EMERGING INDUSTRIES occasional paper

Environment Industry Cluster Development

- the South Australian Experience

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Background Discussion Paper

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Contents

Acronyms

ABS	Australian Bureau of Statistics
ANZIC	Australia New Zealand Industry Classification System
SABV2010	South Australian Business Vision 2010
CEIA	Canadian Environment Industry Association
CRCs	Cooperative Research Centres
EIA	Environment Industry Association (United States)
EMIAA	Environment Management Industry Association of Australia
EMPS	Environment Management, Products and Services Industry
DSEF	Domini Social Equity Fund
IT	Information Technology
OECD	Organisation for Economic Cooperation and Development
OEMs	Original Equipment Manufacturers
PV	Photovolltaics
R&D	Research and Development
SIC	Standard Industry Classification System (United States)
SME's	Small to Medium Sized Enterprises
S&P	Standard and Poor's
SRI	Socially Responsible Investments
TDC	Technology Diffusion Cluster

OECD Definition of the environment industry

"The Environment industry is defined as including activities which produce goods and services to measure, prevent, limit or correct damage to water, air and soil, as well as problems related to waste, noise and ecosystems.

It also includes activities that produce clean technologies, processes, products and services which will reduce Environmental risk and minimise pollution and material use.

Most of the estimates of production, structure, employment and trade of the Environment industry comprise equipment, material and services for air pollution control, water pollution and effluent treatment, solid waste management, protection of soil and water, noise/vibration abatement, monitoring and analysis, Environmental consulting services.

Cleaner technologies and products are usually excluded from estimates, because of the lack of consistent information."

Executive Summary

Executive Summary

There is a tide in the affairs of men

Which taken at the flood leads to fortune

(William Shakespeare, Julius Caesar, iv.iii)

Vision for an emerging environment industry

Nations which invest in the future prosper.

Perhaps most remarkable has been the United States which has continuously re-invented its prosperity over the past two hundred years. In the nineteenth century investment in rail galvanised its road to industrialisation. More recently in the last two decades of the twentieth century, its national commitment to investment in the information technology and communications industry, has resulted in productivity growth out stripping all other OECD countries.

In comparison Australia at the turn of the twentieth century arguably had the highest standard of living in the world. Yet as we enter the twenty first-century Australia continues to drop on the international competitiveness ladder.

Dr Robin Batterham, Australia's Chief Scientist and head of the Commonwealth's inquiry into Australia's science system, has stressed our need to invest in research and development. This means a concerted effort to build the knowledge capacity and capability of industry to compete in markets of the 21st Century. The alternative is to face the consequences of further declines to national income and international investors deserting our shores for the smart economies.

But what has all this got to do with the environment industry?

The answer is, everything!

The emerging environment management, products and services industry is rapidly becoming an "enabling" sector in the new economy, in much the same way the information technology and communications industries are driving the new knowledge economy.

Historically, economic growth depended on consuming non-renewable resources. Future and sustainable economic growth depends on conserving these natural resources, and developing technological solutions to produce more with less.

As the new economy continues to transform itself the boundaries between manufacturing and services not only become increasing blurred, but reconfigured into new ensembles of products and services.

The environment industry historically has played a largely reactive role in wealth creation (ie providing technological solutions and know how to ameliorate the environmental damage caused through unsustainable production and consumption), whereas in this new knowledge economy, it is poised to become a source of new wealth creation as the world takes ever stronger steps toward sustainable economic development.

Business has also realised that economic efficiency and superior returns to shareholders require a commitment to environmental best practice. Successful companies around the world are adopting triple bottom line accounting and management practices.

Despite these advances and new ways of doing business, our social challenge is to build awareness of environmental issues and to look at new ways of working and living. This means investing in our social and educational infrastructure to develop these novel ideas and approaches.

Looking forward also means engaging a new generation of young community and business leaders, scientists, environmentalists, and policy makers in government.

If we are to tap into the jobs and industries of the future, we need to create a new generation of working individuals who are as inventive as they are innovative.

Peter Ellyard, one of Australia's leading futurologists concludes in *Ideas for the New Millennium*, "An innovative culture develops a nation of job-makers rather than job-takers".

Creating new economy and knowledge based jobs for South Australians will depend on becoming globally orientated and winning the race to develop new enabling industries found in the environment industry.

Leadership is required to position South Australia as a driver of this economically strategic and emerging industry.

Shaped through the application of new technology and the demand for new products and services, one of the defining features of an emerging industry from a policy perspective, is that "...there are no rules of the game. The competitive problem in an emerging industry is that the rules must be established such that the firm can cope and prosper under them" (Porter, 1980).

Collaborating to compete is a key policy principle, which needs to be enshrined in these new rules if we are to unlock the door to a new industrial future.

So let's not abandon our prospective prosperity to the tides of indifference.

Collaborating to compete - opportunities for an Environment industry cluster in South Australia

South Australia has a history of innovation and leadership in public policy. The South Australian Business Vision 2010 Industry Cluster Project continues this unique partnership between business and government.

BV2010 has developed a number of industry clusters. Foremost has been the establishment of South Australia's defence industry cluster, known as The Defence Teaming Centre, which has generated some $80 million worth of new contracts.

Meanwhile the Department of Industry and Trade released its Innovation and Science policy in March 2000 resulting in the establishment of the Innovation, Science and Technology Council to progress partnerships between industry, universities and the public sector to encourage advances in innovation and science. It also established the Innovation and Technology Unit within its Industry Policy Division to progress innovation and science policy in South Australia.

These are important initiatives that will contribute to the advancement of research and development and strengthening of Australia's knowledge industries.

It is in this context that the environment industry has been identified as emerging and indeed an "enabling" sector in the economy.

South Australian environment industry champions who have driven the push for the development of an industry cluster are increasingly understanding the dynamics of this new industry.

In 1998 there was the first major trade expo of the environment industry in Australia. Ecobiz 98 was initiated, funded and driven by business. This event provided a major trigger for galvanising the industry in South Australia.

Ecobiz 98 was accompanied by an international conference on industry development opportunities in the environment industry. It included the release of a survey of 800 Australian companies prepared by the School of International Business of the University of South Australia on investment and employment expectations of the industry and an exploration of impediments facing that industry (Genoff 1998).

Corporate and civic citizenship of this type ultimately drives the process of engagement leading to social and economic prosperity.

Activating the process of engagement

Building on such business and industry initiatives, the SABV2010 Board commenced the process of engagement by bringing together some of those champions. They were given the task of:

- understanding the drivers of growth in the industry; and
- beginning the process of manifesting new market and industry opportunities through collaboration and industry clustering.

The following background briefing paper has been prepared for the cluster group to assist them explore the issues and impediments facing the industry. This background research is the first step toward activating the environment industry cluster. The research draws on an understanding of the dynamics of growth and principal drivers of the industry. It also includes feedback from a series of interviews carried out with leading industry participants.

The Environment - a dynamic industry

The environment industry exhibits powerful dynamic characteristics that are economically and industrially transformative. "What is clear about the industry is that it is at the cutting edge of innovation, research and development, and knowledge and engineering intensive industries of the future" (Genoff 1999).

The industry is both a producer and consumer of leading edge technology. This is especially pronounced as it moves upward along its innovation curve from the traditional activities of waste management and recycling to resource recovery, where competitive advantage is driven by research and development, innovation and the creation of new products and services.

While the focus of the media and public policy has been on the regulatory regime as a driver of change and growth in the industry, other major factors are also at work.

Financial markets and fund managers investing in Socially Responsible Investments (SRI) symbolise the new found role for the emerging Environment industry. SRI funds are now out-performing mainstream investments.

Companies with strong environmental track records will not only attract such investments, but will also act as a spur for increased demand for the products and services of the Environment industry. Ultimately it will be the development of new global market opportunities sparked or commercialised through collaboration that will attract the venture capital necessary to compete globally.

The combination of the regulatory regime and opportunities for venture capital to commercialise new research and development will directly contribute to the innovative capacities of the industry, and to productivity growth at a broader industry level.

Environment Industry Snapshot

The EMIAA estimates that the environment industry contributes around $11 billion dollars to the Australian economy.

The ABS (1996/7) estimates that expenditure on environment protection was $8.6 billion, which represented 1.6% of gross domestic product.

Major expenditure included:

Waste Management	$2.5 billion
Waste water and water protection	$3.0 billion
Biodiversity and landscape	$1.5 billion

Environmental protection expenditure by industry:

Agriculture	$191.7 million
Mining	$368.8 million
Utilities	$170.8 million
Manufacturing	$896.3 million
Services	$1019.9 million

Issues facing the environment industry

As summarised in Exhibit 1, the issues confronting the environment Industry are not unlike those to be found in other industries.

This is not to say that the focus should be solely on generic issues such as market development as an end in itself. Rather it may be more strategic for the cluster to develop integrated initiatives and approaches that build the dynamics driving the industry.

As a knowledge intensive industry, the development of social capital and collaborative regimes are critical to its long-term innovative capacity. A business driven industry cluster process could greatly facilitate this approach.

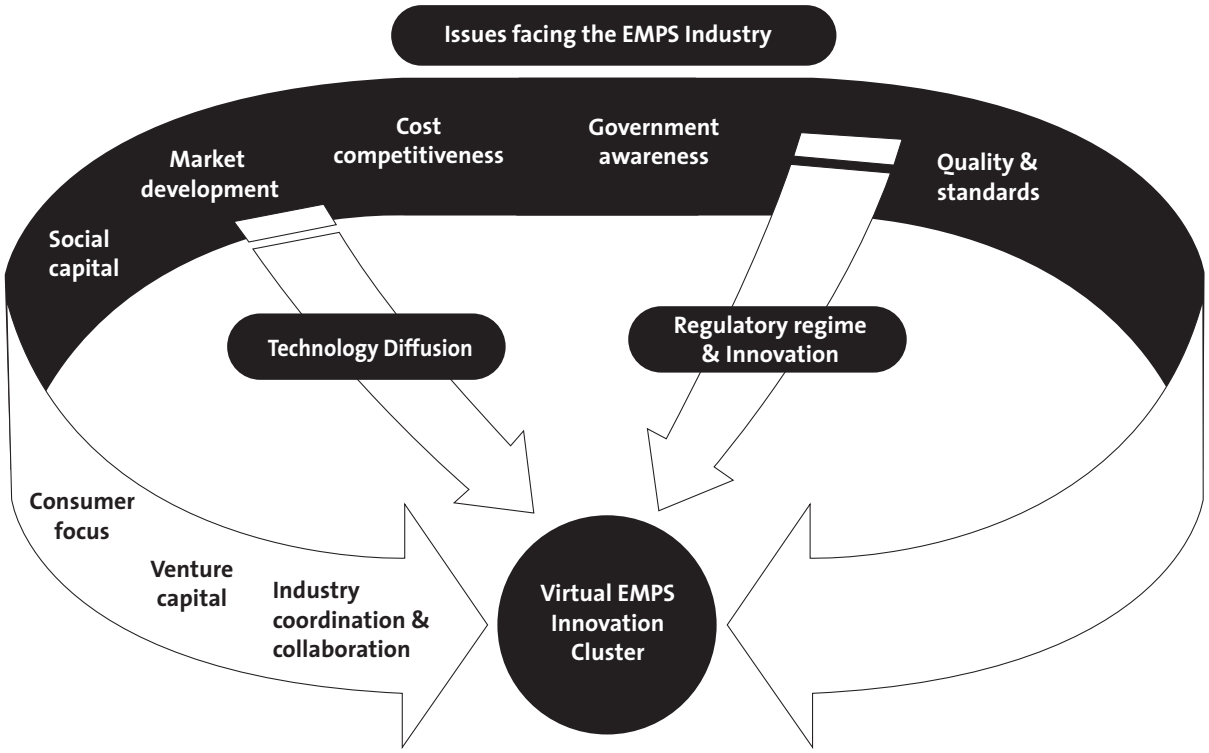
Our research suggests that one of the most complex issues facing the industry and the future role of government, is the issue of how to ensure that the regulatory regime can act as a catalyst for innovation, best practice and new product development.

The traditional carrot and stick approach favoured by regulators, whilst appealing, may well enshrine in practice old economy ideas and principles! When translated into an industry policy framework, this approach can result in picking winners (ie the companies which are identified as industry leaders), while for other companies that had previously invested in good faith, regulatory threats can create uncertainty and undermine prospective investment and market opportunities.

An alternative approach to developing the competitive advantages and opportunities of the Environment industry could involve strengthening complementarities and linkages to be found within and between the sectors that constitute the industry as a whole.

Innovation and technology diffusion will increasingly rely upon collaborative strategies such as virtual cluster organisations to grow new markets and returns to shareholders.

Exhibit 1



Challenges and opportunities in South Australia's environment industry

Distant from markets on the eastern seaboard and overseas, the challenges facing South Australian companies are formidable. Head offices moving either interstate or overseas only serve to reinforce South Australia's sense of vulnerability.

South Australian companies out of sheer necessity have had to become resilient by forging an outward looking and export orientation. Their survival has depended on it. And it is this competitive edge that makes our companies potentially well placed to enter new markets both nationally and internationally.

Ironic as it is, success creates its own draw backs. As South Australia's most successful SMEs expand, they can become targets for either friendly or predatory takeovers.

Takeovers or head offices moving out of the State can result in the diminution of local export, research and industry development efforts, and may become one of the greatest long-term impediments to growth facing South Australia.

However, significant commercial opportunities exist for industry development through collaborative partnerships between business, universities and government.

Virtual structures can be developed to harness these industry growth dynamics.

