Submission to the State Sustainability Strategy for Western Australia 2002

Science and Technology - Future Directions

'We are caught between two worlds, one dying and one ready to be born.'

Robert Theobald,
Futurist (1929-1999)

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Foreword

In a changing world the FV&D4OP Collective believe that there are complementary roles for science and technology to play in realizing both a sustainable economy protection of the environment.

This document discusses these roles and how both economic growth and environmental protection play a part in a sustainable future, based upon experience and knowledge gained both with (Western) Australia and internationally within Northern Europe, in particular the Netherlands. This document forms the submission to the State Sustainability Strategy for Western Australia by the FV&D4OP Collective.

It summarizes how the collective envisages how the State Sustainability Strategy may bring together science and technology, economic stability and environmental protection as Australia joins the global community in moving towards a sustainable future.

FV&D4OP Collective
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1 Research and Development in Australia

Over the period 1993 - 1997 Australia produced 2.7% of the world's scientific publications, and currently holds 3.6% of Organization for Economic Cooperation and Development (OECD) patents. Given Australia's small population and a share of world trade of around 1% (*DETYA 1999b* p135) this is a good result.

However, in terms of research and development (R&D) infrastructure, particularly in large companies, over the last two decades there has been a shift away from in-house research and an increased reliance upon external research institutions including the Commonwealth Scientific and Industrial Research Organization (CSIRO). One such example is in the chemical industry where such a shift was noted by a former Manager for Business Development of Pacific Dunlop Engineered Products who said that

'within R&D in the chemical industry most of the [big] chemical companies have no central research'.

They now rely more heavily upon links with external research facilities. Such a shift is also highlighted by the fact that in 1997 only 47% of all expenditure on R&D within Australia was contributed by business, well below the OECD mean of 62% (*DETYA*, 1999b). This is further highlighted by the fact that, since the time of conception of this submission, Pacific Dunlop Engineered Products have ceased their Business Development Operations in Australia.

The move away from centralized research within industry does, however, emphasize the growing importance on links with external research facilities. Such links are the current focus of the Australian Federal Government's R&D policy as evidenced in the two recently released reports '*Knowledge and Innovation:A policy statement of research and research training*, 1999' and '*Higher Education report for the 2000 to 2002 triennium*, 1999'.

With the increased reliance on links between industry and research institutions the issue of knowledge and technology transfer become important. The fluency of this transfer is equally important, and as

'science parks are instruments aimed at advancing the specific knowledge flow between universities and industry'

(van Geenhuizen, 1993) they have an important role to play in the continuing evolution and growth of R&D in Australia.

2 Science and Technology and the Expansion of the Knowledge Based Economy

Globally, the knowledge-based economy is viewed as a major factor in achieving continuing economic growth. Australia currently has a fair share of knowledge pro-

duction and possesses a strong foundation in basic research. In order to increase this share in the future, research institutions such as universities and CSIRO will be required to enhance links with industry so as to facilitate not only the production of knowledge through research, but also its commercialization.

As stated in '*Higher Education report for the 2000 to 2002 triennium*', released by the Australian federal Government in December 1999, the interaction of universities with industry will be

'... enhanced by technology parks and spin-off companies, which play a valuable role in facilitating the commercialization of new technologies, generating knowledge-based employment growth and creating international links ...'.

Thus, there is an important role for science parks to play in the expansion of the knowledge-based economy in terms of science and technology and establishing links between university and industry. Technology parks and university spin-off companies can create an environment for stimulating R&D, innovation and technology transfer by bringing together researchers, financiers and the market. This, combined with the sense of community and high technology infrastructure developed, make them

'ideal for fostering new technologies and business ventures'

(*DETYA* , 1999b).

Further, the sense of community developed by science parks can bring together a combination of venture capital, technology transfer and business development skills which when combined can form a

'powerful instrument for local economic development'

(deLange, 1992).

The development of such ties through science and technology parks is then central to increasing (Western) Australia's share of the knowledge-based economy and associated economic growth.

3 The Role of Science and Technology in Sustainability

As the realization of the Earth's resources becomes more apparent, the concept of sustainable development becomes more pertinent to society.

Sustainable development is appropriately described using the definition given by Bruntland (1987) in which sustainable development is described as

'dealing with actual needs with out compromising the capacity of our future generations to meet their own needs.'.

