

Western Australian

Technology & Industry

Advisory Council

Annual Activity Report

July 2000 – June 2001



WESTERN AUSTRALIAN
TECHNOLOGY & INDUSTRY ADVISORY COUNCIL



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WESTERN AUSTRALIAN
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 2001, 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 Commerce and Trade'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 Commerce and Trade.

Yours sincerely

□

JOHN THOMPSON
CHAIRMAN

1 July 2001

On behalf of Council Members:

Mr Rex Baker
Dr Lesley Borowitzka
Ms Sharon Brown
Dr Brian Hewitt
Mr Mick McGinniss

Mr Rob Meecham
Mr Richard Muirhead
Dr Nigel Radford
Mr Bruce Sutherland
Professor Lance Twomey

Mr Tim Ungar
Ms Leslie Chalmers (retired Dec 2000)
Professor Tony Tate (retired Dec 2000)
Mr Lloyd Zampatti (retired Dec 2000)

Table of Contents

Letter of Transmission	
1 Introduction.....	1
2 Objectives of the Industry and Technology Development Act 1998	1
3 Functions of the Western Australian Technology and Industry Advisory Council	2
4 Outcomes.....	2
5 Financial Provisions.....	5
6 Members' Remuneration.....	6
7 Executive Staff.....	6
8 Financial Statement.....	6
9 Outlook for 2001 – 2002.....	6

Appendix 1

Summary and Recommendations of TIAC Report:
*“Export of Western Australian Education and Training:
Constraints and Opportunities”*

Appendix 2

Summary and Recommendations of TIAC Report:
“Biotechnology West: Strengths, Weaknesses and Opportunities”

Appendix 3

Council Membership

Appendix 4

Publications of TIAC 1988 – 2001

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 Commerce and Trade 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 this Act, including matters relating to:
 - ◆ the role of industry, science and technology in the policies of government;
 - ◆ the 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;
 - ◆ the 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;
 - ◆ the application of industrial, scientific and technological advances to the services of the Government; and
 - ◆ the promotion of public awareness and understanding of development in industry, science and technology.

4 Outcomes

Council's functions 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 2000 – June 2001)

In its advisory role to the Minister, Council has completed the reports:

- (a) Export of Western Australian Education and Training: Constraints and Opportunities; and
- (b) Biotechnology West: Strengths, Weaknesses and Opportunities.

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 for each of the reports, "Export of Western Australian Education and Training: Constraints and Opportunities" and "Biotechnology West: Strengths, Weaknesses and Opportunities" is detailed later in this report.

4.1.1.1 Community Reaction to TIAC Reports

The launch of TIAC's report entitled, "Drivers and Shapers of Economic Development in Western Australia in the 21st Century" in September 2000 raised a community interest and debate on the future directions of economic development in Western Australia. Council facilitated this debate by conducting "focus group" sessions with:

- (a) the Chamber of Commerce and Industry;
- (b) the Chamber of Minerals and Energy; and
- (c) a business "opinion leaders" group.

Council's reports were quoted and referred to in both the Coalition and Labor parties' election policies of 2001.

The Coalition 2001 Policy entitled, "Building a Future through Science and Technology" referred to the establishment of a State Biotechnology Strategy and Research Support Fund as recommended in TIAC's report, "Biotechnology West: Strengths, Weakness and Opportunities".

The Labor 2001 Policy entitled, “Innovate WA” referred to TIAC’s report, “Drivers and Shapers of Economic Development in Western Australia in the 21st Century” and called for the development of new knowledge industries and the application of knowledge to mainstream existing industries.

4.1.2 Participation on State Advisory and Funding Committees and Councils

Council has accepted invitations for representation and participated in:

- (a) the State's “Co-ordination Committee on Science and Technology”;
- (b) the Steering Committee for the CSIRO National Centre for Petroleum and Mineral Resources Research;
- (c) the “State Funding Advisory Committee” (SFAC);
- (d) the State's “Information and Communications Policy Advisory Council” (ICPAC) and its successor the OnLine WA Council Advisory;
- (e) the Department of Commerce and Trade’s “Technology Operations Group” (TECHOP);
- (f) the Federal Government’s “Commonwealth, State and Territory Advisory Council on Innovation”.