An environment industry cluster can also for example link into the State's water cluster initiatives and strengthen opportunities for export and market development into Asia.

Exhibit 2 below summarises further challenges, opportunities and competitive advantages to be found in South Australia's environment industry. Many of these were identified in the course of our interviews with a number of industry champions in preparation of this report.

As one industry champion remarked, market opportunities "are there for the taking".

Companies and regions that are smart enough, creative enough and are willing to take on leadership roles, will prosper.

Exhibit 2: Summary of challenges facing the environment industry in South Australia as Identified through Interviews with leaders in the EMPS industry

- Strong presence of subsidiaries with head offices either interstate or overseas. This is impeding export development and research and development opportunities.
- Lack of critical mass in the alternative energy industry that has potential for rapid increases in demand. This is estimated to be a $4 billion industry and is being targeted by the Commonwealth for development of industry development initiatives.
- Increase government awareness of the potential of the Environment Industry to contribute to economic and industry development.
- Size of local and domestic markets, together with distances from national and international markets, and the implications this has for logistical issues and market development. These include two key issues:
  a) the testing and trialing sector of the environment industry is advantaged by proximity to customers and similarly disadvantaged if they are distant; and
  b) the perception that operating in markets outside of existing state boundaries still constitutes a barrier to growth, despite advances in transport and diagnostic opportunities available through the advent of new technology, including information and communications technology, and more efficient freight services which have dramatically reduced costs.
- Lack of venture capital available in SA to support innovation and commercialisation.
- The environment industry is also fragmented in nature and has no clear drivers, and is divided between:
  a) companies in the waste management and recycling sectors, which are in the mature phase of the Environment sector; and
  b) the new and emerging companies which are highly innovative, dependent on new markets and the development of new goods and services.
- The weakness of this relationship undermines the potential for the mature industry to create demand for services that are also used by the emerging sector of the industry ie building critical industry mass.
- Mature industries are being driven by intense competition to maintain existing markets. This level of competition is driving down cost structures through automation and advances in technology, but at the same time impeding innovation. This reflects the underlying dynamics involved as mature industries begin to compete head on with new and emerging industries for market share, and in particular, with the resource recovery and life cycle analysis sectors of the environment industry.
- CEOs in these mature industries also reflect old economy management styles. Although they may in fact have best practice service delivery or production methods, there is nonetheless a lack of awareness of international trends toward sustainability and re-investment into new markets ie investment decisions to move up the Environment innovation curve.
- Lack of a clearly articulated environment industry policy framework is impeding broader industry development opportunities.

Exhibit 2 (continued): Summary of environment competitive advantages In South Australia

- The environment industry has a strong outward or export orientation.
- National surveys suggest that demand is not a constraint to growth.
- The environment industry is home to innovative and vibrant SMEs.
- SA has two of thirteen environment-related Cooperative Research Centres, which includes the CRC for Water Quality and Treatment (This CRC has links to the BV2010 water cluster initiative). These CRCs are working models of collaboration between researchers and the business sector (in the first tier product and services sector) to develop first mover advantages in industry which underpin competitive advantage in the environment industry.
- Adelaide as a university city has strong research and development potential: universities are currently active in over 50 collaborative projects with industry and key stakeholders.
- Existence of existing clusters in spatial information, electronics and water offer industry development synergies and the building of critical industry mass within the economy per se.
- A new generation of younger managers and CEOs of SMEs have a management commitment to new economy thinking and the benefits arising through collaboration. However, these same CEOs have remarked that the industry overall is still dominated by old economy management practices and thinking.
- The CSIRO is a key industry stakeholder and champion in the environment industry.

Exhibit 2 (continued): Summary of Opportunities In South Australia for the Environment Industry

- The environment Industry cluster initiative is the first in Australia, and offers opportunities for industry champions to collaborate and break into new markets.
- Rapidly changing environment regulatory regimes and consumer demand is creating a strong demand for the industry nationally and internationally.
- Public sector infrastructure projects offer opportunities for the environment industry to showcase local know-how. In fact there is evidence of South Australian government procurement practices acting as a catalyst for new product innovation. This is a good example of regulatory regimes driving innovation and new product development, and where the public sector plays a key role in creating early stage demand for these products. This practice is common in the United States and the European Union. Where these practices are aimed at broader industry development initiatives and not purely picking winners at the expense of other companies in the industry, they should be supported through an industry development framework. (However competitive tendering processes for public sector infrastructure projects in Australia whist maximising transparency that can at times undermine the potential for collaborative arrangements within the supply chain, and between the products and services sectors of the environment industry. Further consideration of this may be required).
- South Australian manufacturing and precision engineering capacity and capability has the potential to supply inputs into the environment industry in areas such as wind power, and demand for heavy gear-trains and steering systems.
- There is a strong commitment by the SA CSIRO Division toward developing the industry through the provision of research and development infrastructure and technical expertise.
- Major industry development CRCs are to be found in the eastern states and are linked to the largest of our domestic markets.
- Strong local government expertise and support can directly contribute to creating both demand and development of environment products and services. Opportunities also exist for joint business and local government partnerships to develop turnkey projects in Asian and developing economies ie export of the policy architecture for education awareness programs and regulatory regimes, together with active industry development initiatives and turn key solutions.
- Linking industry development opportunities into existing DISR programs and maximising future opportunities as new environment initiatives are developed through that Department.
- Clustering initiatives can contribute to the development of innovation networks in the following industries: Food; Sustainable Energy; Resource Recovery; Waste Water Treatment and Management; Analytical Services; Soil Remediation.

Part One

The Environment Industry – Superior Returns to Shareholders

The Environment industry - delivering superior returns to shareholders

"The concept of corporate sustainability has long been very attractive to investors because of its aim to increase long-term shareholder value. Sustainability-driven companies achieve their business goals by integrating economic, environmental and social growth opportunities in a pro-active, cost-effective and responsible manner today, so that they will outpace their competitors and be tomorrows winners" Dow Jones, Sustainability Group Index (see box page 39).

Companies that adopt environment best practice are some of the most efficient and profitable. The CEOs of these "sustainability companies" also implement governance practices which often make them leaders and industry champions in their own right.

Corporate citizenship is one of the defining features of this new breed of business leader. They often participate in a diverse range of community and business forums which contribute to the dissemination of new ideas, thinking and best practice.

Traditional manufacturers or resource companies on the other hand which pay insufficient attention to environmental concerns are increasingly being punished by the financial markets and called to account by shareholders.

With the Dow Jones Sustainability Index capitalised at around $US4.3 trillion, a new generation of investors who are conscious of environmental issues, are making investment decisions with a view to the medium and longer term, as the rate of return in this sector outstrips more traditional investment portfolios.

Corporate Sustainability Index

The Dow Jones Sustainability Group index identifies five corporate sustainability principles that lead to superior financial performance:

Technology: *The creation, production and delivery of products and services should be based on innovative technology and organisation that use financial, natural and social resources in an efficient and effective and economic manner over the long term.*

Governance: *Corporate sustainability should be based on the highest standards of corporate governance including management responsibility, organisational capability, corporate culture and stakeholder relations.*

Shareholders: *The shareholders' demands should be met by sound financial returns, long-term economic growth, long-term productivity increases, sharpened global competitiveness and contributors to intellectual capital.*

Industry: *Sustainability companies should lead their industry's shift towards sustainability by demonstrating their commitment and publicising their superior performance.*

Society: *Sustainability companies should encourage lasting social well being by their appropriate and timely responses to rapid social change, evolving demographics, migratory flows, shifting cultural patterns and the need for life-long learning and continuing education.*

The Domini Social Equity Fund is now even out performing the Standard and Poor's 500 group of companies (See Exhibit 3).

As reported in the cover story of the stockmarket magazine Shares, "There is something ironic, if not contradictory, in the idea that environmentally friendly companies could become the next big thing in the share market - they could form the basis of a "green boom" to rival the late 1990s...". In Australia, Westpac Bank's Eco Index since its establishment in 1999 achieved a 26.5% return compared to the All Ordinaries Index of 21.7%.

Meantime legislation in the United Kingdom has been passed requiring pensions funds to disclose their policies on socially responsible investment (see Exhibit 4). This will directly increase the level of investment in SRI funds by the international financial community.

These international trends are also influencing the way we do business in Australia. In a global economy this means ensuring that our companies are in step with the compliance and reporting practices demanded in advanced economies.

Not surprisingly, new legal requirements have been introduced in Australia demanding that companies disclose environmental performance in company annual reports.

A survey of Australia's top 100 companies revealed that 71% of these companies filed a statement of their Environmental performance in their Director's Report in their 1999 Annual Report (Lou de Leeuw and Karen Bubna-Litic 2000).

Exhibit 3 Domini Social Equity Fund vs S&P 500

	DSEF	S&P 500
1992	12.10%	7.68%
1993	6.54%	10.08%
1994	-0.36%	1.26%
1995	35.17%	35.50%
1996	21.84%	23.07%
1997	36.02%	33.04%
1998	32.99%	28.58%
1999	22.63%	21.04%

(Source, J Prestbo (2000) Ethical Fund Underperformance: Myth or Reality? editor Dow Jones Indexes)

Exhibit 4 UK Socially Responsible Investment

The second year of the All-Party Parliamentary Group on socially Responsible Investment has seen the first UK legislation on socially responsible investment (SRI) which will come into force into July 2000. The pensions disclosure regulation will require trustees of occupational pension funds to disclose their policies on socially responsible investment and on the exercise of shareholder rights, including voting rights. Shortly after the regulation was laid before Parliament, the government announced plans for a similar regulation for local authority pension funds. These simple but extremely significant pieces of legislation are resulting in socially responsible investment being examined seriously by many in the pensions industry.

Tony Coleman MP, House of Commons, United Kingdom

Part Two

The Environment Industry - Dynamics of Growth

The Environment industry - "enabling" the future"

Whilst SRI trends are increasingly being documented and indeed understood by business and the financial markets, one aspect of the environment industry that is overlooked is its innovative capacity, and the contribution it makes to a nation's research and development infrastructure, and technology diffusion.

In a modern global economy, the process of technology diffusion significantly influences the industrial dynamics of regions and competitive advantage.

OECD research on technology diffusion, has identified five technology diffusion clusters (TDCs). They comprise information technology; transportation; consumer goods; materials, and fabrication. These TDCs and the industry sectors that comprise them are summarised in the Exhibit 5 below. They build on more traditional technology definitions also summarised in Exhibit 5.

The environment industry plays a role in each TDC. For instance, software for the production of sensing equipment developed in the information TDC may then be consumed by the materials TDC, for say monitoring of hazardous materials in the petroleum refining industry.

Technology diffusion occurs within and between these TDCs. Collaboration through linking clustering initiatives is beginning to occur between South Australia's water and spatial clusters. Such initiatives contribute to the dynamics of technology diffusion between those industries.

The nature of formal and informal collaboration between companies in the various TDC's will in turn determine the quality of the technology transfer, and the manner in which it contributes to the company's competitive advantage.

The environment industry has the potential to strengthen these intra-cluster linkages as the industry's role regarding efficiency and greenhouse abatement continues to increase over time.

As the data for Australia indicates, manufacturing and mining are one of the major sectors of the economy that undertake the greatest level of environmental expenditure (see Part 6 on industry statistics).

However, while important statistically, the more critical point is that the manufacturing and mining sectors are both consumers and developers of knowledge intensive environment products and services.

These "traditional" industries exert powerful backward and forward linkages - from the development of new products and services, to their incorporation in new production processes, testing and trialing and the like.

A greater understanding of natural technology pathways within an industrial and regional innovation system can directly contribute to a more sophisticated industry development architecture. Especially one which builds economy and industry wide competencies, and enterprise capacity and capabilities that can grow the knowledge intensive ensembles of the new economy, and its emerging industries.

Exhibit 5 Summary of OECD Technology Diffusion Cluster and Technology Classifications

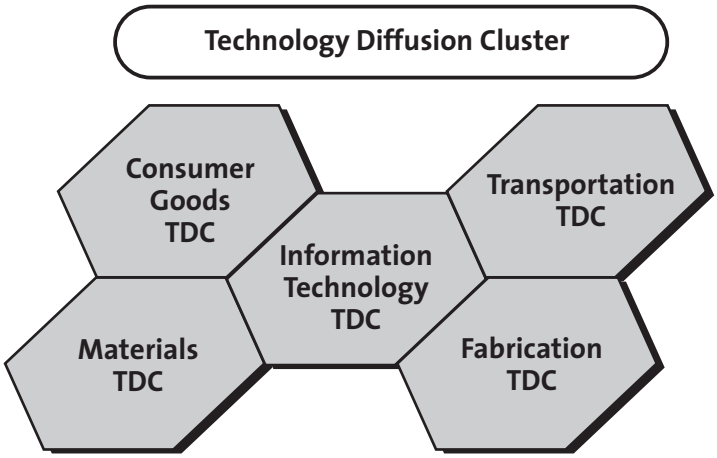
OECD Technology Diffusion Cluster Classifications	Industry Sector
Information TDC	Electrical Machinery Computers Communications & Semiconductor equipment instruments
Transportation TDC	Motor vehicles Transportation Ship building Aerospace
Consumer Goods TDC	Food Beverages and tobacco Textiles Footwear Apparel
Materials TDC	Agriculture Mining Construction Chemicals Rubber and plastics Paper and printing Wood products Stone, clay and glass Ferrous metals Non-ferrous metals Pharmaceuticals Petroleum refining
Fabrication TDC	Fabricated metal products Other non-electrical machinery Other manufacturing

Sectoral Technology Classifications	Industry Sector
High Technology	Aerospace Computers Electronics Pharmaceuticals
Medium high Technology	Instruments Motor Vehicles Chemicals Electrical Machinery
Medium Low Technology	Machinery Other transportation Equipment Petroleum refining Stone, clay, glass Other manufacturing Rubber and plastics Non-ferrous metals
Low Technology	Ferrous metals Fabricated metals Food, drink and tobacco Paper and printing Textiles and clothing Wood and furniture

Again in the Australian context, the manufacturing and mining sectors play a critical role in research and development and the nation's innovation efforts. It is this innovation infrastructure that the environment industry can build upon through collaboration and clustering initiatives.

