

**Small Business Development Corporation
New South Wales**

**Securing Our Manufacturing Future
Small Business Manufacturing to 2015 and Beyond**

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Preface

This Paper is a Resource Document that forms the basis for the Paper released by the Small Business Development Corporation, *Securing Our Manufacturing Future*.

The Paper endeavours to identify and address developments and changes in the operating environment for small business. Given time constraints, as well as the processes of ongoing change, there will be some areas that have not been adequately covered – and some not at all. However, our intention has been to provide a frame of reference for addressing issues that impact on the future direction of small business manufacturing.

The Paper was prepared from a review of literature and data on small business and management, knowledge derived from previous management assignments and discussion and consultations with people and organizations managing small manufacturing businesses and people advising them.

I would like to thank the following people who gave their time during the preparation of the Paper: Graeme Chalker and Paul Orton (Australian Business Limited), Karen Curtis (Australian Chamber of Commerce and Industry) David Gemmell (Venture Capital Partners), Will Hutchinson (Thomas Electronics), Peter Janssen (Utilux Pty Ltd), Narelle Kennedy (Australian Business Foundation) Heather Ridout and Andrew McKellar (Australian Industry Group), Cindy Lucken (Lucken and May), Wayne Sedman (Fairfield Business Enterprise Centre). Needless to say, all views and opinions expressed in the paper are the responsibility of the authors.

Finally, I would like to thank the members of the Small Business Development Corporation for their support for the project and the assistance provided by Pam Clay and Graeme Manning in the Department of State and Regional Development in project management support. Susan Bee is to be commended for her work in editing the summary document for publication.

John Hamilton-Howard
May 2001.

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Executive summary

Australia's small businesses are proving to be innovative, dynamic and responsive to opportunities and challenges.

Business growth and development is fundamental to employment growth and national economic prosperity. This can only be achieved if *business* is internationally competitive and capable of sustaining world-class levels of performance. This applies to *all* business – large and small. By helping individual businesses to succeed, the Government can help improve the competitiveness of the nation as a whole.

In manufacturing, with the progressive removal of protection over the last 20 years, the performance of Australia's large businesses has been found wanting. By contrast, Australia's small businesses are proving to be innovative, dynamic and responsive to opportunities and challenges. In the current environment, with the slide in the value of the Australian dollar relative to the US dollar, and the progressive freeing up of the international trading system, there are major prospects for manufacturing.

Manufacturing in the year 2001 is characterised as being:

- *Globalised*, in the sense that a wide range of functions from R&D and marketing to production and distribution are now undertaken on an integrated global basis
- *Knowledge based* – it will involve greater application of science based technologies in processes and products
- *Networked*, in that the coordination of these functions make intensive use of electronic networks and of virtual and geographical clusters of expertise
- *Customised*, in that methods of production must allow for detailed customisation of products to meet the needs of individual markets and individual consumers
- *Digitised*, in the sense that many of these processes, and particularly final production, are controlled by advanced computers systems that limit the need for human intervention

It will also reflect business trends towards cooperation and collaboration on a regional, national and global basis. These influences will have a major impact on the way manufacturing is undertaken in the future.

This study has looked at small business manufacturing in NSW in 2001 to understand the strategic, commercial and management issues that they face. It has then brought a vast array of research, knowledge and expertise to understand the challenges and opportunities facing these firms in 2015. A range of scenarios and

Small business manufacturing does not have to be big to be global. In fact, small business manufacturing has distinct advantages over the larger firms in a global environment

The future will demand the small business manufacturer to identify and carve out a small niche market. Businesses will become smaller, highly specialised and increasingly technology based

implications for small business manufacturing core competencies in 2015 have also been presented within this framework.

As part of the assignment we have sought to obtain the views of successful and innovative small business manufacturing companies. Companies were identified from the following sources:

- The ABL/Industry Science and Resources case studies of innovative companies
- The nominees for Australian Export Awards
- Companies that have received venture capital funding.

These companies are listed in Appendix 5. The success stories of these companies are documented in a number of sources. Their success reflects a number of characteristics associated with “innovation” and are referenced throughout the Report.

The overwhelming finding is that small business manufacturing does not have to be big to be global. In fact, we argue that small business manufacturing has distinct advantages over the larger firms. In areas such as the ability to change business direction quickly, enter new markets, develop highly specialised skills, knowledge and expertise for a well defined niche market, form strategic alliances with both competitors and colleagues, adopt new technology, and be close to the customer, are within the power of the small business manufacturer and it is a power that may have and will continue with growing gusto, to exploit.

In particular, the study found that electronic commerce makes personal relationships even more important. Small business manufacturers must “get on a plane” and travel to their potential markets, and engage their markets. They must understand their customers better than their competition. Having a superior product that is cost effective to produce and well priced is not enough: in other words, being competitive is a given. The future will demand the small business manufacturer to identify and carve out a small niche market. Businesses will become smaller, highly specialised and continuously research, develop and innovate to stay ahead.

In the technology environment, business owners and managers need to understand that the Internet is, fundamentally, a means of communication. It allows for the transmission of digitised information very quickly over long distances. It also allows for close collaboration between suppliers and customers – but almost paradoxically requires the development and maintenance of a much closer personal relationship with customers.

There are a number of specific attributes and characteristics that manufacturing businesses will need to develop to meet emerging challenges and opportunities in the “information economy”. These include:

- *Information technology competence* - small business managers will find that over the next 15 years they will have to fully embrace information technology in the management of their business. Information technology is now recognised for its *strategic* importance as well as its contributions to operations and “back office” support.
- *Technology awareness and access* – managers will need to identify the sources of technology competence and capability that may assist in business development and growth. State government awareness and diffusion programs and industry association initiatives can facilitate this process.
- *Access to competent, expert and independent advice* – investment in information technology – both hardware and software- can be expensive. Many people selling information technology products and solutions, particularly at the small business end of the market, have never actually worked in a business. Advice should be sought from business associations and through industry networks.

One of the most important issues for the future of small manufacturing business will be demonstrating a “value proposition” and the capacity to manage business risk

Access to finance to fund business development and expansion has been an ongoing issue for small manufacturing businesses. There can be no doubt that this issue will continue to be of importance. Investors, whether providing equity or debt, are interested in what is now termed the “value proposition” – how value will be created through the productivity of the capital investment that is made. In addition to this fundamental issue of return on investment, investors also look at other factors such as the risks and how these will be managed, commitment to innovation and continual product development and the actual marketability of new technology products.

Small businesses, and even large businesses, no longer maintain, or wish to maintain all of the capability they require to meet customer needs. Moreover, for many reasons small businesses want to stay small – they do not want to take the risks associated with major capital investment decisions to increase capacity in a market place that is becoming uncertain.

To meet new business challenges, small businesses are increasingly working in local, regional and even networks where capability is shared and accessed on a collaborative basis. Small manufacturing businesses should explore every opportunity to participate in regional and national business networks as a basis for sharing information and knowledge about market

Business networks and alliance competence will become increasingly important

opportunities, technology developments and business practices.

In the emerging business environment, businesses will need to develop “alliance” competence – that, a capacity to work in cooperative and collaborative arrangements based on reciprocity and trust. Over the next 15 years alliances between small businesses, small and large businesses and between small businesses and research organizations will become central to business activity and success. The management of alliances is anything but easy. They require extreme, and often totally unaccustomed clarity in respect of objectives, strategies, policies and relationships.

In the context of alliances, partnerships and networks, the next 15 years will require the development and maintenance of new forms of business organization – new ways of doing business will need to be explored with a sharing of risk and reward between parties. In this “virtual” environment management and leadership will become more critical for success.

New forms of business organization will be explored

The critical management tasks for small manufacturing businesses include the following

- *Building reputation and relationships* - in some lines of business, a reputation is the major business asset. It ensures continuity in business and long term relationships. Notwithstanding the growth in e-commerce, a businesses reputation will be one of the major criterion of success.
- *Capacity for negotiation* - the business of manufacturing is becoming less about “selling” and more about establishing a “deal” relationship between parties. This requires degrees of both toughness as well as flexibility to meet partner expectations. In a global environment negotiation is cross cultural. Accessing markets in Asia and the Middle East requires an understanding of business culture and expectations.
- *Capacity to manage risk* - small manufacturing business would benefit from building capacity and capability to understand and manage risk, particular as they enter international markets.
- *Cost consciousness and cost management* - a competitive business environment demands attention not only to building the “top line” through sales, but ensuring profitability by control over costs. This means knowing which *products* are profitable (and which are not) and knowing where the business is performing well.

Statutory compliance and access to tax benefits needs to be addressed

We also argue however that just as small business manufacturing can benefit greatly from being global, it is also suffering from a range of legislative conditions that are and will continue to make it difficult to prosper and succeed in the next decade and a half. Issues such as

the workers compensation, and access, or the lack of it, to tax concessions. These areas are holding the small business manufacturing sector back from truly developing into the strong and vibrant force within the NSW economy that they have the potential to become.

In the context of these challenges and constraints, the signs are extremely positive for small business manufacturing. The opportunities lie in being successful in a *global* environment. Small businesses have the advantage in entering new markets of being not only innovative and flexible, but also being less visible to competitors and carrying less “corporate baggage” that accompanies larger businesses – particularly those owned by overseas parents.

1 Introduction

This is a Report to the Small Business Development Corporation as part of its mission to advise government on policy issues

This is a Report prepared in response to a specific brief put out by the NSW Small Business Development Corporation (SBDC). The Corporation is a policy advisory body reporting to the Minister for Small Business.

The primary objective of the Corporation is to advise the Minister in respect of small business policies and programs and to develop that advice through investigation, ie consultations, research, forums, inquiries etc.

The specific objectives and functions of the Corporation, as prescribed in the Act, are to:

- Develop policy objectives for Government programs of assistance to the small business sector of the economy
- Evaluate Government programs in the light of those objectives
- Make recommendations for the improvement of Government programs
- Assist the Government generally in matters relating to the development of the small business sector of the economy.

This Report is a contribution to that process.

1.1 The project brief

The project brief required the identification, in the Australian context, of:

- The expected economic, market, business and technology environment facing firms in 15 years
- The types and levels of manufacturing expected to be in demand in 2015
- The attributes/characteristics firms will need to meet the challenges over that timeframe and to be competitive in the manufacturing environment of 2015
- Strategies small firms should adopt to assume those characteristics.

The project outcomes sought were to include:

- An increased understanding of the strategic, commercial and management issues that face small manufacturing businesses in New South Wales wishing to compete in the projected economic environment

The project brief required examination of economic, business, technology, market business and industry issues

The project required consideration of factors driving change, their impact and implications

- Increased ability amongst small manufacturing owners and operators to identify how to respond to long-term challenges
- A vision of the challenges and opportunities for new and existing small manufacturing businesses in New South Wales over the next decade and a half, with a separate reference to implications for businesses in rural and regional areas of the State
- A set of scenarios for manufacturing in 2015 and the implications for small manufacturers core competencies in 2015
- A report and accompanying presentations which collate material developed through the project's process
- A recommendation on how the project's outcome can be distributed and actioned.

In exploring the future composition and characteristics of the small firm-manufacturing sector, the project will consider:

- The external environment and factors that will drive change
- The impact of this change on small manufacturing businesses
- The implications of this change on government's role in promoting the manufacturing sector.

Reference is to be made to significant relevant work that has already been undertaken both locally and overseas.

1.2 Approach to the project

To meet the project objectives and outcomes and to explore the issues concerning the future composition and characteristics of the small firm manufacturing sector, the following approach was adopted:

- Discussions with members of the Small Business Development Corporation and staff in the Department of State and Regional Development
- Discussions with small to medium manufacturing business owners about their plans and prospects
- Discussion with previous clients and contacts in the manufacturing sector
- An extensive review of the literature and web based information sources on the "new economy", manufacturing technology, business organization and electronic commerce.

Notwithstanding the very large amount of information on the Internet, the material in hard-copy journals, magazines and monographs has been incredibly valuable.

This report contains a detailed analysis of environmental factors and conditions impacting on small business manufacturing

A Summary Report has been prepared for wider distribution

1.3 Structure of this Report

The Report is presented in a format that addresses the objectives of the project. After a brief overview of the small business sector, the report identifies issues in the major components of the small business manufacturing environment. These are:

- The economic and industry framework
- The technology environment
- The finance environment
- The market environment
- The business environment -
 - The external operating environment
 - Trends and developments
 - The internal management environment
- The institutional and regulatory environment
- The environment for government and industry association support and assistance.

The Final section of the Report looks at future directions in policies and programs for small business in the light of the material contained in earlier sections.

An extensive list of reference material is also included. Information containing aspects of manufacturing development and growth potential are included in Appendixes.

A summary report has been prepared which presents the material contained in this report in a format designed for wider distribution among small business owners and managers.

1.4 Some definitions - what is a small business?

The Australian Bureau of Statistics (ABS) regards a business as small if it has the following management or organizational characteristics¹:

- It is independently owned and operated
- It is closely controlled by owners/managers who also contribute most, if not all the operating capital
- The principal decision-making functions rest with the owners/managers.

There are significant practical difficulties in defining business size in terms of employment – not least of which involves businesses that are based on substantial

¹ Australian Bureau of Statistics, *Small Business In Australia*, 1999, Cat 1321.0, May 2000, p. 1.

The definition of a small business is by no means clear. The ABS uses an employment definition. The ATO uses a sales definition

contract activity. However the ABS has adopted the following categories of business size in its most recent publications:

- Non-employing businesses—sole proprietorships and partnerships without employees
- Micro businesses—businesses employing less than 5 people, including non-employing businesses
- Other small businesses—businesses employing 5 or more people, but less than 20 people
- Small businesses—businesses employing less than 20 people
- Medium businesses—businesses employing 20 or more people, but less than 200 people
- Large businesses—businesses employing 200 or more people.²

The Australian Taxation Office (ATO) defines small businesses as those having a total income of below \$10 million. This definition captures a very large proportion of all Australian businesses.

1.5 Small business in NSW

In 1997-98, the ATO NSW small business client base was constituted as follows:

Table 1: ATO small business client base in NSW

Business Category	Number	Percent
Individuals	611,240	56.1
Companies	234,130	21.5
Funds	53,428	4.9
Partnerships	136,361	12.5
Trusts	53,519	4.9
Total	1,088,678	100.0

The ATO advises that 6.3 percent of its clients are manufacturing businesses.

NSW Department of State and Regional Development data indicates that:

- The NSW small business sector is the largest in Australia
- In 1998-99 NSW had 317,600 small businesses³, being 96.2 percent of all businesses in the State - this represents an increase of 6,000 small businesses, or 1.9 percent, over 1997-98 and compares to a national growth figure of 1.4 percent

² Ibid, p. 2

³ The NSW data defines small businesses (excluding agriculture) in non-manufacturing industries as those employing less than 20 employees and in manufacturing industries those employing less than 100 employees;

- Between 1994-95 and 1998-99 the number of small businesses in NSW increased by more than 12 percent, nearly three percentage points above the national average
- 9.1 percent of small businesses are in the manufacturing sector
- The number of people employed in small business in NSW in 1998-99 was 1,056,600, or 46 percent of people employed by all businesses in the State
- A major growth segment in the mid-to-late 1990s was self-employment - partly driven by corporate restructures and the contracting out of non-core business by larger firms
 - Self-employment in NSW grew by 13 percent during the period 1994-95 to 1998-99
 - This figure is compared with a national growth in self-employment of less than seven percent.

With this data in mind, it is opportune to look at the prospects and outlook for small business manufacturing. This is the focus of the material presented in the remainder of the Report.

2 The Economic and Industry Environment

Small business performance has a lot to do with overall economic conditions

The success of small business is ultimately tied up with a strong economic and institutional environment that supports access to markets – domestically and internationally. However, over the last 20 years, there has been a steady decline in the share of Gross Domestic Product (GDP) arising from goods production ((manufacturing and construction) in all developed countries.

The reasons for this apparent decline are generally attributed to the following:

- Greater productivity arising from technological change in the goods industries compared to slow productivity improvement in the services sector
- A shift of demand in high income countries from goods to services - in spite of declining relative prices for goods
- Intense global competition - including from newly industrialising economies.

These trends point not so much to a decline in the importance of manufacturing, but a *fundamental change* in the way in which manufacturing contributes to growth and prosperity.

2.1 The immediate outlook

On a global basis, manufacturing is undergoing major change

On a global level manufacturing activity has suffered a down turn over the last six months. The manufacturing “heavy” industries such as steel and chemicals are going through difficult times. However, these industries are also going through major change – for example, most of the thousands of different steels in use today were developed in the last 10 years and are being used in high value manufacture such as medical devices, lightweight vehicles, aerospace, and modular construction.

Pressures in the global construction industry are pushing innovation in construction methods and materials, not only in new materials but also in traditional materials. The development and application of molecular technologies in this area is both challenging and exciting. A significant aspect of the development is taking place in small, innovative, business with a strong research and technology base. These businesses are characterised by close relationships between large businesses and publicly funded research organizations.

In areas such as food processing, however, resistance to change in agriculture makes driving through sustained innovation difficult.

The bright spots in manufacturing industry have also been in the application of information and communications technologies - computers, computer components and telecommunications equipment. However, many high-tech companies - including Intel and Apple Computer - have warned of slowing profit growth and concerns about future growth have sent share prices down sharply.

2.2 The future of manufacturing

2.2.1 New opportunities, new strategies

The “new economy” does not pose a threat to manufacturing – it creates opportunities

The emergence of the “new” economy, based on information industries is often seen as a threat to manufacturing’s future. In the US, as in Australia, many commentators have raised concerns over the apparent decline of manufacturing and have blamed the shift to services as a major contributing cause.

James Brian Quinn, in *Intelligent Enterprise*, argues that the focus on postindustrial service industries ignores opportunities and capabilities in manufacturing:

If anything, the nation’s growth and competitiveness in services have helped manufacturing by lowering costs, creating new markets, stabilising markets particularly for capital goods and forcing manufacturers to be more responsive to markets. ... services will continue to offer manufacturers their most important new opportunities for future growth in value-added, productivity, flexibility and product sales. Services and manufacturing are now so intertwined and mutually supporting that, increasingly, success in either goes to those who effectively utilise the combined technological potentials of both (Quinn, 1992, p. 174).