4.2 Promotion and Public Awareness Raising Activities

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

- (a) the 2020 Breakfast Seminars, which are short, economic development focused, information dissemination events;
- (b) the Science and Technology Forums which were established under the State's Science and Technology Policy 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 has increasingly used its Internet website to promote and increase the public awareness of both its reports and virtual Science and Technology Forum for school students. Access to the website ranges from 25,000 to 30,000 hits per month inclusive of local, national and international interest and downloading of reports.

4.2.1 2020 Breakfast Seminars

From July 2000 to June 2001, the following 2020 Breakfast Seminars were conducted:

- (a) **“Business Investment in R&D (BIRD): How can we make the BIRD fly higher?”** (August 2000)
Dr Robin Batterham, Chief Scientist, Australian Federal Government;
Managing Director, Research and Technology Support, Comalco;
Chief Technologist, Rio Tinto Limited
- (b) **"Drivers and Shapers of Economic Development in Western Australia in the 21st Century"** (September 2000)
Professor Peter Sheehan, Centre for Strategic Economic Studies,
Victoria University
- (c) **“International Education: Moving from a Cash Chaser to a Capacity Builder”** (October 2000)
Ms Lindy Hyam, Chief Executive Officer, IDP Education Australia
- (d) **“Scenarios for the Western Australian Biotechnology Sector in 2010”**
(December 2000)
Dr Lesley Borowitzka of Cognis Nutrition and Health and
Dr Saliba Sassine of Genesis Biomedical
- (e) **“Agriculture in the 21st Century – The Impact of New Technologies”**
(February 2001)
Hon. Tim Fischer, former Leader of the National Party, Minister for Trade
and Deputy Prime Minister

4.2.2 Science and Technology Forum Activities

In fulfilling its Science and Technology Forum requirements under the State’s Science and Technology Policy, TIAC:

- (a) co-operated 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; and
- (b) conducted a “Drivers and Shapers Consultative Seminar” with the participation of the Minister and opinion leaders drawn from the Business community.

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 2000 – 2001 Budget was \$324,000 with an additional \$80,000.00 specifically allocated for the conduct of Science and Technology Forums under Objective 3 of the State’s Science and Technology Policy.

6 Member's Remuneration

Council member's remuneration and allowances are 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, six Steering Committee meetings for the planning and development of its reports, five 2020 Breakfast Seminars and participated in twelve meetings of other funding and advisory committees and councils.

7 Executive Staff

Council is provided with a full time executive staff of two officers seconded from the Department of Commerce and Trade. 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 Commerce and Trade's Annual Report and Financial Statement.

9 Outlook for 2001 – 2002

Council's activities for 2001-2002 are grouped into two areas:

- (a) the development of two reports:
 - (i) "Towards a Western Australian Knowledge Hub: The University Sector"; and
 - (ii) "Directions for industry Policy in Western Australia within the Global Knowledge Economy".
- (b) the continuation of TIAC's community awareness raising programmes in the form of its 2020 Breakfast Seminars and Science and Technology Forums with an emphasis on managing the effects of globalisation in small business activity in the State.



WESTERN AUSTRALIAN
TECHNOLOGY & INDUSTRY ADVISORY COUNCIL

**Export of Western Australian Education & Training:
Constraints & Opportunities**

October 2000

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

Table of Contents

Foreword

Executive Summary

Abbreviations

1 Western Australia's Education and Training Exports Sector

- 1.1 The Challenge
- 1.2 Perth as a Knowledge Hub

2 Composition and Growth of Existing Markets

- 2.1 Overview
- 2.2 Australia and Western Australia: Analysis of the International Student Market
- 2.3 Contribution to the Economy of Education and Training Exports

3 Pathways Within and Between the Education and Training Sectors

- 3.1 Overview
- 3.2 Existing Pathways
- 3.3 Offshore Growth: A New Development
- 3.4 Potential Pathways in the Education and Training Sectors

4 Support Services for International Education and Training Students

- 4.1 The Role of Support Services in Influencing Student Choice of Destination
- 4.2 Student Satisfaction with Support Services Across Australia
- 4.3 Support Services in Western Australia
- 4.4 Suggestions for Improvement and Change
- 4.5 The Concept of a One-Stop-Shop for International Student Services in Perth City