As summarised in Exhibit 6 below, the information technology TDC can be described as a principal enabler within the new economy. But its benefits to the local economy will depend on each of the TDC's creating avenues for sophisticated and technologically driven demand.

Exhibit 6



In our haste to grasp the contribution the information technology TDC makes to growth, we sometimes overlook the intersectoral dynamics between each of the TDCs and the critical roles played by:

- eduction and training in skill formation;
- research and development in knowledge formation; and
- investment in social and physical infrastructure to productivity growth.

The important point is that skill and knowledge formation, and infrastructure investment are crucial to all five of the OECD's TDCs.

As summarised in Exhibit 7, these factors can be characterised as new economy enablers which directly underpin productivity growth.

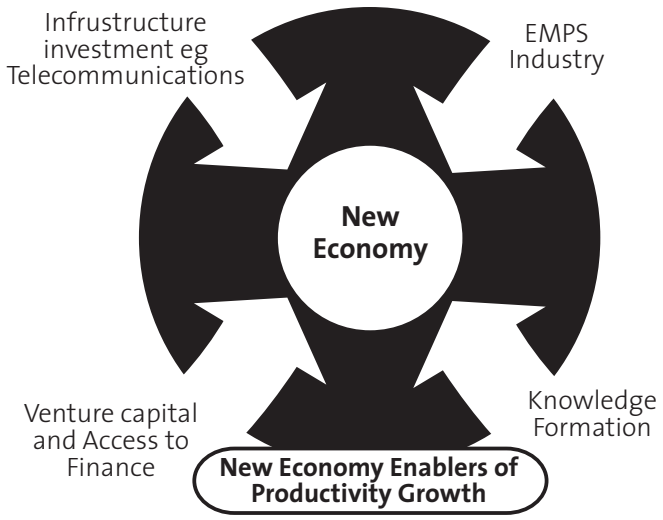
But if these enablers are to exert a powerful role in technology diffusion, the level of education and training needs to be at international best practice and state of the art investment is required in infrastructure. For instance, telecommunications and IT play a crucial role in each of these TDCs.

Concomitantly, the greater the research and development intensity is in our knowledge industries, the greater is the requirement for investment in world class infrastructure, to encourage and attract long term investment and research opportunities.

Infrastructure investment acts as a catalyst for local re-investment and builds confidence to make future investments in research and development, whist in turn creating the pre-conditions for foreign investment and technology transfer.

As illustrated in Exhibit 7, the environment industry plays a similar enabling role across industry as the industry invests to meet new consumer and regulatory demands, while generating productivity gains through enhanced efficiencies demanded by shareholders and financial markets alike.

Exhibit 7



New Economy Enablers of Productivity Growth. (Source: Genoff, de Leeuw, Bubna-LiticCity of Playford (2000) *SMEs Implementing the Green Advantage*)

The Environment innovation curve - the dynamics of growth in an emergent industry

The dynamic nature of the environment industry is shown in Exhibit 8. The innovation curve illustrates the changes that are occurring as we move from mature industries to emerging and new industries of the future.

Whilst life cycle analysis is common to explain the growth and decline of industries, a striking feature of the environment industry is its emerging industry characteristics and prospects for strong growth in the new economy.

The mature side of the environment industry is characterised by waste management and recycling respectively. In terms of the innovation and life cycle of the Environment industry, both have old economy characteristics of competing on price, undifferentiated product, and are part of the mature phase of the industry. The former known for land-fill and the role of road transport as a major input into this industry.

Recycling on the other hand has seen the steady application and uptake of new recycling processes resulting from advances in sorting and separating capital goods equipment. Advances in this industry are characterised more through innovation directed at improvements to recycling processes rather than research and development.

Resource recovery extends the advances made in recycling through the greater application of research and development, and the integration of international best practice in material separation, biodigestion and composting. Rivalry in this sector is intense as companies not only compete for first mover advantages, but become investment destinations for both green investors and the financial markets.

Consequently companies in the resource recovery sector simultaneously undertake research and development, and are high-end consumers of cutting edge engineering, technical and laboratory services characteristic of the knowledge intensive side of the environment industry.

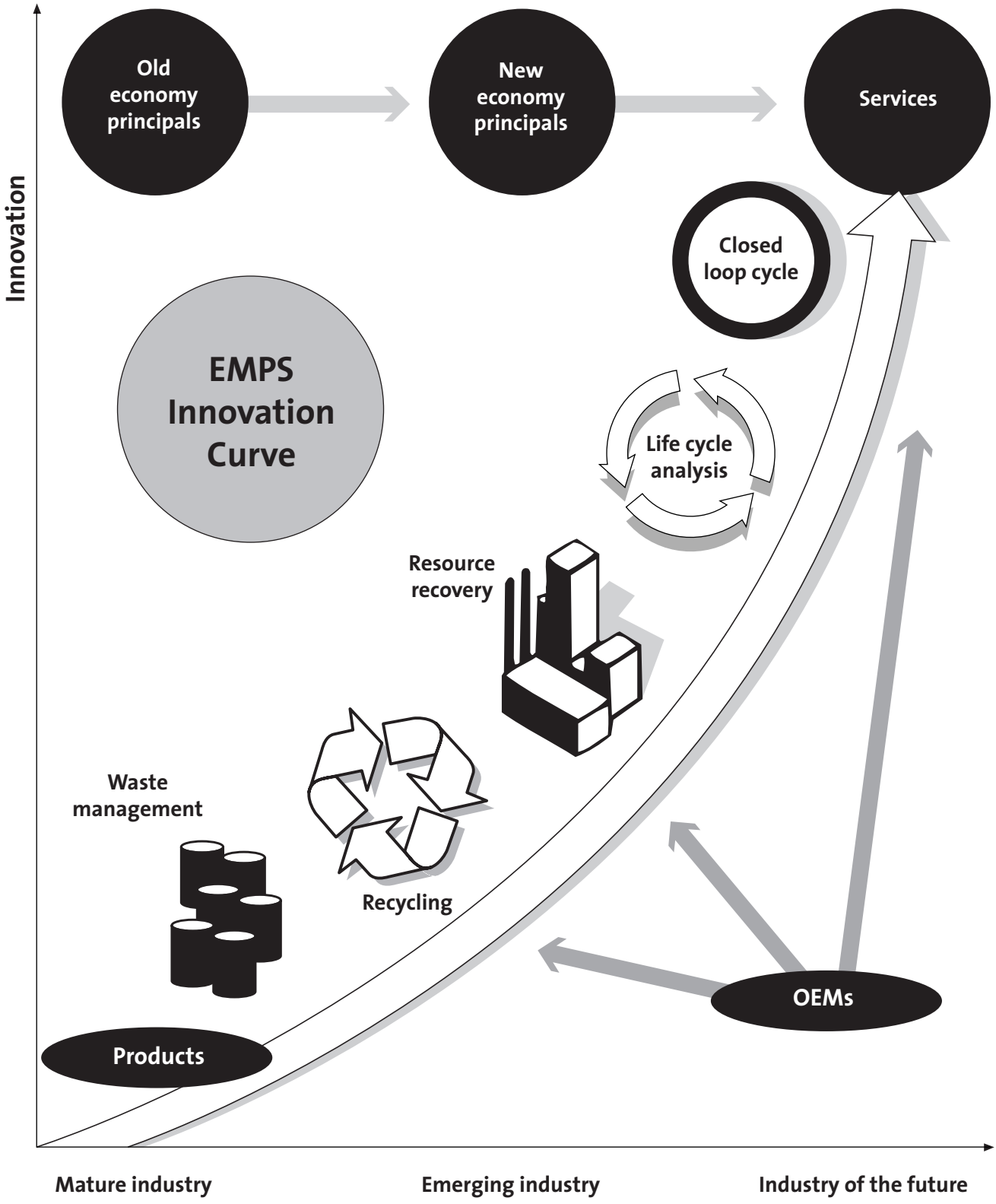
Opportunities exist in this sector of the industry for collaboration and market development opportunities, both domestic and export.

Universities in turn can underwrite industry development opportunities through research and development.

For companies already undertaking research and development and commercialisation of new technology, significant opportunities exist for accessing research and development and innovation industry development funds.

Resource recovery has strong growth prospects, presents significant opportunities for investment and will increasingly form a vital part of investment opportunities for the SRI funds sector, and mainstream investors.

Exhibit 8 Innovation Curve



The quality and direction of investment will be governed through intense competition for first mover advantages and commercialisation of world class technology.

Commercialisation itself will in part be driven through demonstration projects reflecting government priorities to address market failure in the area of waste management and greenhouse related issues. A number of Australia's green listed companies are securing important new contracts with State governments around Australia as they seek to maximise first mover advantages and position themselves in emerging markets.

However the challenge for Australian companies, especially given the level of foreign ownership, is far greater than their US or European counterparts.

Both not only have larger economies and final markets but their governments are also more interventionist and willing to "pick winners".

Consequently the imperative for Australian companies to collaborate to compete makes strategic as well as commercial sense, especially in the race to develop first mover advantages which can be quickly re-engineered in this sector of the industry.

Increasingly it will be new economy principles that shape the success or failure of companies involved in this sector of the industry.

Life cycle analysis is at the cutting edge of new advances and directions in the industry.

Life cycle analysis involves product development and design, and ultimately reuse of materials. This sector of the industry is research and development and knowledge intensive, and is driven by development of new materials and products and services.

Partnerships between universities and business underpin the dynamic and transformative nature of this emerging sector within the environment innovation cycle.

Technological breakthroughs form an important spur for technology transfer within the environment industry and the rest of the economy. At the local and regional level, opportunities exist for growing new markets and demand for our engineering intensive SMEs such as the development of new capital goods and precision instruments by original equipment manufacturers. This in turn creates demand for software developers to be found in the electronics and IT sector.

A discerning public is increasingly willing to pay a premium for goods and services developed in this sector of the industry.

Such companies also rank highly on SRI scorecards and will increasingly attract investment funds at the expense of their old economy rivals. In fact, it may well be one avenue for so-called old economy industries such as the automotive industry to re-position itself in markets for SRI funds. Especially as these SRI fund markets mature and look to developing investment portfolios of "new economy" blue stock companies for longer term investment opportunities!

Our universities and Cooperative Research Centres (CRCs) undertook some of this leading edge research and development.

Thirteen of these CRCs conduct leading edge research into environmental issues such as waste management and land degradation, and play a vital role in technology transfer. In South Australia, the CRC for Water Quality and Treatment also plays an important role in the research and development infrastructure of the SABV2010 Water Alliance Cluster project.

Benefits from such initiatives flow onto the partners or joint-venturers in such research and subsequent commercialisation directly contributes to productivity growth, in the broader economy.

Finally closed loop cycle production represents the industry and the community's long term environment aspirations of totally integrated systems of production directed increasingly at socially useful outcomes and goods built to last.

Closed loop cycle production reverses the market/production philosophy of high turnover and built-in obsolescence that one finds in the production of many of today's consumption goods.

Clearly a sophisticated economy cannot do without an integrated dynamic and vibrant Environment industry, which contributes not only to research and development, but also to the diffusion of technology and know-how.

Part Three

Defining the Environment Industry through Industry Interactions

So what is the Environment Industry?

Background

It has been estimated that the Environment Management, Product and Services (Environment) industries contribute around $11 billion to the Australian economy (EMIAA). Yet little research has been undertaken on these important Australian industries. One of the reasons is definitional.

A changing economy creates new industry structures. The dynamics of growth in turn creates new clusters of industry activities and these are often a nation's new wealth generators. Our challenge is to understand the contribution the industry makes to the economy and its role in nation building through new industry development.

What is clear about the industry is that it is at the cutting edge of innovation, research and development, and knowledge and engineering intensive industries of the future. Because the industry has the word "environment" in front of it, the industry immediately loses valuable currency in the eyes of economic and industry development and financial institutions looking to invest on behalf of shareholders. However, these perceptions are now being challenged by the growth of "green bucks" and green investment portfolios.

Companies which invest in the technologies and markets of the future will develop important first mover advantages in new, discerning and often niche markets. The supply side is being challenged by strong demand for greener goods and services.

However, investment in new industries of the future must result in adequate returns to shareholders. Industry must feel confident in the governments policy settings. This confidence in Australia is all the more vulnerable because we know just how risk-adverse investors are on taking a punt on new industries.

So if the industry is to capture the interest of institutional investors and government, industry's needs must be identified and growth prospects evaluated.

(Rodin Genoff, (1999) EMPS Industry, School of International Business, University of South Australia.)

Some definitions of the environment industry from around the world include:

Environment Management Industry Association of Australia (EMIAA)[5]

"Representing and helping organisations in the business of providing Environment management goods, systems and services.

EMIAA members include organisations working in:

- waste management and recycling;
- pollution, noise and radiation control;
- water and waste-water treatment and reuse;
- energy conservation;
- monitoring and process control;
- cleaner production; and
- soils and land management.