In addition, according to one experienced observer, the long-term outlook for manufacturing industry expansion is bright. The argument is that:

Perhaps the easiest way to understand the truly bright future of manufacturing is to remember that about 90 percent of the world’s population is poor. As the world’s developing nations bootstrap themselves out of poverty, how will they spend their money? Do they ache to acquire such post-industrial products as Wall Street’s latest portfolio hedging services, personal home-page software, or databases of American newspaper clippings? Probably not. More than anything what developing economies want is, of course, material goods. They are not alone in this preference. Even in the most developed parts of the world there are plenty of material wants waiting to be satisfied. In fact, almost no one anywhere feels as

affluent as he or she would like to be, and asked to compile a wish list of wants they would like to satisfy, most people would place more emphasis on material goods than on post-industrial services. (Fingleton, 1999, p.24).

The world's consumers will be more than happy to increase their consumption of material goods as fast as their budgets allow. They will increasingly insist, however, that these goods be made in the most environmentally friendly manner⁴.

Manufacturing requires new competitive strategies

It is clear, however, that the traditional strategies of companies based on their core competence in manufacturing are being supplemented by new competitive strategies and competences. These competencies are increasingly knowledge based and involve the application of advanced technologies developed in a scientific research environment. These technologies range from food technologies (eg, to retain freshness and shelf life) to information and communications technologies, biotechnology, and advanced materials technologies.

The capacity of a small manufacturing business to access new and emerging technologies, economically, efficiently and effectively, is a major issue in the future development of the sector. Initiatives announced in the Government's Innovation Statement, *Backing Australia's Ability*, go some way towards meeting this need.

It is apparent that the era of the global knowledge economy has just begun, and that the forces driving it will generate further fundamental change in the years ahead. Growth for firms, as well as regions and nations will depend heavily on the extent to which they can access and apply new knowledge and new ideas. This has major implications for the manufacturing sector as well as national industry and regional development strategies.

2.2.2 Manufacturing, knowledge and service sector integration

Manufacturing is becoming "knowledge intensive"

In the emerging knowledge economy, there is a shift from goods industries to knowledge and person-based industries in terms of the composition of GDP and employment. However, it is not that one group of industries is replacing another. While there is some increased demand for services as final products, activities related to the creation, production and distribution of goods still lie at the heart of advanced economies.

It is important to recognise that products and services are *both* means to satisfy consumer wants.

⁴ Ibid

Manufactured products have embedded service components that are the major source of customer value

Manufactured products have embodied service components. These represent for many companies a large, and increasing, proportion of manufacturing cost. While manufacturing processes have generally recorded substantial productivity gains through various techniques such as JIT and the application of information technology, there is a concern that similar efficiencies have not been achieved in internal service and support components.

As a result of these concerns, and a desire to tap into a wide range of innovation capability, manufacturing businesses have sought to outsource a range of service components to the services sector – from traditional back office functions through to R&D and marketing and distribution. This has actually *stimulated* growth in the services sector. For example, some of the measured reduction in corporate R&D is a reflection of this process – as R&D is undertaken in public and private research organizations and in universities.

These trends have implications for manufacturing industry development in Australia, particularly in relation to small and innovative companies addressing specialised product and market segments. They also provide major opportunities for small and technology based manufacturing companies. Many of these have very strong linkages into the university research sector.⁵

The core competence or advantage of some manufacturing firms may reside far more in their design, brand image, marketing or distribution channels. Manufacturing, when regarded as being non-core, can be effectively outsourced. In recent years major manufacturers such as GE and Ford have moved substantially away from regarding manufacturing as their core business.

The interactions between services and manufacturing are complex. Linkages between the manufacturing and non-manufacturing sectors, between high-tech and low-tech and between what is local and what is foreign are becoming more and more intricate.⁶ Developments in information technology and the Internet and the emergence of business-to-business (B2B) arrangements will also impact on the way in which services are sourced and supplied in a manufacturing environment.

The clear implication for small manufacturing businesses in Australia, with regard to these changes in global manufacturing firms, is whether to position as a specialist manufacturer (OEM etc) supplying these firms, or to align with the global's other capabilities.

⁵ This was indicated in Howard Partners' research in relation to take-up of the 125 percent tax concession and in the Audit and Review of Victoria's science, technology and innovation infrastructure.

⁶ Harrison, Bennett, *Lean and Mean*, p.231

2.2.3 From “making products” to “creating value”

People do not relate to products as much as the benefits and services it provides.

There is an emerging awareness that production is not where value is created. Traditionally, manufacturing companies produced “things” that it then had to sell. In the emerging environment, the emphasis is on understanding and meeting a customer need. People relate not to a product, but to the benefits it provides – both tangible and intangible. For example:

- Carrier rents cooling services rather than sells air conditioners
- Dow chemical leases “dissolving services” and reuses the solvents
- IKEA provides services to make a house/apartment a home

There is a view that higher profits will come from providing better solutions rather than selling more equipment.⁷

The shift in concept from “value of the product” to “access to the value in the services that the product provides” may also lead to a change in the concept of ownership. This represents a radical shift in business models. It starts with how a company thinks of itself in relation to its customers – as a producer of things or a provider of products made and remade. Some manufacturers have proposed that they will own what they produce forever and thus have incentives to design products that can be disassembled, remanufactured or recycled.⁸

Manufacturers are seeking to build long-term relationships with clients and customers.

This is particularly suitable for small business manufacturing

The changing business strategy is increasingly towards building a long term, strategic relationship with customers to service their total package of needs based around a manufactured product. Japanese manufacturers believe that *customer service* is, quite simply, the primary goal of management. This commitment will become increasingly important in the competitive environment over the next 15 years. Companies are increasing their use of technology to service their customers through “customer communications systems”.

In the US, General Electric has a mission to be a services-led company based on the supply of manufactured products. Thus, while GE manufactures jet engines, it actually sells power by the hour to their customers, taking on the burdens and uncertainties, for example of maintenance and unexpected breakdowns, that previously were transferred to the customer, and

⁷ Senge, Peter and Carstedt, Goran, “Innovating Our Way to the Next Industrial Revolution”, *MIT Sloan Management Review*, Winter 2001, p.32

⁸ Ibid

eliminating many of the financial barriers such as capital expenditure decisions. This is of benefit all round:

- The customer gets assured service and a strategic partner to help develop its business and can concentrate its efforts on its own value-adding activities.
- GE gets a continuing relationship with its customers that means that the customers keep coming back, business can be less sporadic, cash flow more predictable.
- GE learns from its customers and can feed customer learning into new developments, and can charge more for the total package provided to its customers than for the one time sale for the core product.

Consumers are increasingly being more involved in creating a product. Internet technology allows customers to inform suppliers of tastes and preferences and for these to be continuously upgraded.

2.2.4 Integrating education and training into products

Following on from the idea of creating value, manufacturers are finding it necessary not only to deliver products that meet a customer “service” need, they will also be called upon to provide education and training in product use. This goes beyond installation, after sales service and warranties.

Much of the development in on-line training and education has been in the corporate area, where companies have invested in skill and capability acquisition for software applications. This is now being extended into equipment that has a high level of embedded technology. Companies acquiring complex machinery and equipment are unwilling to invest in training and education resources necessary to achieve maximum potential from their acquisitions.

Just as software companies were using third party consultants to advise on installation and training and have now brought that capability in house (IBM, for example, is now a consulting company which generates substantial revenues), manufacturing companies are finding it necessary to take a much closer interest and involvement in how their equipment is used. This has two advantages:

- It protects warranties by ensuring effective utilisation
- It “locks in” customers to the company product range and subsequent upgrades.

In a global context, Australian product manufacturers, particularly those involving complex technology, will have to develop networks of people and organizations who can deliver training and education on their behalf. While

Manufacturers are finding that they can generate revenues by conducting courses and programs in how to use and gain maximum advantage from the products they sell.

company sponsored Internet based resources approaches will be important, customers will also demand access to informed and trusted agents.

2.3 Emerging issues

2.3.1 Sustainability

Manufacturing has a crucial role in achieving the objectives of sustainable development

From an environmental sustainability perspective, providing services rather than selling products has the potential to re-align what is sound economically and what is sound environmentally. Companies are encouraged not to design for obsolescence but for longevity, efficient servicing, improved functioning and product take back.⁹

The crucial role of the manufacturing industry in achieving the goals of sustainable development is widely recognised. Industry will be the most important engine for change in the drive for sustainable solutions to the world's environmental problems. There has been a substantial response from industry to the challenges being articulated by the sustainable development movement. One indication is the emergence of a variety of peak industry bodies to address specific challenges.

The unifying concept in the analyses and proposals emerging from the business community is 'eco-efficiency'. This concept/label is intended to combine both ecological and economic efficiency in business considerations.

According to the World Business Council for Sustainable Development, a company seeking to become eco-efficient should strive to:

- Reduce the material intensity of its goods and services
- Reduce the energy intensity of its goods and services
- Reduce the dispersion of any toxic materials
- Enhance the recyclability of its materials
- Maximise the sustainable use of renewable resources
- Extend the durability of its products
- Increase the service intensity of its goods and services.

There are a wide variety of sustainable development-related issues and mechanisms which will impinge in the future on economic development. They include the following.

- Regulation of process and production methods (PPMs)

⁹ Ibid

- Product-related PPMs deal directly with the permitted characteristics of the product eg toxicity, hazard, etc;
- Process-related PPMs could include issues such as how raw materials are grown and harvested (eg using rainforest timbers), production processes, air, water and waste emissions, transport to market, etc.
- Life-cycle regulation – this might range from raw materials used, proportion of recycled material, to conditions of use, lifetime, etc. through to provisions for disposal/recovery
- Eco-labelling – which will signify that products and services meet an agreed independent sustainable development standard. This may prove very influential over consumer choice.
- The ISO 14001 standard in environmental management – experience of the impact of the ISO 9000 series of standards addressing quality management on business practice in the 1990s would give an indication of possible impact.

Ecological business solutions favour optimal use of energy and materials, minimising waste, storage and transport costs. Concern with the environment also provides an additional reason to be listening to customers.

There is evidence, from various UN and US Congress debates, and positions at the most recent WTO meetings that such considerations might be further broadened to include labour standards on matters such as child and prison labour, and minimum pay-rates.

It is quite clear that the “green wave” is here to stay. The issue for businesses is to integrate ecological concerns into every single management process turning the demand for minimal environmental impact to business advantage.

2.3.2 Corporate citizenship

In North America, Europe and Australia there is a greater expectation being placed on companies to exercise social responsibilities – as well as environmental and economic (wealth creating) responsibilities.

The broader movement to corporate responsibility is reflected also in arguments emerging about the importance, necessity and value of ‘triple-bottom-line’ accounting – whereby companies are required, or see value in, reporting not only financial performance, but also on their environmental and social performance.

Together, these forces suggest that companies will find it wise, or be forced, to develop business strategies, practices, products/services and markets, that can be shown to meet adequate standards of social responsibility.

Developments in other industry sectors create opportunities for new and emerging Australian manufacturing businesses.

2.3.3 Some broader challenges

There are a number of specific challenges, constraints and opportunities for manufacturing, including:

- The scarcity of energy supply – and an increasingly significant component of the cost of production
- The cost of renewable energy is currently high due to cost of equipment – some manufacturers are making rapid progress in developing more efficient production technologies
- Developing these technologies will prove to be one of the most important manufacturing challenges – in the areas of water, wind and solar
- New technologies for mass transportation – desire for longer, quicker travel, meeting environmental regulations – fuel cells – fast trains, aircraft etc.

In all of these areas, Australia has well developed technologies and capabilities for production of machinery and equipment. The challenge is to develop these capabilities into manufacturing businesses. For reasons outlined above, this is unlikely to occur through “organic growth”.

There are already some important signs, however, that Australia is developing capacity to participate in the global manufacturing development process with strategies being applied by university technology transfer companies for the commercialisation of university-based research.

As indicated, however, few large manufacturing firms have, or want to have, all of the necessary capability and experience in-house to grow their businesses. They are developing alliances and partnerships with smaller, specialised firms and with public and private research organizations.

2.4 The manufacturing industry base in NSW

2.4.1 Business establishments

Information provided by the ABS about the number of manufacturing establishments (as distinct from business) in 1997-98 and 1998-99 provides an indication of the spread of small business manufacturing activity.

In 1996-97 there were 17,554 manufacturing establishments in NSW. Most of these were small businesses

There is a spread of manufacturing businesses across all industry sub-sectors

Table 2: Manufacturing establishments, NSW 1996-97

	1996-97 (Census based) No.
Food, beverage and tobacco mfg	1,111
Textile, clothing, footwear and leather mfg	2,211
Wood and paper product mfg	1,561
Printing, publishing and recorded media	2,348
Petroleum, coal, chemical and associated product mfg	1,089
Non-metallic mineral product mfg	623
Metal product mfg	3,199
Machinery and equipment mfg	3,172
Other manufacturing	2,239
Total manufacturing	17,554

Source: ABS, unpublished data.

The data point to a spread of establishments across all sectors. There is a particular concentration on metal products, machinery and equipment, textiles and clothing and in printing and publishing

2.4.2 Employment

In 1999 there were just under 300,00 people employed in manufacturing in NSW. Almost 42 percent of employment was in medium size businesses and a further 23 percent in micro and small businesses.

Detailed estimates of employment by industry sector and size of business is provided in Table 3.

Table 3: Manufacturing employment NSW 1998-99 - by firm size and industry sectors (numbers of employees)

	Micro 0-4	Small 5-19	Medium 20-199	Large 200+	Total
Food, beverage and tobacco	651	4,353	15,980	26,757	47,741
Textile, clothing & footwear	2,310	4,528	9,153	3,434	19,424
Wood & paper products	2,515	2,946	7,871	3,779	17,110
Printing, publishing, recorded media	2,453	7,004	18,268	12,701	40,425
Petroleum, coal, chemicals	1,034	4,507	18,812	10,125	34,477
Non metallic minerals	685	1,684	5,808	2,242	10,420
Metal product manufacturing	3,549	9,224	20,043	19,009	51,825
Machinery & equipment	3,229	8,799	21,442	26,029	59,499
Other manufacturing	2,508	6,587	6,681	317	16,094
Total	18,934	49,631	124,056	104,392	297,015
Proportion (%)	6.4	16.7	41.8	35.1	100.0

Source: Derived from, ABS, *Manufacturing Industry New South Wales and Australian Capital Territory, 1998-99*, October 2000

Overall, the data indicate that the highest levels of employment are in the food, metal product and machinery and equipment sectors. Within the large business category, employment is concentrated in food, beverage and tobacco, metal product manufacturing and machinery and equipment – traditional “heavy” industries.

2.4.3 Industry value-added

Information concerning industry value-added can also be derived from published manufacturing data. This is summarised in Table 4.

Table 4: Manufacturing industry value-added, NSW 1998-99 - by firm size (\$m)

	Micro 0-4	Small 5-19	Medium 20-199	Large 200+	Total
Food, beverage and tobacco	25	243	1,278	2,649	4,196
Textile, clothing & footwear	86	190	375	284	935
Wood & paper products	65	122	625	479	1,291
Printing, publishing, recorded media	88	339	1,200	1,175	2,802
Petroleum, coal, chemicals	37	294	1,855	1,478	3,663
Non metallic minerals	28	104	796	224	1,152
Metal product manufacturing	759	483	1,263	1,585	4,090
Machinery & equipment	116	407	1,313	2,160	3,995
Other manufacturing	76	273	242	141	732
Total	1,279	2,456	9,198	9,923	22,856
Proportion (%)	5.6	10.7	40.2	43.4	100.0

Source: Derived from, ABS, *Manufacturing Industry New South Wales and Australian Capital Territory, 1998-99*, October 2000

The data indicate that medium size businesses contribute 40.2 percent of manufacturing sector value-added and larger businesses contribute 43.4 percent, significantly above the proportion of employment. This points to the greater capital intensity of larger businesses.

Within the manufacturing sector, the highest levels industry value-added are in food, beverage and tobacco, petroleum coal and chemicals, metal product manufacturing and machinery and equipment.

Within the micro and small business categories, there are some significant sectors in terms of their contribution to industry value-added.

Table 5: Manufacturing industry value-added, NSW 1998-99 - by firm size (%)

	Micro 0-4	Small 5-19	Medium 20-199	Large 200+	Total
Food, beverage and tobacco	2.0	9.9	13.9	26.7	18.4
Textile, clothing & footwear	6.7	7.8	4.1	2.9	4.1
Wood & paper products	5.1	5.0	6.8	4.8	5.6
Printing, publishing, recorded media	6.9	13.8	13.0	11.8	12.3
Petroleum, coal, chemicals	2.9	12.0	20.2	14.9	16.0
Non metallic minerals	2.2	4.2	8.6	2.3	5.0
Metal product manufacturing	59.3	19.7	13.7	16.0	17.9
Machinery & equipment	9.0	16.6	14.3	21.8	17.5
Other manufacturing	5.9	11.1	2.6	1.4	3.2
Total	100.0	100.0	100.0	100.0	100.0

Source: Derived from, ABS, *Manufacturing Industry New South Wales and Australian Capital Territory, 1998-99*, October 2000

Table 5 points to the importance of metal product manufacturing and the textile, clothing and footwear groups in the micro and small business categories.

The latest AiG Survey painted a bleak outlook for manufacturing in NSW

2.4.4 The immediate outlook for NSW

The latest Australian Industry Group National Manufacturing Survey, released in December 2000, indicated that production, sales, investment and profit trends fell to their worst level in over a decade. There were large cutbacks in employment and overtime. Growth in manufacturing exports was also down.

These trends reflect the weakness in sectors most affected by the slump in housing and construction – including wood, wood products, base metal products and fabricated metal products. NSW bore the brunt of the decline in demand. The major factors attributed to the decline were higher interest rates, weaker retail demand and the GST. The aftermath of the Olympics would also have had an impact.

These influences point to the impact of domestic demand conditions, particularly the housing and construction sector, on Australian manufacturing.

