture capitalists has been that there are funds available in Perth but there is a lack of deals, or venture capital ready deals. The venture capitalists interviewed stated that many companies who approached them had poorly prepared business plans, poorly defined products or technology and were not willing to agree to the equity sacrifice required. Venture capitalists justified their required equity and returns by stating that they need to provide returns to their shareholders and thus need to selective in the ventures they fund.

A common perception observed within the ICT industry is that venture capitalists have developed a more conservative approach to their funding than they did in the past. Whilst this may be true since the tech boom-bust of 1998 – 2001, if this period was seasonally adjusted venture capital investments have continued to increase from $163m in 1993 to $810m in 2002. As Figure 12 shows there has been a decrease in

the capital raised from 2001 to 2002. However when compared to the reduction experienced in the United States, where venture capital raised declined from $106billion in 2000 to $37.9billion in 2001 and $7.7billion in 2002, the decline does not seem to be so dramatic.

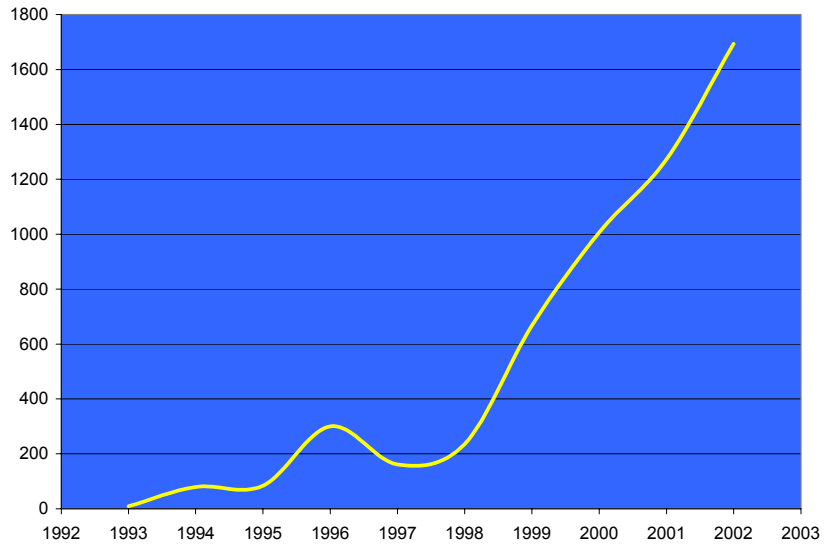
Figure 12 Amount of Capital Raised by Australian Venture Capital Firms ($ millions)



(Source: AVCAL Yearbook 2002)

Furthermore, the amount of capital invested has continued to increase since 1997 ($161m) to $1,694m in 2002 (Figure 13).

Figure 13 Amount of Venture Capital Invested in Australia ($ millions)



(Source: AVCAL Yearbook 2002)

Corporate Venture Capital

The lack of corporate headquarters in Perth has been sited as the main reason for the lack of venture capital provided from this sector. Companies who were interviewed stated that they were happy to explore ventures which had possible synergies with their current business but were less likely to invest in non aligned technology unless it was immanently commercialable. However, several MNC's who have branch offices here in Perth reported that the company does invest in start-up companies but the decision makers are in the Eastern States and the local staff do not see venture capital investment as part of their job portfolio.

MULTINATIONALS

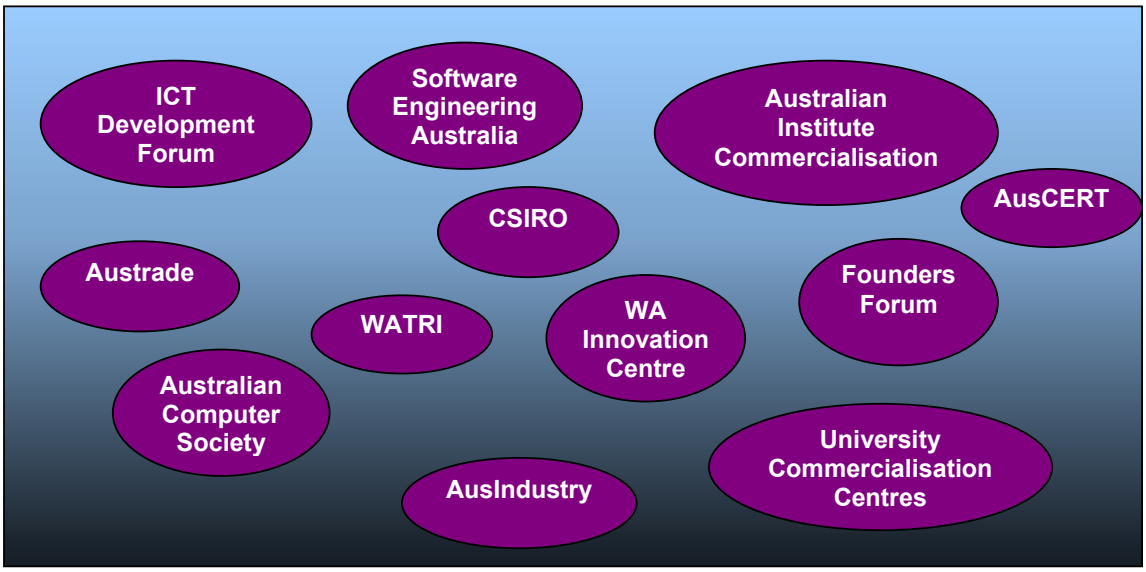
Several multinational companies with a presence in Perth were contacted to provide information for this study. One was established due to the request of a senior executive who wished to settle in Perth for personal reasons. Another was established due to government assistance with funding. A local company which has grown to be a multi-national has remained in Perth due to the founders affinity with the state despite 90% of the companies revenue being generated from overseas. Whilst most of the larger companies credited access to quality graduates from the major institutions as a positive factor, it was not a significant one. In fact one MNC employed very few local engineers, preferring to import them from interstate and overseas stating that the local supply lacks in both skill and experience. The natural environment and cost of living however was a significant factor in these professionals transferring to Perth.

Of significant interest was the relationship these MNC had with the local ICT suppliers. Surprisingly these firms procured very little in the way of ICT services from the local market with infrastructure being provided by global supply partners. Whilst the presence of the MNC's in Perth has obvious export benefits, this is partially offset by the increase in imports required by these firms under the terms of their global supplier agreements. Whilst MNC's have become national champions in other regions, stimulating demand for sophisticated IT services and products, the MNC's in Perth do not appear to have reached this status. Furthermore, the presence of the MNC's in Perth is due in part to the support of the State Government. This "corporate sponsorship" affords the MNC's funding in return for their continued presence in Perth. The governments return on this investment is in the way of payroll tax and exports. Of the Australian telecommunications companies which could be classed as a national champion, such as Telstra, none have significant R&D facilities in Perth.