OECD[6]

"The environment industry is defined as including activities which produce goods and services to measure, prevent, limit or correct damage to water, air and soil, as well as problems related to waste, noise and ecosystems. It also includes activities that produce clean technologies, processes, products and services which will reduce environmental risk and minimise pollution and material use.

Most of the estimates of production, structure, employment and trade of the Environment industry comprise equipment, material and services for air pollution control, water pollution and effluent treatment, solid waste management, protection of soil and water, noise/vibration abatement, monitoring and analysis, environmental consulting services. Cleaner technologies and products are usually excluded from estimates, because of the lack of consistent information."

Canadian Environment Industry Association (CEIA)[7]

"Canadian firms, corporations or divisions or units thereof which provide environmental solutions (environmental products, technologies or services).

Firms, corporations or divisions or units thereof which support the mission of the CEIA and provide products or services to organisations in the environment industry."

The mission of the CEIA is "To promote the interests and development of Canadian companies supplying environmental products, technologies and services."

Environmental Industry Associations (EIA) - USA[8]

"The environmental industry associations represents about 2,000 companies that manage solid, hazardous, and medical wastes; manufacture and distribute waste equipment; offer related pollution- prevention services."

Another definition from the United States of America is that put by Dr Mary L. Good, University of Arkansas at Little Rock with the definition as "all revenue generating activities associated with:[9]

- compliance with environmental regulations;
- environmental assessment, analysis and protection;
- pollution control, waste management and remediation of contaminated property;
- provision and delivery of the environmental resources of water, recovered materials, and clean energy; and
- technologies and activities that contribute to increased energy and resource efficiency, high productivity and sustainable economic growth".

Why the industry has definitional issues

The environment industry does not have a primary activity that allows it to be either easily measured or defined. Nor does it have acknowledged disciplines that allow it to come together professionally or culturally.

[5] www.emiaa.org.au

[6] www.oecd.org, December, 1995

[7] http://www.ceia-acie.ca

[8] www.envas.org

[9] Trans-Atlantic Environment Conference, Little Rock, Arkansas, March, 1999.

Yet the very word or term "industry" not only conjures certain world views, but also expectations of what an industry actually does, and even how it behaves and commercially operates in the eyes of the broader community, business and the media.

Consequently, a number of definitional problems arise:

- organisations involved usually see the environmental service as a part of their overall service eg. measurement services have an environmental effect but are seen overall as part of the electronics industry;
- whether the organisation's services represent a significant portion of the total business of the company eg. Waste transport as compared to other transport activities; and
- the changing nature of the industry eg. eco-efficiency is a new term that did not exist 2 years ago and the companies providing services in this area now, may well have defined their activities differently in the past.

Therefore if we are to view the industry as an industry "enabler" contributing to broader economic benefits and productivity gains, a whole of industry perspective needs to be taken into account.

A useful approach is to first of all examine the industry through its value adding supply chain. This includes:

- End Market;
- First Tier Products and Services;
- Second Tier Products and Services;
- Economic Infrastructure; and
- Institutional linkages.

These are now summarised.

End Markets

End markets represent the final user of the environmental product or service. That is the market that the industry is to enter. These have been identified as:

- Governments – Australian and international;
- Funding and aid Agencies;
- Australian Industry in the primary, secondary and tertiary sectors; and
- International private sector organisations and individuals.

First Tier Products and Services

This tier is most likely to deal with the end users. Characteristics that set this tier and its companies apart from other tiers are:

Size: They are more likely to have national and international locations. If they are successful domestically owned companies, they are also the most vulnerable to overseas takeovers. In fact, South Australia has a history of such takeovers.

Infrastructure: They will have infrastructure in place that gives them project and financial management capabilities to undertake large investment projects and installations.

Marketing: They will market directly to the end user.

Project Management: They will provide project management on the basis of strong and proven track records, and links to financial institutions.

In this role they will add value to second tier products and services and extend the local economy's wealth by exporting products and services nationally and internationally.

Second Tier Products and Services

This tier will generally supply goods and services to the First Tier Products and Services suppliers. They will generally be characterised as:

Size: Small localised firms.

Infrastructure: They will have in place infrastructure to undertake localised work and some capacity for expansion.

Marketing: They will market to First Tier Products and Services suppliers, adding value to their goods and services.

Innovation: They will generally have unique products and services for which they have a proprietary right and directly add value to the First Tier Products and Services. These companies directly contribute to the industrial and knowledge infrastructure of regional innovation systems.

Economic Infrastructure

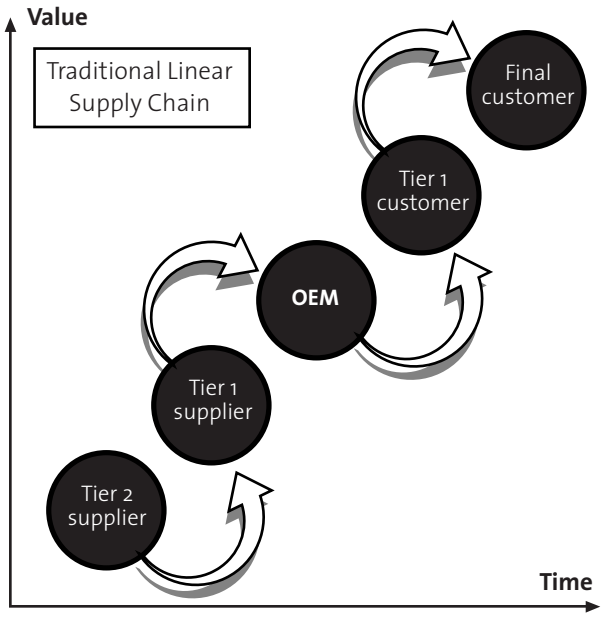
This sector will comprise support for the First and Second Tier Products and Services suppliers in education and training, provision of regulation, assistance to engaging end markets and provision of a structure to communicate between the variety of interested parties in the industry. In short, it builds knowledge and skill formation in the environment industry.

This sector provides the foundations of the industry to add value to their products and services, adding wealth to the local economy.

Exhibit 9 summarises a traditional linear supply chain.

Each link in the supply chain is characterised by high transaction costs and intense competition.

Exhibit 9

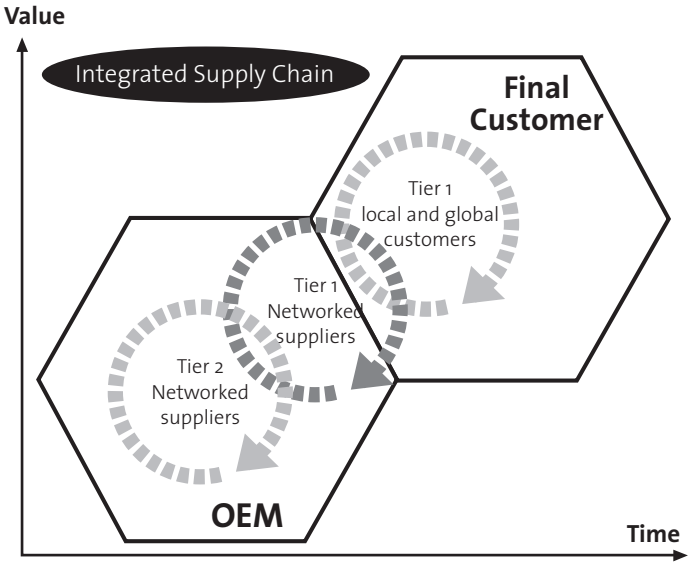


(Source, Genoff, de Leeuw and Bubna-Litic, City of Playford, (2000) SME's Implementing the Green Advantage)

Exhibit 10, on the other hand, summarises an integrated and networked supply chain between first tier and second tier suppliers, and original equipment manufacturers (OEM), and customers on the other.

The key point is that customers can work more closely with OEMs, who are usually specialist, high and medium high technology companies to develop new products (eg precision engineering, sensing and waste management capital goods) with the concomitant spin-off into research and development and innovation. This in turn acts as a catalyst to diffuse new technology and production processes to first and second tier suppliers.

Exhibit 10



(Source, Genoff, de Leeuw, and Bubna-Litic City of Playford, (2000) SME's Implementing the Green Advantage)

It is therefore not surprising that an integrated supply chain is defined through collaborative networked relationships and mutual reciprocity.

The economic benefits of such networked supply chain relationships include:

- increased profitability;
- reduced transaction costs;
- improved delivery times;
- increased throughput;
- improved quality;
- quicker market response;
- higher trust levels and improved partnership relationships;
- better stock turns;
- environmental efficiencies; and
- knowledge and skill formation.

At a broad industry level, Exhibit 11 next page summarises environmental innovation networks for SMEs. The concept described here was developed through a local government environment industry project, *Implementing the Green Advantage for SMEs (City of Playford 2000)*. It summarises how knowledge networks can feed into and underpin business networks.

The challenge for industry policy makers is to develop institutional frameworks and protocols to optimise innovation and innovative practices. They need to do this without opting for the old economy industry paradigm of trying to pick winners or forecast market trends as a basis of allocating resources. In particular, utilising the networks of regulators to work alongside industry to develop new industry opportunities arising from new products and services, rather than being seen to wield the compliance stick.

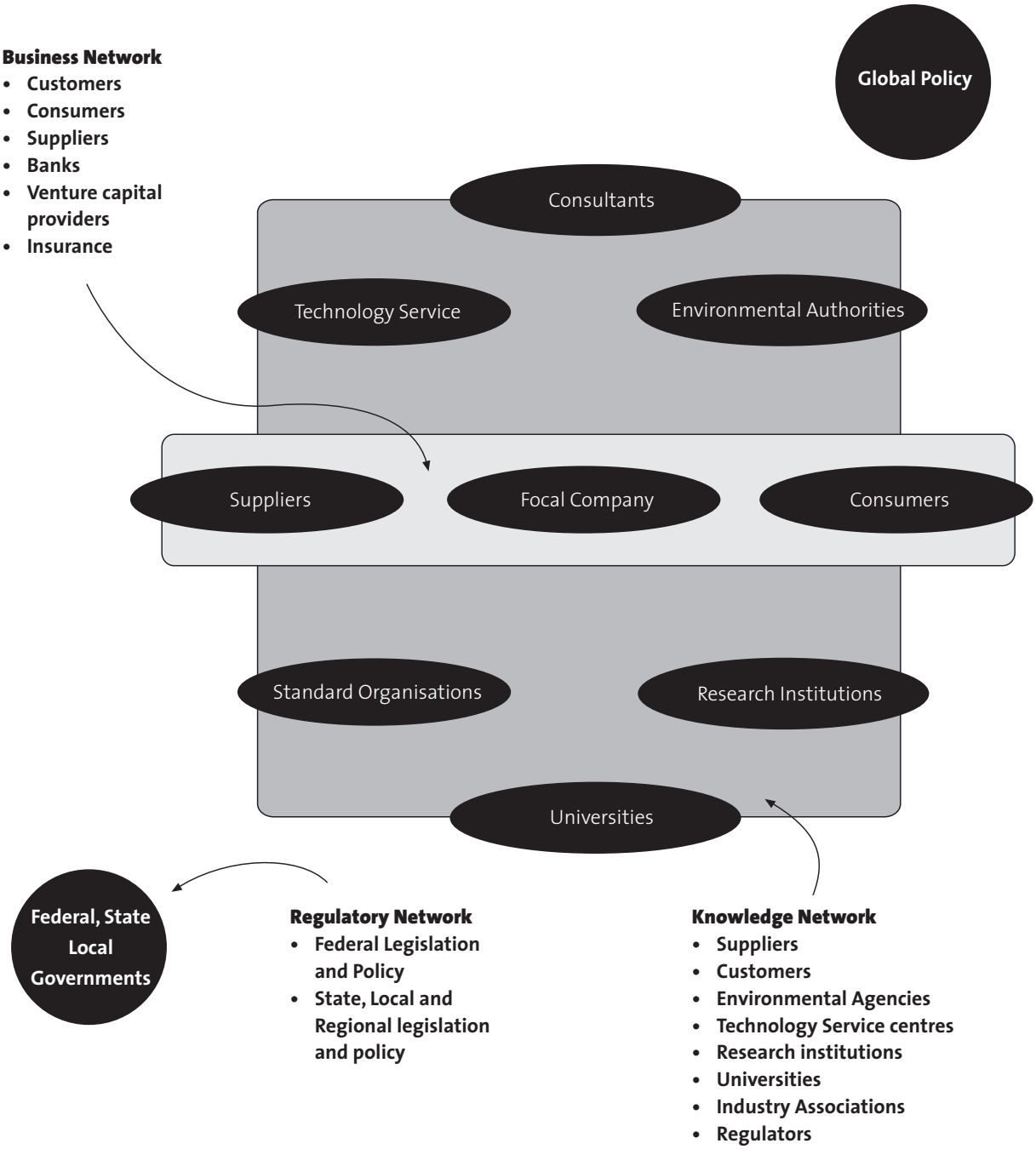
The challenge for the regulators' network is to provide leadership, and collaborative structures and protocols, which can more effectively enable the industry to compete in the global market place, and to be responsive rather than reactive to global regulatory changes.

Principles of mutual collaboration and reciprocity directly inform the environment industry cluster process and can facilitate on the ground translation of this concept into commercial reality by removing cultural and administrative barriers between regulators and the industry.

The industry is part of the solution, not the problem, and must be viewed very differently than it currently is. This is not about weakening the role of regulators, but tapping into their knowledge and understanding of the issues and challenges facing the environment industry.

