Western Australian

Technology & Industry

Advisory Council

Annual Activity Report

July 2001 – June 2002

WESTERN AUSTRALIAN
TECHNOLOGY & INDUSTRY ADVISORY COUNCIL

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TECHNOLOGY & INDUSTRY ADVISORY COUNCIL

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

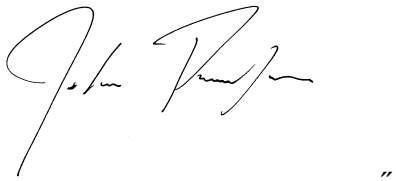
Dear Minister

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 2002, 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 Technology's 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 Technology.

Yours sincerely



JOHN THOMPSON
CHAIRMAN

1 July 2002

On behalf of Council Members:

Mr Rex Baker	Mr Rob Meecham	Mr Bruce Sutherland
Ms Sharon Brown	Professor Nigel Radford	Professor Lance Twomey
Dr Brian Hewitt	Professor Beverley Ronalds	Mr Tim Ungar
Mr Mick McGinniss	Dr Paul Schapper	Dr Lesley Borowitzka (retired Dec 2001)

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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 Technology 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

Council's programmes are divided into two areas:

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 2001 – June 2002)

In its advisory role to the Minister, Council has:

(a) completed a report titled "Directions for Industry Policy in Western Australia within the Global Knowledge Economy"

(b) launched for public comment a report titled "The Organisation of Knowledge: Optimising the Role of Universities in a Western Australian Knowledge Hub".

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.

Copies of the Executive Summary of these reports are provided in Appendix 2 and Appendix 3 respectively.

A copy of the Executive Summary for "Directions for Industry Policy in Western Australia within the Global Knowledge Economy" is detailed later in this report.

4.1.1.1 Background and expected use of these reports

(a) TIAC's "Directions for Industry Policy" report was a development of some of the issues raised in the "Drivers & Shapers" report launched in September 2000. It is envisaged that both these reports will contribute to the development of a State Industry Policy.

(b) In October 2000 TIAC completed a report "Export of Western Australian Education & Training: Constraints & Opportunities", which introduced the concept of a Western Australian

Knowledge Hub. In its "Organisation of Knowledge" report, TIAC has developed the concept of a Western Australian Knowledge Hub which can be grown to become globally recognised for specialised niche skills. It is expected that these reports will contribute to the decisions of the recently established "Ministerial Education Export Advisory Council" (MEEAC) and the development of the Government's "Value of Education for Economic Development" strategy.

4.1.2 Participation on State Advisory and Funding Committees and Councils

Council has accepted invitations for representation and participated in:

(a) the Ministerial Education Export Advisory Committee

(b) the Federal Government's "Commonwealth, State and Territory Advisory Council on Innovation".

(c) the Federal Government's Innovation Festival Steering Committee.

4.2 Promotion and Public Awareness Raising Activities

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

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

(b) the Science and Technology Forums, which are participative workshop events, commenced in April 1997 in order to "raise the awareness of science and technology in the community and increase the community's input in the State's directions in Science and Technology"; and

(c) TIAC's Internet website, to promote and increase the public awareness of both its reports and the virtual Science and Technology Forum for school students. Access to the website ranges from 30,000 to 40,000 hits per month inclusive of local, national and international interest and the downloading of TIAC's reports.

4.2.1 2020 Breakfast Seminars

From July 2001 to June 2002, the following 2020 Breakfast Seminars were conducted:

(a) "Positioning Western Australia in the Global Biotechnology Sector"

(i) "The Australian Biotechnology Report 2001".
(ii) "Bio 2001 (San Diego) – Opportunities for Western Australia"

(b) "Directions for Industry Policy in Western Australia within a Global Knowledge Economy"

(c) "The Organisation of Knowledge: Optimising the Role of Universities in a Western Australian Knowledge Hub"

4.2.2 Science and Technology Forum Activities

Science and Technology Forum Activities conducted were:

(a) involvement with the Science Teachers Association of Western Australia (STAWA) Science Talent Search to develop the "Science and Technology Forum Website Competition". Websites developed by the winners of these competitions may be viewed at www.wa.gov.au/tiac;

(b) "The Challenge on the Journey to a Sustainable Future – Surviving or Thriving" which was a half day workshop with Dr Peter Ellyard, Executive Director, Preferred Future.