5 Commonwealth and State Government Policies that Inhibit or Facilitate International Enrolment Growth

- 5.1 Commonwealth Government
- 5.2 DIMA and Visas
- 5.3 The Immigration Debate – The Case for Liberalisation of Graduate
- 5.4 Facilitating Western Australia's Export Performance: Taking the Quantum Leap
- 5.5 Tourism and Education

6 Legislation Governing International Student Education and Training Provider

- 6.1 Overview of Current Legislation
- 6.2 The Western Australian ESPRA
- 6.3 Concerns Relating to the Adequacy of the ESOS Act

Table of Contents (Cont'd)

7 The Private International Training Sector

- 7.1 Overview
- 7.2 A General Model for the International Training Exports Sector
- 7.3 Specific International Outcomes
- 7.4 Perceived Obstacles to the Expansion of Training

8 Sustaining Export Growth: Nurturing Established Markets and Opening New Ones

- 8.1 The Global Marketing Context: Intensifying Competition
- 8.2 Some Recently Highlighted Global Strategies and Opportunities
- 8.3 Pathways as a Powerful Recruitment Tool
- 8.4 Western Australia's Marketing Positioning: The Need for Greater Diversity
- 8.5 New Markets

9 Thinking Big

- 9.1 Profile Building
- 9.2 Policy Recommendations
- 9.3 Conclusions

References

Appendices

- Appendix A:** Composition and Growth of Existing Markets: Additional Statistics
- Appendix B:** Successful Pathways – Some Examples
- Appendix C:** Support Services Survey
- Appendix D:** Higher Education Sector Meeting and the Smart State Strategy
- Appendix E:** Legislation Governing the Registration of Education and Training Providers – ESOS and ESPRA Acts
- Appendix F:** Case Study of a Successful International Trainer
- Appendix G:** Emerging Markets Opportunities and Strategies
- Appendix H:** Steering Committee and Consultant Team
- Appendix I:** The Western Australian Technology & Industry Advisory Council (TIAC)

Foreword

Western Australian education has a long and proud history of contribution to the education of individuals from neighbouring countries. In particular, the Colombo Plan of the 1950's and 1960's was enthusiastically embraced at all levels, ensuring that a significant number of highly talented people from Asia and the Pacific, undertook much of their education within Western Australia. The legacy of this involvement has been realised in friendship, enhanced goodwill, cultural understanding and business and professional opportunities, which continue to this day.

It was the Western Australian higher education system which was the first to become involved in the export of Australian education to fee-paying students. This year, that initiative is responsible for the injection of greater than \$4 billion dollars into the Australian economy (about \$500 million in WA) and is now among the top 5 or 6 Australian export industries. Indeed, while the export of this clean, green, intellectual product provides substantial rewards today, there is the prospect of much greater returns in the years ahead, as a result of the friendships and contacts developed. While Western Australia has been a leader and significant player in this development, it is evident that, in recent years, our share of the market has declined as other States and countries have learned from our experience and have developed sophisticated government supported marketing initiatives, aimed at ensuring that a significant amount of these funds reach their States.

With this in mind, and in an effort to ensure that Western Australia remains a significant player in this highly competitive global market, TIAC has developed a discussion paper which:

- presents the challenge to Western Australia to respond to the education opportunities and future prosperity which the 'new economy' will bring;
- demonstrates the desirability of Perth developing as a major 'knowledge hub';
- develops the need for greater government participation in the enterprise, especially in regard to marketing, the provision of scholarships and the need for a CEO's forum on international education;
- illustrates the need to expand into the emerging mega-markets of China, India and the Middle East;
- suggests that there is considerable room for improvement in regard to the involvement of government secondary education and private vocational training opportunities;
- shows the importance of the secondary education market, both in its own right and to provide pathways to TAFE and Higher Education.

While this paper has been developed to initiate debate on the issue of the export of Western Australian education, it does seek to provide suggestions for the road ahead. Our State has superb educational facilities at all levels, and the export of education provides a return to the State for that investment as well as a most significant opportunity for Western Australian students to study alongside students from more than 90 different countries. The potential for the future from these friendships and networks is inestimable.