Exhibit 11 Environmental Innovation Networks for SME s

(Derived, Hanson et al)



Part Four

Industry Clusters and the New Economy

The Role of Clusters in Economic Development

"Nations succeed not in isolated industries...but in *clusters* of industries connected through vertical and horizontal relationships. A nation's economy contains a mix of clusters, whose makeup and sources of competitive advantage (or disadvantage) reflect the state of the economy's development" (M. Porter, *The Competitive Advantage of Nations,* 1990).

The importance of Porter's research is his emphasis on the ability for firms, industries, regions and nations to create competitive advantage.

Porter in turn identified four interrelated conditions that inform competitive advantage and cluster development:

Demand Conditions which force suppliers to compete at world best practice level.

Factor Conditions underpinning the need for suppliers to have world class infrastructure, labour skills and a level of knowledge formation enabling them to be internationally competitive.

Supporting Conditions such as world class research and development organisations. These are fundamental to creating competitive advantage in an economic environment dominated by innovation and novelty.

Firm Strategy, Structure and Rivalry relates to the need for intense local competition to drive innovation and growth necessary to develop the economies of scale and scope to compete in international markets.

Successful industry clusters combine these elements in a dynamic and powerful manner to create international competitive advantage.

In terms of the new economy thinking, Porter (1998) concluded that:

"Clusters align better with the nature of competition and the sources of competitive advantage. Clusters, broader than industries, capture important linkages, complementarities,

and spillovers of technology, skills, information, marketing and consumer needs that cut across firms and industries...fundamental to competition, to productivity, and especially, to the direction and pace of new business formation and innovation....Viewing a group of companies and institutions as a cluster highlights opportunities for coordination and mutual improvement in areas of common concern without threatening or distorting competition or limiting the intensity of rivalry."

It is therefore not surprising to increasingly find cluster analysis and development at the focal point of economic and industry policy as summarised in Exhibit 12.

As the OECD (1999) has concluded:

"In an increasing number of OECD member and non-member countries, cluster analysis is seen as an important analytical tool that can underpin industrial and technological policy."

"Networks of innovation are the rule rather than the exception, and the most innovative activity involves multiple actors. To successfully innovate, companies are becoming more dependent on complementary knowledge and know-how in companies and institutions other than their own.

Innovation is not the activity of a single company (like the 'heroic Schumpeterian entrepreneur'), but rather it requires an active search process to tap new resources of knowledge and technology and apply them to products and production processes...

Companies are developing strategies to cope with their increasing dependency on their Environment such as more flexible organisation structures and the integration of various links in the production chain through strategic alliances, joint ventures and consortia...

Exhibit 12

(Source, adapted, M. Porter, 1998)

The main goal of most strategic alliances has been to gain access to new and complementary knowledge and to speed up the learning process.

The important point here is to not only acknowledge that the world is rapidly changing, but that it is changing in a profound way.

As Dunning (1997) observes, the new epoch of the 21st century can in many respects be described as "alliance or flexible capitalism".

Contrasting alliance capitalism with earlier forms of capitalism (see Exhibit 13), Dunning has identified seven key characteristics to compare and contrast this new and unfolding economic system with previous regimes:

- markets;
- specialisation;
- key resources;
- mobility of asset;
- organisation;
- production system; and
- government role.

His analysis is useful because it explodes the myth of a new international division of labour where business make locational investment decisions primarily on cost in highly hierarchical or vertically integrated systems of production.

Exhibit 13

	Entrepreneurial Capitalism (1770-1875)	Hierarchical Capitalism (1875-1980)	Alliance or Flexible Capitalism (1980-?)
Markets	Small and fragmentary, local and national: mainly competitive	National or international: increasingly oligopolistic	Regional and global: dynamic and more competitive
Specialisation	Simple and modest, based mainly on distribution of natural assets	Becoming more complex: both national and international	Extensive and interdependent: the paradox of an increasing global division of labour based on location of created assets, together with sub-national specialised clusters of economic activity
Key Resources	Natural assets, eg fruits of the land and relatively unskilled labour	Physical and some knowledge capital	Intangible assets eg human competence and knowledge, information, organisational and learning capability
Mobility of assets	Little except for finance capital, and some emigration	Gradually increasingly via multinational operations	More inter-firm alliances, single firm hierarchies, corporate networks
Organisation	Factory, small firms	Large integrated corporate hierarchies	More inter-firm alliances, single firm hierarchies, corporate networks
Production system	D form, batch	M form, mass or scale	Innovation driven: flexible
Government system	Limited involvement: active	Growing intervention growth	More systemic and market enabling

(See, Dunby in I. Marsh and B. Shaw *Australia's Wine Industry: Collaboration and Learning as Causes of Competitive Success*, 2000)

While this no doubt is still a feature of the global economy, competitive advantage is increasingly being generated through what are often highly specialised production ensembles of clusters and networked companies across the globe.

Innovation is driving this process and our most successful innovators are demanding new forms of collaborative and inter and intra company governance regimes.

Measuring Industry Clusters - the Challenge!

Measuring new industries presents statisticians with significant challenges. Exhibit 14 (see page 56) draws from material by Stuart Rosenfeld (1995), an international authority on cluster analysis, summarises some of the major pitfalls when one relies too heavily on publicly available data such as that published by the ABS in Australia.

The most important lesson we can learn from this research is the need to develop analytical frameworks which capture the dynamics of the cluster under consideration.

However at the end of the day, no matter how robust the statistical material is, results only give us a snapshot of what was, rather than what is!

Quantitative research such as input-output analysis does, however, enable us to understand the forward and backward linkages between different economic activities. For example, it is possible to quantify the inputs from steel to financial services consumed in the production of motor vehicles.

Unfortunately this is usually where the research process ends, rather than begins. Rosenfeld and in turn Genoff and Sheather, (*Clusters - the Dynamics of Regional Growth 2002 Federation Press, forthcoming*), believe that it is only through undertaking research at the coal face that it is possible to mine for the qualitative industry intelligence that is required for cluster development.

For instance, Rosenfeld gives us an example of "high impact sector analysis", developed by the Michigan Industrial Technology Institute. The model "uses consumer-suppliers relationships as its organising framework...[and applies] national survey data for current and planned uses of technology" to estimate industry competitiveness. However as Rosenfeld points out, "the value of ITI's rigorous methodology is diminished by the weakness of the available data". On the other hand, the organising framework developed by Genoff and Sheather employs similar principles, but is instead based on extensive face to face interviews to develop a regional supply chain competitiveness index based on investment in technology and know-how. Data is in real time and codes strengths and weaknesses to be found in supply chains.

Some core elements of Genoff and Sheather's framework was incorporated into the survey used to undertake company interviews with environment companies in South Australia.

Difficulty of Measuring the Environment Industry

Apart from the difficulties outlined above when dealing with the measurement of traditional industries, the environment industry presents an even greater challenge.

The standard statistical approach is to undertake analysis at the four digit ANZIC level. The problem with undertaking this approach with the environment industry is that activities (which number as many as 10 to 15) that go to make up the four digit ANZIC, only one of the sub-categories may relate to the environment industry.

This makes using publicly available ABS data for the purposes of this project a near impossible task. Despite these limitations the ABS has prepared a number of profiles of the environment industry which are summarised in the final part of this paper.

Exhibit 14:

Looking at the Wrong Picture: Government Data Weaknesses

Significant gaps and difficulties can surface when trying to use government data to uncover regional clustering activity. Here are just a few examples:

The Unit of Analysis, Firm Vs Industry

Traditional industrial development strategies (for example, business recruitment) tend to use the individual firm as their unit of analysis. But development policies that focus on modernisation and enhanced competitiveness demand data that allow analysis of a specific industry. Currently the only way to approximate this kind of information from government data is to aggregate firms within an industry.

Static Vs Dynamic Data

Even if you do aggregate, an additional problem appears: Most data are like "snapshots" of one time, static conditions rather than "moving pictures" that illustrate the dynamic flows over time that are typical in an active industry cluster. To understand an industry, data are needed about the formal and informal activities that generate business transactions and diffuse technology, knowledge and innovation. Companies in a dynamic industry engage in vertical relationships with one another - called value chains or commodity chains - to yield final products.

Although value-added relationships can be estimated using models based on the national aggregate of purchases and sales recorded by business, these models are based only on gross estimates which, at the regional level may diverge significantly from reality.

SIC Limits

Data that is organised by the Standard Industry Classification (SIC) codes of industries focuses on firms that produce the same end products. It does not capture industry groupings that are based on the use of common technologies, especially specialised expertise or skills, or ties to a scarce resource.

(The same can be said for Australia's ANZIC industry classification system).

Industry Changes and Predictive Ability

Because large corporations are increasingly decentralising and outsourcing production, it is changing their make-versus-buy decisions and consequently purchases and sales change so rapidly that official statistics cannot keep pace. Thus these data may lose their value for predicting.

See Stuart Rosenfeld (1995) *Industrial Strength Strategies*.

Part Five

The Environment Industry - Clustering the Future

A new economy paradigm

Over twenty industry champions have participated in face to face interviews with the project team. What is emerging as a notable trend for some of these companies is their shift away from traditional management models and ways of doing business.

Competitive advantage is being increasingly determined by these new approaches (see below).

> *"In the early 20th century, creating wealth was about getting enough capital to develop. Then it was about getting enough good scientific developments to turn into products. By the end of the century, corporations focused on marketing and selling those products and services.*
>
> *But at the start of the 21st century, says Hamel, who had worked with major corporations like Cisco and Charles Schwab, wealth lies in learning how to take an industry apart and put it back together in another way. Such radical re-invention is now de rigueur because the factors which once protected incumbents have broken down through technology, globalisation and venture capital.*
>
> *Once it was enough to gradually and continually improve on products and systems in a linear fashion. Now nothing less than constant, non-linear innovation will be enough to beat back the competition" (The Australian Financial Review, 8 September 2000).*

For the services side of the environment industry, companies have traditionally separated functions such as testing and trailing, laboratory work associated with research and development, and quality assurance and accreditation, into operational hierarchies within each specialised discipline governed by its own norms, culture and way of doing business.

Old economy styles of management are being challenged by new economy thinking which places great importance on collaboration and partnership building within the organisation, and in turn between companies. New economy thinking also places a premium on inter-disciplinary approaches to problem solving and product development.

Enhanced efficiencies and market opportunities are increasingly being realised through new product development based on this new economy approach.

It is therefore not surprising to find that another factor emerging through face to face interviews, is an obvious change in management style, arising from a new and younger generation of executives and senior managers.

These new environment industry champions are younger than many of their old management style contemporaries, and definitely have a new way of doing business.

Noteworthy is the strategic decision of a large company employing around 500 persons, to collaboratively develop long term business relationships with a number of key knowledge professionals who are seen as leaders in their field.

The relationship is not so much with the company that employs these individuals, but with the individuals themselves (even should they go and work for another company).

This strategy is not simply about continuity, but building core professional competencies and collegiate associations, which directly embed and deepen the company's knowledge fabric and competitive advantage.

As industry champions, the companies interviewed responded positively to proposed industry cluster and government initiatives, aimed at developing new product and market opportunities.

Equally, however, they also raised concerns that need to be addressed if such industry initiatives are to be successfully implemented for this emerging industry.

Methodology

During the initial process of engagement, which heralded the start of the SABV 2010 cluster process, key industry champions and companies were identified, approached and interviewed to ascertain:

- where they were placed in the cluster map (see Attachment 2);
- organisational structure;
- size of the organisation;
- resources available to tackle environmental issues;
- accreditation by way of quality and environmental standards;
- awards and prizes for environmental issues;
- training undertaken externally and internally within the organisation;
- supply chains;
- research and development;
- current and future markets; and
- identification of impediments and opportunities in the environment Industry.

The interviews had four principal aims:

- ascertain interest and capability of the company and the industry;
- identify opportunities that were being recognised by the sector and the industry;
- describe impediments that were being encountered in the growth of this sector; and
- engage the interviewee in the cluster process.

Those interviewed represented large Australian corporations, government departments, small businesses, local government, research authorities and education institutions. This cross section of the industry reflects the "new supply chain" analysis and organising framework discussed above.

Participants interviewed represented the following cluster segments:

Cluster Sector	Number Interviewed
End Markets	4
First Tier Products and Services	5
Second Tier Products and Services	8
Economic Infrastructure	5

Summary of Interview Outcomes

Many interviewees whether in business, government or education, identified opportunities for growth in value adding their service or product and creating new markets.

However, not surprisingly, given definitional issues surrounding the industry, several of the companies interviewed considered themselves to fill more than one sector. (This reflects the previous concept of "value adding" within the supply chain and integration of services).

Companies which were vertically and horizontally integrated tended to be located in the mature sector of the environment industry. Consequently they were less likely to be engaged in or entertain the possibility of entering into collaborative practices.

Intense competitive pressure to maintain existing markets is squeezing profit margins. (This is one of the factors contributing to these perceived low levels of collaboration).

Pressure on margins is arising as returns on investment are determined by scale and volume, and the competitive imperative to build market share in ostensibly declining long term product markets. Automation and advances in technology are being used to offset labour costs and maximise returns, thus accelerating this mature sector's capital intensity over time.

As the industry continues to mature, incremental advances in production techniques are increasingly replacing the innovative or novel aspects of the industry.

This reflects the underlying dynamics involved as the mature industries begin to compete head on with new and emerging industries for market share and, in particular, with the resource recovery and life cycle analysis sectors of the environment industry.

One can expect some companies in this mature sector of the industry to be either contemplating exit strategies, or using their knowledge of the industry to plan a round of mergers or acquisitions, as this sector confronts adjustment pressures.