INSTITUTES OF COLLABORATION

Western Australia

There are various organisations within Western Australia who as part of their activities as research organisations or industry associations form linkages with other organisations.



However, whilst some of these organisations have formal linkages, for the most part they rely more on diffusion rather than a transfer of knowledge. Most of the organisations contacted expressed that they would like more interaction with other organisations but felt that other organisations were resistant to more collaboration. Further, each organisation has its own agenda and competes with the others for funding and /or membership. There appears to be no peak body actively seeking to coordinate linkages and advance the industry. Whilst many state that industry advancement is one of their goals anecdotal evidence suggests conflicts between them are hindering advancement. As an example AusIndustry attempts to promote linkages within WA industry through several networking events. It is a participant in the CEO Club (Tech Park) functions and holds State Managers Networking meetings for local firms. However many firms contacted stated that they would like to see AusIndustry become more involved with functions held more regularly.

It is not only a lack of collaboration but also a simple lack of communication which provides a barrier to innovation in WA. AusIndustry, Austrade and the Office of

Industrial Supply all have separate databases of ICT firms in WA. However there is no link between them to share databases. This therefore allows for the potential loss of opportunities.

Queensland Comparison

The Queensland government has invested heavily in the promotion of ICT as part of their "Smart State" initiative. It provides sophisticated web based services as well as partnering other organisations to promote innovation. The Queensland Venture Capital Raising Pipeline, Queensland Entrepreneurs, ICT Industry Profile, ICT Products and Services Guide are all initiatives which significantly assist the local ICT industry and promote investment.

One of the keys to the success of the "Smart State" initiative is the coordination of inter-government departments and their interaction with industry actors. This has been achieved not just through the significant capital investment but also the investment of human capital. The provision of hands on personnel to interact with government departments, industry, R&D institutions and financiers has enabled greater collaboration within the industry.

Whilst it may not suit Western Australia in all areas, some infrastructure created by the Queensland Department of Innovation and Information Economy, could be replicated in WA with great potential.

CULTURE

One of the barriers to successful innovation and commercialisation in Western Australia appears to be a disengaged culture. Many companies contacted admitted to a reluctance to share information regarding their R&D with other firms or institutions. Fearful of a loss of intellectual property was cited as a main cause of the lack of communication between firms. A fundamental lack of trust between companies was evident with many firms contacted. One respondent suggested this was due to the hard landing following the tech crash of 2001. Companies without a stable R&D, financial or product base were severely affected and now more protective of their most important asset.

Perpetuating this disengagement is the wide variance in views of the future directions of the industry. There is a lack of cohesiveness between the actors with personalities and opinions standing in the way of constructive debate.

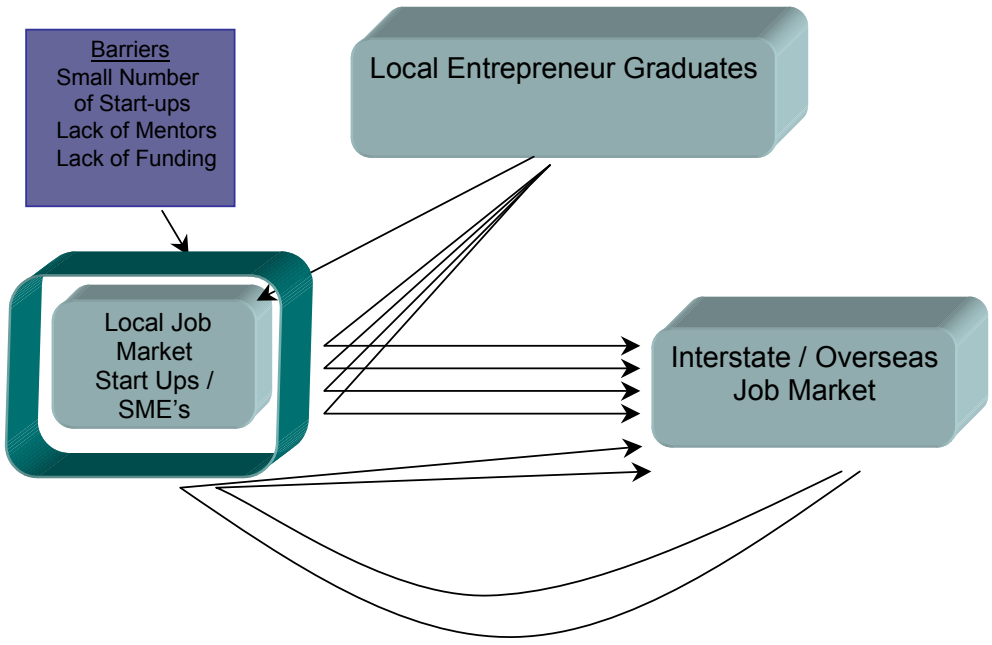
The Pinnacle Blue project is an example of the divided opinions regarding ICT development. The proposal to bring the world's largest supercomputer to Perth was promoted as a means to provide a catalyst for research and development with projects such as the mapping of the wheat genome and deep geological surveying having been confirmed. However a series of factors contributed to its failure. The contracting of IBM to provide the supercomputer without the procurement going to tender is cited as one. The failure of the project proponents to establish a sufficient business case was another. However the most common reason given for its failure by respondents was intense lobbying from other ICT industry groups to reject the proposal. The funding requested for the project ($30m) was argued to be better spent on other projects. As it stands, Pinnacle Blue did not receive funding and neither did other organisations. The project still has its supporters, including those in senior government positions who believe it is the role of government organisations such as CSIRO and IVEC to stimulate the use of high performance computing. A key factor in this position is the belief that R&D use of supercomputing has the potential to produce spin off companies which can commercialise world leading technology produced by the supercomputing facility. WA is lacking in its ability to provide supercomputing facilities. Recent developments by Swinburne University, Adelaide University and a

consortium of five NSW universities to develop supercomputing capabilities has left WA at the wrong end of the technology continuum. This lack of sophisticated facilities is predicted to add to the already significant "brain drain" in WA.

The recent opened IVEC facility, in collaboration with the CSIRO, Curtin University, the University of Western Australia and Central TAFE will go some way to reverse this situation. However the project is still in its infancy. Furthermore the facility lacks any commercial direction, with its focus on pure research. Whilst one of the purported goals of the organisation is to *"encourage the commercial development and exploitation of advanced computing applications with a focus on interactive virtual environment applications",* there appears to be little evidence of this. Current focus is of the modelling of resource industry accidents for investigation and reaps no commercial return. The software developed by the organisation is in open code format, rendering it available for anyone to use it. Whilst this philosophy allows for the accelerated development of software it allows little opportunity for commercial development. The centre has a unique opportunity to develop world class visualisation programs for the local world class mining industry. However this opportunity is void of a priority.