It is important to thank Professor Don Smart, Professor Phil Lewis and Ms Kathy Apenis from the Centre for Labour Market Research at Murdoch University for their considerable energy and assistance in researching and investigative work and for supporting the TIAC Steering Committee in the development of this paper.



Lance Twomey
Chair, Steering Committee

Executive Summary

The Challenge

The globalisation of markets and the significant movement toward the knowledge or 'new' economy are some of the key current international issues and trends driving economic growth worldwide. This represents an exciting window of opportunity for the Western Australian economy, but requires the State to undergo a significant shift to prepare itself to harness the new opportunities and future prosperity that globalisation and the 'new' economy will bring. The driving forces of the 'new' economy will be knowledge, life-long learning, innovation and technology and these must be facilitated by high quality education and training.

Knowledge Hub

The Western Australian education and training sector faces a period of rapid and turbulent change. As globalisation accelerates, key cities around the world are becoming 'Knowledge Hubs'. The characteristic of such hubs is the clustering of large numbers of education, training and research organisations together with strong linkages to industry, technology parks and research and development infrastructure.

With appropriate Western Australian Government leadership, support and resourcing, Western Australian needs to develop, brand and promote Perth as such a Knowledge Hub. This concept can fit well with the Premier's vision of Perth as a Hi-Tech Centre with world-class strengths in areas such as Mineral Value-Adding, Environmental Technology, Oil and Gas Research and Development, Medical Research, etc. (See Chapter 1.)

Importance of the Sector

The education and training exports sector is a significant 'recession-proof' contributor to Western Australia's economy each year. In 1998, it generated approximately \$400 million and as a sector, it has great potential for large future expansion. If student numbers were to grow by 15 per cent per year, not unreasonable given the pre-Asian crisis period, then by 2005 the export of education and training would be worth almost \$800 million! This does not include the significant contribution made to the tourism and investment sectors by international visitors of these students. (See Section 2.2.)

Despite the Asian economic meltdown, Australia's international student numbers have continued to climb reaching an all-time high of 155,100 in 1999. Australia-wide, the significant growth sources since 1994 have been Singapore, India, Indonesia and China. (See Section 2.1.)

Western Australia's growth has failed to keep up with the national growth, and the State's share has fallen from 14 per cent to 12.5 per cent, between 1994 and 1999. The sectors in which the reductions were most marked were vocational education and training and the secondary schools sector. The reduction in vocational education can be attributed in part to the changes brought about by the requirement that the sector be totally client funded. (See Chapter 2, Sections 2.1.2 - 2.1.6.)

Importance of Pathways

A key strategy in attracting significant numbers of international students is the identification, articulation and development of appropriate pathways. (See Chapter 3.) Pathways must be easily understood and accessible to potential international students and designed for the specific needs of students in different countries. One of the best ways of developing new pathways is by offering scholarships. The post war Colombo Plan provides ample evidence of the long-term benefits of scholarships, both in terms of the goodwill promoted and the inter-generational flows of students. (See Sections 4.4.4, 8.2.3, 9.2.2 and Appendix G.)

Several key potential new pathways are identified:

- expanding the Western Australian ‘pilot-secondary schools project’ with the key market for expansion being China. Evidence suggests this could be a significant pathway for the TAFE and higher education sectors (see Sections 3.4.1 and 3.4.2);
- the possible expansion of TAFE International Western Australia’s current offshore program in China, into other sites in China, India and the United Arab Emirates, offering this offshore program as a twinning pathway to onshore vocational and higher education (see Section 3.4.3);
- the introduction of Joint Interstate Qualifications which would involve individual institutions networking with equivalent Eastern States institutions. This would expand both markets by making Australian education and training more attractive to international students who frequently want to experience more than one major city (see Section 9.2.9).

Support Services

It is apparent from many studies that a key determinant of student choice of destination is recommendations from peers and parents of students who have previously studied in the country. Ensuring a high level of support services will make the study experience positive and lead to a flow-on effect of recommendations to friends and family. Some identified areas needing improvement are: security measures, job placement assistance, mentor schemes, scholarship opportunities, organised interaction with Australian students and a One-Stop-Shop in the Centre of Perth for student services. (See Chapter 4.)