(c) "Globally Focussed", also a half day workshop, with Dr Peter Farrell, CEO ResMed Inc.,

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 2001 – 2002 Operational Budget was $403,000.

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, three 2020 Breakfast Seminars, two S & T Forums and participated in ten meetings of other funding and advisory committees.

7 Executive Staff

Council is provided with a full time executive staff of two officers seconded from the Department of Industry and Technology.
The current Executive Officer is Mr Earl White.

8 Financial Statement

TIAC reports under the Financial Administration and Audit Act 1985 through the Department of Industry and Technology's Annual Report and Financial Statement.

9 Outlook for 2002 – 2003

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 and developing "knowledge" industries;

(iii) developing a State Industry Policy;

Council proposes to continue its reports to Government emphasisng 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 next page.

In the 2002 – 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) "Strengthening the Foundations of the Western Australian Knowledge Economy";

(ii) "Creating the Western Australian Knowledge Infrastructure"; and

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

"Towards a Western Australian Knowledge Economy"

"Drivers and Shapers of Economic Development in Western Australia in the 21st Century" (9/00)
(Discusses the long-term sustainability of theWestern Australian economy.)

"From Mines to Minds: Western Australia in the Global Information Economy" (2/99)
(Develops the vision for an enterprising online culture in Western Australia as the foundation for an integrated and sustainable indigenous network of globally–oriented Information Industries.)

"Western Australia's Mineral & Energy Expertise: How can it be optimised? – Growing the R&D Sector" (6/99)
(Proposes the development of a worldclass R&D capability in minerals and energy.)

"Export of Western Australian Education & Training: Constraints & Opportunities" (10/00)
(Proposes increasing WA market share in this sustainable established industry.)

"Biotechnology West: Strengths, Weaknesses & Opportunities" (12/00)
(Proposes the development of a State strategy to grow this new enabling technology in Western Australia.)

"Directions for Industry Policy in Western Australia within the Global Knowledge Economy" (3/02)
(Proposes strategies and policy options for the development of a comprehensive Industry Policy for Western Australia.)

"Towards a Western Australian Knowledge Hub: The University Sector" (6/02)
(Discusses issues relating to optimising the participation of the State's universities in a Western Australian Knowledge Economy.)

2002-2003 Reporting Programme
(to be finalised)

WESTERN AUSTRALIAN
TECHNOLOGY & INDUSTRY ADVISORY COUNCIL

Directions for Industry Policy in Western Australia within the Global Knowledge Economy:

Sustainable Prosperity through Global Integration

March 2002

Copies of Supporting Papers referred to in this report can be obtained from:- www.wa.gov.au/tiac

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

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Foreword

Since the release of our discussion paper, "Drivers and Shapers of Economic Development in Western Australia in the 21st Century" in September 2000, debate has intensified on the impacts of globalisation and the knowledge economy on regional economies, such as Western Australia. New terms, such as 'Branch Office Economy', have been coined to describe the adverse impact of international corporations merging and consolidating their core intellectual property functions at locations external to Western Australia and Australia generally.

Following analysis of feedback from industry and the wider community on the "Drivers and Shapers" report, TIAC developed terms of reference for this follow-up study. While we acknowledge the continuing underlying strengths of the WA economy, we believe the development and implementation of a proactive set of industry policies is an imperative for the current State Labor Government led by Dr Geoff Gallop. This report identifies and describes both the opportunities and the challenges facing Western Australian industry as a consequence of the impacts of globalisation and the advent of the knowledge economy. The report proposes a clear course of immediate action for the government, in partnership with industry, that provides the best chance of continuing strong economic growth and, even more importantly, a significant growth in full-time, highly skilled, quality jobs.

TIAC is strongly of the view that this report provides the appropriate template for a set of sound industry policies for Western Australia. The recommended policy directions have been developed in such a way that they can be embraced by industry. Indeed success will be maximised when industry is fully on board and supportive of Government industry policies.

I would like to thank Professor Peter Sheehan, Professor John Houghton and Mr Ainsley Jolley from the Centre for Strategic Economic Studies, Victoria University of Technology, Professor Ron Johnston from the Australian Centre for Innovation and International Competitiveness and Mr Peter Morris from Whitehorse Strategic Group.