MANAGEMENT EXPERTISE

A key barrier to the commercialisation of technology in WA is the lack of experienced managers who understand the commercialisation process or have the necessary linkages to connect relevant actors. Whilst many of the business schools have begun to offer entrepreneurship courses, they have yet to produce sufficient numbers to make an impact. Responses from companies contacted indicate students graduating from these courses often do not have experience in the commercialisation field and due to a lack of funding these firms are reluctant to take entry level entrepreneurs on. This forces students to search for work overseas and interstate where funding for their appointment is available. Here they gain significant skills and experience and as such are well remunerated – way above what local firms can offer to entice them back.



GOVERNMENT INVOLVEMENT

> ***"Building industry capacity is another major area that we must get right – by using the purchasing power of the state government to increase the capacity of local industries so that they can grow. We are also open to the possibility of government participation in trials for new IT products when they have reached the commercialisation stage."***
>
> **Premier Geoff Gallop 2001**

The state government is the largest consumer of ICT services in the state, however little evidence is available as to the sources of the governments suppliers. Each department keeps separate records and the departments contacted were unable to determine the amount of ICT services provided from within WA.

Discussion with local vendors revealed a significant dissatisfaction with government procurement policy. A key criticism was the lack of coordination between departments, where separate tender or bid documents need to be prepared for each department, incurring significant time and money in their preparation.

In reference to Dr Gallops statement on the governments desire to promote the ICT industry through government procurement, there is anecdotal evidence of closed tendering practices where only a selected few companies are requested to submit tenders and on one occasion all selected tenderers were Eastern States companies. One occasion was reported where software developed within WA was overlooked for software developed by an Eastern States office of an American company.

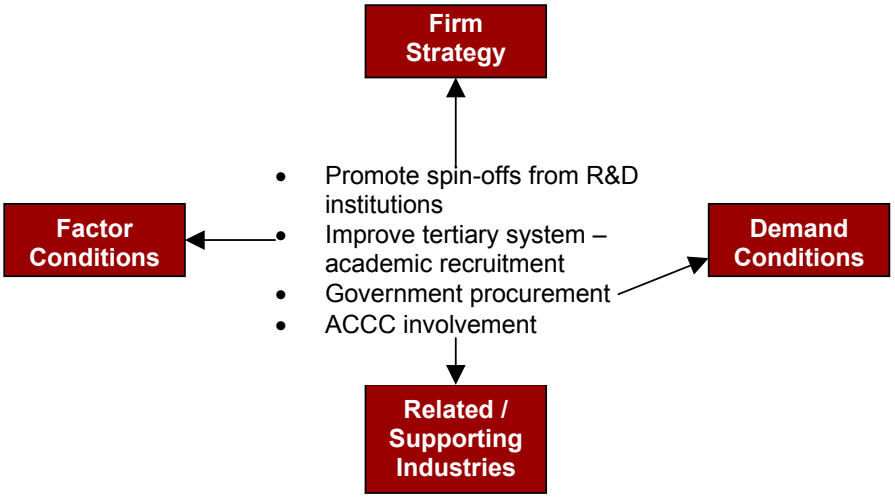
On the issue of government participation in trials for new IT products, the West Australian Police Force trialled, approved and requested a vehicle identification program developed by local firm SuperSoftware. Although used to solve three serious crimes in Perth, purported budget restraints prevented investment in the software. As a result the developers have had to go interstate and overseas for further support of the product.

Whilst this information is cause for concern it is in no way meant to be used to draw conclusions from. It is used simply to illustrate the dissatisfaction expressed by local firms.

In his opening address to the Innovisions conference held in Perth late last year, Premier Geoff Gallop emphasised the importance of innovation to the states future economy. He went on to promote the success to the Western Australian Innovation Support Scheme, giving the examples of Clinical Cell Culture, Q-Mac Electronics and Commtech Wireless as recipients of WAISS grants and management support. These companies have gone on to produce world class products. However, the scheme, administered by the Innovation and Technology Transfer team within DoIR, was suspended two years before this speech with no seed funding awarded since the round 14 (2000) series. The program now consists only of management services to enhance the capabilities of start up companies, focusing on training and access to capital assets. Also, the Innovation and Technology Transfer team has had its staffing levels cut from seven to two leaving it severely under-resourced. To date there has been no replacement scheme introduced leaving a significant innovation progression gap. The WAIS scheme provided essential support allowing a company to undertake preliminary R&D to become investment ready in the eyes of angel investors and Commonwealth funding departments.

Some government departments involved in the study believed industry success should be determined by industry, that government involvement should not be considered necessary. However, as the case studies discussed in Part 1 indicate, government involvement is critical to achieving competitive advantage. However rather than a determinant of competitive advantage, Porter argues governments should influence the components of the diamond (Porter 1990), as shown in Figure 14.

Figure 14 Government's Role in Regional Competitiveness



A recent initiative by the Queensland government saw departments coordinate some telecommunications needs which were then packaged into a deal with Optus for the telecommunications company to underwrite the construction of a fibre optic network between Brisbane and Cairns. The Northern Territory government recently awarded all of its telecommunication business to Optus in return for a commitment from the company to invest $25 million in infrastructure upgrades. These initiatives were recognised by the respective governments as strategic investments in improving both the factor and demand conditions within their economies (Anderson 2003).

State Government & Commonwealth Funding

As a part of the Commonwealth's "Backing Australia's Ability" policy $72.7m in Federal and $30m in private capital has been made available for the pre-seed funding of new ventures arising out of universities or Commonwealth public sector research agencies. Of this, only $20m is set aside for ICT development and of course precludes the private sector from funding. Furthermore the fund managers – Allen & Buckeridge have offices in Brisbane, Melbourne and Sydney and Silicon Valley only.

The COMET program (Commercialising Emerging Technologies) is a federal

initiative designed to assist companies in the early stage growth phase. Whilst providing essential support for companies at this stage it is not applicable for those firms requiring further R&D.

The R&D schemes offered by AusIndustry requires a proven commercial potential which the respondents claim is often difficult to establish without significant market research. Again start-up companies often lack the resources to gain this information.

The BITS (Building on IT Strengths) initiative by the Commonwealth Department of Communications, Information Technology and the Arts (DICTA) provided for $76m in funding for incubator facilities. Of this, $10m went to Western Australia for the Entrepreneurs in Residence (EiR) incubator located in Tech Park, which currently houses 16 companies. However the high equity positions and management fees required has discouraged other start-up companies from following this model.

Some of the comments regarding government funding include:

- "too competitive"
- "too bureaucratic"
- "too time consuming"
- "rather be out chasing customers"
- "can't be bothered with all the hoops I have to jump through"

One government agency, in response stated "companies have to accept that gaining tax payer funded grants has to be competitive" and "companies must be prepared to endure some pain if they're going to be successful".

PORTERS DIAMOND

Factor Conditions

WA has been endowed with an abundance of natural resources which has resulted in the state becoming a world class mining centre. However, when it comes to ICT, the factor conditions are not as obvious.