There are, however, important segments of the sector that are closely connected to growth in the new economy, such as pharmaceuticals, materials processing and scientific instruments. There are important opportunities for small business in these areas.

2.4.5 Manufacturing strengths and capabilities in NSW

The manufacturing industry base in NSW is, however, quite strong

An important part of this project involved analysing ABS small business and manufacturing data and the IBIS world industry data base. From this data, we were able to identify manufacturing industries in which NSW has a comparative strength relative to the rest of Australia. This information is set out in Appendix 1.

The purpose of identifying comparative strengths is to find out where NSW is currently doing well. This may be important for future strategies, as it is important to focus on what NSW is good at – not where others have a comparative advantage, unless it is possible to develop winning strategies in a new sector.

Summary details for industries that are comparatively strong are set out in Table 6. Information on employment and industry value-added (IVA) per employee is also included.

Table 6: Industries in NSW with an Australian comparative advantage

Industry Sector	Comparative strength	Employees ('000)	IVA per employee (\$'000)	Number of businesses in NSW	Involvement of small business
Cereal and baking mix manufacturing	40 percent of cereal foods establishments in NSW	2201	167.6	64	High
Women's and girls' wear manufacturing (fashion)	44 percent of locations by state 49 percent of employment by state	3600	44.1	508	High
Periodical publishing	46 percent of establishments	4339	72.4	155	High
Recorded media manufacturing and publishing	43 percent of industry locations are in NSW	1409	165.9	43	High
Medicinal and pharmaceutical product manufacturing	48 percent of industry location; 49 percent of industry employment	6802	129.5	67	Medium
Cosmetic and toiletry preparation manufacturing	44 percent of industry spread	3307	62.0	62	Medium
Ink manufacturing	46 percent of industry spread	232	127.9	16	High
Chemical product manufacturing	47 percent of employment	1437	98.6	68	High
Plastic blow moulded product manufacturing	36 percent of industry turnover 38 percent of industry employment	1030	130.2	27	Low
Ceramic product manufacturing	60 percent of employment	489	89.9	10	Medium
Basic iron and steel manufacturing	62 percent of iron and steel products turnover	11334	113.8	57	Medium
Iron and steel casting and forging	41 percent of turnover	1862	83.1	71	Medium
Steel pipe and tube manufacturing	49 percent of steel pipes and tube turnover	1966	70.6	26	Medium
Electric cable and wire manufacturing	44 percent of industry establishments	2042	79.3	25	Medium
Battery manufacturing	50 percent of geographic location	196	np	4	Low

Source: IBIS Information Ltd

The large companies that are associated with these industries, and have headquarters in NSW are listed in Appendix 2. Many of these companies work with small business through supplier arrangements, contract manufacturing and research and development.

Included among the companies are a number of knowledge intensive firms. For example:

- Pharmaceuticals – application of biotechnology in drug discovery
- Plastics – extensive use of material sciences
- Iron and steel casting and forging – development of composites

It can be expected that these companies will provide “pull through” mechanisms for the development and growth of small technology based firms (TBFs). The development of these businesses will require:

- Access to investment finance from global technology investors
- Development of management capacity and capability
- Access to new markets

There are also industry sectors in which small businesses have major opportunities for growth and development on a global basis. These include:

- Food
- Specialised clothing manufacture

Other industries in which small business will continue to support other industry sectors, such as building and construction are

- Metal fabrication
- Supplies for building and construction

Economic conditions has created major opportunities in exports

2.4.6 Opportunities in export markets

The decline in the value of the \$AUS against the \$US, and the resurgence in Asian economies has precipitated an export boom. In the year to September 30, exports were up by of 25 percent on the previous.

It is expected that the boom in exports will continue, and it will give Australia the ability to move from a trade deficit of 2.5 percent of GDP, or about \$16 billion last year, to a surplus of one percent of GDP, or about \$6 billion, over the next five years. This is achievable, and the consequence would be a halving of the current account deficit, from 6 percent last year to 3 percent.

NSW companies are making a major contribution in a number of export categories. These include:

- Meat processing
- Beer and malt manufacturing
- Medicinal and pharmaceutical product manufacturing
- Machinery and equipment manufacturing.

Details are provided in Appendix 3.

2.5 The attributes and characteristics that firms will need to meet the challenges

The actions that small businesses will need to take to realise the opportunities in manufacturing will involve:

- Adopting a global focus and seeing opportunities in the mass markets of North America and Europe
- Embracing new research and development and application of new technologies
- Seeking strategic alliances with other businesses in supply, manufacture, distribution and sales
- Developing skills in marketing and relationship management.

These issues will be addressed in the remainder of the Report in the context of the technology, market, business, and management environments.

3 The Management Environment

. . . managers are on a constant quest for new ideas, new interpretations and corporate cues. . . .

. . . Fifty year old lawyers can afford to sit back and contemplate their bedrock of knowledge, knowing that updating it will be an occasional chore. Managers have no such luxury. Fifty year old managers can look back to contemplate their knowledge. If they do so, they will quickly find themselves out of a job. Management demands change and constant development. There is no hiding place. Updating knowledge is a continuing necessity.

Stuart Crainer, *The Management Century: A Critical Review of 20th Century Thought and Practice*, Jossey Bass, 2000. pp214-5

The focus of this Section of the Report is on managing in a new and emerging business environment.

Business success lies not in cost cutting, restructuring or the timeless pursuit of profit. It lies in people's dedication to creating companies around a sense of purpose and core values.

3.1 Building businesses to last

Research undertaken in the early 1990s for the best selling book *Built to Last* found that the most fundamental and enduring aspects of successful corporations was that they "cherished a core ideology" whilst simultaneously stimulating progress and change in everything that was not part of that ideology¹⁰.

The *Built to Last* philosophy has been challenged since the time of publication by the "Silicon Valley" paradigm. This model proposes: come up with a good idea, raise venture capital, grow as quickly as you can then go public or sell up. The Silicon Valley culture had an ethic of impermanence: there was no expectation that a company would be "built to last". Companies such as Hewlett Packard were exceptions. However, recent experience with the "tech wreck" suggests that this model is unviable.

Few companies that proceeded quickly to IPO without a solid business model are still in existence. Those technology companies that were built on a sustainable product, with actual and or potential customers - and who are prepared to pay for the product - are operating successfully.

There is now an emerging view that it is better to concentrate primarily on building an organization that involves *the tangible implementation* of a great and

¹⁰ Collins, James C and Porras, Jerry I, *Built to Last*, Harper Collins, New York, 1994.

sustainable business proposition. Business success is closely associated with:

- A thorough understanding of the market and its customers
- A knowledge of the market environment, including the regulatory framework
- A commitment to a “customer” in terms of quality, consistency and continuity in supply
- Selection, retention and education of key people
- Access to international markets through joint ventures and strategic alliances with processors and distributors already well established in those markets
- Being able to move quickly on opportunities arising from gaps in the market, changing consumer tastes, preferences and perceptions
- A willingness to take a business risk (entrepreneurship), a passion to succeed, as well as a discipline of *managing* risk
- Being able to access and embrace the technologies that are appropriate to the business
- A willingness to change from past practices and procedures
- A high level of cooperation and collaboration between small and large organizations, between business units in large companies, and between companies and research organizations
- An ability to *do business* on a continuing basis with suppliers, research managers, financiers and distributors
- Willingness for hard work and to get involved in the detail, but at the same time hanging on to the big picture.¹¹

These factors are more likely to be associated with success in small business manufacturing over the next 20 years – rather than the quick exploitation of a “big idea”.

The capacity to manage risk is perhaps the most important criterion of business success.

3.2 The foundations of business success

3.2.1 Managing risk

It is often thought that the internal challenges a company faces are of an organizational nature, particularly a shortage of talent and capability. Many papers and much advice has been given about improving product, marketing, strategy, people skills, and so on. There is now a view that these are symptoms of a more

¹¹ Conclusions reached from a series of case studies of innovation in agri-business, Howard Partners, August, 2000.

Being an entrepreneur is much more than having innovative ideas and setting up new businesses. It is about making decisions in situations that are uncertain and unfamiliar.

fundamental problem. What managers say and write, and what they do, are quite often different.

Research has indicated that business success is closely associated with how companies have learned to manage the risk-reward tradeoffs. The common theme is that successful business managers are skilled in risk-reward management.¹² Risks occur in a number of critical areas:

- Funding risk
- Supplier risk
- Product risk
- Market risk
- Liquidity risk
- Credit risk

People and organizations are naturally highly risk-averse in an uncertain environment. They tend to focus on those areas of risk with which they are familiar, thus closing off many options in a rapidly changing environment.

Successful businesses do not avoid risk – they manage it. However, with small manufacturing businesses entering into the global market and developing strategic alliances, partnerships and participating in networks, the business risks also increase substantially. Developing a strong foundation of trust is a critical issue.

People prefer to take risks on the basis of known rather than unknown probabilities and they will back vague beliefs in situations where they feel specifically competent or knowledgeable. An overall conclusion is that:

. . . risk management is the essential skill companies must develop if they want to win the race for the world. . . . it is lack of confidence in their own abilities to manage risk-reward relationships that places the real internal constraints on companies. Managers feel that with high aspirations comes a high likelihood of failure. They feel that if they spend money on unproven ventures, they will look foolish. They fear trusting people who do not think and act like themselves to make decisions – so they are always short of talent.¹³

Successful managers rely on four risk management principles:

- Disaggregate and structure risks so that that decisions can be made on which risks to take

¹² Bryan, Lowell, et.al., *Race for the World: Strategies to Build a Great Global Firm*, HBS, Boston, 1999, pp144-145.

¹³ Ibid. p.145.

Development of risk management capabilities, as well as the capacity to spread risk are, and will continue to be, important issues for small businesses over the next 15 years.

- Take risks only where there are familiarity advantages and where the probabilities of favourable outcomes are high, and shed risks where others have competitive advantages or stronger preferences over risks
- Take advantage of portfolio theory to ensure overall results
- Use options to increase returns relative to risks and to overcome uncertainty.

Successful companies, as well as investors, approach the risk reward trade-off on a portfolio basis. A one-product enterprise and a single investment are very risky businesses. A decision to enter new markets and serve new potential customers must also be based on a full assessment of the risks involved.

Insufficient attention is given in promotional material about innovation and entrepreneurship, and in management development programs, about the realities of business risk and how to manage it.

3.2.2 Markets vs. management

Economists, and particularly organizational economists, have promoted a view that the *market* is the ideal way to organise all economic activities and that organizations are a “special case” to address problems of market failure due largely to limited information and a propensity for people to behave “opportunistically”. However, the focus on efficiency, productivity, individual performance and contracts subverts the cooperation and collaboration that is essential for innovation, both internal and external to the business.

It is in this context that three leading management thinkers recently called for a “new management philosophy”¹⁴. They argue that:

In terms of static efficiency, much of what happens in a company *is* inefficient. That’s the point. It exists precisely to provide a haven and (temporary) respite from the laws of the market in which humans can combine to do something that markets aren’t very good at: innovating.¹⁵

The authors argue for managers to move away from an ethic of value “appropriation” to strategies based on a “value creating logic of continuous innovation”. They point to evidence that successful companies have created innovations through a spirit of collaboration among people that markets, and companies that think of themselves as markets, cannot engender”.¹⁶

¹⁴ Ghoshal, S, Bartlett, C.A & Moran, P. Á “New manifesto for management”, *Sloan Management Review*, 40:3, Spring 1999, p.9-20.

¹⁵ *Ibid*, p. 13

¹⁶ *Ibid*, p. 14

Collaboration between people extends beyond the formal boundaries of an organization.

It has been pointed out in a recent issue of the *Harvard Business Review* that:

The great economic progress of the twentieth century was fuelled by innovation – innovation that resulted from the combined, complementary efforts of new, growing and mature companies. If the coming century is to be as fruitful and prosperous, it will be because entrepreneurs, large corporations, and, possibly, new organizational forms work side-by-side. Free market economies thrive on diversity. The hegemony of one organizational model is dangerous to our wealth.¹⁷

Management is about making decisions under conditions of uncertainty and risk. The future will require that managers are best equipped to make those decisions. This may be one of the most important issues for small business manufacturing managers and owners to address.

It is nonetheless likely that the large industrial organization will continue to dominate the economy. But while these companies control ever-larger flows of cash, they are exerting less and less control over actual business activity – they are “growing hollow”.

Notwithstanding the messages contained in the “newsstand” management literature, management is hard. Managers of the future will not find solutions in the “ten easy steps” or the “seven best ways”.

3.2.3 Management capacity and capabilities

The movement towards different organizational models creates major challenges for management. It is generally acknowledged that any organization needs a structure¹⁸: a structure requires design, and on going maintenance and, at times repair. This remains the task of management. Management is the specific and distinguishing feature of any and all organizations:

- It exists to achieve the results of an organization (whether central or “virtual”) and direct available resources towards those ends
- Someone has to be in charge - with authority to make final decisions – this authority must be commensurate with responsibility
- Collaborative and team approaches are becoming increasingly important, but not appropriate to all situations
- People have to know and understand the organization structure they work in – whilst obvious, it is very often violated.

These considerations apply equally to large businesses and small businesses and increasingly between large and small in cooperative and collaborative arrangements.

¹⁷ Bhidié, Amar, “Forethought Opinion”, *Harvard Business Review*, Sept-Oct, 2000

¹⁸ Drucker, Peter, *Management Challenges of the 21st Century*

The capability of Australian managers is the subject of ongoing criticism

The capacity of Australian managers to take their companies forward into the global business environment has been the subject of a great deal of criticism over the last several years. The most recent was published in the *BRW* of 2 February 2001. The following issues were identified:

- A mixture of scepticism about new ideas, a fear of making mistakes has led to a widespread resistance for Australian financial markets and companies to be innovative – it is easier to reinforce domestic oligopolies, through market tactics and garnering political support, than developing innovative, knowledge based enterprises
- The funds management sector, a major potential source of investment in growing companies, focuses on capital gains rather than a steady flow of dividends
- Funds managers generally rely on numerical analyses that are not designed to identify the “innovativeness” of a company¹⁹.

Notwithstanding the focus of local investors, global manufacturing companies do invest in Australia due to the relatively high productivity of Australian workers. US venture capital funds, capable of making significant investments in commercialising technologies do not, however, invest in Australian start up companies *in Australia*. Investments are made after the companies “migrate” to the US. A top priority should be to encourage these investments to be based in Australia – and NSW.

The future of manufacturing in Australia is likely to be associated with the continued strong performance of small to medium businesses.

These businesses have already demonstrated a capacity to innovate and operate in a global context.

The problem is that Australia does not have a long history of manufacturing industry operating in highly competitive, global environments. Post war economic development was based on encouraging a domestic manufacturing industry protected by a high tariff (the “infant industry” argument). The dismantling of the tariff protection regime during the 1980s, on the not unreasonable assumption that protected industries were maturing, has not been accompanied by business strategies to build the competencies and capabilities of Australian managers in a competitive, global, environment.²⁰

The older and large manufacturing businesses that still have a culture of seeking government assistance to underwrite a significant proportion of their business risk, including investment in product development, will soon disappear. Unless they are taken over, they will re-emerge revitalised as smaller, more focussed

¹⁹ James, David, “Our Creative Dilemma” *BRW*, 2 February 2001, p.48.

²⁰ The “resources boom in the late 70s/early 80s did place manufacturing development at a disadvantage. The high value of the \$A, and *projected* current account surpluses arising from mineral exports, became reflected in strategies to *increase* imports. This became known as the “Gregory thesis” and achieved some policy support.

DSRD should discuss with business schools in NSW the need to develop management education programs and courses relevant and appropriate to the Australian manufacturing business environment

businesses in a pattern that is now generally referred to as “creative destruction”.²¹

When companies (and governments) have to push the frontiers of performance, *managerial capability* is essential. There is very little effective management education in Australia that is targeted at the Australian management environment.

3.2.4 Management strategy

During the 1980s and 1990s mainstream management thinking was towards a structured, analytical approach to the development of management strategy. Many leading management thinkers are now arguing that analysis and especially planning have been over emphasised. On the basis of numerous case studies, management researchers are stressing the need for insight, creativity, learning and innovation – as well as “people” skills.²²

The world is seen as too complicated and unpredictable for strategy to be a purely “top down” process, especially in dynamic markets involving the application and use of high technology. Thus in a rapidly changing environment, successful strategies tend to emerge from a series of decisions, especially strategic investment decisions, heavily influenced by market conditions and technology developments. *There may be no detailed written strategy at all.*²³

The strategic decisions that will form the basis of “emergent strategy” usually involve resource allocation – and often substantial capital investment. Strategic investment decisions (SIDS) are coming to have an increasing role in emergent strategy. They are the “bridge” between finance and strategy – two quite different languages for top management.

This should not come as a surprise to successful small businesses where owners are closely involved in both setting business direction and deciding on the commitment of resources. In large businesses, these functions have usually been separated in different parts of the organization – often at great cost to the business.

The lesson for the future is that successful strategies need not be clearly formulated in advance. Strategy is becoming interpreted as a pattern – a consistent stream of actions over time that reflects an over-arching sense

Business strategies that are based on creating “bullet proof” products and defensible strategic positions, as set out in the management advice of the 1980s and 1990s will not be sustainable in future.

²¹ The concept of “creative destruction” has become almost a standard component of the innovation management literature. It can be traced back to Joseph Schumpeter, and Peter Drucker, but was recently popularised by Richard Nolan and David Croson in *Creative Destruction: A Six Stage Process for Transforming the Organization*, Harvard Business School Press, Boston, 1995.

²² Barrwise, Patrick, “Strategic Investment Decisions and Emergent Strategy”, in Dickson, Tim, ed. *The Financial Times Mastering Management*, Financial Times Pitman, London, 1997, p. 562

²³ *Ibid.* Michael Porter, the champion of analytical strategy has responded with a robust defence of his approach. See *Fast Company*, February 2001.

of commitment and purpose. This, in turn, places a high priority on *adaptability, innovation and learning*. It also places a high priority on an interactive process that relates product and market specifics to the wider financial and technical implications.

