Western Australian

Technology & Industry

Advisory Council

Annual Activity Report

July 2002 – June 2003

Western Australian
TECHNOLOGY & INDUSTRY
ADVISORY COUNCIL

WESTERN AUSTRALIAN
TECHNOLOGY & INDUSTRY ADVISORY COUNCIL

Annual Activity Report

July 2002 – June 2003

WESTERN AUSTRALIAN
TECHNOLOGY & INDUSTRY ADVISORY COUNCIL

Hon. Clive Brown MLA
Minister for State Development
19th Floor
197 St George's Terrace
PERTH WA 6000

Dear Minister

On behalf of Council I am pleased to submit the Annual Activity Report for the Western Australian Technology and Industry Advisory Council (TIAC) for the year ending 30 June 2003, for your information, and subsequent presentation to Parliament in accordance with Section 26(1) and Section 26(2) of the Industry and Technology Development Act 1998.

Council has also reported through the Department of Industry and Resources' Annual Report and Financial Statement in accordance with Section 26(3) of the Industry and Technology Development Act 1998 in compliance with Section 62 of the Financial Administration and Audit Act 1985.

Council acknowledges the valuable support given to TIAC by both your office and the Department of Industry and Resources.

Yours sincerely

JOHN THOMPSON
CHAIRMAN

1 July 2003

On behalf of Council Members:

Mr Rex Baker	Mr Mick McGinniss	Professor Lance Twomey
Ms Sharon Brown	Mr Rob Meecham	Mr Tim Ungar
Dr Brian Hewitt	Professor Nigel Radford	Mr Bruce Sutherland (retired Jan 2003)
Dr Jim Limerick	Professor Beverley Ronalds	

Table of Contents

1 Introduction

The Western Australian Technology and Industry Advisory Council (TIAC) was created by legislation in 1987 (Technology Development Amendment Act - No. 32 of 1987) and was continued under Section 20 of the Industry and Technology Development Act 1998.

TIAC was preceded by the Technology Review Group 1978-1983, and the Science, Industry and Technology Council (SITCO) 1983-1987.

Council is made up of representatives from various sectors of the State's economy who, in terms of the relevant Act, use their varied background and experience, to provide independent policy advice to the Minister so as to make a significant contribution to the development of strategies relating to the State's economic development.

Members of the Council are appointed, by the Minister, under Section 22 of the Industry and Technology Development Act 1998 so as to be representative of the interests of the people of the State. A list of members is provided in Appendix 3.

TIAC reports through the Minister to Parliament under Section 26(1) and Section 26(2) of the Industry and Technology Act 1998.

TIAC reports under the Financial Administration and Audit Act 1985 through the Department of Industry and Resources under Section 26(3) of the Industry and Technology Development Act 1998.

2 Objectives of the Industry and Technology Development Act 1998

The objectives of the Industry and Technology Development Act 1998 under Section 3 are:

(a) to promote and foster the growth and development of industry, trade, science, technology and research in the State;

(b) to improve the efficiency of State industry and its ability to compete internationally;

(c) to encourage the establishment of new industry in the State;

(d) to encourage the broadening of the industrial base of the State; and

(e) to promote an environment which supports the development of industry, science and technology and the emergence of internationally competitive industries in the State.

3 Functions of the Western Australian Technology and Industry Advisory Council

The Council, under Section 21 of the Act is required to:

(a) provide advice to the Minister, at the initiative of the Council or at the request of the Minister, on any matter relating to the objects of the Industry and Technology Development Act 1998; and

(b) carry out, collaborate in or produce research, studies or investigations on any matter relating to the objects of the Act, including matters relating to the:

- role of industry, science and technology in the policies of government;
- social and economic impact of industrial and technological change;
- employment and training needs and opportunities relating to industrial, scientific and technological activities in the State;
- adequacy of, priorities among and co-ordination of, scientific, industrial and technological activities in the State;
- methods of stimulating desirable industrial and technological advances in the State;
- application of industrial, scientific and technological advances to the services of the Government; and
- promotion of public awareness and understanding of development in industry, science and technology.

4 Outcomes

In order to deliver its objectives and provide its functions, Council has divided its programmes into two main areas:

(a) provision of Ministerial advice; and

(b) promotion and public awareness raising activities.

4.1 Provision of Ministerial Advice

The advisory role to the Minister on the objectives of the Act and the encouragement, promotion and use of technology in the State, centres around three key activities:

(a) the development of reports on issues pertaining to the Act and the role of science, industry and technology development in the State. Council's reports are subjected to a public consultation phase before recommendations are submitted to the Minister;

(b) the analysis of reports written or commissioned by various national and international technology and economic development focused organisations and when appropriate, the submission of recommendations to the Minister on strategies relevant to Western Australia; and

(c) Council's participation on various State advisory and funding committees or councils.

4.1.1 Report Activity (July 2002 – June 2003)

In its advisory role to the Minister, Council has:

(a) launched, for public comment, a report titled, *Creating Western Australia's Knowledge Infrastructure: Towards Global Competitiveness and High-Value Employment*; and

(b) completed a report titled, *Enabling a Connected Community: Developing Broadband Infrastructure and Services in Metropolitan Western Australia*. This report is expected to be launched for public comment in September/October 2003.

Copies of TIAC's reports are available in the Parliamentary Library, State Library, the Universities' libraries and on the Internet at www.wa.gov.au/tiac.

A copy of the Executive Summary of the 'Knowledge Infrastructure' report is provided at Appendix 1.

4.1.1.1 Background and Expected Use of Reports

Both reports undertaken in 2002-2003 were directed for 'whole-of-government' consideration and action. It is envisaged that they will be tabled for 'whole-of-government' consideration at a meeting of the Cabinet Standing Committee on Economic Policy and considered by both the Office of Science and Innovation and the Department of Industry and Resources.

4.1.2 Participation on State Advisory and Funding Committees and Councils

Council has accepted invitations for representation and participated in:

(a) the Federal Government's Commonwealth, State and Territory Advisory Council on Innovation;

(b) the Federal Government's Innovation Festival Committee;

(c) the Ministerial Education Export Advisory Committee;

(d) the Information and Communication Technologies Strategic Advisory Group to the Department of Education and Training; and

(e) the Centres of Excellence State Funding Advisory Committee of the Office of Science and Innovation.