The most significant factor in the production of ICT products and services is labour. Western Australia does have access to world class engineers and other ICT professionals through the output from world class universities and also the attraction of ex-pats and foreign national attracted by enabling working conditions. The labour cost of employees in Perth is also significantly less than in other leading ICT regions.

The knowledge resources which reside in the states universities and research institutions are significant, although hindered by the lack of collaboration and communication between them. Large bodies of knowledge is also held within the many industry associations. Again however this is stifled by the protectionism which also resides with the associations which has prevented efficient collaboration. The apparent conflict between the industry's associations, or the lack of communication between AusIndustry, Austrade and the Office of Industrial Supply is evidence of this.

The sheer vastness of Western Australia and the country provides significant barriers. A lack of a high speed network connecting all regions inhibits collaboration and communication. The location of many decision-making centres in the Eastern states coupled with the relative high cost of air travel contributes to Western Australia isolation.

Australia has a relatively sophisticated capital market. However this is mainly controlled in the Eastern States. The lack of venture capital firms, corporate headquarters and the infancy of the local angel networks contribute to WA experiencing difficulty in raising funds. This is exacerbated by the lack of state government funding and the absence of Commonwealth government pre-seed funding institutions in Western Australia.

To sustain an advantage with a high technology industry, specialised factors are

required. However, WA possesses few specialised factors. A tertiary system producing skilled labour is one. The newly created WATRI is another as an organisation solely focused on telecommunications research. Whilst significant, these factors alone may not be enough to develop and sustain an advantage.

Some comparative international rankings of availability of specialised factors are shown in Table 3.

Table 3 Comparative Ranking of Selected Specialised Factors

Ranking of the relative availability of Engineers		**Availability of Competent Senior Management**		**Relative cost of Management Salaries (lowest to highest)**		**Numbers of R&D personnel (Full time equivalents per 1000 population**	
Country	Rank	Country	Rank	Country	Rank	Country	Rank
Finland	3	Finland	9	Estonia	1	Finland	1
Hungary	4	Singapore	11	Hungary	2	**Australia**	**12**
India	7	Ireland	12	India	6	Singapore	14
Australia	**8**	India	13	Finland	16	Ireland	20
Singapore	13	**Australia**	**18**	**Australia**	**17**	Estonia	23
Ireland	22	Hungary	27	Ireland	26	Hungary	28
UK	43	UK	30	Singapore	32	UK	31
Estonia	48	Estonia	43	UK	35	India	43

Sources: World Economic Forum Global Competitiveness Report 2001/02,

Western Australia's ICT factor conditions are not all negative. The relative access to the Asian market both in geographic proximity and time zone alignment allow for communication between the two regions not enjoyed by the worlds leading ICT regions. Furthermore the time zone contrast with Europe and the US allows for "follow the sun" business practice opportunities for multinational companies. This is seen as a significant factor in IBM's and Motorola's presence in Perth.

Porter argues that those factors which are most important in maintaining a competitive advantage are those created, not inherited. The endowment of natural resource on the state has provided a platform for competitive advantage in the resources industry, but it is hardly sustainable in the long term. Although the various experts predictions of the life of our resources range from decades to centuries, one thing they do acknowledge is that it is finite. Therefore we must create factors to ensure sustainability. This can only be done by investments, both public and private, to

extend our production possibility frontier. This investment is in the form of education institutions, apprenticeship programs, institutes of collaboration and continued innovation. There must be a coordinated push in a common direction to provide for the most significant spillovers.

Factor disadvantages such as the high relative cost of manufacturing compared to our Asian competitors should be viewed as a source of potential innovation not as an insurmountable obstacle. New developments in technology to decrease production costs need to be given as much priority as the innovation of new products. This can only be achieved through the development of world class management practices. Whilst the local business schools are seen as a world class source of management graduates, industry perception is that there is a lack of management expertise in Western Australia, especially with international experience. This of course is a cyclical effect of the lack of positions available in WA forcing graduates interstate and overseas.

Related and Supporting Industries

Porter argues that the existence of internationally competitive related and supported industries is important to the success of local industries. Competitive suppliers are able to provide efficient, early, rapid and preferential access to inputs. Competitive related industries allow for the coordination or sharing of activities along the value chain leading to cost benefits and knowledge transfer.

However it appears that some sectors within the domestic ICT industry are becoming less competitive –

- Domestic production remained a constant share of income from communication services between 1995-96 and 2000-01, while falling 2.3 percentage points as a share of income from information services.
- In 1995-96, domestic production accounted for over 51% of income from sales of packaged software, but by 2000-01 domestic production had declined to just 36% of income.
- Domestic production accounted for almost 30% of income from ICT equipment sales in 1995-96, compared with just 21% in 2000-01.

- Conversely, imports accounted for more than 46% of income from sales of packaged software in 2000-01, compared with less than 32% in 1995-96.
- Income from sales of imported ICT equipment accounted for 64% of sales in 2000-2001 compared with 55% in 1995-96.

(Houghton 2003)

This lack of competitiveness by local ICT sectors may be a result of cost/price pressures, or superior differentiation by overseas competitors. This has obvious flow on effects for local firms as customers, through loss of scale benefits or reduced technology. Further disadvantages may be experienced through a lack of supply synergies as discussed above. Furthermore a contraction of the industry will reduce any spillovers that are currently present.

As discussed in Part 1 of this paper, to enjoy maximum spillovers, critical mass must exist. Whilst it is evident that critical mass does not exist in WA ICT, neither does it exist in any sub-sector. A possible exception may be in the mining software sector. The presence of internationally renowned suppliers such as Surpac and Micromine as well as emerging world class suppliers such as Fractal Graphics / Technologies may provide for a spillover producing network.

Contributing to the lack of critical mass within WA is the broad range of sub sectors within the local ICT industry (see Table 2). This may contribute to the fragmented nature of the ICT industry with a lack of cohesiveness between peripheral sectors. Whilst some companies within each sub-sector may be internationally competitive, there are few with the required scale to provide significant spillover benefits.

However the emerging biotechnology industry in Perth may provide for some synergies with the ICT sector. A developing acceptance of Western Australia as a producer of advanced biotechnology may spillover to ICT. Furthermore there may be common features of the value chain which may be leveraged by both industries.

Of all the companies which were involved in the study, none cited Perth's supporting or related industries as significant to their presence. The MNC rated government incentives, cost and access to labour and environmental factors above quality of local industry. Local firms who had an international focus cited the same reasons plus the fact that Perth was their original home as deciding factors. Furthermore the MNC's contacted stated they had little interaction with the local ICT industry, with upstream products and services sourced through global supplier agreements.

Firm Strategy, Structure and Rivalry

The context in which a firm operates within an industry and the rivalry between firms can characterise the industries competitiveness. Management ideologies tend to converge within a localised industry as firms seek to compete with rivals. This homogenisation of firms within an industry will either promote or restrict the regions competitive advantage. The rivalry between firms in a localised industry will determine the level of innovation within the industry. Vigorous competition will force firms to find new products and / or processes, improve quality, reduce costs or invest in upgrading factors. This in turn provides an impetus for becoming a world class competitor (Porter 1990).