3.3 Innovation and innovation management

There is a great deal of discussion in the management literature, in government and in boardrooms, about innovation and innovative organizations.

3.3.1 The concern over innovation

Innovation is a strategy to create change. Change is no longer a one-off event: it is continuous and enduring.

Paraphrasing Peter Drucker, if the purpose of a business is to create a customer then in order to keep customers in a competitive environment, a business must be continually innovating. *This defines the fundamental tasks of management.*

Innovation involves the exploitation of opportunities on the basis of business decisions about how to reach new customers. It is the *practice of management* through which new ideas are encapsulated into business strategies and resources allocated to achieve commercial results and outcomes.

Innovation is the outcome of an integrative approach to management – the melding of strategy, marketing, production, R&D and finance. It is the result of a participatory process coupled with a relentless determination to make things happen (planning, control, follow through, prototyping, revision).²⁴ Innovation is rarely the consequence of a moment of brilliance.

The new business environment provides opportunities for small businesses to work collaboratively with other businesses – both small and large. There are also opportunities for small businesses to work collaboratively with knowledge based organizations, such as universities and research organizations.

3.3.2 Sources of innovation

Businesses that have mastered the art of competition have innovation firmly embedded in their corporate strategies.

The criticality of innovation to business success is being recognised by managers, and policy makers, in the global and competitive business environment.

Innovation and innovative capacity is commonly associated with *small* firms and businesses. It involves

²⁴ Urban, G. L. 1998, "Strategic Roots of Innovation" in William Dauphinais and Colin Price (eds) *Straight from the CEO*, Nicholas Brierley, New York, p.266-7.

Increasingly science and technology is being called upon for implementation of innovative opportunities.

systematic monitoring of several distinct sources of innovative opportunity²⁵ -

- Unexpected successes (or failures) that arise from events outside the frame of reference of a business and which create both problems and opportunities
- Incongruities that emerge between business reality as it actually is and reality as it is assumed to be (or as it ought to be)
- A need for change in a process due to considerations of cost, quality or customer satisfaction
- Changes in industry structure and/or market structure
- Changes in demographics – such as age, income and lifestyle that impact on the pattern of demand
- Changes in consumer perception, mood and meaning
- New knowledge – both scientific and non scientific.

Science driven product development involves activities such as safety testing, prototyping and functions in an environment where there is close collaboration between business and research organizations. *Small businesses will need efficient and effective access to these resources.*

In all cases, however, innovation is sourced from ideas. Gary Hamel, in *Leading the Revolution*, refers to innovation as a *process* that involves three broad stages:

- Generating as many ideas as possible, about what markets can be targeted, what can be sold and how to accomplish this
- Selecting from these ideas the ones that business/industry pursue and putting to one side the ones that it does not wish to pursue
- Proposing implementation strategies for the selected ideas, while remaining flexible to ongoing changes in the business and industry environment.

This approach to innovation sees business development in terms of a portfolio of opportunities and options. A range of opportunities is required because not all identified opportunities will come to fruition. There will be some wins, and some inevitable losses.

3.3.3 Innovation and strategy development

According to Hamel, the outcome of the strategy development process is an “Innovation Portfolio”. It will consist of:

- A portfolio of credible ideas – untested, but promising development concepts

²⁵ Drucker, P. 1999 *Innovation and Entrepreneurship*, p.286. These points are reiterated in a study by William L Miller and Langdon Morris, *Fourth Generation R&D: Managing Knowledge, Technology and Innovation*, Wiley: New York, p. 287 ff.

A “portfolio” approach to innovation is replacing the “grand strategy” thinking of the 1980s and 1990s.

- A Portfolio of “experiments” – ideas that have particular merit which might be validated through pilot programs
- A Portfolio of “actions and options” – experiments that look promising.

This approach is similar to others that are emerging in management thinking²⁶. It is a departure from the “grand strategy approach” advocated by management consultants and others during the 1970s to 1990s.

The portfolio approach points to the importance for small business of having a number of products and market opportunities that are in the process of development. It also points to the need to anticipate as far as possible changes in the market environment and be able to respond quickly and decisively

One of the greatest risks for small manufacturing companies is relying on a single product for business success – particularly when there are substantial investments required in product development, production capability and marketing. Successful entrepreneurs, including university spin off companies, have shared this risk with venture capitalists and a range of business and alliance partners.²⁷

3.3.4 Australian data on innovation

The rate of innovation in manufacturing is, according to the latest available ABS data, directly related to the employment size of the business. Innovation activity was recorded in 19 percent of firms employing less than 10 people compared to 89 percent of firms employing over 500 people. This is indicated in Table 13.

²⁶ See for example, Markides, Constantinos, *All the Right Moves: A Guide to Crafting Breakthrough Strategy*, Harvard Business School Press, Boston, 2000

²⁷ Many inventors simply want someone to take their “good idea” and develop, manufacture and market it on their behalf. They are often alarmed when an investor wants to take a major proportion of the equity in the start-up company. The equity stake simple is a return for risk. Interestingly, and following the US model, academic researchers are becoming more committed to make a substantial financial investment in a technology start up company.

Table 7: Proportion of manufacturing businesses undertaking innovation by employment, Australia, 1996-97

	Type of Technological Innovation		
	Product %	Process %	Total %
Less than 10	16.0	12.5	18.7
10-49	39.1	28.0	42.6
50-99	47.3	45.7	53.6
100-499	63.9	56.6	70.6
500 or more	83.3	80.6	89.2
Total manufacturing	22.9	17.8	26.0

Source: Derived from, ABS, Innovation in Manufacturing, 8116.0, Canberra, June 1998

While the proportion is quite low for very small businesses, the proportion increases rapidly in the 10-49 and 50-99 categories. This would confirm a view that innovation does occur in a small business environment. There is also anecdotal and limited empirical evidence²⁸ that the wording of the ABS survey, and the data collection of very small businesses, produces an underestimate of the level of innovation (often regarded as “just doing business”) in small firms.

According to the ABS over two thirds of all manufacturing businesses considered that there were important barriers that constrain technological innovation projects.

The factor that was most frequently cited by business as a barrier to innovation was “government policy and taxation”. This was followed by “current economic climate not conducive to innovation”, “insufficient retained earnings” and “potential market already dominated by established businesses”. Information has not been published on this assessment by firm size.

The way in which innovation capability is acquired varies considerably by firm size. Micro businesses are less likely to acquire innovation by research and development – but this increases substantially in the 10-49 employment group. Businesses in this group also acquire technologies from third party sources – which may, for example, be a manufacturing technology to be adapted for product development in local market conditions, or to meet specific supply requirements.

It is noted that some of this data suffers from substantial sampling error.

²⁸ Johnston, 1998

Table 8: Expenditure on technological innovation in manufacturing by type of innovation activity 1996-97

	Less than 10	10-49	50-99	100-499	500 or More	Total
<i>Expenditure</i>	<i>\$'000</i>	<i>\$'000</i>	<i>\$'000</i>	<i>\$'000</i>	<i>\$'000</i>	<i>\$'000</i>
Research and development	99.7	266.4	134.2	446.5	1037.9	1984.7
Acquisition of technologies developed by others (patents, trademarks, etc)	21.7	40.0	15.1	44.2	52.9	173.9
Training & further education related to introduction of innovation	14.8	26.0	27.4	26.5	43.1	137.8
Expenditure on tooling up, industrial engineering, start up	128.5	222.3	117.8	188.9	482.3	1139.8
Marketing of new or improved products	43.0	82.9	47.4	119.2	128.3	420.8
Other	3.5	10.5	27.4	8.9	33.4	83.8
Total expenditure	311.2	648.1	369.4	934.2	1777.9	3940.8
Average \$'000 per employee	2.2	3.1	3.8	3.7	5.3	3.9
<i>Percentage of total</i>	<i>%</i>	<i>%</i>	<i>%</i>	<i>%</i>	<i>%</i>	<i>%</i>
Research and development	5.0	13.4	6.8	22.5	52.3	100.0
Acquisition of technologies developed by others (patents, trademarks, etc)	12.5	23.0	8.7	25.4	30.4	100.0
Training & further education related to introduction of innovation	10.8	18.9	19.9	19.2	31.3	100.0
Expenditure on tooling up, industrial engineering, start up	11.3	19.5	10.3	16.6	42.3	100.0
Marketing of new or improved products	10.2	19.7	11.3	28.3	30.5	100.0
Other	4.2	12.6	32.7	10.6	39.9	100.0
Total expenditure	7.9	16.4	9.4	21.2	45.1	100.0

Source: Derived from, ABS, Innovation in Manufacturing, 8116.0, Canberra, June 1998

Table 12 indicates a very strong commitment to innovation in the 10-49 employment category. It is in this range that new technology based forms typically operate.

3.4 Knowledge management

Over the last five years much has been said and written about knowledge becoming the key economic resource and the dominant source of competitive advantage. *The active management of organizational knowledge is now considered as a key business issue.* It has cultivated a boom in knowledge related publications from academia, technology, consulting, organizational design, human resources, industry economics, librarianship – and business.

The acquisition and effective management of organisational knowledge will have an important and pervasive impact on the processes of the creation, production and distribution of goods, and for economic growth generally.

From a business perspective, where firms are working to leverage their knowledge capabilities, there are seven levels of knowledge management.²⁹

- Infrastructure – creating the physical and technological support environments that allow knowledge sharing and representation
- Content – representing, embedding, organising and supporting knowledge content and intellectual capital

Improved performance for businesses (small and large) as well as regions and nations will depend heavily on the extent to which they can access and apply new knowledge and new ideas.

²⁹ Ruggles, R., et.al., "Gaining the Knowledge Advantage" in Ruggles, R and Holthouse, D, eds, *The Knowledge Advantage*, Capstone, 1999, p. 13.

- Processes – actively bringing knowledge to bear in the context of specific processes (eg new product development)
- Organization - consciously designing and structuring elements of an organization to support knowledge management and application – eg – reorganising communities of practice, creating incentive systems which support knowledge sharing
- Relationships – establishing and maintaining knowledge based relationships with customers, suppliers and other strategic partners
- Products and services – enhancing the organization's offers by embedding knowledge within them or in their interactions with users
- Strategy – setting corporate strategy based on the belief that knowledge is the key resource – realising that the basic strategic question is “how can we create the most value from what we know as an organization?”

The efforts of most companies, even at state of the art, are still primarily concerned with getting the first three or four of the above areas working well.³⁰

There are three areas where knowledge management practitioners focus their efforts:

- New product and service development – coming up with new ideas
- Operations – making things happen
- Customer connections – supporting and learning from them.

This focus draws attention to the fact that knowledge management is not just for some special case companies: it is an approach that takes all organizations to even higher levels of innovativeness and effectiveness.

3.5 Management and leadership

There is a vast literature on leadership and its importance in management practice.

Chester Barnard, one of the first writers to set out the responsibilities of managers in a systematic way in the *Functions of the Executive* (first published in 1938), suggested that “the endurance of an organization depends on the quality of leadership; and that quality derives from the morality upon which it rests”. He argued that a “low morality will not sustain leadership for long, its

Management writers have identified the importance of leadership for success in organisations

³⁰ Ibid.

influence quickly vanishes and it cannot produce its own succession".³¹

To Barnard, leadership goes to the heart of management responsibility. Leaders are able to reflect the attitudes, ideals, hopes derived from "without themselves" to bind the "wills of men to the accomplishment of purposes beyond their immediate ends, beyond their times".³²

Sixty years later, Marvin Bower, McKinsey's Managing Partner from 1950 to 1967, wrote in *The McKinsey Quarterly* that a leader is "a person who sets attractive goals and has the ability to attract followers, or constituents, who share those goals" and, "above all, a leader must be trusted and respected"³³

To Bower, leadership involves both qualities and attributes. Qualities refer to elements of character and personal make up that are difficult to learn. They include trustworthiness, integrity and fairness. Attributes, are more like skills, and therefore easier to learn. They include:

- Unassuming behaviour
- Capacity to listen
- Open mindedness
- Sensitivity to people and situations
- Good judgement
- Flexibility and adaptability
- Capacity to make sound and timely decisions
- Capacity to motivate
- Ability to create a sense of urgency (as opposed to panic).

Peter Drucker argues that effective leadership is essential in times of change. He argues that "a central 21st challenge for management" is to see change as an opportunity. A change leader is a manager who builds into the business a systematic policy of innovation – that is, a policy to create change.³⁴ Such a policy produces a mindset that sees change as an opportunity.

There is a vast literature on leadership and leadership skills – the quality is very uneven

There is also a voluminous literature on leadership that comes from the contemporary human relations and organization development perspectives that forms much of the content of popular management writing. Much of this plays up the concept of the "charismatic" leader and offers advice on how to become a leader by mastering a

³¹ Barnard, Chester, I., *The Functions of the Executive- Thirtieth Anniversary Edition*, Harvard University Press, Cambridge Mass., 1968, p.282-3

³² Ibid, p.283

³³ Bower, Marvin, "Developing Leaders in Business", *McKinsey Quarterly*, 1997, No.4, p. 6

³⁴ Drucker, Peter F., *Management Challenges of the 21st Century*, Harper Collins, New York, 1999, p. 84

Strong leadership qualities are regarded as vital to successfully capture the value of new businesses.

few techniques and adopting the practices ascribed to successful leaders.

There are also available numerous books that contain analogies between business leaders and the characteristics of leaders in other fields of endeavour – such as captains/coaches of sporting teams, conductors of symphony orchestras, leaders of jazz bands. Regrettably, this material conveys a simplistic view of management and organization and underplays the importance of hard work and commitment required for business success.

Recent accounts in the popular management literature have attempted to define the practices adopted by “real change leaders”. These include mantras such as “democratic principles”, “joint accountability” and “open dialogue”. Regrettably, in much of this literature, there is an inconsistency between what leaders say and what they do. Moreover, the causal links between advice and implementation are not straightforward.³⁵

The importance of leadership has been given renewed emphasis in recent thinking about the criteria for success of fast growing small businesses in advanced technology areas. These qualities include:

- An ability to build bridges between a new business and established larger businesses
- To build teams
- To attract talented people
- To tolerate ambiguity.

Managers of new and growing technology based businesses need an ability to anticipate and address the changing needs of a business as it matures.³⁶

3.6 Looking for “best practice”

A very large number of businesses have had experience with management improvement initiatives such as TQM, BPR, JIT, etc. However, many businesses had very mixed results from the implementation process. Research has indicated that only a few management practices have a consistent impact on performance across all organizations. These related to:

- Clarity of strategic intent - widespread understanding of the strategic direction, both inside and outside the organization

During the 1980s and 1990s a large number of businesses set about implementing what were often seen as universally beneficial management practices at an unprecedented rate.

³⁵ For a recent discussion on this issue see Argyris, Chris, *Flawed Advice and the management Trap: How managers Can Know When they Are getting Good Advice and When They are Not*, Oxford University Press, New York, 2000.

³⁶ Albrink, J., et al. “Adventures in Corporate Venturing”, *Strategy+Business*, First Quarter 2001, p. 127.

- Process improvement methods - process value analysis, process simplification, process cycle time analysis
- Supplier certification programs - certifying suppliers is a standard practice in the manufacturing sector.

Supplier certification, through quality accreditation, is now becoming almost a condition of entry of firms into industries and markets. With the growth in e-commerce, this will become mandatory³⁷.

A number of successful small manufacturing businesses in NSW are already undertaking benchmarking on a global basis.

For poor performing businesses there is an overwhelming need to focus on business fundamentals - building the capacity to develop and deliver reliable products and services. These fundamentals include control over costs, training and customer service. Many Australian manufacturing companies will reap considerable benefit from concentrating on these fundamentals over the short to medium term. Once high levels of performance have been attained, it is then appropriate to move onto more sophisticated practices.

It is only in the high performance business category that the most widely espoused new management practices (benchmarking, empowerment, externally oriented planning tools) are actually having a beneficial impact.

Thus, for businesses going forward over the next 10 years, benchmarking will become an integral part of business productivity and performance improvement efforts. Managers should look for benchmarks that are best of class, or world class, and attempt to use these as a way of evaluating their own processes, learning how to improve and launch into global markets.

The Department of State and Regional Development and Business Associations should assist small manufacturing businesses in identifying global benchmarking partners and assist, where appropriate, in accessing benchmarking databases.

A major difficulty with benchmarking, particularly for small business, is finding real best practice partners. Benchmarking cannot deliver best practice improvements if enterprises fail to find genuine best practice firms. There is a role for the Department of State and Regional Development and industry and professional associations, to support benchmarking strategies for firms that have the potential to be globally competitive.

3.7 Work practices

The basis of workplace relations is still very much based on the "factory" rather than a broader concept of the working environment.

This observation is made notwithstanding the extensive change that has taken place in awards and workplace agreements. But the "adversarial" approach of workers

³⁷ American Quality Foundation, *International Quality Study (IQS)*

In a number of important respects, work practices and work place relations have not kept pace with the emergence of the knowledge economy.

The foundations of success are unique to each company. Uniqueness is a product of the firm's resources and its contracts and relationships – between employees, customers, investors, and shareholders.

vs. management is still very strong in the workplace culture.

In the emerging new workplace environment, business owners and managers have a preference to retain engage unskilled staff on a casual basis. However, recent changes to workplace awards that have the effect of converting casual employment to permanent after 12 months (or in the case of the metal industries, 6 months) is likely to lead to more changes.

It is likely that the next 15 years will see an expansion in the role of the independent "labour hire" businesses – where employees work for a number of companies and permanence is provided through the hiring company but small businesses retain employment flexibility.

3.8 The attributes and characteristics that small businesses will need to develop

There are no recipes or generic strategies for success: if there were, there could be no sustainable competitive advantage.

Business success is more often based on exploitation of the capabilities that a firm already enjoys – deriving from history, location, and established market position. Firms must look to identifying, defining and concentrating on their "distinctive capabilities" – characteristics that other firms lack. It is very difficult to build them from scratch.