Striving for such a goal has ramifications for many facets of society, including the redefinition of the notions of progress, economic growth and environmental protection.Whereas at present, economic growth and environmental protection are seen as opposing forces, under a sustainable development scenario,

'economic growth and environmental protection are inexplicably linked'

(Martins, 1994). Further, in order to achieve sustainable development,

'environmental protection shall constitute an integral part of the development process and can not be considered in isolation from it.'

(Rio Declaration 1992).

Clearly, embracing such change in today's society requires both a shift in ideology as well as a review of the practical aspects of development and growth.

Scientific and technological industries are at the forefront of meeting and facilitating this change, and it is the challenge for these industries to thrive under conditions of increased environmental and commercial uncertainty. Further, it is acknowledged by the Australian Federal Government that

'Research, as a key source of knowledge and new ideas, is central to success in the global knowledge economy'

(*DETYA*, 1999a). As such, it seems there is a dual role for science and technology to play in the future; providing a significant contribution to economic stability through the knowledge economy, while at the same time leading a shift towards sustainability in both environmental and economic terms.

The previous section discussed the contribution of science, technology and science parks to increasing Australia's share of the knowledge-based economy. But, drawing on international experience they also have a role to play in the shift towards sustainable development.

As noted by Gordon (1994),

'there is a contribution to the long term aims of sustainable development which science parks are able to make...'.

Such contributions include fostering environmental technology development, provid-

ing energy efficiency, pollution control and integrated development. The promotion of such sustainable approaches to development through the planning and design of science parks may also have a flow-on effect to the surrounding community, and later on larger scales.

As suggested by Chambers, Panfold and Cousins (1994) 'this "action oriented" approach to science park planning is perhaps their most important contribution towards the concept of sustainability ...'.

4 The Outlook for Australia

For Australia, as one of the world's wealthier nations, the outlook for continued growth and development is good. However, it is fair to say that a large proportion of Australia's wealth is generated via industries based upon finite resources, and that consumption of products from these industries is beginning to have readily identifiable consequences, particularly within the natural environment. This is true not only for Australia but also for the majority of industrialized countries.

The recently released '*Global Environment Outlook 2*' suggests that

'the major environmental problems of this century will stem from existing problems that do not currently receive enough policy attention.'.

For the Australasian region, the most frequently cited environmental issues are climate change and the quantity and quality of water resources. Socially, the major issue is population growth (*Global Environment Outlook 2*, 1999).

As a major producer of greenhouse emissions, Australia has a correspondingly large impact on global warming, a major contributor to climate change. Within Australia, Western Australians are the largest producers of greenhouse gas emissions per capita.

The supply of fresh water in Australia has always been scarce when compared to Northern European countries, and to some extent is a limitation to the possible population expansion into geographical regions outside major current population centres. In fact, the summer of 2001-2002 has bought water resource issues into the spotlight, and arouse community concern over the future of water use in Western Australia.

As such, the availability of fresh water and population growth are inextricably linked.

Between 1900 and 1995 global fresh water consumption rose sixfold, more than double the rate of population growth. Further, if global water consumption patterns continue it is predicted that 2 out of every 3 persons on Earth will live in water stressed conditions within 50 years (*Global Environmental Outlook 2*, 1999).

These statistics have implications for Australia, and particularly for Western Australia, where the population is predicted to rise by between 67 and 74 % by 2051 (Australian Bureau of Statistics, 1998). Fresh water has already become scarce to the point where water restrictions have been imposed, largely due to the expansion

of the metropolitan area.

Through this brief description of the three main global environmental and social problems as they relate to (Western) Australia, and the discussions of the role of science and technology in the global knowledge economy and sustainability (sections 3 and 4), it is apparent that the reasons for the importance of science and technology in the future of (Western) Australia are twofold;

- securing a larger percentage of the knowledge-based economy
- addressing environmental concerns through promoting a global shift towards sustainable development.

5 The Future of the Market for Knowledge and Technology Transfer

Having now briefly discussed the state of R&D in (Western) Australia, the possible roles of science and technology in economic growth and sustainable development and issues of global change facing (Western) Australia, it remains to define some possible ways in which knowledge and technology transfer may assist in the development of solutions to the issues impeding the transition to a sustainable society .

From a global perspective, funds should become available for the development of environmentally sustainable technologies as currently governments around the world spend of the order of $US700 000 million subsidizing a range of environmentally unsound practices in areas such as energy, water, agriculture and road transport (*Global Environment Outlook 2*, 1999). As Dunkel, Seibt and Nascimento (1998) suggest

'Technology will play a major role heading towards sustainability.'