Bruce Sutherland
Chairman
TIAC Steering Committee

Executive Summary

Interpreting the Knowledge Economy

The starting point for this study is the fact that globalisation and the transition to a knowledge-based economy are driving a transformation of the nature and structure of the world economy. The rise in the *knowledge intensity* of economic activities and the increasing *globalisation* of economic affairs are driving pervasive change affecting every industry, firm, individual and region.

This transformation is not a matter of one or two technologies or industries. Nor is it just another way of emphasising the ICT revolution or any particular new technology, such as biotechnology. These are all important, but they are not the whole story. Knowledge generated on a global basis is being applied to all industries, and many existing industries are very advanced. For example, the Australian mining industry is a global leader in innovation and development. The response of existing industries will be as important as the creation of new industries, and will give rise to many new business opportunities.

In seeking to understand emerging trends, much of the contemporary literature emphasises the *systemic* nature of relationships and activities in the economy. The systemic approach recognises a whole range of non-market linkages that are central to the economic system (such as organisational and institutional persistence, cooperation, alliances, information exchange and mutual dependency), as well as the role of organisations other than firms.

This systemic character is of three main forms. One is the persisting influence of past events on present and future outcomes (*path dependence*). The second is the complex linkages between many different institutions and organisations at a given point of time, such as those that determine the level of innovation (*the innovation system*). The third is the linkages between the various aspects of a complex system involved in the creation, production and distribution of a product, or a set of products (*the product system*).

Recognition of this systemic character has many important implications for policy. They include the need to focus on a region's innovation system and on the positioning of its firms within global product systems. This systemic character also implies that, however urgent and trans-formative it is, change must be evolutionary, with a progressive strengthening of the organisations, institutions and systems supporting regional growth.

The major elements in the global knowledge economy all impact on the choices made by firms about where to locate their activities. These impacts may weaken the position of many economies. Indeed, the new technologies have made possible the consolidation of particular aspects of the product system in preferred locations on a global basis. This has led to the 'hollowing out' of peripheral regions in many important respects.

Thus a central challenge facing many economies is to use the increased access to global markets and information sources that the new economy makes possible to offset the impact of global consolidation on the structure of their economies.

The Position of Western Australia

Like Australia as a whole, Western Australia is forced to address the challenges facing small peripheral economies in the emerging world. But it does so from a base of centrality in certain resource areas, and in some other areas as well. This report, as indeed most discussions of the State's longer-term future, is essentially concerned with this interplay between the problems of small peripheral economies and the opportunities provided by the State's existing strengths.

Several conclusions emerge from a review of the situation of Western Australia at the beginning of the 21st century. The State has continuing strengths in a range of goods industries, and in the services that underpin these industries. This is evident not only in the mining and resources sector but also in manufacturing, where employment has continued to grow against the national trend and where exports are growing strongly in specific niche areas.

On the other hand, there are several signs in the State of that 'hollowing out' of domestic capabilities characteristic of a peripheral economy in a globalising world. These signs include falling full-time employment in recent years in certain service areas (finance, cultural services and personal services); slower than national employment growth in communications and a low share of the ICT industry activity; and sharp falls in business sector R&D in recent years. It is perhaps too early to draw any definitive conclusions from these signs, but these are early warnings of powerful forces at work.

This suggests that our conclusion above about many peripheral economies applies also to this State. That is, that a central challenge for policy in Western Australia is to use the increased access to global markets and information sources that the new economy makes possible to offset the impact of global consolidation on the structure of the economy.

The Role of Industry Policy

The role of industry policy is one of the most contentious issues in applied economics. The position taken in this report is that, in the global knowledge economy, factors giving rise to market failures are pervasive, and even systemic, and that in appropriate circumstances government policy can generate an improved outcome. This means that there is a definite role for carefully specified industry policies. But it must be clearly recognised that governments as well as markets can fail and that, as far as possible, such policies should enhance rather than confound the operation of market forces.

This position is consistent with the dominant trend in the theoretical and empirical literature, with much of the specific literature about the knowledge economy, and with the practice of many governments around the world in responding to the emerging economic situation. If industry policy is to be effective, it is also vital that the programs in which it is expressed be up to the scale of the challenge facing Western Australia. This

implies that they are both sufficiently well resourced, and sufficiently well targeted on a limited number of programs, to make a real difference to the structure of economic activities in the State. The many industry policy initiatives that currently operate within the State may be too small and diverse to have such an impact. Our assessment is that a coordinated program of the order of $200 million a year for four years, or about 1% of GSP over the four year period, would be of a sufficient scale to influence the long term structure of the Western Australian economy.