- *Building reputation and relationships* - in some lines of business, a reputation is the major business asset. It ensures continuity in business and long term relationships. Notwithstanding the growth in e-commerce, a businesses reputation will be one major criterion of success
- *Capacity for negotiation* - the business of manufacturing is becoming less about "selling" and more about establishing a "deal" relationship between parties. This requires degrees of both toughness as well as flexibility to meet customer expectations. Deals are typically *negotiated* and cover important business issues such as market access, finance, price and the bases for cooperation and collaboration. In a global environment negotiation is cross cultural. Accessing markets in Asia and the Middle East requires an understanding of business culture and expectations
- *Capacity to manage risk* - small manufacturing business would benefit from building capacity and capability to understand and manage risk, particularly as they enter international markets

- *Cost consciousness and cost management* - a competitive business environment demands attention not only to building the “top line” through sales, but ensuring profitability by control over costs. This means knowing which *products* are profitable (and which are not) and knowing where the business is performing well. For many businesses this will require investment in management accounting capability. Fortunately, software for this work is affordable and manageable. The real test is using it as a basis for decision-making.

4 The Technology Environment

The future of manufacturing should be seen in terms of its knowledge intensity and new and emerging technologies

In Australia, and specifically NSW, manufacturing has been closely tied to the fortunes of the housing, building and construction industries. The cyclical nature of these industries has made manufacturing vulnerable to changing economic conditions.

For the future, there is a need to look at manufacturing in the context of its capital and knowledge intensity and the enabling technologies and the contribution they make to productivity growth. In addition, it needs to be recognised that some of the most significant opportunities in manufacturing are for production of “knowledge embedded” machinery and infrastructure used in traditional manufacturing processes.

Some manufacturing technologies will be developed in Australia, but it is important that Australian, and NSW companies have access to technologies developed on a global basis through technology transfer initiatives that facilitate Australian companies gaining access to leading edge knowledge and expertise.

The purpose of this section is to focus on new and emerging technologies that will have an impact on manufacturing over the short to medium term.

4.1 Information and communications technologies

Despite the extensive public policy discussion and reports about the “information” economy and periodic government reports on the topic, there is very little agreement among economists and government officials about what constitutes the “information sector”. Governments and international bodies such as the OECD continue to use “industrial age” categories and classification codes. However, information economics impacts on a wide range of goods producing firms that have not been thought of as part of the information business.

4.1.1 The “new” economy

The term “new economy” is a source of much confusion

In public policy terms, the term “new” economy generally reflects the association of low inflation, sustained growth with high investment in information and communications technologies (ICT), and substantial restructuring of the economy. Thus, the three main characteristics of the “new” economy (in economist’s terms) appear to be:

- A higher trend growth, based on higher growth in multi-factor productivity resulting from more efficient business practices using ICT
- A change in the business cycle³⁸ resulting from a shift in the trade-off between inflation and unemployment which allows the economy to expand for a longer period without inflationary pressures emerging - this results from the combined pressures of
 - Global competition on wage rises
 - ICT investment on inflation (the latter a product of the enormous growth in the capability/price ratio of ICT technologies)
- New sources of growth in the economy from sectors which benefit from increasing returns to scale, network effects, externalities and spillovers.³⁹

In practice and reality there is no substantial difference between the “old” and “new” economies under this definition. The new economy concept refers to a process of technological change and development within all industry sectors that is having a profound effect on productivity growth.

Notwithstanding the perceptions of some journalists and consultants, from a manufacturing point of view, the terms “old” and “new” economies are not mutually exclusive. From a business perspective, then distinction is quite unhelpful.

Metaphors of the “new” economy also describe what is often referred to as “information” economy and the “knowledge based” economy. More broadly, the “new” economy has become associated with rapid technological innovation and the growing importance of information as a productive resource.

The “new” economy is contrasted with what is perceived as an old “industrial” economy that is seen to involve large capital investments in physical infrastructure and goods producing (manufacturing and construction) activities.

Perhaps to end the argument, Michael Bloomberg wrote in the March 2001 issue of *Fast Company*

I don't think there is a new economy. I think there are new tools for *the* economy. The basics of commerce remain: You've got to have something that people need, something that they can't get elsewhere. And the more they can't get it elsewhere the more they need it. Adam Smith said it all: With a small supply and a big demand you have a business⁴⁰.

³⁸ Extreme views have suggested the new economy spells the end of the business cycle and the prospect of endless growth. Recent reports that the US economy is entering a downturn suggests the cornucopian future may have to be postponed.

³⁹ OECD, *A New Economy? The Changing Role of Innovation and Information Technology in Growth*, Paris, 2000, p.17.

⁴⁰ Bloomberg, Michael, *fast Company*, March 2001, p. 93

The emergence of information as a productive resource has been one of the most profound changes in business during the 1990s.

4.1.2 Information as a resource

At the heart of the issues has been the growing reliance on information as a source of income and wealth and, in particular, the extent to which technology driven firms have become the sources of this new wealth and centres of economic activity⁴¹. It has been a change that has “crept up”, but is now embedded in a very broad range of economic activities as well as business processes and products.⁴²

Up until quite recently time managers in both the private and public sectors were expressing disappointment and concern about the failure of IT investment to deliver benefits in terms of increased productivity and bottom line performance. EDI proved to be a disappointment. A common criticism was that IT was allowing for *automation* of business processes – but not *innovation*.

The concept of the new economy/information economy is closely associated with the *convergence* of information and communications technologies. Content, whether voice, data, video or image can be converted into a common digital format that can be sent over a common transmission (communications) media.

Communications is one of the primary drivers of the present round of change by allowing for the development and sustaining of personal and business networks within firms and between firms – nationally and internationally. This, in turn, allows for enhanced access to capability, faster decision making and an enlargement of traditional markets – at a time when the world is going through a wave of free market reforms.

Information also allows businesses to have more knowledge about their own performance. It has allowed for the introduction of lean manufacturing where there is greater knowledge about each stage of production and a capacity to plan and schedule with greater precision.

4.1.3 The application and use of information technologies

Information technology has opened up opportunities for enhanced application of information intensive activities that manufacturing industries are involved in - such as on-line monitoring and diagnostics of installed equipment and knowledge intensive processes such as new product development.

⁴¹ Cortoda, James W., *21st Century Business: Managing and Working in the New Digital Economy*, Financial Times-Prentice Hall, New Jersey, 2001, p.7

⁴² The issues were extensively researched through an Ernst & Young/MIT study in the early 1990s (Scott-Morton, M, et al., *Management in the 1990s*, Oxford, 1993). Many of the current knowledge management “gurus” were associated with this Study

Information technology will continue to facilitate the integration of purchasing, sales and customer service, and order management, as is the case with B2B and B2C. These developments are well underway in Australia.

Extended networks of specialists, perhaps from different companies, working together using a common product data model across time zones are already technically feasible and many companies and their collaborators are embracing this opportunity, reducing time to market and increasing the exploitation of Intellectual Property. Companies contacted during this Review are well advanced in this direction. *Control* over intellectual property remains an issue in this context.

The introduction of new information technologies into manufacturing has not been an easy road. Companies have learned, for example, that the adoption of a particular software solution cannot guarantee success – benefits do not emerge directly from an increase in IT resources (as in the case of an increase in R&D resources). These early disappointments prompted many to outsource their entire data processing functions⁴³.

There is now a greater recognition that IT can be an important driver of process and product innovation⁴⁴. Information technologies and multi-media simulations hold significant commercial potential. Simulation in engineering R&D, for example, has had a major impact in the cost of R&D, potentially making functions such as product testing and proto-typing more accessible to small business⁴⁵.

Simulation software allows R&D output to be delivered earlier and more intensively. For example, rapid virtual prototyping, rather than conventional tooling up allowed an auto parts manufacturer to reduce manufacturing costs on tail lights by 60 percent and reduce delivery time by 12 weeks.⁴⁶

In addition to simulation, technology allows for integration of engineering data and tasks. Challenges in R&D management, such as reducing development time and broadening technical expertise, are forcing companies to integrate their own core processes and development partnerships through technology.

Looking forward, access to information is now at a stage where it is cheap and ubiquitous. Notwithstanding its value as a resource, information is in abundant supply and inexpensive. Moreover, as a core technology, the computer chip is aging.

⁴³ Kempis, R and Ringbeck, J, Manufacturing's Use and Abuse of IT" *McKinsey Quarterly*, 1998:1, p. 140.

⁴⁴ The importance of IT in process innovation was first documented by Tom Davenport in *Process Innovation*, 1990

⁴⁵ See Michael Schrage, *Serous Play: How the World's Best Companies Simulate to Innovate*, HBS, Boston, 2000.

⁴⁶ Kempis, R and Ringbeck, J, op vit, p. 143.

4.1.4 Future developments in computing and communications

The falling cost of computer chips will continue to allow small businesses to develop new and innovative products – subject to sustainable business models.

Two of the most significant elements in the emergence of information as a resource have been the Internet and the progressive refinement of the computer chip (integrated circuit). The deployment of computer chips in products, transportation, and the array of communications tools that facilitate the creation and maintenance of electronic networks is closely linked to the growing importance of ICT in the economy. The computer chip, and the Internet, have turned globalisation from a loose affair to a tangible reality.⁴⁷

Computer chips have become the key element in many automated and semi automated business processes. The number of computer chips made for devices other than computers exceeds those going into computers, while the production of computers still continues to grow. The result is that every part of life is alive with cheap computer power. This has had a phenomenal impact on manufacturing industry productivity.

Computer chips are present in a wide variety of appliances such as microwave ovens, clocks, stereo equipment, CD players and refrigerators. Dozens of chips go into automobiles – to the extent that some are tempted to describe automobile manufacturers as computer companies. Research indicates that chip technologies can be developed for increasing amounts of productivity without any fundamental change.

Computer chips are making it possible for people to dictate what activities and services they want their machines to perform. They allow for manufacturers to add knowledge to a product, and for products to “learn”. Products can be differentiated by the information embedded, as well as building in assistance and training capabilities.

Moreover, the rapidly falling price of computer chips, the possibility of increasing returns, the speed at which ideas can be turned into actions, and the seemingly endless scope of (envisioned) consumer and industrial applications, has given small start-up companies an important place in the process of technological innovation.

Costs of computer chips are likely to fall further with the development of transistors based on organic (carbon based) molecules and polymers (plastics) to replace more expensive silicon in chips.

Most observers consider that electronics associated with computer power and communications will continue to

⁴⁷ Cortoda, op cit, p.23

The usefulness of computers is now very much determined by the software that, in turn, is falling in price and becoming increasingly commoditised. As a result, computer aided capability in manufacturing is also tending to favour the small business.

Most biotechnology companies are small businesses – doing some manufacturing but mainly “product development” R&D for pharmaceutical manufacturing companies.

have profound impacts in the next 20 years⁴⁸. The leaps in the power of the PC have a little while to run before the miniaturisation of chips reaches practical limits. There is already now a trend towards optical (photonic) rather than electronic signals. The next generation of computers will provide enough capability for businesses to do anything they want with them.

At some time in the future, a stage will be reached where there is little point in putting more power into computers – just as there is little point in putting more power into cars. Small companies are almost able to afford to purchase the computing power that was previously only available to large companies. This will allow small companies to compete against large companies in a global context. *There will be no comparative advantage in size in collecting, storing and processing information.*

Developments in telecommunications based on optical fibre technologies will allow for a huge expansion in the volume of data that can be transmitted around the world at a rapid speed and high quality. Data compression technologies will also allow for continued use of the copper wire technology in home and small business establishments. One of the major barriers to accessing high speed and high quality communications at the moment is cost and service quality.

4.2 Biotechnology

Biotechnology is a term used to refer to a wide range of technologies and businesses that have an aim to understand, alter or direct the function of a wide set of organic cells - including plant, animal and human. There are approximately 4000 organizations around the world that describe what they do as biotechnology. The biotech industry is generally seen as having several segments:

- Human health care products
- Agricultural biotechnologies
- Instruments, devices and suppliers of laboratory products
- Chemical and environmental
- Bio-informatics.

Most biotechnology firms are small businesses, focussed solely on research and development and a small amount of manufacturing. They rely, however, on the pharmaceutical manufacturing firms to handle marketing and distribution of their products and services. There are only a few large biotechnology firms (e.g. Amgen,

⁴⁸ For example, McRae, H, 1994, *The World in 2020*, Harvard Business School Press: Boston

There will be a substantial growth in demand for biotechnology-based products over the next 15 years – mainly in the medical area (associated with population aging) 1

One of the critical issues for industry development in this area is strengthening the linkages between the research base, the biotechnology small business start-up sector and the pharmaceutical companies that invest in this technology.

Genentech and Genzyme) that have significant sales in end user markets.

Ten-year projections suggest that the market for biotech products will more than triple in real terms and that medical markets (pharmaceuticals, devices, etc) will account for 90 percent of sales. Market size will also be impacted by biotech innovations in industries such as chemicals, agriculture, mining and environmental remediation.

The impact on small business of these developments cannot be underestimated. Substantial opportunities are emerging in manufacturing through linkages between pharmaceutical companies, universities, research organizations and biotechnology start-up companies that “spin out” from these institutions. (Biotech start-ups are, of course, “small businesses”). Pharmaceutical companies look for linkages with university laboratories and are major investors in biotechnology start-up companies.

In Europe and North America regional governments support bio-networks (eg Bio Valley in the Rhine, covering 300 start-ups) to help finalise business plans, secure funding and find office space. Other groups are set up within sub-regions and have their own support organizations, which create a “patchwork” effect rather than a seamless cooperative territory – a pattern resembling Australia with SE Queensland, Victoria (Bio21) and NSW (BioHub) involved in supporting biotechnology.

Australia, and NSW in particular, has a strong base in pharmaceutical manufacturing with linkages to a robust biotechnology research capability. There is potential to create a strong biotechnology based pharmaceutical sector in the State over the next 10-15 years. The State has also a strong capability in medical device manufacturing which is associated with small, technology based, companies operating on a global basis. The NSW Government is pursuing a number of initiatives in this area.

Entigen, formerly eBioinformatics, is a spin off from the University of Sydney and is now operating in the US. It provides integrated on-line information for researchers using global genomic and proteomic databases.

4.3 Manufacturing technologies

The potential impact of new and emerging technologies over the next 15 years on manufacturing product and processes will be considerable. Outlined below are some examples of developments and potential impact of a number of technologies. There are also technologies developed in other business and industry areas that will,

Composite structures and materials will have a major impact in manufacturing processes and products

undoubtedly, have an impact on manufacturing. These include artificial intelligence and computational mathematics – made possible by the speed and power of computing.

4.3.1 Advanced materials technologies

Australia and NSW has a strong capability in the design, manufacture and performance of composite structures and materials, materials and production engineering, stress analysis, structural and environmental testing, resin chemistry, and fire performance of materials.

In order to maintain and improve the competitiveness of composites, it is essential to improve design procedures for structures and reduce their manufacturing costs, by developing innovative procedures and improving the understanding of these materials. For example, research and development is being undertaken in universities, research organizations and industry in the following areas:

- Novel and improved materials from composite structures – fibreglass and carbon fibres are now being used in textiles
- New and more efficient processes for manufacturing composite structures, such as liquid moulding, thermoforming, automated layup
- Reducing the weight of components and increasing structural efficiency – achieved through mathematical modelling rather than prototyping
- Improved analytical procedures to optimise the design of structural components and joints, and to predict failure in both traditional laminated and novel 3D-reinforced structures.
- The durability and fire resistance of composite structures.

These technologies will create product development opportunities and have a major impact on manufacturing businesses over the next 15 years.

4.3.2 Intelligent manufacturing systems and technologies

Artificial intelligence and other machine learning strategies are being developed to provide improved these autonomous decision-making capabilities.

Advances in performance, flexibility and operating speed of machines and equipment is vital to industry competitiveness. Industry is calling for vastly improved autonomous decision making ability and real-time control strategies, which automatically adapt to changing environments and varying process requirements.

Sensor Technology is an emerging area of science and technology with tremendous industrial and commercial potential. The contribution of sensor technology in a manufacturing environment is strongly related to process

Demands for wear and corrosion resistance, higher thermal strength and toughness, lighter weight, and environmental friendliness demands will all lead to more difficult manufacturing and application of new technologies.

control. Emerging new sensors are being adapted to rapidly changing manufacturing products and processes in order to ensure quality and achieve improved performance.

Environmental laws are already forcing companies to employ process control and produce more environmentally friendly products. Global demand has triggered a search for technology solutions, aimed at clean processes and reduction of pollutants. Australian research is being directed in the product design and manufacturing stages. This research ranges from product assessment, through re-design of products and manufacturing processes to recycling and re-use strategies

The state of the art technologies associated with high speed machining and grinding of materials, future cutting technologies, and next generation plastics processing simulation are a major focus of attention and with significant implications for manufacturing over the short to medium term.

4.3.3 Micro electro mechanical systems

Micro Electro Mechanical Systems (MEMS) is considered to be an emerging enabling technology that will have a revolutionary impact on the manufacturing sector. Projected market share of this technology in the near future is considerable.

MEMS is an approach for fabricating mechanical systems with dimensions in the micron to millimetre range. MEMS fabrication has built on and extends the techniques used in the electronics industry to produce truly three-dimensional and freestanding, microscopic structures. The fabrication process based on the microelectronics industry is limited to a few materials with silicon predominating.

The major advantages of MEMS technology derive from the batch processing fabrication giving improved performance and reliability, multiple functionality with significant cost and production time reductions.

4.3.4 Robotics

With current technology, it is expensive to design and make robots smart enough to adapt readily to different tasks and physical environments. Robots are currently used on simple and highly repetitive tasks – such as automobile assembly lines. The challenge is to build in more complexity without a high investment of custom tailoring.

Companies are investigating new technologies and Internet based processes, such as genetic-algorithm software, VEC (virtual engineered composites) cells and manufacturing control via the Internet, to cut costs, decrease cycle time and deliver personalised products faster

A critical issue for small manufacturing businesses is obtaining access to new technologies

An “evolutionary” approach to robot building has been developed – using computers to conceive, test and build the configurations of each robotic system.⁴⁹

4.3.5 Internet based technologies

A recent article in the *Sloan Management Review* suggested that “technological complexity and burgeoning product variety are placing more demands on manufacturers than they can handle, even organizations that claim to have adopted lean manufacturing principles”⁵⁰.