They also state simple reason for this; 'Today's technologies are mainly unsustainable.' It is also the case that

'cleaner production has proved highly profitable (financially and environmentally) to industries that have embraced the concept ...'

(Global Environmental Outlook 2,1999). So it does appear that there will be an emerging, profitable role for science and technology in the development of new environmental technologies leading towards future sustainable development.

Given that this is the case, what then are some possible examples of market niches which may emerge in the future? In terms of its recycling programs, use of renewable energy technology and the development of policies to promote the implementation of such technologies, the Northern European region is quite advanced compared to Australia. It may be that such technologies could find a market within Australia as

it strives towards a sustainable way of life and tighter environmental policies filter down to Australia from regions like Northern Europe. One translatable example is the recycling of labels from returned Heineken bottles in the Netherlands being reprocessed into lightweight bricks (*Global Environmental Outlook 2*, 1999).

The transfer of environmental technology to and from Australia may also prove to be an expanding market, since as Dunkel, Seibt and Nascimanto (1998) note;

'environmental technology is considered a key industry in a densely populated country ... and a key sector for future sustainable development.'.

They go on to suggest that 'water and air quality and material recycling systems belong still to a dynamic innovation field ...' as measured by the number of patents. It is also the case that 70 % of firms within the Zernike Science Park in Groningen in the Netherlands in 1993 were biotechnology oriented, including environmental protection (van Geenhuizen, 1993). It may then be that as Australia strives to rationalize its water usage and expanding population, that international markets will arise for water recycling production developed within Australia. This is particularly pertinent to Western Australia since, as noted earlier, there is currently a large community focus on the future of water resources in WA.

It is also pertinent to note the increasing recognition that remote sensing, a field of research with which members of the collective are familiar, is achieving world-wide as a major new technology for studying the environment, particularly on a global scale. The rise to prominence of the enhanced greenhouse effect during the last decade has highlighted the need for the study of climate change on a global scale and as a result the Global Climate Observing System (GCOS) (http://www.wmo.ch/web/gcos/gcos.html) will be implemented in the near future. It is envisaged that remote sensing technologies will play a significant role in global change studies within this program. Indeed, with an office of the international Oceanographic Committee having been opened in Perth this may well be the case in the near future.

It is also the case, as *Global Environmental Outlook 2* (1999) notes, that

'there have been some impressive achievements in ecosystem monitoring by satellite imaging.'.

For this reason the use of remote sensing is also becoming more popular amongst Commonwealth, State and Territory departments in Australia. Internationally, remotely sensed products are also increasingly being employed, by government agencies in particular. One such relevant example is the use by Dutch water authorities of remotely sensed water quality products developed by the Remote Sensing Unit in the Institute for Environmental Studies at Vrije Universieit (http://www.vu.nl/ivm) in the Netherlands. Similar projects are being initiated by CSIRO Land and Water within Australia.

With the focus in R&D in Australia increasingly being upon industry-university links, as discussed in section 2, the forging of new links and the transfer of knowl-

edge from other countries already addressing issues of sustainability to Australia may facilitate the fluency of knowledge and technology transfer and help to build momentum for the transition to sustainability worldwide. Business sources suggest that a lack of this 'fluency' is one of the current barriers to forming research links and that 'finding common ground' between the goals of industry and university in collaborative research can also hinder research and development. These would not be problems unique to Australia and perhaps experiences overseas may provide some benefits in these areas.

This general discussion of the possible applications of knowledge and technology transfer shows that there is at least the possibility of a variety of market niches emerging within Australia in the future, which may bring wealth to Western Australia, as well as contribute to a sustainable society.

This document has emphasized the dual roles that science and technology can play in the future of Australia. It looks at science and technology as being a major contributor to economic stability in the future through securing a larger portion of the knowledge-based economy. It also discusses the future of science and technology from and environmentally sustainable development perspective.

The result, the collective believes, is that it has been shown that these two roles complement each other. In moving towards a scenario of sustainable development, there needs to be a significant role for scientific research in developing the technologies which allow this transition. Such technological development combined with fluent technology transfer could have the benefit of securing greater economic gains through securing a larger portion of the knowledge-based economy.

In this way, the collective see science and technology being fundamentally involved in the drive towards sustainability.