Underlying competition between the mature and emerging sectors of the environment industry also has implications for the level of collaboration one could expect between these sectors.

Of the companies interviewed the service sector was over represented compared to those from the products.

This may reflect that those in the service industry have a collaborative culture underpinned through professional associations, links to universities and business organisations. Therefore they are more likely to have a greater cultural inclination toward networking activities and the value of "value adding" the supply chain. (But then one should not expect each sector to exhibit similar behavioural or collaborative attitudes).

At a deeper level, however, the tension between collaboration and competition also reflects the manner in which the different sectors which go to make up the industry "do business", and the type of contractual arrangements they engage in.

For instance, in larger engineering or infrastructure projects, specifications developed by engineers for say environment related capital goods may favour companies with proven track records. Needless to say, this reflects standard practice to reduce risk between products and services in the supply chain.

Within this traditional or old economy approach, little if no emphasis is placed on collaboration to diffuse technology and know-how aimed at ultimately building new markets for novel products and services. In reality this acts as a brake on the diffusion process.

Nor is this process assisted by contractual arrangements to do with tendering out of say government infrastructure projects requiring competitive tendering arrangements to maximise transparency and return to the "taxpayer".

In fact, such arrangements may even undermine the potential for collaborative arrangements to be developed within the supply chain, and between the products and services sectors of the environment industry.

Benchmarking and an industry awareness programs are required to broadcast the benefits of collaborative public/private sector initiatives. For instance, the Bolivar-Virginia pipeline is a cogent illustration of how public sector procurement practices were used to develop a best practice project, and build the innovative and engineering capacity of the environment water related industries and their SMEs.

Government procurement practices have traditionally been used as an industry policy tool to advance research and development and uptake of products and services.

In future, as industry development opportunities are identified that can enhance the welfare of the industry as a whole, resources should be made available to benchmark processes and outcomes. This is very much part of the process of needing to establish the "rules of the game" for an emerging industry as described by Porter earlier (1990). And for public policy to be effective, this understanding needs to be contextualised and integrated into a broad raft of environment industry policy measures.

Interview Results

Cross Cluster Sector Application

Education institutions and semi-government research organisations often see themselves not only as operating as part of the Economic Infrastructure, but also as First Tier Suppliers of Products and Services. This reflects the current trend for the drive to autonomous funding by these bodies.

Private organisations interviewed expressed some concern about this trend due to the perception that these organisations were subsidised and the full cost of the service did not need to reflect commercial realities.

This may represent a barrier to collaboration between the private sector and commercially orientated research undertaken in the public sector.

Interviewees believed the tension sometimes becomes particularly acute in early stage research when competition for funds is most intense. The extent to which this is an industry reality or perception amongst the companies interviewed requires further investigation.

Cluster development in this respect has both a brokerage and market development role - ie to grow the market pie, rather than to compete over the crumbs!

Environmental Regulation

Environment related organisations across the board from local government to those in the services sector, considered the implementation of environmental regulations as lacking "teeth" to force industry compliance.

However, some of the company's interviewed believed that a more balanced view needed to be developed regarding issues of regulation and compliance, in order to maintain business and investor confidence in South Australia.

Government Attitude

Lack of focus and integration at Government level on commercial environmental issues and the potential for industry growth was cited as an impediment to the growth.

However, of those companies interviewed, only a few had approached government for industry development assistance. This reflects the emerging status of the environment industry as defined by Porter (1980) and the lack of an articulated industry development program available to that industry.

Clearly, there is a need for an environment industry policy framework.

Educational Institutions

Universities indicated an interest in commercial environmental opportunities. A survey of one educational institution identified 52 commercial environmental activities conducted within it. Consequently significant opportunities exist for collaboration.

This presents new opportunities to develop a whole industry approach to integrate the new "service paradigm" in line with "Networks of Innovation" discussed earlier.

The environment industry is ideally suited "To successfully innovate, [as] companies are becoming more dependent on complementary knowledge and know-how in companies and institutions other than their own" (OECD, 1999).

For example the redefinition of the waste management industry will see greater innovation as we move from land fill to closed loop production. This will put pressure on the waste industry to move up the innovation curve into the sustainable energy sector.

Of course many of those interviewed are pursuing this model, which as well as presenting a world best practice view, also suits South Australia in that it encourages "doing more with less."

This perception requires further exploration with these industry leaders through the cluster processes with a view

to developing "innovation networks" in the following key South Australian Industries:

- food;
- sustainable energy;
- resource recovery;
- waste water treatment and management;
- analytical services; and
- soil remediation.

Education

As Dr Robin Batterham has stressed, we need to invest in research and development and build the productive capacity of industry to compete in markets in the future.

To do this we require a cross institutional approach. For example, this could include working with existing university projects, (one university had 52 projects on environmental issues being conducted), to develop future research objectives, as part of a broader government agenda to address environment policy objectives. That is the development of partnerships between universities and industry leading to the commercialisation of these ideas.

As we develop and extend these skills we also extend the ability to influence the markets that we are aiming for. With a cross-institutional education structure in place we have the ability to tap these markets with South Australian technical expertise, educational experience and South Australian systems and equipment.

Training in this way builds South Australian expertise, while drawing on the facilities and technical equipment which may be embodied in turn key solutions developed by our companies.

In other words, trainees will have a strong predisposition to use "familiar" systems when undertaking environmental projects in their state, or country of origin.

South Australia has the facilities to complete this strategy through partnerships between the CRC's, CSIRO and the universities. However, this process would require co-ordination infrastructure and an aggressive marketing strategy.

Renewable Energy

Renewable energy is cited as a potential growth area largely due to expected renewable energy quotas in mainstream energy supplies.

Wind

Wind is the fastest growing renewable energy sector in the world. It is also quite mature and dominated by a small number of major players.

There are a number of proposals on the table in South Australia. However the following impediments stand in their way:

- passing of the additional 2% renewables legislation;
- negotiations with landowners;
- approvals processes (some consider wind farms to be ugly); and
- connection costs.

Opportunities exit for South Australia's manufacturers to participate in the construction of wind turbines. Local companies could be involved in civil works, electrical distribution, maintenance (the heavy gear-trains and steering systems can be troublesome), towers and perhaps blades which are difficult to transport.

Biomass energy

This offers quite a contrast to the wind energy arena. Biomass energy is complex. As one interviewee indicated, "Though large, vertically integrated organisations (such as Origin Energy) will take significant chunks of the market", niche opportunities will still be available.

Local knowledge of agronomy, waste problems, infrastructure, suppliers and the client base will often provide competitive advantage to local players over the larger corporations.

Combining this with our discussion of "Innovative Networks" this is an opportunity to pursue.

Photovoltaics (PV industry)

Photovoltaics, although the visible part of renewables with its connection to "solar power" would have to grow quite significantly before local manufacture could be contemplated.

New South Wales, is the current focus of activity in this sector and has a well established supplier base.

South Australia, however, does have expertise in the installation and maintenance of the systems. In other words South Australian companies have a strong presence in the second Tier Service Providers.

Nonetheless significant research has been conducted in South Australia to develop innovative solutions to the harnessing of energy and its use in photovoltaics.

This expertise is valuable to both local industry and interstate suppliers, and can form the basis for competitive collaboration for national and international projects.

Energy efficiency

The interviewee suggested that this is a service sector which should be doing much better than it is in South Australia. Energy efficiency services could integrate with other maintenance, asset management and risk management services. Though the returns can be significant from energy efficiency initiatives, local business and government has failed to invest in these opportunities.

However discussions with the Office of Energy indicated that the department would welcome private sector commitment and investment in this area.

Vision of South Australian Industry

Universal concern and frustration was expressed by the companies interviewed regarding the short-termism and lack of vision adopted not only by South Australian companies in the environment industry but also Australian companies in general.

However, of greatest concern, was the perception by interviewees that the industry was disregarding at its own peril, the need to invest in best practice necessary to make it internationally competitive.

Clearly this issue requires greater investigation, because should these perceptions be correct, the industry's ability to break into new markets and the benefits arising from greater supply chain integration are diminished.

Costs and Benefits of Company Ownership Structures in SA's Environment Industry

Some First Tier Suppliers do not have head offices in South Australia.

Consequently market opportunities are regionalised, ie linked to local or regional markets. This issue may represent a significant barrier to the development of cluster initiatives that focus on broader market development or export opportunities. In other words, such initiatives were the responsibility of a head office which could be located overseas.

Logistics

For some of the companies interviewed, distance from markets has been cited as an impediment to growth.

Choice of Suppliers

During the interviews, the choice of suppliers was often seen to follow a pattern that would determine how the environmental products and services would be marketed. These patterns included:

- choice of suppliers by company
  Particular firms were identified by the customer and dealt with.
- choice of individuals within firms
  Particular individuals were chosen irrespective of the company that they worked with.
- suppliers were chosen from another office
  Adelaide or South Australian branch office and suppliers were chosen from an interstate head office with little or no input from the local office.

(A summary of the challenges, competitive advantages and opportunities for the South Australian environment industry arising from the industry interviews undertaken for this section of the report, are outlined in Exhibit 2 in the Executive Summary at the beginning of this report.)

National opportunities and impediments to growth

This final section of the chapter summaries results of the national EMPS survey prepared by Rodin Genoff (1999) of the School of International Business of the University of South Australia. The survey covered companies employing 54,000 people throughout Australia and included questions on impediments facing the environment industry. These are summarised in Exhibits 15 and 16 respectively.

Of most concern in the environment industry is the government's performance on research and development and innovation, which scored poorly.

It therefore comes as no surprise that government awareness was ranked as the principal impediment facing the industry, well ahead of demand which ranked as a fifth order issue.

Recent research and development data show declining national expenditure for research and development, and reinforces calls by industry groups for the government to strengthen its R&D and innovation industry policy framework.

"Overall, Australia's expenditure on R&D as a share of gross domestic Product 1998-99 was 1.49 per cent in the mid range of OECD countries, but expenditure in the business sector is markedly lower than the OECD average, ranking seventh lowest among 24 OECD countries - and is falling while the average for OECD countries continues to rise" (The Australian Financial Review, 8 September 2000)

Findings from the survey most relevant to the cluster process regard the identification of procurement opportunities to build local expertise. This the industry believed would underpin broader market and export development opportunities.

Companies nationally expressed their willingness to network - this goodwill needs to put to work - sooner rather than later.

Exhibit 15 Impediments Index

Impediment	Percentage of respondents
1. Government awareness	58.5%
2. Customer awareness	52.2%
3. Tax system	41.0%
4. Skill shortages	35.6%
5. Lack of demand	33.2%
6. Access to finance	32.2%
7. R&D	31.7%
8. Lack of capacity	27.3%
9. Innovation	26.3%
10. Export devt	26.3%
11. IT	17.6%
12. Import competition	17.6%
13. Access to the net	6.8%

(Source, Rodin Genoff, National Environment Survey, 1999, School of International Business, University of South Australia.)

Exhibit 16 Government Performance Ratings

	Very Poor Poor	Good Excellent
R&D	59%	7%
Innovation	59%	5%
Exports	36%	22%
Tax Reform	48%	22%
Venture Capital	67%	4%
Greenhouse	58%	11%
Industry Development	43%	11%

(Source, Rodin Genoff, National Environment Survey, 1999, School of International Business, University of South Australia.)

Part Six

The Environment Industry - Statistical Overview

The following chapter of the report overviews the following ABS publications:

1. Environmental Protection Expenditure (this provides an overall industry snapshot). Sections 3 and 4 below summarise broader industrial overviews of the performance of the energy and mining industries given the importance of these industries as a source of demand for the environment industry.
2. Waste Management Industry
3. Electricity, Gas, Water and Sewerage
4. Mining

1. Environment Protection Expenditure[10]

Overview

Total national expenditure for environmental protection was estimated at $8.4 billion in 1995/96 and $8.6 billion in 1996/97, roughly equivalent to 1.6% of gross domestic product in each year.

The majority of national expenditure to protect the environment was on waste water management and water protection, $2.9 billion and $3.0 billion in 1995/96 and 1996/97 respectively, and waste management activities $2.4 billion and $2.5 billion in 1995/96 and 1996/97 respectively.

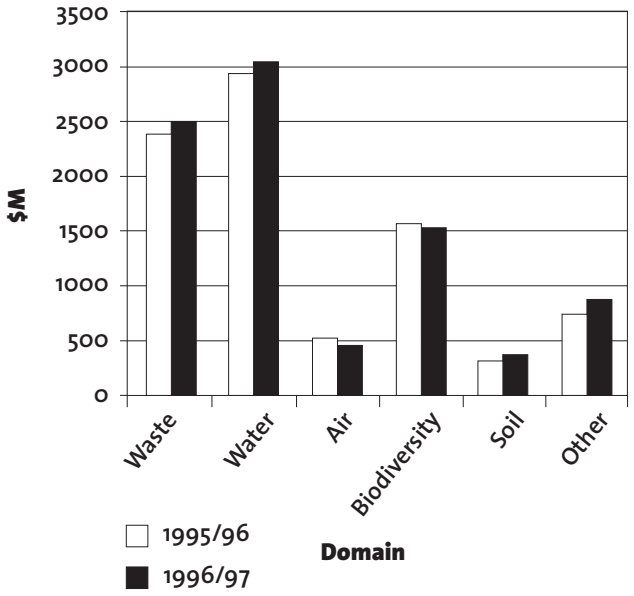
Expenditure to protect biodiversity and landscape contributed a further 18% to total expenditure ($1.5 billion in both years), with protection of ambient air and climate, and soil and groundwater representing only about 6% and 4% respectively.