4.2 Promotion and Public Awareness Raising Activities

Council's promotional and pubic awareness raising programmes consist of two main types:

(a) the 2020 Breakfast Seminars, commenced in 1990, are short, economic development focused, information dissemination events; and

(b) TIAC's Internet website, to promote and increase the public awareness of its reports and encourage school students to participate in TIAC's virtual Science and Technology Forum. This activity is managed in conjunction with the Science Teachers' Association (STAWA) Talent Search Organisation.

TIAC's website received approximately 80,000 hits in May 2003 which represented a 100% increase on the May 2002 figure of 40,000. An average of 60,000 hits per month were recorded during this reporting year.

4.2.1 2020 Breakfast Seminars

The following 2020 Breakfast Seminars were planned for 2003:

(a) "Leveraging Benefits off an Effective Knowledge Infrastructure"; and

(b) "Enabling a Connected Community: Developing Broadband Infrastructure and Services in Metropolitan Western Australia".

4.2.2 Virtual Science and Technology Forum Activities

The virtual Science and Technology activities conducted were by involvement with the Science Teachers Association of Western Australia (STAWA) Science Talent Search to develop the "Science and Technology Forum Website" website competition. Issues raised in the 2002 winners websites included:

- Global Warming
- Musically Minded
- Control of the Bridal Creeper
- DNA and Technology

The presentations may be viewed on TIAC's website at www.wa.gov.au/tiac.

5 Financial Provisions

The expenses of Council are provided for under Section 15 of the Industry and Technology Development Act 1998 via the Western Australian Industry and Technology Development Account.

The 2002 – 2003 Operational Budget was $347,000.00.

6 Member's Remuneration

Council member's remuneration and allowances were determined under Section 24 of the Technology and Industry Development Act 1998 resulting in:

(a)	Chairperson's Salary	$40,000.00 (per annum)
(b)	Members Sitting fee – Non-Public Sector	
	Council Meetings	$800.00 (per meeting)
	Other Meetings	Nil
(c)	Members Sitting Fee – Public Sector	
	Council Meetings	Nil
	Other Meetings	Nil

Council conducted eleven Board meetings, eight Steering Committee meetings for the planning and development of its reports, two 2020 Breakfast Seminars, and participated in six meetings of other funding and advisory committees.

7 Executive Staff

Council is provided with a full time executive staff of three officers seconded from the Department of Industry and Resources.

TIAC's executive staff also provided secretarial and executive services to the Minister's Information and Communications Technology Industry Development Forum.

8 Financial Statement

TIAC reports under the Financial Administration and Audit Act 1985 through the Department of Industry and Resources' Annual Report and Financial Statements.

9 Outlook for 2003 – 2004

Council has, over the past three years, been developing a series of reports under a theme titled "Towards a Western Australian Knowledge Economy". In this series it has carried out studies which have discussed the advantages of:

(i) encouraging the further development of a 'knowledge component' to Western Australia's traditional industry strengths in mining and agriculture;

(ii) diversifying the State's economy by developing 'knowledge' industries and knowledge infrastructure; and

(iii) developing a State Industry Policy.

Council proposes to continue its reports to Government emphasising the need to manage the consequences of globalisation and strengthen the foundations of a Western Australian Knowledge Economy.

A diagrammatic summary of TIAC's series of reports under the theme, "Towards a Western Australian Knowledge Economy" is provided on the following pages.

In the 2003–2004 period, TIAC will be considering the development of a series of themes to act as 'umbrella topics' for its policy advisory reports.

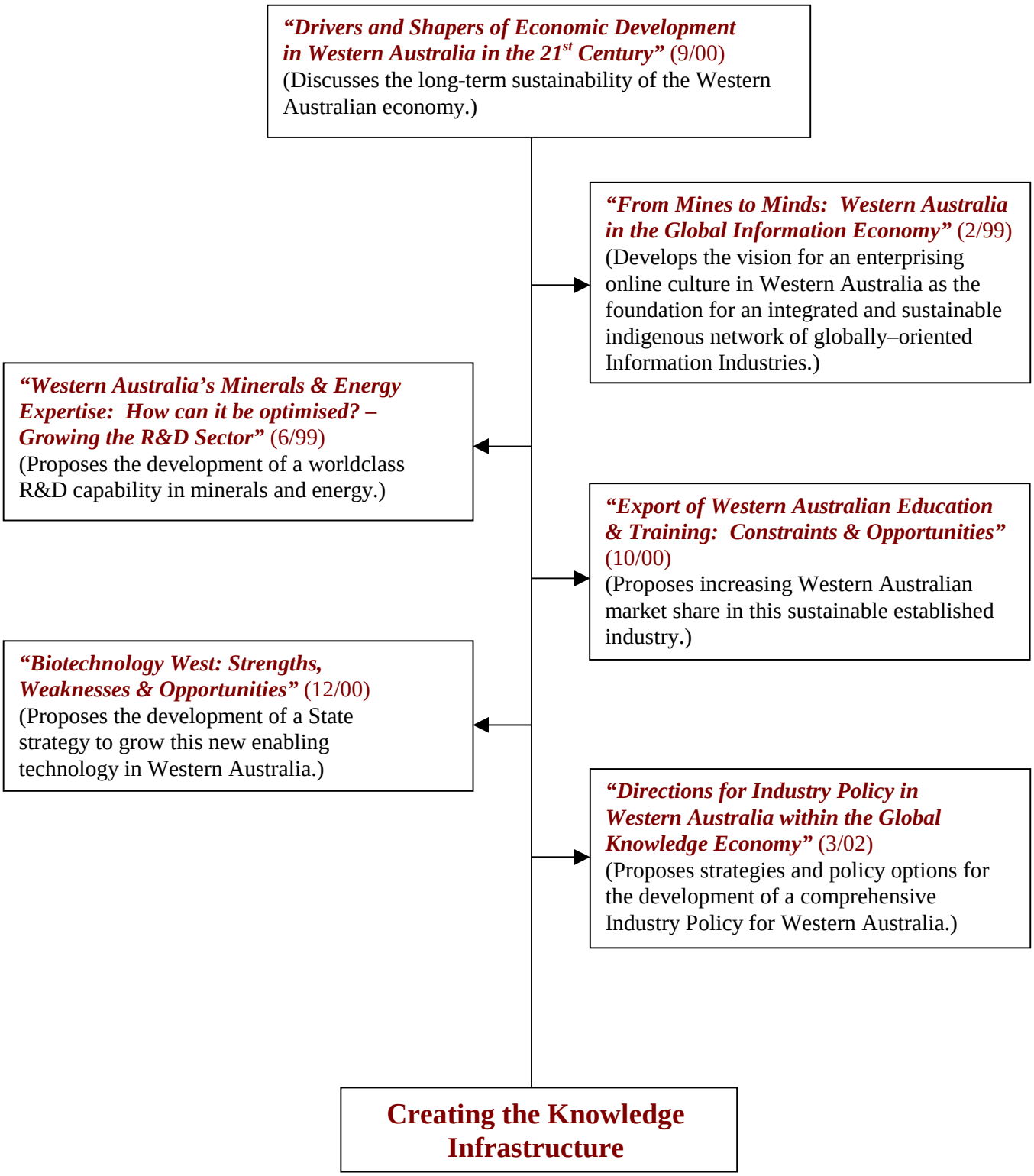
The themes will be developed in a similar way as the present theme of "Towards a Western Australian Knowledge Economy". The themes under consideration are:

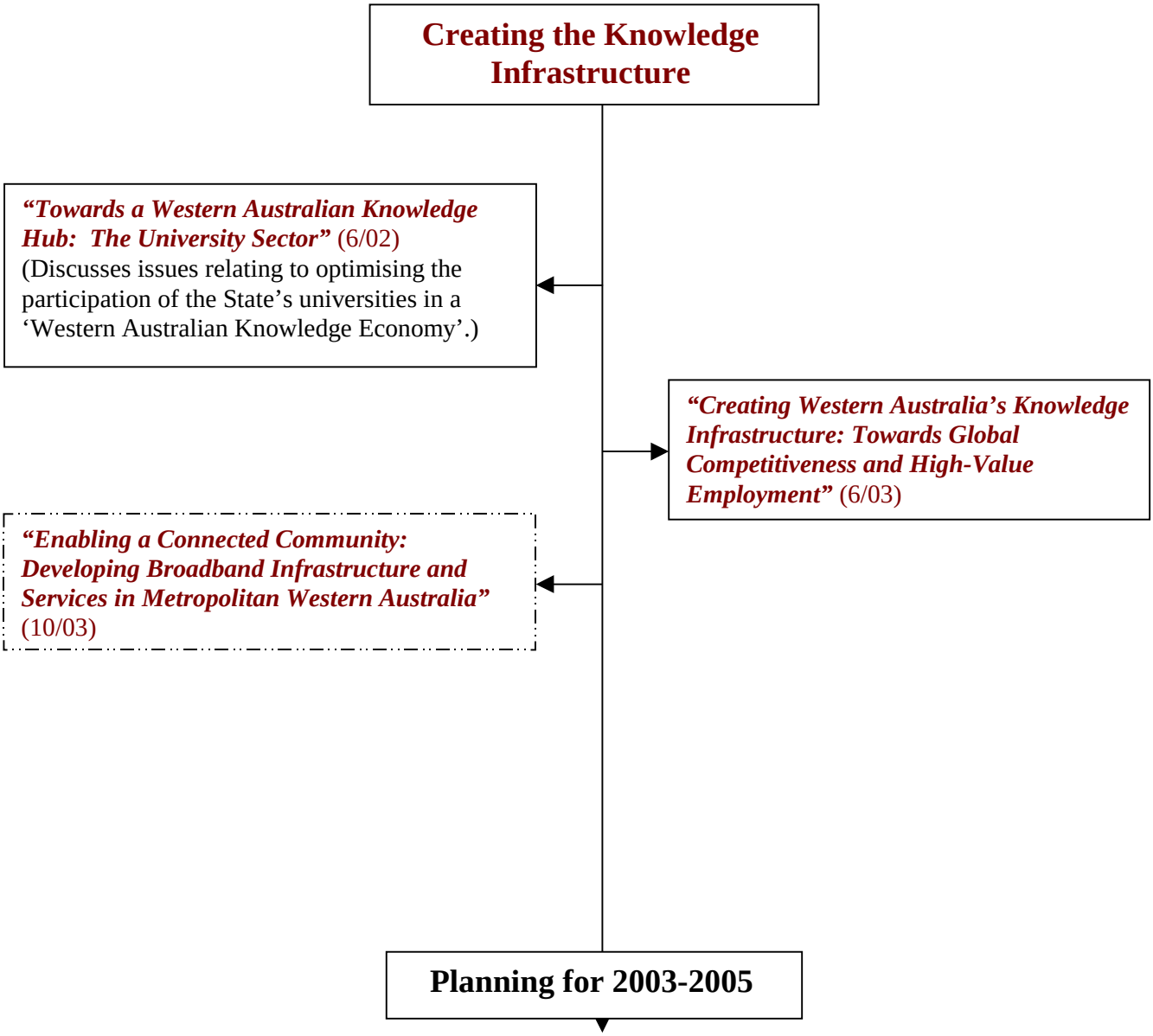
(i) "Creating the Western Australian Knowledge Infrastructure";

(ii) "Initiating and Supporting Major Economic Infrastructure for State Development"; and

(iii) "Doubling Western Australian's Export Earnings – The Next Leading Industry".

Towards a Western Australian Knowledge Economy 1999 - Present





KEY:

———— Completed Reports

–··–··– Planned Reports

Copies of these reports can be obtained from our website – www.wa.gov.au/tiac

WESTERN AUSTRALIAN
TECHNOLOGY & INDUSTRY ADVISORY COUNCIL

Creating Western Australia's Knowledge Infrastructure: Towards Global Competitiveness and High-Value Employment

June 2003

Additional copies of this report can be obtained from our website – www.wa.gov.au/tiac

Foreword

The last half of the Century has seen massive changes in the global economy which have, in turn, driven transformations in the Western Australian economy. Some industries, like whaling, have disappeared. Others, like the wool industry, are shadows of their former glory. The resources boom and North West Shelf developments are among a range of new activities that have supported wealth creation over recent years, whilst the global information and communications technology revolution is enabling further change by transforming how business is conducted.