Genetic algorithm software packages use computational software to find the best solutions to a problem by an iterative search process. They are being used in production scheduling and logistics.

VECs are transportable factories for manufacturing moulded parts from fibreglass and plastics. Moulds have traditionally been expensive and cumbersome (therefore costly) to move. VECs run a manufacturing process and provide operators with computer controls and simple visual and audio instructions that guide operators through the moulding process. The software can be upgraded and controlled over the Internet and can therefore deliver a consistent process regardless of where they are located or who is operating them.

4.3.6 Implications for small business manufacturing

Advances and developments in manufacturing technologies create opportunities for small manufacturing businesses – in terms of productivity improvement and new products in new markets. As a result of cost considerations new technologies are no longer the province of large businesses.

Awareness of new and emerging technologies is a major issue for small manufacturing businesses. Technology diffusion programs make an important contribution, but small business owners and managers should seek closer involvement with the work of research centres at universities, including the cooperative research centres.

The issue of business-university interaction is addressed later in the Report. Both manufacturing businesses and university research centres have much to gain through closer cooperation and collaboration. Regrettably, the focus of government funded research organizations, such as the CSIRO is now on “contract” research - driven

⁴⁹ “10 Emerging Technologies that will Change the World: Robot Design”, *Technology Review*, February 2001.

⁵⁰ Moody, Patricia, E, “What’s Next after Lean Manufacturing”, *Sloan Management Review*, Winter 2001.

by a cost recovery strategy. The CSIRO is becoming a R&D consultancy organization which tends only to be available to large businesses.

University research centres and faculties are beginning to change their culture from a situation where working with business was seen as peripheral to their main activities, potentially compromising “academic independence” and being a necessary burden undertaken to fund their other research programs.

There are a number of very successful collaborative research centres in science and engineering – some of which receive support under the Commonwealth’s Cooperative Research Centre Program.

Academic researchers in science and engineering are seeing career opportunities in manufacturing businesses – and faculties are looking to business for teaching input. Business owners and managers are also becoming more aware of the resources that universities can provide. These forms of interaction are some of the most effective ways to achieve technology transfer.

4.4 Food technologies

Technology development in the food industry is very much “business driven” – arising from directly market opportunities. Those market opportunities are global as well as national.

Food innovation can be segmented into at least five distinctly different groups, which have different risks and rewards according to the business focus.

- Product innovation - basically deals with the development of new products, including new plant varieties.
- Process innovation - deals with cost reduction, efficiency improvement and/or quality enhancement within a plant through new equipment or process applications.
- Packaging innovation - innovation includes both the packing material itself, and the process of packing the product.
- Transport and logistics innovation – concerned with the distribution method and time for delivery
- Chain innovation – looks at building business through supply chain competitiveness, supporting relationships that will enable non-price factors to be developed. This is especially important for international trade.

Food companies have good access to the capabilities of several universities and specialist consulting businesses.

Australia is well served in capacity and capability in food technology. The major challenge is transferring that technology into marketable products and services.

Technology convergence in biotechnology and materials sciences may be almost equally pervasive and revolutionary as the information technologies

Small and innovative food processing and manufacturing businesses are constrained in their access to some technologies due to cost recovery policies of institutions and research organizations.

4.5 The convergence of biotechnology and advanced materials technologies

As we move into the new millennium, it is becoming apparent that technologies which can create and structure materials and products at the atomic level - nanotechnologies – will have a major impact in manufacturing

In areas as diverse as genetically customised drugs, energy storage, new materials (ceramics, polymers or structural materials), production processes, electronics and bioelectronics, technologies at or near the atomic level will provide a fundamental element of the context of advanced manufacturing in 2020.

A recent account of the biotechnology industry has predicted that the world is about to exit the Information Age and enter a new age of “bioterials”⁵¹ – a convergence of advanced materials technologies and biotechnology.

- Whereas advanced materials technologies are essentially an extension of early materials sciences concerned with creating applications for existing materials using their unique characteristics, the new science is radically different: it starts with the commercial application, then “designs” the atomic architecture of the new or improved material to meet commercial need
- Biotechnology is now being taken to include the entire area of new materials and the use of biotech processes for industrial production: this places an emphasis on the importance of biology for basic manufacturing and the rapidly developing potential for mass and customised production of health care products.⁵²

Instead of experimentation manufacturers will, potentially, be able to decide new product characteristics and use science to arrange the appropriate molecular structure. MIT and DuPont have entered a five-year multi million-dollar alliance to develop bio-based materials and processes – including alternative energy sources and bioelectronics. (Ordinary plastics are made from petroleum, producing waste and using up a finite resource - as well as taking a long time to break down and being difficult to recycle.)

⁵¹ Oliver, Richard W, 1999, *The Coming Biotech Age: The Business of Bioterials*, McGraw Hill, New York

⁵² Oliver, op.cit, p. 19

Government can assist small businesses by supporting initiatives to identify technology capability within companies and research organizations

MIT/DuPont expect to produce plastics made from cornstarch⁵³. Cargill Dow Polymers have manufactured a plastic derived from the sugars contained in corn. DuPont is also looking at DNA science to build electronic devices, one tenth the size of current devices for medical diagnostics. Significant advances are also taking place in “smart materials” used for packaging, medical and other applications that change their properties depending on environmental conditions.

Other research is underway to change the atomic design of paints, ceramics, and plastics so they are better, cheaper, faster and more useful than objects currently known about. In a number of areas, the distinction between organic and inorganic materials is beginning to blur. There is an intersection of biology and electronics in “bionic” ears, noses, etc.

Development of these technologies requires massive intellectual and financial investments in research and development. It is a collaborative effort between government, private and university laboratories. Universities and governments will play larger and more pivotal roles. Small start-up laboratories are essential for the development of the industry.

A difficulty for small businesses is that information about capability is fragmented and “locked up” in laboratories and research institutions. Manufacturing opportunities could be created by aggregating knowledge into potential investment portfolios. Existing regional networks could be called upon to facilitate the development of this information base. The Hunter Region is in the process of taking such an initiative.

The NSW Government could have a role to identify the level of investment and the capability in new and emerging manufacturing technologies in NSW universities, research organizations and small technology based manufacturing businesses - with a view to creating further opportunities for product development and manufacturing investment in the State.

From our discussions with businesses during this project, the Innovation Patent will be of substantial benefit to small businesses and will remove an important element of risk associated with marketing new products in new markets

4.6 Intellectual property issues

Protection of intellectual property (IP) is a critical issue for small manufacturing businesses that have developed new process and product technologies. The current patent system is seen as too expensive, too time consuming and inflexible. The result is that many Australian innovations, developed in a business environment, do not reach their full potential.

⁵³ The CRC for Food Packaging Science has been looking at wrapping made from cornstarch

The standard patent system requires a “significant and substantial improvement to a product, process or technology”. Many small to medium businesses are not able to sustain the investment needed to develop their innovative idea to that level. They have tended to commercialise the technology without protecting their property rights, or pushed their resources to the limit in an effort to complete the development process.

Collaborative research with university research centres and faculties has gone some way to resolving the problem by accessing relatively inexpensive resources. As indicated elsewhere in the Report, public research organisations that work on a contract research basis have not assisted in this process – and may have made the problem worse for small manufacturing businesses.

IP Australia has introduced an “Innovation Patent” to facilitate protection of IP from small businesses. The “inventive height” has been lowered to allow small businesses to protect and commercialise each stage of development. They will be able to take each incremental innovation to market and start to recoup their investments before the research project is finished. Application will be able to be done on-line. The Innovation Patent will be introduced in May 2001.

4.7 Expectations of new technology take-up

The technical changes that will really affect peoples’ lives in 2020 are much more mundane than advances in technical knowledge suggests

Predictions of aggressive consumer take-up of new products have often been wrong. First to market does not necessarily mean commercial success. These difficulties notwithstanding, leadership in innovative products has long represented one of the main sources of high quality manufacturing jobs for advanced economies. There will be successes, as well as many failures.

Within industries, technological change will tend to be evolutionary, with progressive improvements in process efficiency and productivity and added product functionality. There will be changes in factory size, less polluting vehicles and better-insulated homes. However, manufactured consumer products will be more efficient, durable and have more add on capabilities.

As has occurred consistently in the past, major changes will be associated with the application of technologies developed *outside* of the industries in which they were created to establish *new* industries.

It is common to associate a particular technology type with a specific industry sector or segment. It is clear, however, that new enabling technologies are being applied in “old” industries where they are creating major new production, distribution and service possibilities and

opportunities – such as in the production of new fibres and fabrics, newer and lighter metals, simulation, etc.

These and other new technologies are being applied in new manufacturing industry segments. Manufacturing will be called upon to manufacture new kinds of goods that have not yet been invented. However, the market potential for revolutionary new products has been consistently underestimated, for example: the telephone, computers, copiers, transistors, lasers, and microprocessors.

Apart from the impacts of biotechnology and information technologies there is a view that the impact of technological change in the economy will be relatively benign over the next 20 years. It is of interest that these two areas account for the greater part of investment activity by venture capital firms, particularly those involved in “advanced technology investment”.

Technological developments will be used to hold down costs, particularly in infrastructure – where manufacturing is an important input.

Hamish McRae in *The World in 2020* suggests that:

- Advances in electro-mechanical technology will not be sufficiently radical to make many great changes for people in the industrial world
- Electronics will be increasingly coupled with mechanical products to improve performance
- Non-electronic consumer goods will continue to be found in the home in much the same way as present
- Fabrication costs of consumer durables will continue to fall
- Social conditions will push for
 - A return to manufacture of goods that can be repaired, rather than replaced
 - Pressure for manufacturers to take back goods at the end of their life
 - Expectation of greater durability and quality in products
 - Changes will be facilitated by low inflation and low interest rates that will extend the product pay back period
- Changes in customer tastes will be increasingly impossible to predict – the greater the degree of uncertainty, the greater the need to spread and manage risk
- New technologies will not always end up in new products – technical possibility, and prototypes, are often a long way from commercial viability (eg mag-lev trains, supersonic passenger aircraft)⁵⁴

McRae argues that there have been periods in the past where mechanical technologies have suddenly advanced, such as with the steam engine, the internal

⁵⁴ McRae, Hamish, *The World in 2020*

combustion engine and the gas turbine. This is not one of them.⁵⁵

Technological advances in manufacturing will continue to boost product and process innovation, improve productivity, and enhance competitiveness. However because of Australia's small domestic market, these opportunities can only be realised in international market place. Small manufacturing businesses have demonstrated that they are very effective in accessing new markets.

4.8 Research and development in small business manufacturing in NSW

The Australian manufacturing sector is the major R&D performer in Australian industry.

The purpose of this section is to provide some information about the present status of innovation in small businesses in Australia. Notwithstanding the recognised importance of small business in innovation, most of the published statistics concerning small business give prominence to employment data and related characteristics⁵⁶.

While employment is a key economic indicator, other aspects of business activity are also important for assessing economic impact and growth potential. In the current policy and management environment, one of the critical indicators is commitment to innovation. Moreover, in the context of the "new" economy, small business "start-ups", and "new technology based firms" (NTBFs) are of considerable interest.

NTBFs have potential to grow through continuation of research and development and the support of high technology investment. This segment of the finance sector in Australia is still relatively immature, but has potential to grow with the internationalisation of US venture investors and the growing trend of Australian venture capital investors to enter into alliances with US funds.

In 1998-99, expenditure on research and development in the manufacturing sector amounted to \$1,962.6m. This represented 49.2 percent of all R&D expenditure by Australian industry.

Information concerning expenditure on research and development by firm size is provided in Table 9. The data point to high levels of R&D in chemicals, and electronic equipment sectors, which are usually associated with the application of advanced manufacturing technologies.

⁵⁵ Ibid.

⁵⁶ This issue is being addressed through an ABS survey currently underway which is collecting information about new technology based firms and access to capital.

Table 9: Expenditure on manufacturing industry research and development by firm size, Australia 1998-99 (\$'000)

	Less than 10	10-19	20-199	200 & Over	Total	Total
	\$'000	\$'000	\$'000	\$'000	\$'000	\$
Food, beverages and tobacco	372	2,562	31,112	172,031	206,077	10.5
Textiles, clothing, footwear and leather	792	1,038	11,316	6,153	19,299	1.0
Wood and paper products	553				88,913	4.5
Printing, publishing and recorded media	837	2,343	8,750	13,854	25,784	1.3
Petroleum, coal, chemical and associated product	5,141	10,769	130,202	193,417	339,529	17.3
Non metallic mineral product	1,630		3,841	48,869	54,340	2.8
Metal product	2,685	2,095	128,649	135,359	268,788	13.7
Motor vehicle and part and other transport equipment	5,501	3,937	24,229	338,177	371,844	18.9
Photographic and scientific equipment	6,773	5,453	29,079	60,939	102,244	5.2
Electronic and electric equipment and appliances	14,996	21,724	112,912	228,797	378,429	19.3
Industrial machinery and equipment	7,679	8,545	44,386	49,145	109,755	5.6
Other manufacturing	4,051	2,652	6,825	4,078	17,606	0.9
Total manufacturing	51,009	64,773	401,994	1,444,831	1,962,607	100.0
<i>Total Manufacturing (%)</i>	<i>2.6</i>	<i>3.3</i>	<i>20.5</i>	<i>73.6</i>	<i>100.0</i>	
Total R&D All Industries	180,183	190,346	1,134,943	2,486,263	3,991,735	49.2
<i>Total R & D Industries (%)</i>	<i>4.5</i>	<i>4.8</i>	<i>28.4</i>	<i>62.3</i>	<i>100.0</i>	

Source: ABS, Research and Experimental Development, 8105.0, Canberra, July 2000

The data indicate that the greater proportion of R&D is carried out in large businesses, and in particular, in the motor vehicle, electronic and electrical equipment, petroleum and chemicals, and food sectors. Interestingly, the R&D undertaken in the electronics and electrical equipment sectors accounts for the largest single component of R&D expenditure by small business. This is reflected in Table 10.

Table 10: Distribution of manufacturing industry research and development by firm size, Australia, 1998-99 (%)

	Less than 10	10-19	20-199	200 & Over	Total
	\$'000	\$'000	\$'000	\$'000	\$'000
Food, beverages and tobacco	0.7	4.0	7.7	11.9	10.5
Textiles, clothing, footwear and leather	1.6	1.6	2.8	0.4	1.0
Wood and paper products	1.1	0.0	0.0	0.0	4.5
Printing, publishing and recorded media	1.6	3.6	2.2	1.0	1.3
Petroleum, coal, chemical and associated product	10.1	16.6	32.4	13.4	17.3
Non metallic mineral product	3.2	0.0	1.0	3.4	2.8
Metal product	5.3	3.2	32.0	9.4	13.7
Motor vehicle and part and other transport equipment	10.8	6.1	6.0	23.4	18.9
Photographic and scientific equipment	13.3	8.4	7.2	4.2	5.2
Electronic and electric equipment and appliances	29.4	33.5	28.1	15.8	19.3
Industrial machinery and equipment	15.1	13.2	11.0	3.4	5.6
Other manufacturing	7.9	4.1	1.7	0.3	0.9
Total	100.0	100.0	100.0	100.0	100.0

Source: ABS, Research and Experimental Development, 8105.0, Canberra, July, 2000

Other significant R&D performing sectors are in the chemicals, scientific equipment and industrial machinery areas. The level of R&D effort in small business in the food sector is quite low.

The aggregate data substantially understate the contribution of small to medium size businesses to research and development. The Industry Commission has argued that because of the much larger number of small firms than large firms in manufacturing, small to medium sized businesses are of overwhelming

significance in terms of the *number* of technological innovations.⁵⁷

The Industry Commission estimates that 98 percent of technological innovation in manufacturing in 1993-94 occurred in small to medium businesses. However, as indicated in Table 7, the expenditure in large businesses is much greater.

4.9 Small business access to R&D capability

Many small technology based businesses require funds to support research and development in relation to product development from a technology they have developed or to acquire a technology needed for full commercial exploitation.

The Commonwealth's policy Statement, *Backing Australia's Ability*, contains a number of initiatives intended to increase small business investment in R&D and access to technologies.

While there is government assistance to support the *commercialisation* of research and development for small business⁵⁸ there are few that are directed to supporting research and development *per se*. Many small businesses finance research and product development (like most of their other investments) out of cash flow and borrowing against committed orders.

The Australian Research Council provides support through the Strategic Partnerships with Industry, Research Training (SPIRT) Program, but there is limited involvement of small business with Cooperative Research Centres. Many businesses have informal linkages with university laboratories but given that many small manufacturing businesses start off with very little cash, they have limited capacity to make up front payments for research and product development.

The NSW government should support a fund for small businesses to invest in product development where existing technologies require further development and testing prior to commercialisation.

Apart from the R&D tax concession, there is little government financial support for this purpose. The major constraints are:

- COMET does not support product development
- IIF fund managers tend not to invest in R&D
- The R&D Start program is too administratively cumbersome and expensive for small business⁵⁹ - there are very high costs in preparing and submitting applications
- The CSIRO operates on a cost recovery basis - which means that its capability is inaccessible for cash starved businesses.

⁵⁷ Australia. Industry Commission, 1997, *Innovation and Firm Performance in Australian Manufacturing*, Staff Research Paper prepared by Ribert Phillips, Canberra, p.29.

⁵⁸ For example, Commercialising Emerging Technologies (COMET), venture capital assistance provided from the Innovation Investment Fund (IIF)

⁵⁹ In many instances, the success of small businesses in achieving START assistance is the same as for bank financing.

For small technology based businesses to develop and reach their potential over the next 15 years, we consider that there is scope for government to support R&D product development and technology acquisition for small business. This should be linked with other State Government initiatives, particularly where there are opportunities for export or to link with foreign companies seeking to locate in NSW.