This report is about the directions for industry policy in Western Australia. It does not attempt to develop detailed policy specifications, to prescribe specific funding levels nor to allocate a suggested level of funding over policy areas or specific programs. The detailed development of policies, and the allocation of funding, is a matter for the Government and its departmental advisers. We do emphasise, however, that financial responsibility involves not only short-run management of revenue, expenditure and debt, but also requires that prudent attention be given to the long run health of the State's economy.

Directions for Industry Policy in Western Australia

The key directions for industry policy in Western Australia should be the following:

1. *A strategic, whole of government approach to industry policy.* The policy needs to be strategic in that its various elements are integrated into a coherent whole and in that the many relevant activities and resources of government are brought to bear to achieve the overall objectives. Focus and priority setting, and hence adequate support (in terms of both funding and staff) of a small number of programs, is also critical.

2. *Systematic programs to increase the number, scale and impact of globally oriented firms active in the State.* In our view, these programs should have three elements:

   - a strong investment attraction program, focused specifically on firms which bring dynamic benefits to the Western Australian economy and innovation system, and using support measures which recognise those dynamic benefits;
   - continued and expanded programs to support the emergence of local firms to global competitiveness; and
   - a new linkage program, to promote and deepen the linkages between globally oriented firms and other firms and organisations within the economy.

   Taken together, these programs would aggressively pursue new investment in the State by global firms, support the growth of local firms looking to world markets and develop in a systematic way the linkages between various types of firms and organisations in Western Australia. The report outlines a methodology for identifying, and providing incentives to, firms that will enhance, in systemic ways, the ability of the State's economy to compete and prosper in a rapidly changing world. It also draws on the important UNCTAD document, *World Investment Report*

2001: Promoting Linkages (UNCTAD 2001), to develop an outline of a linkage program that would be quite new in the Australian context.

3. *Initiatives to build the Western Australian innovation system.* These initiatives should focus particularly on increasing the scale of innovative activities, on generating greater collaboration, shared focus and hence critical mass within the innovation system, and on facilitating stronger international linkages.

4. *Programs to generate increase leverage off national policies.* Resources within the State are inevitably limited, so that systematic attention needs to be given to ensuring that Australian Government programs are fully utilised to support development within the State.

Consistent with the theme of Minister Clive Brown's address *Building WA: A Strategic Partnership* of 4 September 2001, a number of these programs could be effectively developed and delivered through a public-private partnership. Thus their delivery might involve both the proposed Western Australian Business Investment Centre and existing agencies, and they need to build on, enhance and where necessary replace existing programs in these areas.

A Profile of a Western Australian Knowledge Economy

The report also outlines one possible scenario for Western Australia's future in the knowledge economy, and hence provides one profile of continued prosperity for the State in this emerging world. This profile is intended to give substance and direction to the policy process, by illustrating one possible outcome of a successful policy process. It is neither a forecast nor a projection, but a scenario to provide a quantitative framework for the development of policy. In the current era of turbulent change, it is not possible to predict future outcomes with any certainty, and forecasts or projections which claim to do so are misleading. But policy should be developed and implemented with an awareness of the key magnitudes involved, and of the possible outcomes of policy initiatives. The scenario is intended to provide such a framework, with regard to full-time employment.

One specific feature of this WA scenario is renewed growth in the goods industries, with an increase of 40,000 new full-time jobs (1.7% per annum) over the period. Reflecting policy initiatives in terms of innovation and the environment, agricultural employment shows renewed growth. Mining employment continues to expand, and policy supports accelerated growth in manufacturing. The key policy impacts are in manufacturing and agriculture. If achieved, this growth in full-time employment in the goods industries would be one continuing way in which Western Australia is different from the rest of Australia.