The remainder, less than 10%, was expenditure for research and development, noise and vibration abatement and expenditures on other environment protection activities. Figure 1 provides a visual representation of these expenditures.

Expenditure for waste management and protection of air and climate is dominated by the corporate sector, followed by the consumption of these services and activities by the household sector, with smaller amounts spent by general government.

In contrast, general government contributed the greatest amount of resources towards the protection of biodiversity and landscape, with relatively small amounts spent on these activities by households and the corporate sector.

Figure 1 National Expenditure by Environmental Domain



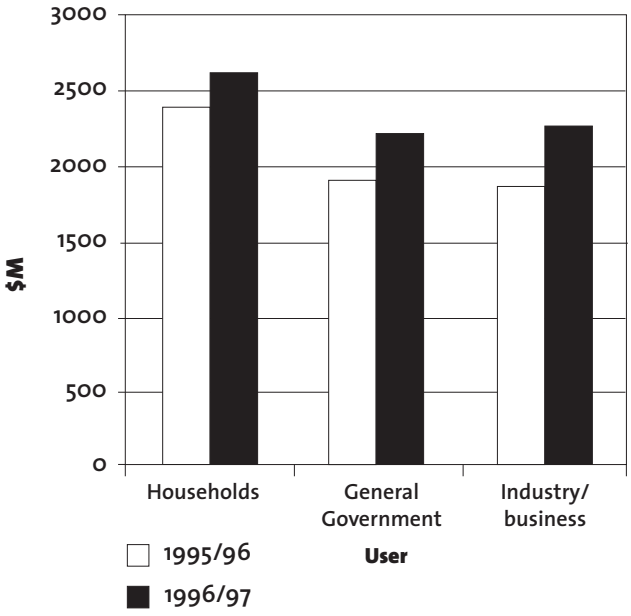
The household sector spent the most on wastewater and water protection services. A substantial proportion of expenditure by the corporate sector was also for these purposes, with expenditure by general government on these activities being relatively small.

Households were the largest consumers of environment protection services and products, spending $2.4 billion in 1995/96 and $2.6 billion in 1996/97.

General government spent approximately 22% ($1.9 billion) and 25% ($2.2 billion) of national expenditure for environment protection in 1995/96 and 1996/97 respectively. This represented about 1.9% of total final consumption expenditure by general government for 1995/96 and 2.2% in 1996/97.

Industry and business spent $1.2 billion in 1995/96 and $1.5 billion in 1996/97 on the purchase of market services and products to protect the environment. A further $657 million in 1995/96 and $747 million in 1996/97 was expenditure by industries to mitigate the impacts of their production activities on the environment.

Figure 2 Sectoral expenditure[11]



The Environment protection industries consisted primarily of producers of waste management services and waste water management services (sewerage operators) and comprised the bulk of total environmental protection output, 85% ($6.8 billion) in 1995/96 and 84% ($7.0 billion) in 1996/97.

Production of these services was shared between government and the corporate sector. The remainder of production, ($1.2 billion in 1995/96 and $1.3 billion in 1996/97) was by other producers.

Of the total environment protection output produced by government and industry, the majority was market output, 68% in 1995/96 and 67% in 1996/96.

[10] The figures quoted and material used in this document is from the Australian Bureau of Statistics *Environmental Expenditure 1995/96 and 1996/97*, Catalogue no. 4603.0, ABS, Canberra, 1999.

[11] The figures for industry/business include the expenditure to mitigate the impacts of production activities on the Environment.

Environment protection products and services provided free or at minimal cost to consumers (non-market output) accounted for approximately 23% in 1995/96 and 24% in 1996/97 of total products and services produced.

The remainder, 8% in 1995/96 and 9% in 1996/97 was the production of environmental protection activities for internal use by industries.

Environmental Protection Expenditure by Industry and State[12]

The Agricultural Sector

Table 1 provides an overview of environment protection expenditure by State for the agricultural sector.

Table 1: Environmental Protection Expenditure, Agriculture Sector by State 1996/97

Jurisdiction	$M
NSW	51.2
Vic	34.3
QLD	72.3
SA	6.5
WA	25.0
Tas	2.3
Aust[13]	191.7

Queensland spent the most on environmental protection. When expressed as a percentage of farm business turnover by State for 1996/97,[14] environment protection expenditure in Queensland was also proportionately higher than other States (approximately 1.2% of farm business turnover).

The next two states in terms of proportional expenditure were New South Wales and Victoria, where environment protection expenditure represented approximately 0.7% of farm business turnover. South Australia spent the least on environment protection expenditure when expressed as a percentage of farm business turnover (approximately 0.3%).

Within the sector, the grain growing industry with $44 million (23% of total) reported the highest expenditure on environment protection. Other major contributors to environment protection expenditure were the grain-sheep, grain-beef cattle farming industry with $36 million (19% of total) and beef cattle farming with $28 million (14% of total).

Overall the highest proportion of expenditure on environment protection to total industry turnover was in beef cattle farming with 1.0% of total turnover, followed by grain growing, grain-sheep, grain-beef cattle farming, dairy cattle farming and sugar cane growing, all reporting expenditure representing 0.9% of total turnover. These figures are presented in Table 2.

Table 2: Environment protection Expenditure, Agriculture Sector by Industry 1996/97

Industry	Total ($M)	Total Turnover (%)
Fruit Growing	5.1	0.3
Vegetable Growing	8.0	0.5
Grain Growing	44.3	0.9
Grain-sheep, Grain-beef Cattle Farming	36.0	0.9
Sheep-beef Cattle Farming	7.7	0.6
Sheep Farming	9.7	0.7
Beef Cattle Farming	27.6	1.0
Dairy Cattle Farming	25.8	0.9
Pig Farming	4.3	0.6
Sugar Cane Growing	11.4	0.9
Cotton growing	8.2	0.7
Other Agriculture	3.5	0.2
Total[15]	**191.7**	**0.7**

[12] Environment protection expenditure estimates for industries were compiled from a survey of businesses for the 1996/97 financial year.

[13] Includes NT and ACT. Figures may not exactly add-up due to rounding.

[14] Australian Bureau of Statistics, 1998, Agriculture Australia, 1996/97, Catalogue No. 7114.0, ABS, Canberra.

[15] Figures may not exactly add-up due to rounding.

The Mining Sector[16]

Metal ore mining recorded the highest level of expenditure on environment protection for 1996/97 with $173 million (47% of all environment protection expenditure within the mining sector). The next highest contribution to environment protection within the sector was coal mining with $103 million (28% of total expenditure).

The breakdown of total environment protection expenditure between current and capital expenditure was $228 million for current expenditure and $141 million for capital expenditure (62% and 38% respectively).

Total expenditure for 1996/97 was $369 million, representing 1% of total industry turnover for all mining industries. The breakdown is presented in Table 3.

Table 3: Environment Protection Expenditure ($M), Mining Sector by Industry 1996/97

Industry	Capital Expend	Current Expend	Total Expend
Coal mining	44.4	58.5	102.9
Oil and gas Extraction	10.4	21.9	32.3
Metal Ore Mining	69.2	103.9	173
Other Mining	15.7	31.2	46.9
Services to Mining	1.1	12.7	13.7
Total[17]	**140.8**	**228.1**	**368.8**

The Utilities Sector

The electricity production industry spent $157 million (92% of total expenditure on environment protection by utilities) on environment protection measures. This industry also had the highest capital and current expenditure (99% and 86% of total environment protection capital and current expenditure by utilities respectively) on environment protection measures. Table 4 shows the expenditure by this sector.

Table 4: Environment Protection Expenditure ($M), Utilities 1996/97

Industry	Capital Expend	Current Expend	Total Expend
Electricity Prod'n	72.4	84.1	156.5
Gas Prod'n	1.1	13.2	14.3
Total	**73.5**	**97.3**	**170.8**

The Manufacturing Sector

The metal product industry spent the most on environment protection with $244 million (27% of total environment expenditure by all manufacturing industries). Other major contributors to total environmental protection expenditure came from the food, beverage and tobacco industry with $205 million (23% of total expenditure) and the petroleum coal, chemical and associated product industry with $151 million (17% of total expenditure). Table 5 presents data on these and other manufacturing industries.

Table 5: Environment Protection expenditure ($M), Manufacturing Industry 1996/97

Industry	Current Expend	Capital Expend	Total Expend
Food, Beverages & Tobacco	77.8	127.0	204.9
TCF&L Products	21.8	32.4	54.2
Wood and Paper Products	31.5	45.3	76.8
Print, Publishing and media	3.8	15.3	19.0
Petroleum, Coal, Chemicals	70.1	81.1	151.1
Non-met Mineral Products	29.4	28.6	58.0
Metal Products	146.7	97.3	244.0
Machinery	30.3	41.1	71.4
Other Manufacturing	4.5	12.5	17.0
Total[18]	**415.8**	**480.5**	**896.3**

[16] Data for the mining sector was obtained from a census.

[17] Figures may not exactly add-up due to rounding.

[18] Figures may not exactly add-up due to rounding.

As a percentage of total capital expenditure, manufacturers spent 4% on environment protection measures. Capital expenditure on environment protection by metal product manufacturers accounted for 10% of their total capital expenditure. Textile, clothing, footwear and leather (TCF&L) manufacturers spent 9% of their capital expenditure on such measures.

Service and Other Sectors

Total expenditure for environment protection by service industries was $775 million in 1995/96 and $1020 million in 1996/97. Overall, current expenditure on environment protection activities for both years was largest in the construction industry, retail trade and wholesale trade sectors.

Together this group of industries accounted for over one-half of current expenditure on waste management and environment protection by the service industries sector (55% in 1995/96 and 60% in 1996/97).

Table 6 shows the breakdown for these industries for 1996/97.

Table 6: Environment Protection Expenditure $(M), Service Industries 1996/97

Industry	Capital Expend	Current Expend	Total Expend
Agriculture, forestry & fishing	2	4.1	6.1
Construction	16.7	196.1	212.8
Wholesale Trade	17.2	222	239.2
Retail trade	30.8	134.1	164.9
Accom', Cafes and Restaurants	1	92.3	93.3
Transport and Storage	18.6	52.2	70.8
C'munication Services	0	0.1	0.1
Finance and Insurance	1.5	44.9	46.4
Property and Business Services	11.2	85.7	96.9
Education	0.8	9.3	10.1
Health and Community services	1.1	49.2	50.3
Cultural and Recreational Services	0.2	18.9	19.1
Personal and Other Services	0.6	9.3	9.9
Total	**101.7**	**918.2**	**1019.9**

2. Waste Management Industry[19]

Overview

There were 1727 businesses and organisations involved in providing waste management services at the end of June 1997, consisting of 1023 private and public trading businesses and 704 general government organisations.

A large majority (89%) were involved in the collection and transport of waste. There were 845 private and public trading businesses and 688 general government organisations carrying out this activity.

Income

During 1996/97, the 1023 private and public trading businesses in the waste management industry generated total income of $1,493 million. The two major sources of this income were the collection and transport of waste which accounted for $876 million (59% of total industry income) and the treatment/processing and/or disposal of waste which generated $380 million in income (25%).

91% of the income from the collection and transport of waste related to solid waste. The two major sources were commercial, industrial, construction and demolition waste ($498 million) and domestic and municipal waste ($248 million).

Other major income sources for these businesses were the collection and transport of recyclables ($92 million) and the treatment/processing and/or sale of recyclables ($60 million).

General government organisations received $134 million from the treatment/processing and/or disposal of waste (66% of their total waste-related income) and $45 million from the collection and transport of waste (22%).

Expenditure

Private and public trading businesses in the waste management industry had total expenses of $1.35 billion during 1996/97. Labour costs of $369 million represented 27% of total expenses with the average labour cost per employee being $39,200.

Other major expenses of the industry were fees paid for the treatment/disposal of waste ($167 million), depreciation and amortisation ($153 million), contract expenses for waste management services ($144 million) and on-road motor vehicle running expenses ($135 million).

General government organisations had total waste management expenses of $833 million. Contract expenses of $420 million and wages and salaries expenses of $154 million were the major items of expenses representing 50% and 18% of total expenses respectively.

Profitability

The private and public trading businesses in the industry recorded an operating profit before tax of $142 million, which represented an operating profit margin of 9.6%. Businesses employing 5-19 persons had the highest operating profit margin of 16.5%.

Employment

At the end of June 1997, there were 9956 persons employed by private and public trading businesses in the waste management industry. A further 608 owner-drivers worked for businesses in the industry on a contract basis.

There were 554 working proprietors and partners of businesses in the industry. Accordingly, there were 9402 employees (94% of industry employment). A total of 8230 persons (83%) worked on a full-time basis.

In addition, general government organisations employed 4891 persons on waste management activities.

Business Size

There were 728 private and public trading businesses in the industry at the end of June 1997, which employed less than 5 persons. While this represented 71% of all businesses in the industry, these 'micro' businesses only accounted for 15% of industry employment and 9% of total industry income. In contrast, there were 11 businesses employing 100 persons or more, which accounted for 44% of industry employment and 56% of total industry income.

State and Territory Dimension

The respective roles and hence relative contribution of the public and private trading sectors and general government organisations in waste management activities varies from state to state.

[19] The figures quoted and material used in this document is from the Australian Bureau of Statistics *Waste Management Industry 1996/97,* ABS, Canberra, 1998.

At the end of June 1997, 31% of the private and public trading businesses in the waste management industry had operations in NSW. These businesses accounted for 33% of employment (3255 persons) and 42% of total industry income ($626 million). The NSW proportion of industry income was boosted by $229 million in income from treatment/processing and/or disposal of waste, which represented 60% of the industry's income from this activity.