In 1999, TIAC commenced a series of reports under the title, *"Towards a Western Australian Knowledge Economy"*. The lead report of this series was entitled, *"Drivers and Shapers of Economic Development in Western Australia in the 21st Century"* (see Appendix 4).

In 2002, TIAC commenced work on a sub-section entitled, *"Creating the Knowledge Infrastructure"*. This is the second report debating the knowledge infrastructure development.

TIAC is mindful and supportive of the State's fiscal discipline with respect to the recommendations made in this document. The recommendations are made with the objective of assisting the Western Australian government to develop policy in order to optimise economic development in Western Australia over the next decade.

I would like to thank The Allen Consulting Group for their help in undertaking research and analysis and in supporting the TIAC Steering Committee in the development of this report.

Sharon Brown
Chair, Steering Committee

Table of Contents

Executive Summary

The Importance of the Knowledge Infrastructure to Western Australia's Future

Obtaining value from the creation, sharing and use of knowledge is becoming an increasingly dominant factor in determining which economies prosper and which do not.

A transition is underway in developed economies around the world that is changing the fundamentals of economic performance and prosperity. Put simply, obtaining value from the creation, sharing and use of knowledge is becoming an increasingly dominant factor in determining which economies prosper and which do not. This capacity for systemic "innovation" is set to be a differentiator of competitive performance of countries and of regions for the foreseeable future.

Western Australia is not immune. The need to create a strong and vibrant Western Australian knowledge economy with high quality "knowledge infrastructure" as its foundation should be seen as both a challenge that has to be met and an opportunity that should be grasped.

Western Australia is not immune from this. The need to create a strong and vibrant Western Australian knowledge economy with high quality "knowledge infrastructure" as its foundation should be seen as both a challenge that has to be met and an opportunity that should be grasped. Ultimately, the State's success or otherwise in this regard will have a marked bearing on the future quality of life experienced by all West Australians.

The challenge for Western Australia in terms of positioning itself in the global knowledge economy can be stated in terms of three propositions:

- using knowledge to add value to the State's traditional industries;
- using and sharing knowledge to create new businesses; and
- connecting the State to global knowledge networks.

What is the 'knowledge infrastructure' anyway?

Knowledge infrastructure is the people, institutions and processes, and the linkages between them, which combine to provide the essential building blocks for creating and transforming ideas into tangible economic performance.

Knowledge infrastructure is defined as the people, institutions and processes, and the linkages between them, which combine to provide the essential building blocks for creating and transforming ideas into tangible economic performance.

Creating, building and developing knowledge infrastructure (such as the education and training system, research institutions and facilities, information and communications technology (ICT) systems as well as more intangible infrastructure such as clusters of elite researchers, technologists, teachers and business entrepreneurs and national and international networks and linkages) is neither a quick nor easy process. Success requires a long term and ongoing commitment and investment by governments, business and the community more generally, and where the terms "partnership", "cooperation" and "collaboration" have to be given tangible expression. There are few, if any, shortcuts.

Adopting a Global Perspective

Western Australia needs to be aware of and measure itself against world's best practice, recognising it is the global market more so than the national market that will ultimately determine Western Australia's prospects.

The reality is that Western Australia must find its place within the global economic system and, in this context, a "draw globally, adjust and apply locally" approach is an appropriate way of thinking about knowledge infrastructure creation. There are many international "exemplars" for use as reference points. This report (in Section Two) identifies some of these exemplars as being of practical relevance to Western Australia.

There is an understandable inclination for Western Australia's performance in the development of the innovation system and creation of knowledge infrastructure to be modelled on or compared against other jurisdictions in Australia, particularly those with similar natural endowments and/or economic characteristics (and against the national average). While such comparisons are appropriate up to a point there is a bigger picture to consider. Western Australia needs to be aware of and measure itself against world's best practice, recognising it is the global market more so than the national market that will ultimately determine Western Australia's prospects.

There is no external "blueprint" that can be replicated directly in the Western Australian context. The imperative is to discern and distil the key characteristics from elsewhere that are applicable to the Western Australian situation and seek to apply them intelligently by taking account of cultural, institutional and resource endowment differences.

There is no external "blueprint" that can be replicated directly in the Western Australian context. The imperative is to discern and distil the key characteristics from elsewhere that are applicable to the Western Australian situation and seek to apply them intelligently by taking account of cultural, institutional and resource endowment differences.

The Current State of Western Australia's Knowledge Infrastructure and Innovation System

Western Australia has a reasonably sound infrastructure platform but there are also gaps and some weaknesses.

Western Australia has a reasonably sound infrastructure platform for developing a knowledge economy, but there are also gaps and some weaknesses.

Western Australia has a well developed education and training infrastructure with evident high literacy and numeracy standards and performance. There are, however, weaknesses in participation levels, in particular, participation in higher education. Western Australia's research and development base is diverse with internationally recognised excellence in a number of areas. However, the research system as a whole is fragmented and lacks critical mass when considered in global terms.

The major areas of concern are participation rates in the education system, fragmentation and lack of critical mass in the R&D system, immature state of commercialisation infrastructure and availability of higher bandwidth ICT infrastructure.

The commercialisation infrastructure is less well developed and, as evidenced by indicators such as royalties and patents, commercialisation performance is lacklustre. The ICT network infrastructure is also an area of particular concern in respect of the variable availability (and, in some instances, affordability) of infrastructure capable of carrying higher bandwidths.

Building Western Australia's Knowledge Infrastructure – Key Messages?

The Western Australian government has recognised the challenge to the State's future prosperity represented by the need to increase the State's innovative capability. There are a significant number of government initiatives in place or in progress relating to Western Australia's knowledge infrastructure, most notably the Innovation Fund announced by the Premier in 2002, involving a commitment of $50 million over five years.

Notwithstanding the range of initiatives being undertaken and the investments already made, there remains a major long-term challenge to achieve the goal of a globally competitive Western Australian knowledge economy characterised by a highly skilled, high value workforce.