Whilst homogenization may promote competitive advantage, inter-regional homogenization may restrict it. As shown in Table 4, NSW and Victoria have a large representation of firms from all four major ICT categories. As such they have a much larger scale compared to WA and will enjoy more spillover benefits than WA. Attempting to compete in all categories with other regions who enjoy similar basic factor conditions will be difficult due to these scale and spillover benefits. An industry structure which focuses on fewer categories or sub-sectors may provide for greater concentration of resources and efficiencies.

Table 4 Location of ICT Firms % by State

	NSW	Vic	Qld	WA	SA	ACT	Tas	NT
Communications Services	36	25	15	12	4	3	4	1
Information Services	42	31	11	7	4	4	1	0
Equipment Manufacture	36	24	14	9	12	3	1	1
Wholesale	37	25	16	10	7	2	2	1

Mazzarol (2002) determined that the majority of local ICT firms ranged between micro and medium sized enterprises with only 6% classified as large. A national survey (Houghton (2003) found small ICT firms (employing <20 people) accounted for 95% of all ICT firms with only 1% of firms employing more than 100 staff. Whilst this may allow the firms to compete domestically (due to the size homogeneity), it provides difficulties in competing internationally due to the scale benefits enjoyed by MNC's located overseas. Further, the MNC's tend not to experience the same critical events as SME's such as cash flow or access to labour and other resources.

However, a factor which was said to exist within the SME's and absent within the MNC's was an openness to new technologies. Several of the start-ups canvassed were initiated out of the frustration the owner had with their previous MNC employer in their bureaucracy.

However most of the start-ups involved were created by an individual with extensive technical knowledge but little management knowledge. Many openly conceded that a lack of time and management skills was the greatest barrier to them becoming successful. A lack of capital required them to engage in consulting work to cover their expenses whilst spending as much time as practicable on R&D. Many objected to the equity and or fees required by venture capitalists and incubator facilities and were thus required to self fund the venture, which did not allow them to engage management expertise. However most registered a clear need for management advice and direction in particular strategic, marketing, IP and financial skills.

This appears to indicate a significant gap between the company's needs and the owners willingness to relinquish control. Whilst many may argue that the equity positions and fees required by VC and incubators are excessive, the financiers argue that the technology entrepreneurs need to understand that specialist advice and management comes at a cost. The financial aim is to produce profits and increase the net worth of the company so as everyone shares in the wealth, which will only occur with specialised management. Giving up equity so as the company can be managed,

which in turn increases the net worth of the company to a level which is greater than the equity relinquished will provide greater returns than the owner acting independently. The old adage "50% of something is better than 100% of nothing" applies.

All of the investors and grant administrators canvassed commented that many of the firms seeking funding within Western Australia were too focused on the domestic market. These firms failed to conduct sufficient market research to investigate the sustainability of their business model by either overestimating their target market or underestimating their competitors. The financiers stated that local firms needed to have an international focus due to the lack of scale in the domestic market. The other common division between companies and financiers was that many companies believed financiers focused solely on short-term results whilst companies were concerned with product and market development. This appeared to indicate a lack of understanding from both parties of the other positions.

One of Porter's strongest principles is that a strong domestic rivalry is required to promote change, innovation and sustainable competitive advantage. Porter believes that domestic rivalry is of greater importance than international competition in industries which require constant improvement and innovation rather than static efficiencies, such as ICT (1990). Given the lack of critical mass in WA there is also a lack of a strong domestic rivalry, probably due to a lack of local demand (discussed later). As shown in Table 1 and Table 4, WA is home to a small percentage of the nations ICT firms. As such there is less pressure to innovate and upgrade as it is still possible to have moderate success in relation to the few domestic competitors present.

Demand Conditions

The local demand conditions play an integral part in defining industry structure. The local demand can often act as a predictor of emerging global buyer needs, putting pressure on local firms to innovate faster to achieve a more sophisticated competitive advantage over rivals from different regions. Further, it is the character and mix of the demand which is important, not only the size of the market (Porter 1990).

However many companies do not see the local market as crucial to their growth and have established overseas offices to seek out markets. ComTech Wireless, Laser Safe, Ausgene and Qmac are just a few firms who see the international market as a priority. Furthermore, one government agency believed that many small WA companies were too focused on the local market when they should be targeting overseas markets.

As shown in Figure 1, domestic demand for ICT products & services in 2000-2001 was estimated at $61.5 billion and has been growing since 1993. Unfortunately there is no data available on ICT demand on a state by state basis. In comparison, United States demand for ICT services for 2001 was 759.2 billion. Worldwide demand is recorded at $2,200 billion for 2001(Assinform 2003).

Mazzarol (2002) determined that 52% of local ICT firms were involved in exporting, however they only generate 18% of their sales from overseas. This is consistent with comments from several grant agencies that local firms focus disproportionately on the local market. 2003 has been declared by the state government as the "Year of Exports for Western Australia" in an attempt to reverse this situation.

However, the view that sustainable advantage starts with strong local demand means that WA should also look to develop other industries. ICT development has a significant impact not just vertically within the industry but also horizontally – across industries (see Figure 15).

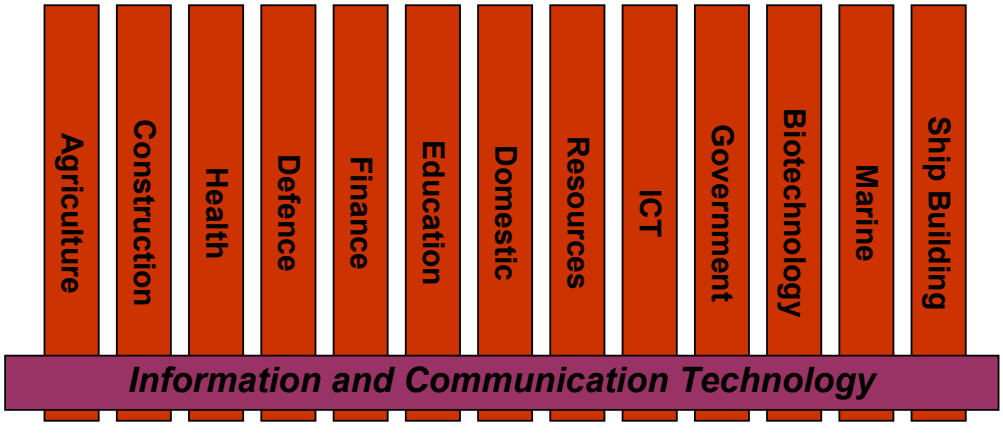


Figure 15 ICT - Vertical & Horizontal Links (Adapted from Morris & Hope 2001)

Unfortunately the scale of demand amongst these industries is unknown. This lack of information indicates that the demand is fragmented without any cohesiveness. Despite the governments' assertions regarding their openness to strategic procurement to benefit local industry, the ICT vendors who participated in the study were dissatisfied with the government in this area. Response from the state government was that they believe too many firms were looking to the government as a provider of revenue, instead of a partner in the industry. Many vendors who have established R&D departments stated that they have little intelligence of future demand. One comment received was "we have a great R&D department but we don't know what to R&D".