Government Obstacles

Removing obstacles to expanding any export market should be a major consideration of government, particularly when governments themselves create these obstacles. There are a number of issues that need consideration with respect to the impact and role that the State and Commonwealth Governments have in educational exports. The major impediment for recruitment of foreign students is aspects of DIMA’s student visa policy and processing. Other identified problems include a lack of State co-ordination between those responsible for the industry, both ministerial and bureaucratic, and State interaction with Commonwealth authorities. Western Australian international education and training currently lacks a powerful voice at the Commonwealth level and even at the State bureaucratic level is not particularly influential. (See Chapter 5.)

Reputation, Recognition and Accreditation

Perceptions about academic reputation and financial reliability are important factors in the recruitment of international students. Under the Commonwealth ESOS Act and the Western Australia ESPRA the integrity of the industry in this State has been maintained. There have been problems in some other states and because of this the Commonwealth is currently redrafting the ESOS Acts. It intends to implement insurance-style fidelity funds and this could have important implications for the industry. (See Chapter 6, Section 6.3.1 and Appendix E.2.)

Private Training Provision

There is considerable scope for increasing the share of the private international training market for Western Australian providers. Initial promotion of private international training exports should be in areas that reflect the industry base or specialisations of Western Australia. The largest industry base is the resource sector and especially oil and gas. The most significant areas of potential expansion, particularly into the Asian region, are in personal services and health training, such as aged nursing care and in the provision of training for government administrative staff undergoing reforms related to devolution and deregulation.

Other areas of offshore training demand are specialised industries such as Austal Ships, which have developed their own world-class technology and training. In building on this established foundation the reputation of the Western Australian training sector could be developed and expanded to other areas. Although there is a willingness of trainers to involve themselves in the international market, many do not have sufficient know-how or resources to build up the networks within international markets. The role of government in helping to facilitate the growth of the international training industry would be to provide this networking and market intelligence. (See Chapter 7.)

Need for New Markets

Western Australia has been overly conservative in its strategies for expansion. There are inherent risks in the excessive concentration of students from the two traditional markets of Singapore and Malaysia. Indonesia has also been a source of students for some time now and can be regarded as a traditional market that still has great potential. While Western Australia must strive to maintain these key traditional markets, it is also important to exercise initiative in finding new markets, new countries and new products, and to adopt dynamic marketing strategies. The rapidly emerging mega-markets of China and India need to be given considerable focus by the education and training industry, as these markets have the greatest potential for significant growth and are already being developed by our Eastern States competitors. Europe, North America and the Middle East also have potential. (See Chapter 8 and Appendix G.)

Recommendations

To effectively promote Western Australia's international education and training sector and its global profile, this State needs to re-brand itself. It should be possible for Western Australia to have two distinct brands, the "Elle" (or Wilderness State) and the Education/Hi-Tech (Knowledge Hub) brand. This new structure and brand have, as the centrepiece, the creation of a Knowledge Hub, gluing together all aspects of the international education and training industry and various other research niches and knowledge industries. (See Section 9.1.)

*Annual Activity Report
July 2000 – June 2001*

A Chief Executive Officers (CEOs) Forum on International Education should be created and overseen by the Ministry of Premier and Cabinet and include the following government instrumentalities: Treasury Department, Department of Commerce and Trade, Education Department, Department of Training and Employment, Department of Education Services and the Tourism Commission. The Forum will have the following as its terms of reference in relation to enhancing the export of education and training:

- focussed efforts to recruit international students from the emerging mega-markets;
- increasing the offering of postgraduate, undergraduate and vocational education and training scholarships to significant markets;
- lobbying for a national review of the co-ordination of and connections between immigration policy and international student policy, making the processing of visa applications easier and giving higher immigration status and increased opportunities to remain and work after graduation to international students who study in Australia;
- examining the current regulatory management environment within which the VET sector's educational exports currently operates, in order to address this sector's relative performance in the export market;
- creating and maintaining, in a central Perth location, a One-Stop-Shop that would contain all the student services necessary to facilitate international students' stay in Western Australia. This shop should also be linked via phone and web hotline in order to field any problems and esquires of international students;
- substantially expanding the government secondary schools sector's international student intake. This program needs increased levels of funding and should be focussed on the growing and emerging markets, especially China;
- pathway articulation and publicity - with special responsibility for identifying and promoting new pathways and researching education and training markets;
- promotion and networking of the international private training sector to relevant markets;
- joint interstate training and education; and
- a regular State conference that would facilitate industry expansion and seek to overcome existing problems.