Notwithstanding the range of initiatives being undertaken and the investments already made, there remains a major long-term challenge to achieve the goal of a globally competitive Western Australian knowledge economy characterised by a highly skilled, high value workforce. This report highlights key messages and proposes recommended actions considered to be priorities and, in some cases, requiring urgent attention.

Setting Clear Strategic Directions and Goals

It is difficult to understate the importance of the government communicating effectively to the Western Australian community the key concepts, strategies and specific plans of action being pursued in building the State's knowledge infrastructure, and the benefits of doing so.

Even some stakeholders directly involved with the government's innovation initiatives are unsure of many aspects of the government's agenda and strategy.

It is too easy for discussion and debate concerning innovation and knowledge infrastructure creation to take on the character of a technical treatise that sounds more concerned with means than ends and runs the risk of being impenetrable to many in the community and therefore misunderstood, ignored or rejected as irrelevant to their needs.

What has not yet been conveyed to intended audiences is a sense of a coherent strategic plan of action or "game plan" for the development of the State's innovation system and how this needs to be pursued in order to achieve the goals set (e.g. a high value workforce and global competitiveness) and the benefits this is expected to generate for the State.

Investigations conducted as part of this study have shown that even stakeholders directly involved with the government's innovation initiatives are unsure of many aspects of the government's agenda, even more so in respect of the overall strategy being pursued and its connection to business competitiveness and the State's economic prosperity.

In particular, what has not yet been conveyed to intended audiences is a sense of a coherent strategic plan of action or "game plan" for the development of the State's innovation system and how this needs to be pursued in order to achieve the objectives set (e.g. a high value workforce and global competitiveness) and the benefits this is expected to generate for the State.

Ensuring Effective Intra-Governmental Coordination Arrangements

The government needs to satisfy itself that its current inter-governmental arrangements are optimal.

The way the Western Australian government seeks to manage its own knowledge infrastructure affairs (and is perceived to do so by other stakeholders) will have a major bearing on the success or otherwise of actions designed to influence others outside government to contribute strongly to knowledge infrastructure creation. The government needs to satisfy itself that its current inter-governmental arrangements are optimal.

Some of the main messages to emerge include:

There is no clearly established Ministerial authority concerning knowledge infrastructure matters and, by implication, no visible "product champion".

There is no clearly established Ministerial authority concerning knowledge infrastructure matters and, by implication, no visible "product champion", also leading to bureaucratic lines of responsibility/authority being unclear.

Opaqueness concerning the makeup and functional arrangements of Cabinet sub-committees makes it difficult to discern how the government would deal with innovation and knowledge infrastructure matters that required Executive decision but were not the focus of an expenditure proposal (i.e. under the Expenditure Review Committee) or requiring full Cabinet consideration in the first instance.

It is not apparent to what extent, if at all, there is a functional whole-of-government coordination/networking system in place that links advisory bodies.

It is not apparent to what extent, if at all, there is a functional whole-of-government coordination/networking system in place that links advisory bodies and/or integrates their advice.

Existing structural arrangements are somewhat redolent of "ministry silos" with cross portfolio coordination, to the extent it does occur, being heavily focused at the decision making level (i.e. between Ministers and their respective Ministerial offices).

Establishing a more coherent and transparent "whole-of-government" set of coordination responsibilities and arrangements should be investigated.

Establishing a more coherent and transparent "whole-of-government" set of coordination responsibilities and arrangements should be investigated.

Improving Government Programs and Services

Not all programs and initiatives relating to knowledge infrastructure would "pass muster" according to effectiveness and efficiency criteria.

There is an array of existing Western Australian programs and initiatives relating to knowledge infrastructure. The results of this study suggest that not all programs would "pass muster" according to effectiveness and efficiency criteria.

Quite a number of programs are small and administratively costly while others have not been or are not currently subject to regular review (including in the context of current or prospective infrastructure priorities).

There is apparent fragmentation of effort, leading to concerns about whether sufficient critical mass exists in key areas for effective results to be produced (even if program objectives and mechanisms are appropriate).

Taken in aggregate, there is apparent fragmentation of effort, leading to concerns about whether sufficient critical mass exists in key areas for effective results to be produced (even if program objectives and mechanisms are appropriate).

Building and Retaining Skills

People are integral to the success of the knowledge economy. Skills acquisition, development and retention, creativity and entrepreneurship (the State's human capital) are the 'engine' which drives it. Education and training is thus an issue of fundamental importance.

Good quality graduates are being produced but there is nevertheless a supply shortfall in key disciplines.

There are a number of features and strengths of Western Australia's education and training system that are important in it potentially fulfilling a pivotal role in knowledge infrastructure creation (a track record of maintaining high standards in secondary student education, a TAFE system which is market oriented and has generated a number of innovative learning platform models, and universities strong in a number of disciplines). However, education and training is an area of differing perspectives and strong opinions. Some of the key messages are:

While Western Australia is producing good quality graduates, particularly in areas where the State is strong (e.g. engineering and physical sciences) there is nevertheless a supply shortfall in these disciplines.

In secondary education there is a need to balance increasing retention rates with skills development, including the linkage to tertiary entry requirements and industry needs.

In respect of secondary education, the need is to strike a balance between increasing retention rates and skills development, including the linkage to tertiary entry requirements and industry needs. This necessitates increased interaction between business and curriculum developers.

A potential disjunction exists between education as an industry (i.e. students as a revenue stream in an educational export business model versus students as participants and partners in a life-long relationship with Western Australia and the universities they attend).

Enhanced production of high level skills in entrepreneurship and innovation management is required as a complement to science and technologies skills development.

There is a demonstrable need for enhanced production of high level skills in entrepreneurship and innovation management as a complement to science and technologies skills development.

.

Clearly, some serious issues need to be addressed if the contribution of Western Australia's education and training system to knowledge infrastructure creation (in terms of scale and quality required for global relevance) is to be realised.

Clearly, some serious issues need to be addressed if the positive features and strengths of Western Australia's education and training system are not to be compromised and its potential contribution to knowledge infrastructure creation (in terms of scale and quality required for global relevance) is to be realised. Foremost among these is breaking down a propensity to not think and act beyond the bounds of the corporate objectives of the individual entity (whether it be at the level of an individual university faculty or at the level of organisations/institutes as a whole).