4.10 The attributes and characteristics that firms will need to meet the challenges

The attributes and characteristics that manufacturing businesses will need to develop to meet the emerging challenges fall into a number of categories:

- *Information technology competence* - small business managers will find that over the next 15 years they will have to fully embrace information technology in the management of their business. Information technology is now recognised for its *strategic* importance as well as its contributions to operations and “back office” support.
- *Technology awareness and access* – managers will need to identify the sources of technology competence and capability that may assist in business development and growth. State government awareness and diffusion programs and industry association initiatives can facilitate this process.
- *Access to skills* - it is also important to have a pool of entrepreneurial, educated and creative workers willing and able to take risks. Some of these people already exist within companies – but they need to be encouraged to work on projects that have a chance of technological and commercial breakthrough rather than seek security from regular salary and prestigious positions.

5 The Finance Environment

It is possible to think of today's financial system as a global system, similar to the Internet, that can be freely accessed by any firm that has standardised software and trained personnel necessary to "hook up".

In principle, equity finance is the most efficient way for small business to finance higher-risk investments. It allows the investor to share the upside risk, and helps the firm avoid the cash flow problems associated with debt finance.

Technological advances in telecommunications, data processing and computing, beginning in the 1960s, have dramatically reduced transactions costs for the financial services industry.

Advances have stimulated innovation of new financial products, new markets and institutional arrangements.⁶⁰ These include financial futures, "swaps", mortgage backed securities, exchange traded options, "junk" bonds, shelf registration, asset based financing, MBOs, and LBOs.

Rather than creating their own set of institutions, countries can concentrate their limited resources on developing the financial and technological expertise needed to access the global financial network⁶¹. Increasingly, the global system is becoming accessible to small and growing businesses.

5.1 Finance for small to medium businesses

Businesses in their start-up and early stages of development will usually need to obtain external finance, but they may face significant problems in obtaining it. Technology intensive firms face particular difficulties in obtaining finance in subsequent stages of their growth and development. Small businesses also require access to working capital to finance their ongoing operations.

For the majority of small businesses, savings, family and friends and bank finance, in the form of secured loans, provides the most important source of external finance. Personal credit cards are also an important source of finance for small business. There are many successful small businesses in Australia that have been financed through sale of the family home – such is the level of commitment and passion of an entrepreneur.

Cash flow is also a major source of finance for small business development. It is also one of the main parameters that bankers and investors now look for in considering financing options. A very large amount of small to medium business investment is financed from cash flow rather than borrowing or equity. However, current taxation provisions effectively penalise this form of financing. The proposed "cash in cash out" method of

⁶⁰ Crane, Dwight B. et.al., *The Global Financial System: A Functional Perspective*, Harvard Business School, Boston, 1995., p. 6

⁶¹ *Ibid*, p. 12.

taxation proposed by the Ralph Committee would address this issue.

Loan finance does meet part of the financing needs for technology-based businesses, but it is normally not a suitable form of finance for technology-based firms at start-up and early stages of their development. This is because:

- Such investments are often perceived to be high risk in nature; but loan providers will not normally share the upside of the investment to compensate for the perceived risk
- The long lead times of some investments mean that firms can face difficulties making regular payments to service the debt.

Nevertheless, in practice the majority of small businesses use debt finance at some stage in their life, because the use of bank overdrafts can be an important way of meeting short-term financing needs, such as working capital. More often than not, these loans are secured with personal assets.

5.2 Venture capital finance

Venture capital has made an important contribution to financing the technology based firms in the US, Israel and many other countries. Government support has also encouraged early stage investing in Australia.

5.2.1 Venture capital and the “new” economy

From about 1995 in the US economy, there was a rapid increase in the number of start-up companies, financed by venture capital investment. These forced existing firms to move faster, adopt new technology and cut prices.⁶² The circumstances, were, however, very much unique to the US:

The key in every case was the same: cutting-edge Internet technology plus the financing to mount a credible challenge. Unlike any other country, America had a vigorous venture capital industry that was not just willing but committed to financing innovative start-ups. Unlike any other country, America had pension funds, university endowments, and other large institutional investors not just willing but anxious to channel their money into venture firms that funded new businesses. And unlike any other country, America had a vibrant IPO market not just willing but eager to buy shares in businesses of the future.⁶³

The high risk, high return start-up and early stage technology-based manufacturing businesses have attracted, and will continue to attract funding from venture capitalists.

⁶² Mandel, Michael J, *The Coming Internet Depression*, Basic Books, New York, 2000, p.15.

⁶³ *Ibid*, pp15-16

The rapid emergence of the “new economy” in this context has been based on the combination of technological innovation and access to risk capital. The financial markets have been an essential part of the process of driving innovation and productivity forward. With the possibility of big gains from innovation, the incentives changed to make it much more profitable to invest in high risk businesses.

These developments were made possible by the emergence of a new set of financial institutions – extensive networks of well-financed venture capital firms, deep and liquid stock markets able to absorb IPOs and the availability of stock options to motivate workers.

The US style venture capital fund is seen as the great financial breakthrough of the 20th century.

The “old” economy accessed the financial markets to support investment in physical capital (factories, equipment, etc) while the so-called “new” economy uses the financial markets to finance innovation. This is the critical difference between the old and new economies.

The “new” economy is under challenge at the moment as the bubble burst on funding Internet companies with unsustainable business models. Venture capital investors, who have traditionally achieved returns through capital gains, often based their investment in a management team and an imaginative technology. They are now also looking at the capacity of a business to turn a profit.

Recent assessments have pointed to a “basic truth” that the new economy was all about productivity gains – and still is.⁶⁴ Notwithstanding the dot.com mania, the new economy has involved “old” economy corporations embracing new technologies and enhancing their performance. Many of these breakthroughs are based on Internet technologies financed through venture capital investment.⁶⁵

The main reason that Internet company valuations soared was that investors initially believed that only start-ups would be able to harness the productivity enhancement of information technologies. “When old economy companies demonstrated that they could implement the same technologies, they realised their mistake”⁶⁶. The benefits of ITC breakthroughs have accrued to the big users – not to companies with unorthodox business models.⁶⁷

⁶⁴ *Business Week*, January 22 2001, p.60

⁶⁵ There is a view that the Internet technologies would have been developed without venture funding – but it would have taken longer.

⁶⁶ *Ibid*

⁶⁷ This followed a period in the 1980s and 1990s when companies were concerned about the lack of impact of ITC on productivity.

Australia has a strong and rapidly developing formal venture capital market. However, much of the growth in the size of the market has been dominated by management buy-outs and buy-ins (MBO/MBIs).

Over the next 15 years it is likely that there will be many Australian technological inventions that will require venture capital for their development. Access to this form of finance will depend critically on what is done to "globalise" the Australian venture capital sector.

5.2.2 Venture capital in Australia

In terms of the relationship between technological innovation and risk capital, Australia has not really participated in the emergence of the new economy. This has been a major concern for policy makers and business leaders. In the US, the main drivers of the new economy have been small technology based innovative firms, financed by risk capital, as well as large firms adopting these new technologies.

While there is no shortage of technological invention in Australia, our venture capital sector is relatively immature, although it has come a long way over the last five years. In general, however, early stage funds are small - limiting the capacity to make large investments and diversify risk. Some technological inventions have been financed in the US, through US venture funds. With some notable exceptions,⁶⁸ venture capital investors lack the knowledge, experience and networks to invest in high technology areas.

The further development of the new economy in Australia, involving the finance of small high technology businesses, will be associated with the globalisation of the US venture capital sector and venture strategies of the large IT, the pharmaceutical companies and traditional manufacturing companies moving into the "life sciences" business.

At the moment, US venture capitalists tend to invest "close to home" where they keep an eye on their investments. They are, however, looking to Asia and Europe. To attract the interest of the US venture funds and corporations in Australia there are, however, other issues associated with taxation and the corporations law that need to be addressed.

Australian venture capital funds must develop strong linkages with US funds for investment in advanced technologies. Any statutory and taxation limitations on US funds investing in Australian companies should be removed.

5.3 Development capital

Development capital is equity finance available for business expansion and to finance buy-outs and buy-ins. Australia has a well functioning development capital sector with many financial institutions involved. Some function as venture capital firms, investing on a portfolio and funds basis, whilst others are part of the more general investment-banking sector.

⁶⁸ One Australian venture capital fund has established linkages with the US venture capital and IPO markets and is actively investing in start-up technology businesses.

The maturity and liquidity of the development capital market will provide opportunities and incentives for owners and managers to invest and build their business with a view to a more reliable exit strategy over the next 15 years.

“Business Angels” are experienced investors providing equity capital. They tend to invest in areas where institutional venture capital providers are reluctant to commit.

There is a very limited supply of development capital through State government owned development corporations. The Australian Industries Development Corporation ceased active investing in 19xx and the experience of the Victorian Economic Development Corporation has been salutatory for other Governments. There is also a view that the private financial market now caters well for this asset class.

Owners and managers of manufacturing businesses wishing to sell often seek development capital to put the business in a position that will be more attractive for public listing or sale to another company. The development capital market in Australia is well serviced with late stage venture capital funds and investment banks. The major problems in this area remain in the early stages of a company's life-cycle.

5.4 “Informal” venture capital

Informal venture capital is a term used to describe investments by private individuals (“business angels”) made either independently or in a consortium. They tend to have substantial wealth and experience in business as entrepreneurs and senior managers.

Research in the US and UK indicates that the informal venture capital sector provides substantially more finance for small and growing companies than the formal venture capital sector.

Business angel investments exhibit the following characteristics:⁶⁹

- The amounts invested tend to be relatively small, between \$10,000 and \$500,000 – well below the threshold of typical venture capital funds
- They are predominantly in start-up and early stage ventures.

Venture capital fund managers also invest in start-up companies as individuals rather than through a formal fund.

Business angels are more likely to be a source of long-term patient capital than many venture capital firms. They tend to take an active part in the management of a company, particularly in relation to strategy and market development. This contrasts with the monitoring and control contribution of the venture capital fund manager sitting as a member of the Board of a company.⁷⁰

There are a number of business angel networks in Australia that seek to match entrepreneurs with

⁶⁹ Industry Commission (1997), *Informal Equity Investment*, p.12

⁷⁰ Ibid.

investors. There are also numerous Internet “marketing” services than can be accessed.

US data indicates that private individuals account for just under half of seed funding for new companies. Formal venture capital becomes more critical at the development and expansion stages.

Unfortunately in Australia negative gearing provisions encourage private individuals to invest in property rather than in innovation. Negative gearing and the tax-free status of capital gains on residential property also pushes a large amount of private capital investment in this area.

5.5 Corporate venture funds

Large technology companies in the US have established venture funds to support the development and growth of entrepreneurial companies, particularly in the start-up stage. It reflects a process of technology integration and recognizes the difficulties that large corporations have in creating an innovative environment within corporate bureaucratic (command/control) structures.

Corporate venturing is not common in Australia. The Telstra Development Fund, established as a Pooled Development Fund, had linkages with the Telecom Research laboratories, is no longer active. It invested \$12m in 70 companies over a ten-year period.⁷¹ Telstra was a driving force in the development of the Australian electronics industry. Other Australian public utilities have also made substantial investments in technology development.

The lack of a corporate venture funding capability in Australia is a sharp contrast between Australian manufacturing companies and their overseas counterparts (or parents).

Recently US and European corporate venture funds have been active in investing in Australian technology based businesses. It is a strategy that allows the host corporation to manage a series of “investment options” for acquiring new technology.

Corporate venture investment may become increasingly important as large corporations seek to squeeze out the independent venture capitalist and high technology investors.

Small entrepreneurial companies, and local industry in general, is severely limited by the relative lack of risk capital supplied and managed by large manufacturing companies as a means of entering new technologies and markets

⁷¹ *Australian Venture Capital Journal*, September 1998.

Over the next 10 to 15 years we are likely to see a much more active role of universities in the commercialization of research through equity investment and corporate partnerships.

Given the changed environment and more promising outlook for start-up companies, the ASX has decided to wind down the operation of the Enterprise Market with operations ceasing on 30 April 2001.

Easier listing requirements will provide an enhanced capacity for small manufacturing businesses to access equity capital.

5.6 Universities venture funds

University commercialization arms support the commercialization of research outcomes from within their universities. Their main role has been to license and market technology through companies established for that purpose.

A number of Australian universities provide assistance, in the form of equity, to inventors who wish to establish a start-up company. Other institutions, as well as faculty members, see a potential for a conflict of interest where scholarly research might be skewed by potential financial gain. Experience has demonstrated that there is a critical role for independent business advisers in this area.

The greater the extent to which University based technology can be commercialized within NSW, the greater the opportunities for wealth and employment generation.

5.7 Australian Stock Exchange

5.7.1 Enterprise Market

The ASX began the development of an internet based Enterprise Market in 1997 with the purpose of bringing together venture capital suppliers and small to medium size companies seeking equity funds. It aimed to do this utilizing the expertise of the many 'intermediaries' such as accountants and lawyers who would verify the business opportunity.

When the Enterprise Market was launched March in 1998, there were limited opportunities for start-up enterprises to gain access to funding. Since then, the global and Australian venture capital market has grown substantially, admission criteria for listing on the ASX have been altered to facilitate entry for smaller, new companies and other companies have established substantially similar services to that provided by the Enterprise Market. The Market has now closed.

The Enterprise Market is one of many Australian based introduction services that have closed. It points to the difficulty of establishing and operating business introduction services in terms of both affecting matches and doing so on a profitable basis.

5.7.2 Public listing

Admission criteria for listing on the Australian Stock Exchange (ASX) were altered during 1999 to make it easier for small businesses to access funding.

The public sector has taken an important role in supporting new innovative and technology based firms by making it easier to access equity capital.

Changes meant that new companies with a value down to a \$2 million NTA no longer had to satisfy the Binding Contracts Test. Instead, a less stringent Commitment's Test was deemed sufficient to allow the companies to enter the ASX. The changes have enabled approximately 120 companies to take advantage of the opportunity to raise capital to assist with growth.

5.8 Public sector role

The public sector has implemented a number of initiatives aimed at improving access to equity capital. These should benefit small manufacturing businesses. The main contributions have been the Pooled Development (PDF) vehicle and the Innovation Investment Fund Program.

5.8.1 Pooled Development Funds (PDFs)

The Commonwealth Government introduced the PDF scheme in 1992 to provide new equity capital in Australian resident companies that had total assets of less than \$50 million and were seeking funds to expand production or markets.

The guidelines were recently revised and information is available in the 1999-2000 Budget documentation.

5.8.2 Innovation Investment Funds (IIFs)

The Government introduced the Innovation Investment Fund (IIF) program to remove financing bottlenecks experienced by small technology based firms, ensuring that Australian innovations flow directly to the economy. The program is intended to help small, technology based firms access venture capital for growth and expansion⁷². The intended effect of IIF funding is to reduce cost and risk to the venture capital investor through the mechanism of government contribution.

5.8.3 Recent initiatives

The Government announced in the recent Innovation Statement, *Backing Australia's Ability*, that it would support the establishment of "seed funds" for the commercialisation of technology.

⁷² Australia (1997) *Investing for Growth*,

5.8.4 Other publicly supported venture capital funds

During the early 1990s, the Commonwealth Government provided support for the establishment of venture capital funding initiatives, such as:

- Australian Technology Group – which had a focus on seed and start-up investments
- Australia Multimedia Enterprise – acquired by Allen and Buckeridge.

There have also been a number of state government supported venture funds managed by economic development boards and corporations. In the US, State and Local Governments support venture funds of various forms.

5.9 The attributes and characteristics that firms will need to meet the challenges

Small business has a range of financing options – the main problem however is that the finance is usually not available when it is most needed. On the other, investors are keen to invest when success has been achieved.

Investors, whether providing equity or debt, are interested in what is now termed the “value proposition” – how value will be created through the productivity of the capital investment that is made. In addition to this fundamental issue of return on investment, investors also look at other factors such as:

- The risks and how these will be managed
- The partners in the investment and the extent of the product range
- The actual marketability of new technology products – notwithstanding spectacular successes, there are many inventions and innovations that simply “will not sell”
- The actual and potential size of the market
- The industry, its size and likely competition
- Commitment to innovation and continual product development
- Alliances and strategic market networks (“What do they know, who do they know, and who knows them?”)
- The availability of management teams with the executive, financial and marketing, capacity and capability to plan, organize, manage and sustain businesses.

Investors invest as much in the management of a company as they do in the technology and product.

One of the critical factors in accessing finance is ensuring that small business owners have access to competent, expert and independent advice. In high technology investing, there is also a role for “honest brokers” to sit between the investor and the investee.

Indications are that funds will be available for investment in small business ventures, but that the investment appraisal process will be even more rigorous.

6 The Market Environment

Global market opportunities create a bright future for small business manufacturing in NSW

The globalisation of business and industries will have the most pervasive impact on the future of manufacturing in Australia over the next 15 years and beyond.

The market environment for all businesses is undergoing rapid change. These changes create major opportunities for small business as the impact of globalisation, electronic commerce and the Internet chip away at the traditional advantages of scale and scope in markets and market access held by large, multi-national corporations.

6.1 Globalisation

In 1999 it was estimated that truly global markets produce and consume about 20 percent of world output (\$US6 trillion of the world's \$US28 trillion Gross Domestic Product (GDP)). Over the next 30 years, as global GDP expands to an estimated \$91 trillion, global markets are expected to multiply 12 fold reaching 80 percent of world output.⁷³

Globalisation is both a business issue, through integration of companies across national boundaries, as well as an economic phenomenon. The main factors driving globalisation have been:

- Trade liberalization
- Scale and scope economies
- Freeing up capital flows
- Management and organizational innovation
- A recognition by governments that foreign direct investment (FDI) is important to sustained growth.

These factors have created the framework for the development and growth of "multi-national" corporations that operate and compete on a global basis. The following business issues are approached on a global basis:

- Investment choice
- Access to human talent
- Markets
- Research and development.

Only seven of the *Fortune* 500 corporations are headquartered in Australia. Most are in mining and services sectors. Only one, (BHP) has any manufacturing interests. However, manufacturing is one of the industries that is becoming increasingly global in its orientation and organization.

⁷³ Bryan, Lowell, and Fraser, Jane 1999, "Getting to Global", *McKinsey Quarterly*.

Corporate size is not the only (or most important) measure of a global company.