One of the keys for achieving these recommendations will be better co-operation and co-ordination at all levels of government. (See Chapter 9 and Section 9.2.)



WESTERN AUSTRALIAN
TECHNOLOGY & INDUSTRY ADVISORY COUNCIL

**Biotechnology West:
Strengths, Weaknesses and Opportunities**

December 2000

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Table of Contents

Foreword

Executive Summary

Common Acronyms

1 Introduction

- 1.1 Terms of Reference
- 1.2 Methodology

2 Biotechnology-Based Industries and Their Importance

- 2.1 What is Biotechnology?
- 2.2 Role of Biotechnology in Key Sectors

3 Inventory of Public Sector Resources for Biotechnology in Western Australia

- 3.1 Inventory of Higher Education and Training
- 3.2 Major Equipment and Centres of Expertise
- 3.3 Inventory of Public Sector Research
- 3.4 Conclusions

4 The Western Australian Industry and the Impact of Biotechnology

- 4.1 Economic Background
- 4.2 Major Characteristics of Biotechnology Firms
- 4.3 Target Markets of Biotechnology Companies
- 4.4 Other Factors Influencing Western Australia's Economy
- 4.5 Greenhouse Gas Emission and Global Climate Change
- 4.6 Natural Resources
- 4.7 Alignment with Asian Time Zones
- 4.8 Public Attitudes
- 4.9 Conclusions

5 Western Australian Government's Activity in the Australian Context

- 5.1 Western Australian Government Co-ordination and Responsibilities
- 5.2 Western Australian Government Programs to Support Industry Development
- 5.3 Biotechnology Related Programs in Other States
- 5.4 Commonwealth Programs
- 5.5 Conclusions

6 Success Factors Identified from International Trends

- 6.1 Introduction
- 6.2 Success Factors
- 6.3 Conclusion

Table of Contents (Cont'd)

7 Opportunities and Constraints for Biotechnology in Western Australia

- 7.1 Introduction
- 7.2 General Success Factors in Western Australia
- 7.3 Company Case Studies from Western Australia
- 7.4 Conclusions

8 The Way Forward

- 8.1 Current Activities
- 8.2 Step Change in Investment, Government Commitment and Focus
- 8.3 Conclusions and Recommendations

Appendices

- Appendix A:** Steering Committee and Consultant Team
- Appendix B:** Western Australian Biotechnology Firms
- Appendix C:** Major Centres and Equipment Inventory
- Appendix D:** Inventory of Public Sector Research
- Appendix E:** Western Australian Funding from Federal Grant Programs
- Appendix F:** Higher Education and Research Statistics
- Appendix G:** Respondents
- Appendix H:** The Western Australian Technology and Industry Advisory Council

Foreword

Over the past century, Western Australia's industries of mining and agriculture have achieved world class efficiency and revenues, through investment, innovation and the wise utilisation of the resources of this State.

In the 21st Century, these and other industries are being transformed by the two new enabling technologies, biotechnology and information technology. Biotechnology is transforming agriculture, with better nutritional quality of crops, and reduced use of pesticide and fertiliser; mining, with extraction processes which are reducing damage to the environment; medicine, with new drugs and treatments, and it is showing potential for solving the environmental problems we face in the 21st Century such as salinity, the degradation of land and greenhouse gas emission.

Other states in Australia, and countries such as Singapore, USA, and Ireland have pro-actively embraced biotechnology both as a major transformer of their "old economy" industries and a creator of new industries and products.

Western Australia is now at the point of choosing whether to commit itself to reaping the economic benefits of biotechnology by adding maximum value to its established industries and establishing new industries based on world class biotechnology research, **or** taking no initiatives and as a result, continuing to be an "old economy" supplier of raw materials to the world.