It is difficult not to draw comparisons between the situation pertaining to international exemplars referred to in Section 2 and that of Western Australia. The apparent differences epitomise why Western Australia has some way to go to approach the level of world's best practice and be regarded as an exemplar for others.

Building Critical Mass and Linkages

Innovation system participants tend to seek their own diverse goals in isolation from one another - "silo thinking", a "linear" rather than an "ecosystem" approach and an inability/unwillingness to break out of sectoral bounds.

A consistent message to come out of this study is the need for greater attention to, and improvement in, building critical mass and strengthening linkages within the innovation system in Western Australia.

During public consultations, it was revealed that innovation system participants in Western Australia tended to seek their own diverse goals in isolation from one another. For example, prevalent "silo thinking", a "linear" rather than an "ecosystem" approach and an inability/unwillingness to break out of sectoral bounds were but a few of the descriptions proffered.

Coupled with Western Australia's research and development expenditure, an indicator of innovation, being low by national and international standards, this fragmentation of effort means the deck is stacked against Western Australia achieving critical mass and effective linkages unless there is a circuit breaker.

The prevailing view amongst stakeholders seems to be that the government needs to take steps to show it is serious about fostering a collaboration culture in the State without stifling beneficial competition.

The prevailing view amongst stakeholders seems to be that the government needs to take steps to show it is serious about fostering a collaboration culture in the State without stifling beneficial competition. It is also apparent that there is widespread support for the government taking a leadership role in bringing relevant stakeholders together (i.e. as convenor/facilitator) focused on developing a tangible initiative that would build on and extend from the State's acknowledged economic strengths and existing clusters and networks.

Attracting and Securing Investment

The ability to attract investment and to secure reinvestment from outside Western Australia (by ensuring that capability is strongly "embedded") is an important aspect of building Western Australia's knowledge infrastructure. In the same way, fostering strong growth in knowledge infrastructure investment from within the State (both public and private) is also fundamental.

A challenge for the government is getting to a position of being able to make informed decisions about what are worthwhile investments.

A challenge for the government in the context of securing high quality investments in knowledge infrastructure is getting to a position of being able to make informed decisions about what are worthwhile investments and how valuable they are in terms of the benefits they are likely to contribute to Western Australia. This becomes a particular area of concern and importance when the government is either approached by external parties or proposals arise from within the government system to financially support a particular knowledge infrastructure investment or proposition.

There is an absence of coherent decision criteria supported by a defined and rigorous evaluation process for dealing with investment proposals.

There is currently an absence of coherent decision criteria supported by a defined and rigorous evaluation process for dealing with such cases. The risk of not addressing this issue is that government consideration of investment proposals could become ad hoc and inconsistent (relatively and in the context of government policy frameworks/settings).

There needs to be an appropriately assigned body to represent the Western Australian government in external negotiations and in coordinating whole-of-government assessments of investment proposals.

There also needs to be an appropriately assigned body to represent the Western Australian government in external negotiations and in coordinating whole-of-government assessments of investment proposals, recognising that in most instances it is neither appropriate nor prudent for such dealings to involve Ministers.

Developing Clusters

There are relatively few well established and globally competitive clusters in Western Australia.

There are relatively few well established and globally competitive clusters in Western Australia. However, competitive clusters that are recognised and regarded as such do exist in mining and energy and in agri-food. There also appears to be some other 'emergent' clusters (such as in environmental services, biomedical services, and maritime and defence engineering).

To date there appears not to have been any focused attempt to 'map' Western Australia's existing or emergent clusters (e.g. against world's best examples) as a basis for validating assumptions about what they actually comprise and for guiding governmental action directed at facilitating their further development.

However, to date there appears not to have been any focused attempt to 'map' Western Australia's existing or emergent clusters (e.g. against world's best examples) as a basis for validating assumptions about what they actually comprise and for guiding governmental action directed at facilitating their further development. This is important for a number of reasons, including in determining what role technology parks or enterprise precincts can/should play in cluster formation and development (recognising the government's previous and possible future investments in this area).

Strengthening ICT Networks

ICT network infrastructure in Western Australia is currently not of sufficient quality and coverage to make it a key driver or enabler of innovation.

The existence of a functional and robust ICT network is an essential infrastructure component, not just from the perspective that ICT companies potentially represent important high skill, high wage employers, but also because they are the providers of products and services that are the enablers for other sections of the knowledge economy to communicate and operate.

ICT network infrastructure in Western Australia is currently not of sufficient quality and coverage to make it a key driver or enabler of innovation. It is suggested that there is not a lot of options for government in seeking to upgrade the State's ICT networks or to stimulate the industry to take similar action (i.e. encourage carriers to invest) that would not either involve major public expenditure and/or result in market distortions.

A forthcoming TIAC report (Broadband Bandwidth in Metropolitan WA) deals specifically with ICT network issues.

This is not to say the government should do nothing. Noting that another forthcoming TIAC report (*Broadband Bandwidth in Metropolitan Western Australia*) deals specifically with ICT network issues, there are actions that could be taken that would have a positive long-term effect without significant public expenditure or market intervention, such as in the area of urban and industrial planning.

Improving Leverage Potential with National Programs and Initiatives

Western Australia has not been particularly successful over recent years in securing what is considered to be a satisfactory proportion of national program resources

Western Australia has not been particularly successful over recent years in securing what is considered to be a satisfactory proportion of resources available from national programs, except in areas such as agriculture and resources.

A variable appreciation of joint venture and alliance building as a winning strategy in competitive bidding processes, coupled with variability in the skill sets of researchers concerning preparation and presentation of high quality bids, is hampering Western Australia's performance in securing Commonwealth funding.

There is a highly variable appreciation and regard for joint venture and alliance building as a winning strategy in competitive bidding processes, which tend to be the predominant character of Commonwealth programs relating to innovation. This, coupled with variability in the skill sets of researchers concerning preparation and presentation of high quality bids, is hampering Western Australia's performance in securing Commonwealth funding.

There is also, paradoxically, evidence of a tendency for many Western Australian research bodies to be overly preoccupied with securing Commonwealth funds. While perhaps understandable in the circumstances of Western Australia's relative underperformance in this respect, this does, however, have the potential to divert attention away from research which is integral to achieving the primary mission of research bodies.