Whilst specific demand levels are unknown, it is clear that the state government and the resources sector are the two largest individual consumers of ICT products and services in the state. It is estimated the national demand for ICT products and services is $3 billion (Figure 11). As WA accounts for approximately 50% of resource production one could estimate state ICT demand by the resources sector at $1.5 billion. Mining business have a higher adoption rate of innovations than other industries. Between 1994 and 1997, 42% of the nations mining businesses had undertaken technological innovation. In oil & gas the adoption rate was 96% while metal ore mining was 78%. In comparison, only 26% of manufacturing firms had adopted technology during the same period (ABS 2003). Further, $8.5 billion was spent on technological innovation within the resources sector (ABS 2003). However it is difficult to determine how much of this was pure ICT. For more information refer to Appendix 2.

Crucial to the development of ICT in WA is determining how much of this expenditure is spent in WA. Furthermore, determining the precise requirements of this sector followed by coordinated development of products and services may provide a significant catalyst. A recent initiative by members of the resource sector IT community – the Resource Sector IT Leaders Forum has undertaken to perform a demand mapping exercise of the resource sector.

The recently completed review of telecommunications services in rural and remote areas revealed that only 3.8% of regional businesses are using high speed internet facilities due to a lack of access. Further, satisfaction with internet services was as low as 55% in some regional centres (DoIR). Quite clearly there is a significant demand for high speed telecommunications in rural Western Australia. Provision of sufficient infrastructure will open up regional markets for local ICT firms.

A characteristic of the local market is its consumer heterogeneity. This makes it of similar composition to the large markets of North America and Europe. As such it should provide an appropriate test market for innovative products. AutumnCare, a start-up in incubation in Technology Park is currently testing its PDA health care software at a local nursing facility. This model of development may be attractive for other companies.

THE ROLE OF THE RESOURCES SECTOR IN ICT DEVELOPMENT

The greatest opportunity for job-creation related to mining lies in capturing a large share of the market for inputs to the mining industry. Inputs to the mining industry are rapidly increasing even as labour requirements are being reduced. It is a basic fact of technological progress that labour will continue to be replaced by inputs of skill, capital and technology.

To continue to compete, Western Australia will have to offer a highly skilled and specialised workforce, leading-edge technology, and easy access to partners at all levels.

> ***"Governments should reinforce and build on established and emerging clusters rather than attempt to create entirely new ones. New industries and new clusters emerge best form established ones" (Porter 1998).***

It can be argued that Western Australia has an established cluster in the area of mining and mining supplies. The state has established cluster assets (see) such as the CSIRO & ARRC, world class tertiary institutions including the School of Mines, Chamber of Mines and a government committed to resource industry expansion. This combination of existing infrastructure and high need for ICT products and services should act as a catalyst for ICT development.

This leaves the option of continued resource sector ICT investment and the development of collaborative linkages within the industry. However, as exists in the wider ICT industry, there also lacks a measure of collaboration in the resources sector in regards to ICT development. The industry's peak association – The Chamber of Minerals and Energy actively pursues linkages within the industry. A part of the chamber of minerals and energy charter is "to support member companies to achieve world's best practice…." and "provide an avenue by which members can work together to advance and promote the interests of the membership". This in part is achieved through a number of standing committees which seek to focus on various issues affecting the mining industry. A notable exception is a focus on technology as a driver of mining in Western Australia. As the majority of employment growth

within the resources industry will come from the development and implementation of new technology, this is an area which should be explored.

The chamber hopes to establish a "minerals institute" later this year. Initially its role will be to promote employment in the resources industry with linkages with education institutions. There is possible scope for this body to adopt a role in ICT development within the resources industry.

An example of the possibilities for collaboration within the resources sector is the establishment in March this year of a SAP applications management and development centre in Perth, a joint $30 million investment by Woodside petroleum and Accenture. The centre, based on a shared service model, sees Woodside and Accenture provide 40 employees to develop SAP based systems for the oil & gas industry. Woodside sees benefits as being an increased access to quality personnel and a decrease in turnover of software engineers. However the relationship highlights a deficiency in the local industry when an international firm was called upon to form the partnership. This is an illustration of how collaboration can lead to job creation and innovation acceleration and as such underlines the importance an industry intermediary can have in the innovation process.

What is needed is an organisation whose agenda includes the pursuit of technological excellence by way of R&D, facilitating the collaboration of industry partners and the maximising of returns through technology commercialisation. Using the Woodside case as an example, a collaborative institution could work with the lead customer (Woodside) and the local supplier network to agglomerate the required resources.

An existing organisation which may provide a reference model is the Mining Innovation, Rehabilitation and Applied Research Corporation (MIRARCO) based in Northern Ontario, Canada. MIRARCO links several mining related research organisations and provides a communication conduit for their activities, responding to R&D demand provided by industry. Initially government funded, its business plan directs the organisation to become self funded through the commercialisation of technology it develops and by performing a linkage role.

WESTERN AUSTRALIAN STATE GOVERNMENT ICT STRATEGY

The recent draft ICT strategy document released by the Department of Industry and Resources (DoIR) promoted the need for the development of WA's ICT industry. It contains many positive points such as:

- Focus on innovation
- Acknowledgement of the importance of industry linkages
- Recognition of government role – research into WA's capabilities, business advisory service, "match-making role" (capital, R&D partners etc).
- Importance of nurturing intellectual capital
- Recognising the need for a coordinating body.

An area which may require a re-examination is the papers focus on MNC's as a solution to the problem. Whilst the role of MNC's is not to be underestimated, their role within the current environment needs first to be re-examined. As discussed earlier, corporate sponsorship at the expense of endogenous growth is a short term solution if they do not make use of local suppliers. Local firms should be supported to become champions and not just supporters of international MNC's.

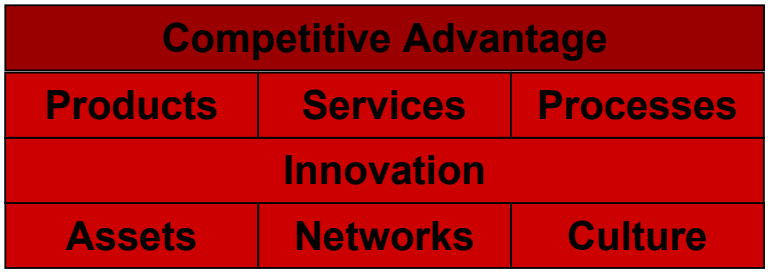
The paper also lacks clear strategies for development, instead outlining goals and objectives. There have been many papers in the past outlining the future direction for ICT in Western Australia. What is needed is some clearly defined strategic initiatives which can be discussed. Whilst cluster development has seen international economies flourish it is not something that can be implemented in the short term. It needs to be developed and grown over decades not years. It requires bipartisan political support and significant investment,

Whilst these comments are noted, it is recognised that the document is a draft discussion paper. The department is to be applauded for its pro-active efforts – but more is needed.