It is "decision time" for our State's future and TIAC has produced this report, for the community's consideration, which:

- Provides an inventory of resources available in this State, for biotechnology researchers and companies;
- Puts Western Australia's biotechnology activity in the context of that of other states and internationally;
- Considers existing and potential applications of biotechnology to build this State's economy;
- Identifies factors which have led to successes in biotechnology companies and research institutions around the world;
- Identifies constraints which are holding back success in biotechnology in Western Australia;
- From these findings, recommends ways of building a world class, biotechnology based industry in Western Australia.

I would like to thank the small but enthusiastic community of biotechnology researchers and companies in Western Australia, whose vision of the future benefits to the State has inspired us.

I would like to thank the members of the TIAC Steering Committee, consultants Dr Lyndal Thorburn and Dr Kelvin Hopper and their staff for the research, and Professors Ian Constable, Fiona Stanley and Val Alder for their helpful comments.

Dr Lesley Borowitzka
Chair, Steering Committee

Executive Summary

Biotechnology and Information Technology are the two major new enabling technologies of the new century. They are adding new value to established economy industries, and are creating businesses and whole industries which could not have been imagined 20 years ago.

Biotechnology is defined as the use of living organisms or parts of organisms to create products and processes. It has created insulin and human growth hormone for the medical and health industry, insect resistant cotton and slow ripening tomatoes, improved rennet and food additives in the agriculture and food sector, provided bacteria tailored to breakdown specific environmental pollutants and to reduce sulphide ores to their oxides in the mining industry.

It is the type of technology that, in TIAC's opinion, can be utilised to assist in addressing some of the issues raised in Council's previous report, "Drivers and Shapers of Economic Development in Western Australian in the 21st Century".

In the past year, public awareness and commercial interest in biotechnology has accelerated. The completion of the project to sequence the human genome was announced jointly by USA President Clinton and British Prime Minister, Tony Blair. The USA announced an unprecedented investment in biotechnology research, and Queensland and Victoria announced biotechnology initiatives of A\$270 million and A\$400 million respectively. In October 2000, CSIRO plant biotechnologists, Dr Jim Peacock and Dr Liz Dennis, won the inaugural Prime Minister's Science Prize.

This report identifies the present state of biotechnology-related research and industry in Western Australia, and recommends specific and cost effective ways to assist building it to a world class industry. To achieve this we must focus on what Western Australia is good at, and add further key infrastructure as needed, to develop significant new industry in the State.

Western Australia led Australia in establishing a State Science and Technology Policy, but it has no stated whole of government policy or strategy for biotechnology. For our aspirations to succeed, we urgently need support from across Government, in the form of a strong strategy and political leadership to lead and inspire our companies, researchers, and financiers.

This study confirmed that Western Australia has excellent foundations in quality research and infrastructure to support the structure of a world class biotechnology industry, and that it has a relatively high number of very independent, but generally isolated entrepreneurial small biotechnology companies who are "doing it tough".

Western Australia has world class research in agricultural biotechnology at the State Agricultural Biotechnology Centre. It also has world class research in biomedical biotechnology at the Lions Eye Institute, the Institute for Child Health Research, the Western Australian Institute for Medical Research and the Western Australian Biomedical Research Institute. However, compared with the Australian average, it has a relatively low rate of patenting discoveries, commercialising research from universities and institutes and in forming spin-off companies. Clustering of new companies in incubators around research institutions, a process which has succeeded in supporting and nurturing spin-offs in the USA, Europe and Queensland and Victoria, has not happened in Western Australia.

Unlike Queensland, NSW, Victoria and South Australia, Western Australia has no large biotechnology based companies, to provide employment, training, and experience for our otherwise well trained and educated students, or support for local suppliers and contractors. The attraction of the headquarters, production facility or an R&D centre of a major biotechnology company would add significant infrastructure to the sector.

The number of researchers, facilities and infrastructure are not limiting our present low level of biotechnology activity, but will become a major limitation as we start to grow the industry. Case studies show that the most cost-effective way of building strong research teams is to attract a world-leading researcher, with a chair, probably endowed for 5 years.