However, the major source of employment growth over the period is knowledge based services, which provides half of the increase in total full-time employment. Many of the policy initiatives taken by the Government, and many of the increased activities of foreign firms, are concentrated in business services, where full-time employment is assumed to grow by 6% per annum on a strengthening base. A number of areas are seen

as contributing to the growing business services sector: further progress in building global activities in mining services; expansion in environmental services, to meet both local needs and international markets; increased innovation and technology support services, and so on. It is also presumed that there is increased spending by both the public and the private sectors on education, and that health employment continues to grow. The profile also assumes some improved performance in Western Australia - as a result both of policy and of a stronger, more globally integrated economy - in those areas in which polarisation is particularly evident (finance, information technology and communications services and cultural services).

WESTERN AUSTRALIAN
TECHNOLOGY & INDUSTRY ADVISORY COUNCIL

The Organisation of Knowledge: Optimising the Role of Universities in a Western Australian 'Knowledge Hub'

June 2002

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

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Additional Tables

Foreword

The Western Australian Technology and Industry Advisory Council (TIAC) has been developing a set of studies with the theme entitled "Towards a Western Australian Knowledge Economy".

These studies have explored the opportunities available to the State to develop appropriate policy and programmes which will increase the "knowledge component" of the Western Australian economy and, as a result, the level of high skilled, high wage employment in the state.

In the development of this report titled "The Organisation of Knowledge Optimising the Role of Universities in a Western Australian Knowledge Hub", TIAC has explored the opportunities available to the State to develop a "Western Australian Knowledge Hub" by encouraging the Universities towards greater participation in a Western Australian Knowledge Economy.

I would like to thank Professor Tim Turpin and his project team for their research and support in the development of this report.

John Thompson
Chairman, TIAC

Executive Summary

A feature of globally competitive knowledge-based economies is that governments, universities and industry work together in these economies to create regional 'knowledge hubs'. A knowledge hub is essentially a "region" with an ensemble of knowledge-intensive organisations located in both public and private sectors. Knowledge hubs have three major functions: to *generate* knowledge; to *transfer and apply* knowledge; and to *transmit* knowledge to others in the community through education and training. The present study was commissioned by TIAC with a view to developing options to optimise the role of WA's universities in supporting a WA Knowledge Hub.

Universities have an important part to play in all three functions of a knowledge hub. However, the present study has identified some structural weaknesses that inhibit the optimal contribution of the State's universities. The analysis and recommendations developed in this report are based on: recent national, State and WA regional data sets; a review of international experiences in developing knowledge-based development strategies; and a series of interviews with key WA 'stakeholders'.

1. Summary of Issues

(i) International Experiences

International experiences illustrate the importance of institutional diversity and collaboration between universities in providing a strong knowledge base for a well functioning knowledge hub.

- The formative role of universities in strengthening knowledge capacity has not been a function of their size. On the contrary, in many cases quite small universities have been able to maximise their contribution by collaborating in just a few key strategic areas (See Chapter 3).
- In the more dynamic knowledge hubs institutional specialisations and strengths have been maintained and provide key platforms for supporting "regional" industrial and economic development. *The case of Georgia Institute of Technology in the US and its sustained strategy of engineering excellence (Chapter 3) illustrates the benefit of maintaining and building on research excellence in key strategic areas for state development.*
- In almost all cases, some form of agency or authority has been instrumental in promoting partnerships. Two-way partnerships between universities and industry are important but collaboration across a whole range of institutions and organisations is necessary for a well functioning knowledge hub. *The case of Alberta Province in Canada, comparable to WA in many ways, provides a good example of how industry policy has served to provide a catalyst for building closer collaboration between universities, industry and other knowledge intensive sectors (Chapter 3).*

- In most cases collaboration in graduate training and research rather than in undergraduate teaching programs provides the platform for developing international knowledge hubs. If these areas are functioning effectively undergraduate programs tend to follow.
- In many of the overseas cases, universities have had to undergo considerable organisational change. This has been necessary to enable them to adapt to new and challenging industrial and social demands. This has required building more flexibility into the ways knowledge generation, transfer and transmission are managed.

(ii) The Challenge for Universities in a WA Knowledge Hub

Until 1996, WA appears to have been well placed to become a national knowledge hub. It had a higher level of general expenditure on R&D per person than the national average. More significantly, it had a higher level of business expenditure on R&D than every other State, except Victoria. Further, in WA the proportion of business sector investment in R&D increased rapidly through the early 1990s, from just over 33 per cent in 1989 to 57.8% in 1996-7, higher than all other States.

Since 1996, however, the situation in WA, has changed dramatically. The State has now entered a new and less favourable period in knowledge development with a considerable downturn in business sector R&D investment.