CONCLUSION

Three Pillars of Regional Innovation

To be successful, Western Australia must invest heavily in the Three Pillars of Regional Innovation:



Assets.

As discussed, WA possesses significant assets for the advancement of ICT. Tertiary institutions, research centres, world leading firms and infrastructure are all crucial. As is the knowledge capital contained in these institutions. Effort is needed not only to expand and advance the knowledge generation from the institutions but also in the attraction and retention world class academics and researchers.

Networks

Networks provide the framework of an innovative region. Whilst Western Australia does have several formal and networking organisations, politics and conflicts prevent them from being adequately leveraged. As discussed in Part 1, social network theory states that trust and obligation are built by establishing social ties, and allows for greater collaboration between firms. Furthermore innovation is an interactive process requiring participation by all actors in the network. The walls between government, business, tertiary facilities and industry associations must come down. The separation and hierarchies which exist in Perth retard ICT development, where speed is of the essence. Knowledge creating networks are the key to industry development.

Culture.

Western Australia has been built on a pioneering and innovative culture. However the spoils of a rich resources industry and isolation from global market pressures have prevented WA from developing a truly innovative culture. Entrepreneurs and

researchers need to be publicly acclaimed and supported, to be given as much admiration as we do our sportspeople. Further, the industries actors must lose their fear of competition and embrace it as a means of innovation. An adoption of "coop-tition" is needed to share ideas and capitalise on our knowledge resources.

It will be only through significant investment in these three areas can WA achieve growth in its ICT industry. Political bipartisan support and an application of will is required to carry the vision to reality. Whilst many of the issues discussed, and the strategies outlined below have been raised in the past, there has been little implementation. The strong vision for a prosperous ICT industry must be accompanied by strategically aligned policies, designed to capitalise on the states strengths.

Within these policies, clear goals must be established to maximise productivity from our universities and research institutions, coordination of private sector development, and the provision of resources to facilitate the innovation process. Further, the development of SME's is crucial to the innovation process, and as such policies to stimulate this growth should be implemented. Access to knowledge and capital, and interaction between firms needs to be facilitated to establish strong linkages between the actors and to leverage the industries resources.

RECOMMENDATIONS AND STRATEGIES

Vision
To expand the capabilities of the Western Australian ICT industry to enhance its regional competitiveness. To provide world class products and services in our areas of expertise, and to grow the economy for the benefit for all.

ICT development should be made a government priority with leadership taken by key departments. A comprehensive program should be established to investigate, diagnose, formulate and implement constructive strategies. The REACH (Regulatory framework, Estate and infrastructure, Advancement programs, Capital, Human resource development) program initiated by Jordan, and the Tasmanian "Intelligent Island" initiative are useful models but beyond the scope of this paper to explore in detail.

Specific Initiatives

Peak Body (Institute of Collaboration)	Establish an ICT peak industry body and/or a resources sector ICT peak body. *Rationale: Many initiatives could be performed by a peak industry body. Ideally this would be a not for profit organisation and encompass a whole industry approach - not just membership based. This is needed to ensure impartiality.*
	Peak body to have access to ICT industry databases (through ICT audit as outlined above). *Rationale: Peak body to have responsibility of creating partnership relationships between industry actors and promote knowledge transfer.*
ICT Audit.	Undertake a comprehensive audit of the ICT firms in Western Australia. Determine the regions ICT capabilities. See Queensland's ICT Industry Profile. *Rationale: There is no current data on WA's ICT capabilities.*
	Identify those areas where a competitive advantage exists and those where a potential competitive advantage exists. *Rationale: Once these areas are identified, these areas can be refined to strengthen competitive advantage and build champions within them.*

Demand Mapping	Identify areas within the major local industries ie. resources sector where common demand characteristics exist. *Rationale: Create scale of demand to build local capabilities.*
Government Procurement.	Undertake a study to determine the exact nature of government ICT demand. *Rationale: Currently this information is held within each department. This information needs to be coordinated to determine common needs across departments.*
	Coordinate ICT procurement through one central body. *Rationale: To achieve scale in procurement to stimulate local firms to achieve capabilities. If WA lacks capability in particular area – coordinate procurement to attract interstate / overseas firms.*
State Based Pre Seed Funding	Re-introduce the WAISS scheme or equivalent. Recommence pre-seed funding of local start-ups. Facilitation of business skills workshops – capital raising, pitching skills etc. This may incorporate cooperation of the Australian Institute for Commercialisation or similar body. *Rationale: There is a funding gap preventing WA firms from becoming investment ready.*
International Market Focus	Increased funding/activity by Austrade, AusIndustry & DoIR in promoting WA ICT firms overseas – trade fairs, missions etc. *Rationale: The overseas market has been recognised as crucial to the development of local firms.*
Government Restructure	Investigate efficiencies of the Office of Science (Department of Premier & Cabinet) and the Innovation and the Technology Transfer Team (DoIR). *Rationale: These departments appear to perform complementary roles targeted at similar outcomes.*
R&D	Rationalise R&D activities to concentrate of several specific areas. *Rationale: There is little to be gained in being good in many areas. The state needs to develop world class expertise in areas where it can develop competitive advantage.*
Commercialisation forums for Industry Actors	Bring together members of academia, venture capital, angel investors and commercialisation departments. *Rationale: To facilitate an exchange of ideas between the parties to gain a better understanding of different agendas.*

Attract World Class Academics	Provide increased funding for academic bursaries to encourage world class researchers to Perth R&D institutions and universities. *Rationale: World class researches have the ability to produce new innovations but also attract research funding from public and private sector.*
Commercialisation as a Job Requirement	Tertiary Institutions should outline clear commercialisation goals when recruiting new academics. *Rationale: Making commercialisation initiatives a condition of employment will assist in recruiting commercialisation friendly academics allowing for smoother transition of technology to products.*
Awards Program	Public and Private sponsored awards for science, innovation and entrepreneurship, and public exposure for awardees. *Rationale: Public recognition of achievements needed to enhance innovative culture.*
Entrepreneur Networks	Integrate entrepreneurship units into undergraduate science / engineering courses. *Rationale: Highlighting the importance of technology commercialisation at this stage will promote an entrepreneurial culture.*
	Establish local entrepreneur associations amongst undergraduate and postgraduate business students with links to private sector. *Rationale: Promote networking of young entrepreneurs and give exposure to industry demands.*
ICT Industry Showcase	WA to host an ICT industry showcase (See Tasmanian Industry Showcase). *Rationale: Promotion of the local industry will raise awareness of local capabilities and attract investment*
Mentorship	Establish a mentorship network. *Rationale: Many start-up firms require periodic management advice and support. A network will also facilitate knowledge transfer.*
Industry Forums	Regular industry forums should be held bringing together representatives from all actors. *Rationale: To promote the raising and discussion of key industry issues and the transfer of knowledge.*
Social Network Functions	A role suited to a peak body is the encouragement and organisation of social events to bring together the industries actors. *Rationale: To promote social interaction in a non threatening environment to encourage the development of social and professional linkages. (See Social Network Theory – Part 1)*