6 Benefits and Outcomes

In light of the preceding discussions on the possible future roles of science and technology, the collective sees the benefits to society in striving for a sustainable future to include;

- The development of technology which works in unison with environmental processes rather than against them. Western society has moved away from traditional land management techniques which allowed indigenous societies in many countries to exist for thousands of years. The development of appropriate technology may bridge the gap which has emerged between traditional and industrialized practices over the last two centuries, and decrease the ecological footprint of our society.
- The development of appropriate technologies which provide simultaneous solutions to existing environmental problems. An example of this is recycling of greenwaste into compost, thereby solving landfill problems and the use of excess chemical fertilizers in agriculture. A simultaneous solution for which there is already an existing model developed by a WA based company.

- Achieving quality of life for this and future generations and, importantly, preservation of the habitats of all living things, other than human beings.
- The potential to combine science and technology with environmental protection and economic stability through the contribution of knowledge and technology transfer to society with a view towards achieving a sustainable future.
- Ecologically sustainable generation of wealth through active participation in the knowledge economy.
- Restoration of the balance between the environmental and economic facets of out society.

7 Conclusion

Western Australia has the environmental and economic impetus to develop environmental technologies to meet future needs in a sustainable way. The FV&D4OP Collective believe there are benefits to WA, both from the development of environmental technologies within (Western) Australia which, as we head toward sustainability in all its many facets, may be socially, culturally, environmentally as well as economically beneficial for Western Australia.

Although the FV&D4OP Collective recognizes that science and technology in general is but one facet of our society, it is likely to be important in achieving a sustainable society, within the social paradigm in which we in Western Australia exist today.

This document has focused on the role which science and technology may have in addressing the often conflicting notions of environment and economics. Though not providing all the answers, this document makes it clear it is clear that in order to achieve a sustainable society that these often opposing elements of our society must be reconciled. The development of environmental technologies which address the existing and emerging ecological problems we face combined with active participation in the knowledge-based economy has then potential to facilitate such results.

The FV&D4OP Collective possess a diverse range of knowledge, skills and wisdom and participate within all areas of the social change movement from grass roots and community to international levels of planning and action towards a just and sustainable future for all. The FV&D4OP Collective congratulate the Western Australian State Government for its vision in establishing the framework of the State Sustainability Strategy, but urge it, on behalf of the planet, to ensure that the strategy goes beyond rhetoric and is put into practice.

8 References

Australian Bureau of Statistics, 1998, *Population Projections 1997 to 2051.* Cat. no. 3222.0, ABS, Canberra

Bruntland, G. 1987, *Our Common Future*, WCED, Oxford Press

Chambers, D., Panfold, A. and Cousins, W. 1994,'Science parks: sustainable or sustaining. Epitome of anathema. The United kingdom experience' in *The Economics of Science Parks*, eds P. Formica and M. Guedes, Faculdade de Tecnologia, Brazil

de Lange, L. 1992,'Financing start-up companies at the Zernike science park', in *The Economics of Science Parks*, eds P. Formica and M. Guedes, Faculdade de Tecnologia, Brazil

DETYA 1999a, *Knowledge and Innovation: a policy statement on research and research training*, AGPS, Canberra.

DETYA 1999b, *Higher Education report for the 2000 to 2002 triennium*, AGPS, Canberra

Dunkel, T., Seibt, C. and L. F. Nascimento, 1998,'Technology policy and sustainable development in Germany and Brazil:shaping natural systems of innovation towards a sustainable future', in *Management of Technology, Sustainable Development and Eco-efficiency*, eds L. A. Lefebvre, R. M. Mason and T. Khalil, Elsevier Science Ltd, Amsterdam.

Global Environment Outlook 2 1999, United Nations Environment Program, Earthscan Publications Limited.

Gordon, M. 1994,'Green science parks? The contribution of Science parks to sustainable development', in *The Economics of Science Parks*, eds P. Formica and M. Guedes, Faculdade de Tecnologia, Brazil

Martins, M. 1994,'Environmental and competitive advantages of companies:the role of science parks', in *The Economics of Science Parks*, eds P. Formica and M. Guedes, Faculdade de Tecnologia, Brazil

Rio Declaration 1992, Earth Summit '92, Regency Press Corporation (extract)

van Geenhuizen, M. 1993,'Knowledge transfer: managing change under increased uncertainty', in *The Economics of Science Parks*, eds P. Formica and M. Guedes, Faculdade de Tecnologia, Brazil