The low proportion of engineering and science students engaged in postgraduate studies in WA is a cause for considerable concern. In 2000 only 3.3 per cent of the State's postgraduate students were enrolled in engineering and only 14% in science. If WA is to become an internationally recognized knowledge hub, this imbalance across the disciplines will need to change.

The five WA universities (4 public and 1 private) represent considerable institutional diversity and have developed quite different student and research profiles. However, while they are clearly performing a valuable role in the development of WA's knowledge base, there is an urgent need to overcome some structural weaknesses that are presently inhibiting their role in a WA Knowledge Hub (See Chapter 2).

Universities have performed a critical role in consolidating the economic base in knowledge hubs in other parts of the world. WA must draw on the capacity of all five universities in the State to contribute to the economic base of a WA Knowledge Hub.

(iii) Challenges for the Generation of Knowledge

- By international comparisons the level of research investment taking place in Western Australian universities is modest.
- Universities in WA are winning less than their proportional share of national competitive grants.
- While combining resources would bring some economies of scale, having fewer but larger universities will not overcome the inherent structural financial constraints.
- The WA business R&D environment is heavily concentrated in the mining sector. This presents a challenge because fluctuations in business fortunes in the sector leave on-going investments in university knowledge generation volatile and uncertain.

Because of the comparatively small size of the WA knowledge-economy a WA Knowledge Hub is only likely to achieve world class recognition in a small number of specialized areas.

(iv) Challenges for the Transfer of Knowledge

In WA there is a disjunction between R&D investments at universities and those in other sectors - business, Commonwealth research agencies and State government agencies. This is not necessarily a problem because the sectors each perform quite different roles in a knowledge hub. However, functional complementarities between the knowledge generation activities are essential. It is the linkages between the institutions rather than what takes place within each element that is the key to a well functioning knowledge hub.

- Unlike other regions around the world (as well as in some other Australian States) government in WA plays only a minor role in steering collaboration toward State strategic goals.
- In contrast to knowledge hubs elsewhere, the links between universities and other institutions in WA are rather loosely structured, fragile and under-funded.
- Many innovative and valuable examples of collaboration can be found in the WA university system but each is driven almost entirely by a small number of key individuals and, with only a few exceptions, have not generated the critical mass necessary to sustain a globally competitive knowledge hub.
- Research carried out at WA State research institutions represents a small proportion of the overall WA R&D effort (12 per cent) and this is spread across a number of agencies. There is a need to find ways to enable these investments to contribute to a State based critical mass in strategic key areas.
- WA universities contribute to national Cooperative Research Centres and are engaged in partnerships with industry and institutions with funding through national research schemes. However, their share in these programs is below that of most other States.
- One of the key factors in knowledge transfer is the capacity of individuals to work across institutional boundaries. By overseas comparisons, WA academic staff are not particularly mobile. *In order to maximise the role of the State's universities there is a need to increase the flow of highly trained personnel between universities and other sectors.*

(v) Challenges for the Transmission of Knowledge

- The number of WA students enrolled in university education appears to have reached a plateau.
- While Australian enrolments continue to grow, enrolments in WA actually decreased between 1999 and 2000.
- The number of postgraduate students in WA since 1989 has grown at only half the national rate.
- Other studies around the world have shown how much industry relies on the role of universities for training highly specialised personnel.
- In WA there are worrying trends in the pattern of student enrolments, particularly at postgraduate levels and in science and engineering.
- In some areas of postgraduate study, small numbers of students are isolated from colleagues and academic staff because of institutional boundaries, in spite of the fact that they are working on similar problems. *There is a need, therefore, to find ways to build greater critical mass in key areas and link them to research and development across all universities and institutions in the knowledge hub.*

(vi) Challenges for Regional WA

Regional issues raise some specific challenges for WA. Numbers of university students from the regions have been decreasing. This is in spite of an increasing proportion of 15-19 year olds living in the regions and the fact that all WA universities have some form of regional presence.

Given the presence of all five universities in some parts of regional WA, and the diversity of training available, there is a need to generate closer cooperation between universities as well as between universities and the TAFE sector at the regional level.

Western Australian
Technology and Industry Advisory Council
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The Organisation of Knowledge: Optimising the Role of Universities in a Western Australian Knowledge Hub	Jun 2002