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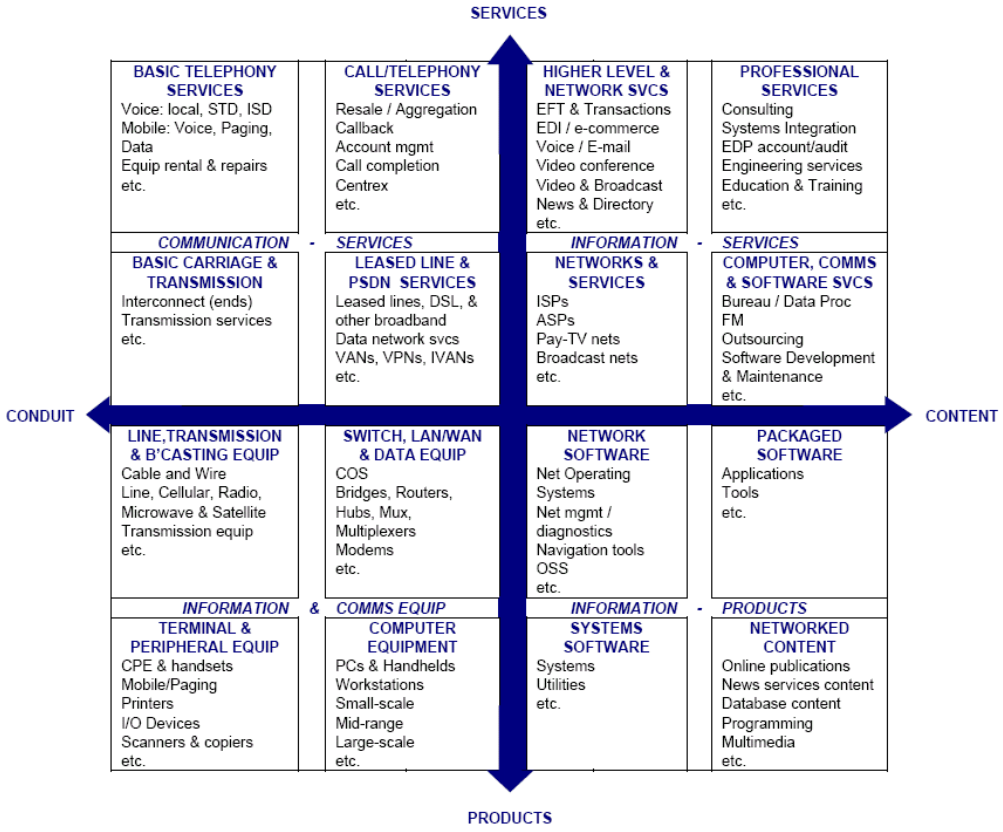
APPENDICES

Appendix 1 ICT Map



(Source: Houghton 2003)

Appendix 2: Technology Expenditure by Industry

Type of innovation activity	Coal mining $m	Oil and gas extraction $m	Metal ore mining $m	Other mining $m	Services to mining $m	Total $m
Exploration	24.4	581.3	748.5	*21.1	439.8	1 815.0
Feasibility studies	37.0	37.0	150.6	1.5	**40.4	266.6
Research and development	71.5	34.6	*305.8	*20.2	27.2	459.3
Mine development and construction costs	534.7	740.5	1 059.8	**59.4	686.2	3 080.6
New technology and capital replacement	629.6	207.6	1 384.3	*111.1	72.3	2 405.0
Environmental assessment, management and rehabilitation	70.4	24.9	113.8	6.5	31.0	246.7
Marketing	52.6	19.2	72.6	19.7	6.4	170.4
Training and further education	29.4	6.7	44.5	3.3	12.0	95.9
Total	**1 449.6**	**1 651.7**	**3 879.9**	**242.8**	**1 315.5**	**8 539.4**
Average expenditure per business	25.1	67.2	23.8	1.5	5.7	13.4

Source: (ABS 2003)

Appendix 3 Objective of Undertaken Technological Innovation

	Importance of the objective		
Objective	Not applicable %	Not important %	Important %
Cost reduction			
Lower labour costs	20.4	*10.1	69.5
Lower energy consumption costs	32.2	*10.5	57.3
Lower material consumption costs	32.1	*10.0	57.9
Lower capital equipment costs	26.7	*9.7	63.6
Lower wastage costs	22.9	*9.1	68.1
Production process			
Increase production output	22.1	**3.2	74.6
Decrease cycle times	36.6	*13.5	49.9
Maximise recovery rates	28.6	**4.8	66.6
Improve production flexibility	28.6	*2.9	68.5
Replace machinery or equipment	29.8	14.5	55.7
Environmental issues			
Reduce environmental impact	21.0	**3.3	75.6
Develop cleaner operating techniques	26.2	*9.3	64.5
Habitat management	27.5	*13.8	58.7
Land rehabilitation including waterways	26.2	*10.5	63.3
Recycling or reusing	26.7	21.9	51.4
Market share			
Maintain market share	34.3	*12.1	53.6
Increase market share	37.2	*8.1	54.6
Open new domestic markets	41.8	*8.1	50.1
Open new overseas markets	61.5	*8.4	30.2
Increase export level	66.5	*6.9	26.6
Other objectives			
Attracting staff	44.6	25.0	30.4
Improve working conditions	35.9	*10.8	53.3
Safety of staff	24.3	1.0	74.8

Appendix 4 Definition of Technological Innovation (extract from Catalogue 8121.0)

> ...comprise implemented technologically new products and processes and significant technological improvements in products and processes. An innovation has been implemented if it has been introduced on the market (product innovation) or used within a production process (process innovation). Innovations therefore involve a series of scientific, technological, organisational, financial and commercial activities. An innovating business is one that has implemented technologically new or significantly technologically improved products or processes during the period under review. Based on the Oslo Manual, the ABS has defined technological innovation in mining businesses to include:
>
> - *Product innovation,* which occurs if any *new* minerals or energy sources result from the exploration, extraction, mineral processing, smelting or refining activities of the businesses; and
> - *Process innovation*, which involves the use of any *new* technologies, techniques or processes in the exploration, extraction, mineral processing, smelting or refining activities of the businesses.