Opportunities should only be pursued if they are consistent with strategic intent. Such opportunities are more likely to be of this character where the Western Australian research agency is able to develop a "partnership" with the Commonwealth agency.

Developing International Linkages

An "alumni" approach to creating and extending Western Australia's international networks has been suggested as one potentially highly effective, relatively low cost means of extending Western Australia's "sphere of influence".

The establishment and maintenance of effective networks lies at the centre of the most successful knowledge economies. While there are a number of ways of building international linkages, an "alumni" approach to creating and extending Western Australia's international networks has been suggested as one potentially highly effective, relatively low cost means of extending Western Australia's "sphere of influence". It also has relevance for attracting talent and investment.

It is apparent that there is quite an extensive informal, if fragmented, network of Western Australian expatriates, many in very senior research, business and other roles, spread around the globe. Taking steps to establish an encompassing and systematic approach to tracking, informing and interacting with expatriates who are associated with the knowledge economy and who are familiar with or have connections to Western Australia is regarded as worthy of investigation.

Measuring and Monitoring Performance

Integral to a strategic approach to building Western Australia's knowledge infrastructure has to be serious ongoing attention to measuring and monitoring performance. This has not been a feature of the Western Australian system to date.

Integral to an emphasis on adopting a strategic approach to building Western Australia's knowledge infrastructure has to be serious ongoing attention to measuring and monitoring performance. This has not been a feature of the Western Australian system to date.

Performance measurement and monitoring needs to operate effectively at two levels. At the "macro" level it involves measurement of progress in Western Australia's knowledge infrastructure creation and of outcomes that can be attributed to the "investments" made (such as in relation to high-value jobs created, discernible improvements in business performance and competitiveness and broader economic results in relevant industries or the economy as a whole). The Porter-Stern framework for measuring the innovation capacity and performance of an economy (as discussed in Section Two).

At the "macro" level this involves measurement of progress in Western Australia's knowledge infrastructure creation and of outcomes that can be attributed to the "investments" made (such as in relation to high-value jobs created, discernible improvements in business performance and competitiveness and broader economic results in relevant industries or the economy as a whole).

At the "micro" level (i.e. in respect of individual programs or initiatives) the imperative is to have performance measurement and monitoring integrated in their design and operation as the basis of a transparent and recurrent evaluation/review methodology. Performance measurement needs to focus on both effectiveness (i.e. measuring outcomes achieved against goals and objectives set) and efficiency (i.e. measuring program/initiative outputs relative to the administrative cost of delivering them).

Recommendations

The Technology and Industry Advisory Council (TIAC), being mindful and supportive of the government's fiscal policy, makes the following recommendations.

Setting Clear Strategic Directions and Goals

Recommendation 1

The West Australian government, as part of its innovation policy statement, set out clearly defined goals in respect of building Western Australia's knowledge infrastructure and the details (principal initiatives and mechanisms) of a strategic plan of action by which it will seek to achieve them.

Ensuring Effective Intra-Governmental Coordination Arrangements

Recommendation 2

The Western Australian government assign explicit Ministerial responsibility for knowledge infrastructure matters, carrying with it the responsibility for developing and implementing effective 'whole-of-government' (including inter-Ministerial and inter-agency) coordination/networking arrangements.

Improving Government Programs and Services

Recommendation 3

The Western Australian government consolidate available resources into an integrated set of key programs which have (i) clear objectives relating to agreed policy priorities (ii) appropriate scale (iii) low administrative overheads (iv) strong inter-program and external synergies and (v) clear evaluation and review arrangements.

Recommendation 4

The Minister for State Development recommend that the Department of Industry and Resources extend the online innovation portal known as the 'WA Centre for Innovation' into a full 'one stop' entry point for external stakeholders (i.e. a 'hub' for government information) to (i) consolidate, synthesize and disseminate information on Western Australia's innovation system (ii) act as a repository for relevant national/international developments and (iii) act as both a physical as well as virtual (i.e. online) 'portal' for stakeholders concerning innovation system and knowledge infrastructure issues.

Building and Retaining Skills

Recommendation 5

The Western Australian government take action to encourage the graduate business schools in the Western Australian universities to collaborate to establish an internationally recognised and regarded (i.e. a "WA brand") post graduate course with a curriculum focus on entrepreneurship and innovation management in a global knowledge economy and the outcomes achieved in this process be used as a basis for assessing other potential collaborative initiatives in the Western Australia education sector.

Recommendation 6

The Western Australian government investigate vocational training models (i.e. learning platforms) such as those being developed by some of the TAFE's (e.g. Central TAFE's 'The Design Centre' pilot program to provide real and virtual vocational training solutions for industry) for their relevance in the context of creating the research incubator/knowledge hub proposed in Recommendation 8.

Building Critical Mass and Linkages

Recommendation 7

The Western Australian government incorporate in the eligibility criteria for State funding of research programs and initiatives a requirement that all collaborative opportunities and pathways have been fully investigated by prospective recipients as a basis for awarding funds and that where funding is awarded on the basis of a collaborative initiative there be a mechanism to ensure collaboration continues after the funds are provided.

Recommendation 8

The Western Australian government develop a proposal, in collaboration with Western Australian universities, vocational training bodies, research institutes and potential business participants/sponsors, for establishment of a 'research incubator' modelled on successful international examples (such as Yamacraw in Georgia in the USA referred to in Section 2 of this report) that would (i) act as a 'knowledge hub' (ii) provide a focus for research collaboration and commercialization (iii) link research and training to business/market opportunities and (iv) assist growth in knowledge-intensive areas according to market determinants.

Attracting and Securing Investment

Recommendation 9

The Western Australian government, through the Departments of Premier and Cabinet, Treasury and Finance, Industry and Resources and Education and Training, develop decision criteria (for consideration by Cabinet) and which, once agreed, will be made public and used by the Western Australian government to guide its decisions in respect of major investments in the knowledge infrastructure (i.e. those requiring an explicit government decision at Cabinet or Ministerial level).