In contrast, more businesses in the waste management industry operated in Victoria (33% of all businesses). However, these businesses accounted for only 24% on industry employment (2390 persons) and 22% of total industry incomes ($323 million).

The major income source for general government organisations was from the treatment/processing and/or disposal of waste ($134 million), which was dominated by Victoria (27% of this income), Queensland (23%) and NSW (22%).

South Australia

There were 99 organisations in the waste management industry operating in SA as at June 1997 (9.7% of total organisations), employing 904 people (9.1%) and paying $22.7 million in wages and salaries (6.9%). Total incomes for SA was $115.7 million (7.8%).

3. Energy[20]

Electricity

In the past few years the Australian electricity industry has been experiencing fundamental change. This mirrors changes that are occurring globally in the electricity supply industry, where competition is replacing traditional monopolies in generation, transmission, distribution and retailing.

Generation

In 1997-98 a total of 176,211 million kWh of electricity was produced nationally, 5% more than the previous year. NSW remained the largest generator, representing 35% of national production. Victoria was next at 23%.

[20] The figures quoted and material used in this document is from the Australian Bureau of Statistics *Electricity, Gas, Water and Sewerage 1997-98*, ABS, Canberra, 1999.

Consumption

Total electricity consumption in Australia in 1997-98 was estimated to be 157,290 million kWh. At the state level the pattern of electricity consumption reflects the location of major industries and population distribution. In 1997-98 NSW and the ACT accounted for 37% of total national electricity consumption (58,713 million kWh), followed by Victoria (22%) and Qld (20%). SA consumed 6% (9,939 million kWh), slightly ahead of Tasmania (5.7%).

Overall electricity consumption increased by 5.4% in 1997-98. Qld led the growth with a 12% increase in demand, followed by the NT (10%).

Similarly NSW and the ACT had the most customers with almost 3 million (35% of total customers), with Victoria second with just over 2 million (25%). South Australia has almost 725,000 customers (8.7%).

Employment, wages and salaries

Employment, wages, and salaries have been affected by restructuring, with employment continuing to decline. Wages and salaries nationally dropped by 6% ($123 million) compared with 1996-97. Employment also fell by 5% to 33219 (down 1919 persons). A large proportion of the fall in employment in the electricity industry has been due to redundancies. Employment was down 7% in Qld (down 507 to 6941 persons), down 3% in Victoria (181 persons to 5700) and also down 3% in WA (98 persons to 3437). Figures for SA were not published.

In 1997-98 service income in the electricity industry rose by $1.5 billion (62%), while payments for contract, sub-contract and commission work increased by $1.9 billion (211%). The majority of this increase resulted from the splitting of distribution and retail activities, which led to the creation of transmission costs between companies and transmission income to the service providers. The main published state contributing to the increase was Qld, where service income rose by $906 million to $1.2 billion.

Income and expenditure

Sales of good and services increased nationally by $351 million (2%) to $20.6 billion in 1997-98. Qld recorded an increase of $672 million (17%) to $4.6 billion, mainly due to the recording of receipts of transmission income after the splitting up of the electricity operations into several new entities. The income was previously a transfer within the one organisation.

In 1997-98 operating profit before tax (OPBT) at the Australian level decreased by 8% ($221 million) to $2.3 billion, although trading profit increased by 3% ($237 million). The main contributors to the fall in OPBT were a $372 million (58%) decrease in other income, a $53 million (20%) decrease in capitalised wages and salaries and a $151 million (6%) million (6%) increase in interest expenses. The increase in sales of goods and services also resulted in an increase in turnover of 2% ($362 million) to $21.6 billion.

Assets and Liabilities

Restructuring has resulted in revaluation of assets, changes to the level of liability of businesses and, in some cases, the sale of assets. In addition, some companies, which are buying into the industry, are bringing in assets and liabilities, which were previously classified to another industry, contributing to a rise in these two items in the electricity industry.

In 1997-98 the total value of assets nationally increased by $6.5 billion (10% to $74.8 billion). Non-current assets accounted for $5.2 billion of the increase. Total liabilities increased by $5.8 billion (16%) compared with 1996-97 to $42.4 billion. Of this, non-current liabilities have increased by $6.9 billion (to 435.5 billion in 1997-98) and current liabilities have decreased by $1.1 billion to $6.8 billion. These changes have resulted in an increase in net worth of 2% ($654 million).

Gas

Until relatively recently the Australian gas supply industry was largely State-based and State-regulated with little interstate trade, while most of the main companies involved were State-owned utilities. However, over the last few years major changes have occurred as a result of the gas reform process.

Output

In 1997-98, 650,216 TJ of gas was available for issue through mains compared with 636,658 TJ in 1996-97, an increase of 2%. The amount of gas available rose in all States except Victoria and Tasmania, with the largest increase being in WA (up 13% or 25,944 TJ) and Qld (up 11% or 5,298 TJ). The increase in these two States resulted from additional providers increasing the supplies available. In SA, 78,440 TJ of gas was available (12% of the total available through mains).

Consumption

The total amount of gas sold via utilities (as distinct from direct sales for public electricity generation and some industrial uses) in 1997-98 was 338,414 TJ. Victoria recorded the highest level of sales, with 52% of the total, followed by NSW with 32%. SA recorded 11% of total sales.

At the State level, the ACT recorded the highest residential consumption of gas per person, with 9.6 GJ per person, followed by SA with 5.1 GJ. (Figures for Victoria and WA were not available).

Employment, Wages and Salaries

Employment in the gas supply industry at establishment level at June 30, 1998 was down by 31% (1,503 persons) to 3,281 persons. Wages and salaries also fell, by 43% ($128 million) to $171 million. These decreases are mainly due to establishments being reclassified to industries other than gas supply, as a result of restructuring in the industry, although some redundancies did occur.

Income and expenditure

In 1997-98, sales of goods and services in the gas supply industry rose by 57% ($1.5 billion) from $2.7 billion to $4.2 billion. This increase was mainly due to the changes occurring with restructuring and privatisation, which have seen companies devolve their function under new entities. Increased transmission and distribution income and service income account for almost all of the rise in the sale of goods and services in 1997-98.

The increase in sales was offset by increase in purchases and selected expenses, which rose by $1.3 billion (72%) from $1.8 billion to $3.1 billion. As a result the overall increase in trading profit for 1997-98 was $211 million (23%). The increase in purchases and selected expenses has predominantly been the result of the external transmission expenses which are now being paid, and sales commission expenses paid to gas retailing and wholesaling businesses. Freight and cartage expenses increase from $85 million to $853 million (907%) in 1997-98, while payments for contract work increased by $666 million (601%) from $111 million to $776 million.

OPBT increased from $39 million in 1996-97 to $660 million in 1997-98. It was abnormally low in 1996-97; however, OPBT was still significantly higher for 1997-98 compared with 1995-96, when it was $314 million. The rise in OPBT reflects the increase in trading profit (partly as a result of the

increase in sales and service income), the increase in other income and the reduction in selected labour costs. Earnings before interest and tax (EBIT) increase from $257 million to $889 million, for the same reasons as explained for OPBT.

Assets and Liabilities

Restructuring has resulted in variations in the way assets are valued, the level of liability of businesses and in some cases the sale of assets. Companies buying into the gas supply industry are bringing in their own assets and liabilities, contributing an additional rise in these two items. In 1997-98 other current assets rose by $886 million to $1.5 billion (137%) and current liabilities increased by $1.2 billion to $1.8 billion (183%), while non-current assets rose by $792 million to $4.5 billion (21%) and non-current liabilities by $810 million to $2.9 billion. In 1997-98 net worth fell by 19% ($322 million) to $1.4 billion.

4. Mining[21]

Industry Size, Turnover and Profits

Australia is one of the world's leading producers of minerals. It is the world's largest producer of bauxite, diamonds, lead, tantalum and the mineral sand concentrates ilmenite, rutile and zircon.

Total mining industries turnover for 1996-97 was $34.1 billion, up $2 billion (6%) from 1995-96. All sectors reported increases in turnover with oil and gas the highest with $1 billion, followed by coal with $631 million and metal ore mining with $385 million.

The coal-mining sector was the largest contributor, accounting for 32% of total turnover in 1996-97, while oil and gas extraction increased its contribution to 27%.

WA remained the largest contributor to national turnover, accounting for 43%, while Qld with 22% was the next highest contributor. WA also has over 35% of all mining establishments with 175, Qld, 25% with 127, NSW, 24% with 121 and SA, 3% with 15 establishments.

Total trading profit increased by $993 million (6%) to $18.5 billion in 1996-97. The improvement in trading profit resulted from an increase in the value of sales of goods and services of $2.2 billion (7%), which was only partially offset by the increase in cost of sales of $1.3 billion.

The trading profit margin decreased slightly from 55% in 1995-96 to 54% in 1996-97. Return of funds and return on assets were stable for these years at 15% and 11% respectively.

Exploration

A total of $2 billion was spent during 1996-97 exploring for minerals and petroleum in Australia and in offshore waters, 20% more than in 1995-96. Exploration expenditure for minerals was $1.2 billion, $255 million for oil onshore and $617 million for oil in offshore waters. During 1996-97 Australian resident companies spent $760 million on overseas exploration for minerals and petroleum.

Expenditure on exploration for minerals rose in all States and Territories in 1996-97 except for Qld and the NT. Increases ranged from 73% in SA to 18% in NSW. Expenditure was the most in WA in 1996-97 with $690 million (60% of total expenditure), followed by Qld with $162 million (14%). SA spent $42 million (3.6%).

Production

The ex-mine value of mineral commodities produce during 1996-97 was $31.4 billion. The metallic minerals group was the main contributor with 43% of the total, followed by the coal industry with 29% and the oil and gas industry with 28%.

WA was the largest producer of energy minerals (coal, oil and gas) with 29% ($5.2 billion), and metallic minerals with 67% ($9 billion). Overall that State contributed 45% ($13.4 billion) to Australian production ($26.7 billion). Figures for SA were not published.

Trade

The coal mining, oil and gas extraction and metal ore mining industries had sales of $32.4 billion during 1996-97, 55% ($17.9 billion) of which was export revenue. Black coal was the largest mineral commodity export in 1996-97, with a total value of $8 billion (44% of mining exports), followed by metal ore mining at $6 billion (33%) and oil and gas extraction at almost $3.8 billion (21%). Mining products accounted for 23% of Australia's goods exports in 1996-97.

[21] The figures quoted and material used in this document is from the Australian Bureau of Statistics Australian Mining Industry, ABS, Canberra, 1999.

The Northeast Asia region was the main market for Australian mining commodities, taking 56% of the total value of mining exports in 1996-97. Shares for other regions were: Europe 11%, Southern Asia (includes India) 4%, and Southeast Asia (including Indonesia, Singapore and Thailand) 4%.

The Northeast Asia sales were predominantly to Japan, and to a lesser extent, the Republic of Korea, Taiwan and China. In 1996-97, 45% of coal, 13% of oil and gas and 33% of metal ore was exported to Japan; 12% of coal and 10% of metal ore was exported to the Republic of Korea; 7% of coal was exported to Taiwan; and 13% of metal ore was exported to China.

Employment

Total employment at in the coal, oil and gas extraction, and metal ore mining industries decreased by 2% to 55,700 persons in 1996-97.

This may be explained by changes occurring within the mining industry. One factor was increased productivity, including changes to working practices at a number of mines. Another was greater use of contractors, whose industry of employment is specific to the activities they undertake rather than the mining industry.

Mining employment continued to be predominantly male, with 92% of all employees being male, compared with around 57% in all industries.

Wages and salaries paid in 1996-97 were $4.1 billion, up 4% on 1995-96 figures. Payments for contract mining expenses increase by 14% from $1.9 billion to $2.2 billion.

Attachment 1

Industry leaders approached for interviews	
Mr. Con Manias	Adelaide Brighton Cement Ltd
Mr. Ravi Naidu	CSIRO
Mr. Simon Brown	Mobile Reclaimers
Mr. Tony Ackroyd	Amdel Ltd
Ms. Trish Drioli	EPA
Mr Ashley Watson	Piper Alderman
Mr. Ray Doherty	SA Water
Mr. Steven Scherer	Plastic Granulating Services
Mr. Simon Crawell	Cleanaway
Mr. Colin Pitman	City of Salisbury
Mr. John Falzon	Energy Developments
Ms. Monica Oliphant	Energy Consultant
Dr. Nick McClure	Flinders University of SA
Mr. Gordon Ure	Quality Assurance Services
Mr. Neil Clarke	Enviro Management Pty Ltd
Mr. John Fargher	URS
Mr. Alan Berry	Brown & Root Services Asia Pacific
Mr. Jock Lankenau	EGIS
Mr Tony Gardner	Ultraviolet Technology of Australasia Pty Ltd
Mr. Jim Killich	CM Coffey & Co Pty Ltd
Mr. Bruce King	Office of Energy Policy
Mr. Tim Waterhouse	Sentek Pty Ltd
Assoc Prof Gary Howatt	University of South Australia
Mr. Oleg Morozow	Santos
Mr Vic Farrington	WMC
Mr. Jim Northing	South Australian Wine & Brandy Industry Association Inc.
Dr. David Cruickshanks-Boyd	PPK Environment & Infrastructure
Mr. Allan Holmes	DEHA
Mr. Rob Thomas	EPA
Mr. Geoff Upton	Austrade

Commercial Environmental Industry Cluster Map