Excellent researchers, supported with the necessary infrastructure, attract good students, further excellent researchers and research grants which produce Intellectual Property, spin-off companies and revenues to the State.

Recently, the previously poor availability of seed and venture capital in Western Australia has been improving, but must be monitored carefully, to make sure that it does not impede the growth in new biotechnology companies.

Western Australia's biotechnology based industry is small but entrepreneurial, with some world class researchers and excellent teaching. In interviews and discussion groups it was made clear to us that these people are very keen to grow the industry fast, want to be part of a major success story in Western Australia, but are frustrated by their perception that we are being left behind by other states in Australia, as well as by the USA, Singapore, Ireland, India, Israel and others.

Starting with commitment and leadership from the State Government to in turn activate the support and enthusiasm of our businesses, researchers and financiers, the State can quickly build new businesses in biomedical products and treatments, add significant value to the existing agricultural and mining industries and in waste treatment. Furthermore, we can also creatively address the burden of greenhouse gas emissions.

Western Australia can position itself to add increasing value to its strong established industries of Mining and Agriculture as well as be able to use the tool of biotechnology in new enterprises and industries which have not as yet been defined.

Recommendations

Recommendation 1

In recognition of the enabling aspect of biotechnology when applied across all industry sectors, it is recommended that a Biotechnology Strategy be developed through the Department of Commerce and Trade and the Co-ordinating Committee of Science and Technology and incorporated into the State's Science and Technology Policy.

This strategy should contain programs which:

- (a) Actively promote biotechnology enabled industry in Western Australia;
- (b) Build a strong R&D base for biotechnology in Western Australia;
- (c) Support properly controlled trials of biotechnology based processes and products in Western Australia;
- (d) Support the development of business plans for the application of biotechnology across all sectors of industry including:

- (i) health and medicine,
- (ii) agriculture,
- (iii) mining and mineral processing,
- (iv) environment and waste management, and
- (v) marine industry.

Recommendation 2

The Strategy should establish separate biotechnology funding to be used to implement the programs and business plans contained in the State's Biotechnology Strategy.

Recommendation 3

It is recommended that the Biotechnology Strategy contains programs which:

- (a) Strengthen and encourage the commercialisation of biotechnology based research in universities, government agencies and other institutions – this includes clarifying institutional policies on sharing royalties between researchers, research entities and students;
- (b) Facilitate seminars through ABA, AIM and AICD to raise the awareness of researchers in:
 - (i) funding start-ups,
 - (ii) duties and responsibilities of directors,
 - (iii) the availability and source of grants and other government assistance available for industrial research;
- (c) Facilitate the clustering of newly formed companies either through an incubator program or through facilities around research institutions such as SABC at Murdoch University or Sir Charles Gairdner/UWA for a biomedical facility.

Recommendation 4

The successful application of biotechnology as both an enabler and problem solver across industry and as a development tool for new industries, is assisted by the fostering of linkages and networks. It is recommended that the proposed State Biotechnology Strategy contain programs which will:

- (a) Support the Western Australian branch of the ABA so as to facilitate inter and intra State events which raise awareness of issues relating to biotechnology based industries;
- (b) Support through the overseas offices of the Department of Commerce and Trade and Austrade, international linkages with biotechnology based institutions in the USA, Singapore, Ireland, India and Israel;
- (c) Use the State's very successful Centres of Excellence program;
- (d) Leverage and add value to Commonwealth funding that eventuates through Biotechnology Australia and discussions on the Biotechnology Innovation Fund.

Recommendation 5

It is recommended that the proposed State Biotechnology Strategy contain a program which funds key international researchers in biotechnology by providing:

*Annual Activity Report
July 2000 – June 2001*

- (a) Endowed chairs for five years;
- (b) Funding for post-doctoral researchers;
- (c) Attractive support and facilities, and scholarships for students to build the research groups.

The main criterion for choice of key researcher should be excellence, then, defining a particular field of expertise. The business plans in the proposed Biotechnology Strategy for each sector will help define areas of expertise that will contribute most to the State. Case studies indicate that these key researchers will in turn attract funding, equipment, facilities and other good researchers and students.

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Technology and Industry Advisory Council
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