Recommendation 10

The Western Australian government give consideration to appointing/assigning a person or body to represent the Western Australian government in non-Ministerial liaison/negotiation with the Commonwealth government in relation to major knowledge infrastructure investment/development proposals and in this context, to be a coordinator of inputs and advice to the Western Australian government decision making process on such matters.

Developing Clusters

Recommendation 11

The Minister for State Development recommend that the Department of Industry and Resources undertakes work to 'map' Western Australia's existing and emergent clusters so that their substantive makeup and characteristics can be described in sufficient detail to assist policy making and public communication concerning their relevance and potential contribution to a Western Australian knowledge economy.

Strengthening ICT Networks

Recommendation 12

The Western Australian government through the Department of Planning and Infrastructure, in consultation with Landcorp, Western Power (incorporating Bright Communications) and other relevant agencies collaboratively review the arrangements governing the development of industrial and residential land with a view to determining the extent of any impediments (such as legislative, planning or financial) to installing 'broadband ready' infrastructure (e.g. conduit fibre optic cables) as part of the development process, in order to ensure that all government sponsored and funded developments are 'broadband ready'.

Improving Leverage Potential with National Programs and Initiatives

Recommendation 13

That the Minister for State Development recommend that the Department of Industry and Resources develop and maintain a "tool kit" for prospective applicants for Commonwealth programs and establish a dedicated advisory service (potentially in association with the proposed establishment of the "one stop entry point" initiative at recommendation 4), with a view to improving the capacity of Western Australian applications achieving success in competitive bidding processes.

Developing International Linkages

Recommendation 14

The Western Australian government support the establishment and maintenance of a Western Australian alumni database and network (focusing on expatriate graduates and postgraduates from Western Australian universities and elite researchers/technologists, teachers and business leaders/executives with experience of Western Australia), with a view to developing a global network of contacts with connections to/appreciation of Western Australia, supported by an online information service.

Measuring and Monitoring Performance

Recommendation 15

The Minister for State Development recommend an annual "State of Knowledge Infrastructure in Western Australia" report, be prepared and publicly released by the Department of Industry and Resources, either as a stand alone volume or as part of a broader compendium, such as "The State of Western Australia's Innovation System". The report should be set against the best practice principles set out in Section 5.1 and should incorporate chapters on (i) high-value jobs created (ii) a description and, where appropriate, measurement of, the cost of and benefits derived from programs and initiatives taken by the government during the period and (iii) a performance assessment of Western Australia's knowledge infrastructure and innovation system, based on the Porter-Stern or other appropriate methodology, against relevant international benchmarks.

Western Australian Technology and Industry Advisory Council Membership

Mr John Thompson
TIAC Chairman
National Chief Executive (Australia)
SGS Australia Pty Ltd

Mr Rex Baker
Chairman (formerly)
Executive Committee/Board of Directors
Worsley Alumina Pty Ltd

Ms Sharon Brown
Strategic Business Manager
AlphaWest

Dr Brian Hewitt
Chief Executive Officer and Managing Director
Clough Limited

Dr Jim Limerick
Director General
Department of Industry and Resources

Mr Mick McGinniss
Agricultural Producer
Director of CBH Ltd

Mr Rob Meecham
Director of the Business Development Unit
Challenger TAFE

Dr Nigel Radford
Chief Geochemist
Newmont Australia Ltd

Professor Beverley Ronalds
Chief of Petroleum Resources
CSIRO Petroleum

Professor Lance Twomey
Vice Chancellor
Curtin University of Technology

Mr Tim Ungar
Chairman
Telecommunications Services Australia

Publications of TIAC 1988-2003

PUBLICATION TITLE	DATE
Support for West Australian Software Industry	July 1988
New Challenges & Opportunities	July 1988
Technology Parks	July 1988
Intelligent Buildings: What role for the WA Government?	Sept 1988
US State Government Policies Designed to Encourage the Commercialisation of New Ideas: Some Recommendations for WA	Sept 1988
WA Software Industry (Second Report)	Oct 1988
An Industrial Science Policy for Western Australia: Some Seed Ideas	Oct 1988
Towards a West Australian Science Policy for the 1990's	Nov 1988
Inquiry into Venture Capital in Western Australia	March 1989
The Case for a New Branch of Manufacturing to Provide Smart Equipment for the Mining Industry	March 1990
The Export Debate	May 1990
Tomorrow's People in Science & Technology	March 1991
Bentley Technology Precinct: An Exploratory Study	Sept 1992
The Western Australian Technology School of the Future: A Feasibility Study	Oct 1992
Capturing Opportunities in Asia with Western Australian Science & Technology	Nov 1992
Telecommuting 2000: Making the Future Work for Western Australia	Dec 1992
Telework 2000: Making the Future Work for Western Australia	July 1993
R&D and the State's Economic Development: What is the best fit?	April 1994
Medical Research Infrastructure Funding in Western Australia	April 1995
Towards an Information Infrastructure Policy for Western Australia – the Business Aspect	Feb 1996
Financing Options for Regional Infrastructure in Western Australia	Nov 1996
Telecommunications Deregulation – Is Western Australia prepared?	Dec 1996
Western Australia's Minerals and Energy Expertise: How can it be optimised? – *Defining the Issues – A Background Paper*	Sept 1997

Publications of TIAC 1988-2003 (Cont'd)

PUBLICATION TITLE	DATE
Research & Development: Role of the State Government in attracting External Funding	May 1998
Western Australia's Minerals and Energy Expertise: How can it be optimised? – *Growing the R&D Sector*	June 1999
Technology, Skills and the Changing Nature of Work	April 2000
Drivers and Shapers of Economic Development in Western Australia in the 21st Century	Sept 2000
Export of Western Australian Education and Training: Constraints and Opportunities	Oct 2000
Biotechnology West: Strengths, Weaknesses and Opportunities	Dec 2000
Directions for Industry Policy in Western Australia within the Global Knowledge Economy	March 2002
The Organisation of Knowledge: Optimising the Role of Universities in a Western Australian Knowledge Hub	June 2002
Creating Western Australia's Knowledge Infrastructure: Towards Global Competitiveness and High-Value Employment	June 2003
Enabling a Connected Community: Developing Broadband Infrastructure and Services in Metropolitan Western Australia	Oct 2003