Being global involves a commitment to global markets and to operate, to the greatest extent possible, as a local company – that is, responding to local demand conditions, consumer preferences and ways of doing business. A truly global company would be one that wherever it operated, people would think it as a local company⁷⁴. In this respect, many small and medium businesses can be, and are, global in their orientation.

Large multi-national companies used to be able to rely on the high cost of capital and technology to protect themselves from competition – as well as close relations with governments around the world. The cost of capital and technology is now falling, start up technology-based companies have access to venture finance (see Section 5.3 above) and a rules based system of trade is making ties with government less important.⁷⁵

Under these circumstances, the advantage in global markets is shifting from incumbents to innovators – opening up the “space for competition”. As is discussed in Section 7, large multinational companies are finding that it is in their interests to collaborate with innovators through various forms of partnership and alliance. *This trend places small business squarely in the globalisation frame.* Development and maintenance of these relationships is facilitated by communications and information technologies.

Globalisation is closely associated with a country's capacity to innovate in the following ways:

- It provides the opportunity to create and satisfy profitable customers in new ways – in new locations
- Global companies are, increasingly, looking to strategic alliances for innovation, flexibility and access into national markets
- Being global is not a function of business size.

Australian manufacturing businesses have not been seen as being committed to, or being part of, the global economy.

Kenichi Ohmae, writing in 1995, says that Australian managers tend to suffer from Asia phobia. He argued that if a country like Australia keeps the global economy at arms length, its resources will, over time, become commodities, and commodity prices inevitably fall.⁷⁶ Ohmae adds that growth also depends on:

. . . creating and leveraging value-adding economic linkages that ignore political borders, not on ruthlessly stamping them out in the name of “national interest” as an insult to the prerogatives of sovereignty. A

⁷⁴ According to this definition, there are few global companies. Large companies, such as GE, Ford are identified very strongly as US companies: they are “multi-national corporations” rather than global. See FT.com, “Davos 2001 – Management”.

⁷⁵ Wooldridge, A., “Global Warriors Strike Back”, *The World in 2001*, Economist Publications, 2001, p.113.

⁷⁶ Ohmae, K., 1995, *The End of the Nation State: The Rise of Regional Economies – How Engines of Prosperity are Reshaping Global Markets*, Harper Collins: New York, pp 61-2. Ohmae noted that only 14 of Australia's largest 100 companies had a representative in Japan

closed economy model makes cities and regions rivals with each other. This is because the cities and regions feel that they are competing for a larger share of the same pie. The nation state solution assumes a “zero sum” game for limited resources. The region state model, open to the global economy, is a “plus sum” as prosperity is brought in from without.⁷⁷

Until very recently, Australia’s large companies have not focussed on new products and new markets to the same extent as US, European or Japanese corporations. This reflects not so much a lack of opportunity, through research capability and new product development, for example, but in the management capacity, capability and ability of Australian companies to focus on global market opportunities. Australian companies have tended to have a “commodity” and “economic” approach to export. Without a strong “value proposition”, these companies have been take-over targets.

6.2 Globalisation and the opportunities for small business

Globalisation provides major opportunities for small business in new markets and as alliance partners in local markets.

There is now a realisation that business relationships are as important to gaining international market access as good product quality and price competitiveness. There are two critical issues in this respect:

- Trade is negotiated between people and organizations that make business decisions - as well as being conducted in markets where consumers make economic (consumption) decisions
- As is pointed out in Section 5, electronic commerce makes personal relationships even more critical to business success.

It is becoming increasingly clear in the new environment, that international trade is not the province of large companies. It is therefore important for small business to be aware of market opportunities and build on these developments and enter the network of global manufacturing and supply chain alliances and partnerships.

In this environment the Commonwealth Government has a role to facilitate trade by negotiating bilateral trade agreements that clarify the rules and the basis on which trade will be conducted. “Free trade” is no longer an issue in terms of removing tariff barriers. The constraints are “technical” in nature and relate to market access and removing regulatory constraints that prevent products being sold in overseas markets.

A number of Australian small businesses, and NSW companies in particular, have been successful in global

⁷⁷ Ibid, p.62.

Small manufacturing businesses have a number of advantages

markets through the process of becoming known and establishing relationships with importers, retailers and consumers. They have committed to becoming aware of market conditions by establishing a presence and regular program of contact and visits – thus engendering trust and understanding of business conditions. These strategies have been a major criterion of business success.

Small manufacturing businesses have a significant advantage in entering new markets. In particular, by not carrying a large amount of “corporate baggage” they can respond and adapt more easily to local conditions. In addition, incumbents do not see them as a threat – and are quite often willing to collaborate if they are filling a gap.

The Department of State and Regional Development and Industry and Business Associations should give priority to informing and assisting, where appropriate, small business owners and managers becoming aware of international market opportunities and strategies for realising those opportunities

Traditionally, individuals and micro businesses have been associated with high levels of entrepreneurship and innovation. The way in which these business units interact and relate to large businesses is an important issue in overall business development and growth.

6.3 Product specialisation

A recently published McKinsey study, *Race for the World*, suggests that in 20 years the forecast \$US50 trillion of globally integrated economic activity will allow for an extraordinary degree of specialisation – allowing, perhaps, for 5,000,000 tightly defined “global nanostructures” representing \$US10m of production each.

These nanostructures are referred to as “slivers” – a specialised product, or service, that is economically viable at the global level. McKinsey suggest that companies that are successful in delivering slivers to an ever widening market do so by developing infrastructures specifically geared to the task. These structures are different from traditional industry structures:

- Traditional industry structures were built by integrated companies that controlled or owned every aspect of the value chain
- Micro industry structures are complex webs of alliances, counter party agreements, standards and protocols that allow companies to participate in a discrete element of the value chain without owning the whole thing.

An example of this pattern is in the medical devices industry where a series of global micro industries deliver “slivers” to multiple local markets – the world’s global health care providers. While patient care is local, the knowledge of medical practice is global in orientation. Discovery, which lies at the heart of medicine and any

new procedure, is spread rapidly. The most global aspects of health care delivery are pharmaceuticals and medical devices. In the areas of drug discovery and medical devices, Australia and NSW has a distinctive capability.

There are a number of companies in NSW that have developed specialised products for the global market.

6.4 Mass customisation

Electronic commerce and the Internet has actually *increased* the need for a specific customer focus:

- It provides the opportunity to meet customer needs specifically and directly
- Customers can, and do, switch easily to alternative suppliers.

In an environment of *mass customisation*, the task is not only to make a new product, and identify potential demand, it is also important to identify how it will be marketed and, where necessary, the substitute products that it will replace.

The current market environment is sending a consistent message: focus on the main factor factors associated with success – “creating and keeping customers”. Such a focus draws attention to management capabilities, and particularly, entrepreneurial and marketing management.

For Australia, which has a small population and low population growth, new customers will be located in the mass markets of North America, Asia and Europe.

Moreover, successful businesses are those that have worked out how to meet a customer need – as distinct from selling a product. The product is often part of a wider experience that a customer is looking for.

6.5 “Trusted agents” and “honest brokers”

Small manufacturing businesses have achieved success in global markets by not only establishing a presence but also identifying and working with agents who take a keen and committed interest in the business and its products. As indicated previously, business is conducted not only on anonymous market transactions: it is conducted between people and organizations who rely on trust, integrity and commitment.

Austrade has performed a highly valuable function in identifying business partners for Australian firms to work with in overseas markets. Global professional services firms and industry associations also provide market

Global linkages, through export, venture capital, foreign direct investment, bi-lateral trade agreements, etc, are thus essential for business success

Regional business networks and industry associations have an important role to play in the provision of trade advisory services.

advice and intelligence. Unfortunately for small to medium business, Austrade has adopted a cost recovery approach to provision of market advisory services. Interestingly, however, the US Departments of Agriculture and Commerce provide a great deal of international market information on their websites.

There is a plethora of information available about market access and people able to assist in distributing it. The problem for small business is obtaining *specific advice* upon which a business decision will be based. There are also numerous people and organizations willing to provide that advice – but not all have the knowledge and experience relevant to specific business needs. With the emergence of the new global trading environment, access to competent advice will become increasingly critical.

6.6 The attributes and characteristics that firms will need to meet the challenges

Specific attributes and characteristics that firms will need to develop include:

- *Awareness of the business environment* - small businesses need to become aware of the *global* market environment. This involves not only developing export opportunities but also exploring opportunities for domestic production, under license, of global brands.
- *Familiarisation with markets by making regular contact and following up* - the amount of information about the business environment is immense. Regrettably many of the Australian based business magazines tend to be parochial and political in their orientation. Globalisation is a fact of economic and business life – and in order to embrace it, it must be understood.
- *Building ongoing relationships with distributors and retailers in target markets* - business relationships develop in an organizational context. Trade and commerce in manufacturing is increasingly based on trust and ongoing commitment. A high level of trust takes time to build and can be quickly eroded.
- *Committing to quality, consistency and continuity on a continuing basis* – in the new market environment, quality is not a distinctive capability – it is a given, a condition of market entry. Businesses must have an unswerving commitment to product quality on a consistent and containing basis.

7 The Business Environment

You can drown yourself in new economy Web sites, magazines and TV programs, and still not learn a thing. The Internet is a new and ever-changing phenomenon. Advice that seems fundamentally sound one day can be completely wrong the next. In the end, no-one knows exactly how e-business will evolve, and there are plenty of talking heads out there who are simply dishing out sound bites to get their fifteen minutes of fame.

"An Entrepreneurs Survival Guide", *Red Herring*, 91, January 30, 2001.

Much has been written about revolutionary changes in the way business will be conducted with the widespread introduction of electronic commerce and the Internet.

Many of the claims made about change in the business environment are seriously overstated. Some clearly reflect the commercial interests of the proponents – those who seek to gain business by sale and installation of e-business solutions. There is no doubt, however, that there will be some profound impacts of the new communication medium, although the extent of change in by no means clear.

An experienced business observer and commentator has identified the following enablers as representing the essential building blocks in businesses of the future:

- Growth in implementation of networked business strategies
- Expansion in digital and other intellectual assets
- Continued technological innovation and the use of standards.⁷⁸

These enablers apply across all industries, including manufacturing. They form the basis for the analysis in this Section of the Report.

7.1 Small business intentions

The Global Enterprise Monitor (GEM)⁷⁹ study for Australia has pointed out that only a very small number of medium to small businesses in Australia could be described as entrepreneurial. A very large number of business are "life-style" businesses.

Respondents on the 1998 business longitudinal study were asked to indicate their business intentions over the next three years. The data indicating proportion of firms with particular business intentions are summarized in Table 11.

Not all small businesses will become "businesses of the future".

⁷⁸ Cortoda, *21st Century Business*, p.20.

⁷⁹ Hindle, etc

Table 11: Business Intentions, 1997-98

Firm Intention	Micro	Other Small	Total Small	Medium	Large	Total
	%	%	%	%	%	%
Significantly increase production/services	22.2	35.0	26.4	50.9	50.8	28.0
Maintain existing production/services	49.7	49.3	49.6	38.6	41.0	48.8
Significantly decrease production/services	4.0	1.5	3.2	0.8	0.6	3.0
Open new locations	2.4	7.3	4.0	20.8	23.7	5.2
Close new locations	3.5	1.9	3.0	3.2	18.8	3.0
Maintain or commence exporting	2.2	2.5	2.3	6.6	16.3	2.6
Introduce new goods or services	10.7	22.9	14.7	34.1	33.3	16.0
Sell the whole business	9.3	7.7	8.8	6.5	2.3	8.6
Open the same business elsewhere	7.8	1.8	1.8	2.8	1.7	1.9
Sell equity in the business	1.2	4.0	2.1	9.1	6.1	2.6
Close the business	8.0	2.7	6.3	2.1*	np	6.0

Source: *Portrait of Australian Business*

Increasingly, small firms are participating in networks in order to capture the advantages of scale and scope without the downside risks associated with sudden changes in business conditions.

The data in Table 11 suggest that small businesses generally wish to maintain their current scale of activities and few intend to introduce new goods and services. The data suggest that medium and large businesses are the drivers of growth. This observation must be qualified to the extent that large businesses may be pursuing growth through alliance and sourcing arrangements with small businesses.

The information should not be construed as reflecting adversely on micro and small firms. Many small firms do not wish to expand because of the costs and risks involved. Moreover, it is arguable that the contribution of small business to economic growth will come not so much from small businesses growing into larger businesses, but a growth in the number of innovative and entrepreneurial small businesses. (see Section 6.3 above).

Small see advantages in participating in business networks involving both small and large enterprises. Increasingly, they are electronically based.

7.2 Electronic networks

Electronic networks allow information to be shared instantaneously and inexpensively among many people in different locations, provided they have the necessary knowledge and skills to interpret and use it – a capability that is by no means inexpensive to generate. It also allows for decentralized decision-making and the elimination of bureaucracy. Some see these trends resulting in fundamental changes in the way business is done, with major implications for small business. For example

- Electronic networks allow autonomous micro-businesses to tap into the global reservoirs of information, expertise and financing that used to be available only to large companies
- There will be an important role for brokers who act as conduits between the micro-businesses and markets

Electronic networks have facilitated the emergence of new forms of work organization and have the potential to fundamentally change the way work is done. The basic unit in this scenario is the individual, or micro-business, not the corporation, working in fluid and temporary networks to develop, produce and sell products and services.

- Supply chains will become ad-hoc structures, assembled to fit the needs of a particular project and disassembled when ended
- Manufacturing capacity would be bought and sold in an open market and independent, specialized manufacturing concerns would undertake small batch orders for a variety of brokers, design shops and consumers
- Brokers or companies that owned brands and certified quality of merchandise would undertake a marketing function.

This view is highly idealized and the industrial organization landscape may in fact emerge in ways not yet foreshadowed. There is, however, one critical factor - the establishment and acceptance of a set of standards reflected in classes of agreements, specifications and common architectures. Standards may be set by either established companies or by new entrants.⁸⁰

John Chambers, CEO of Cisco systems has identified the "network effect" - the integration of employees and suppliers so that they appear as one virtual company to customers – as having a most profound impact on productivity, and the pace at which an economy can grow without stimulating inflation⁸¹.

7.3 The impact of the Internet

7.3.1 Opportunities

The network effect is facilitated by information technologies and the widespread availability of high-speed communication. The Internet, which is a network of networks, provides that communication capability. The Internet is essentially about moving large amounts of digital information over vast distances at "the speed of light". Chambers argues that:

The countries and companies with robust, standards based IT infrastructures lead in the implementation of Internet based applications and business models. They are already far ahead in terms of redefining business and government processes, as well as in the creation of new value for customers and constituents alike.⁸²

The capacity of the Internet to deliver the opportunities of the "network effect" is determined by available bandwidth. A major problem for Australian small business is the unavailability of high speed access

⁸⁰ MS-DOS and subsequently Windows, established as the industry standard by Microsoft

⁸¹ Chambers, John, "You ain't Seen Nothing Yet: How ready is your Country for the Network Effect?", *The World in 2001*, Economist Publications, London, 2000, p.119.

⁸² Ibid

Large firms have responded to competition by opening up the possibility of collaborative arrangements with firms that are in that competitive space.

The fundamentals of good businesses are just as important on the Internet. Overall in 2000, most Australian businesses believe that having a web presence has positively impacted on their brick-and-mortar operations.

and/or the very high cost. Small businesses located in technology parks, particularly those near universities, have a major advantage in this regard.

It is important to be aware, however, of “one size fits all” proclamations⁸³. Companies can only operate in a virtual mode when the performance of their products is more than adequate for what customers need – so that some of their activities can become standardized.

The Internet allows companies to establish direct links to customers, suppliers and distributors to complete transactions or exchange information more easily. Significantly, technology allows small companies to bypass others in the value (supply) chain and, potentially, to develop and deliver new products and services to new customers. In this way, the Internet has also allowed smaller companies to “nibble at the margins” in the markets of larger businesses.

7.3.2 The Australian position

Australian research, contained in the recent *Sink or Swim* study, has indicated that awareness among small to medium businesses of e-commerce is almost universal, but many businesses have little strategic sense of its relevance or benefits to their business.⁸⁴

Adoption of e-commerce solutions was found to have more to do with particular features of a business and its organization and structure rather than the industry sector. Resistance stems from satisfaction with well-established, existing business practices and an inability to see the benefits to the business from the Internet.⁸⁵

The study concluded that businesses that are slow to adopt computer technology are generally micro-businesses with neither the time, resources nor interest in adopting e-commerce. The businesses that are using the Internet to transact business on-line are seen as the innovators in their industries.

Many businesses have difficulty in seeing the benefits and have little incentive to make the investment of time and resources. There is also a view that customers are not ready and a concern over the cost of transition.

The study reported that businesses in rural Australia have a strong sense of how the Internet can benefit them, particularly in terms of access to new markets. They were concerned, however, about disintermediation

⁸³ Christensen, Clayton M., “Perspectives: Limits of the New Corporation” *Business Week*, August 28, 2000.

⁸⁴ National Office for the Information Economy, *Sink or Swim: Small Business Attitudes to Electronic Commerce*, Canberra, 2000, p.3

⁸⁵ *Ibid*, p. 4

and limited access to quality assurance and strategic advice.

A study completed in December 2000 confirms that while Australian businesses are increasingly establishing an eCommerce presence (up approximately 50 percent since the start of 2000), maintaining fundamental business principles such as timely service and quality control are essential for e-business in retaining customer loyalty.

Businesses are often motivated by the need to keep up-to-date with technology and a fear of lagging behind competitors. In addition to traditional sales and marketing channels, use of the Net in business settings is generally being used for communication and research purposes, including competitor analysis. Of all the industries, manufacturing in particular has been quick to adopt the Internet to benchmark pricing against their competitors. Also, the importance of the Internet in day-to-day business operations is highlighted by the fact that over half of businesses with Internet access, provide it to all employees.⁸⁶

Approximately 18,000 Australian websites had eCommerce facilities. Of these, approximately half were established from January to June and it is predicted to double in the next twelve months.

The most commonly cited barriers to doing business online are the lack of personal contact, security concerns, and the lack of technical know-how among customer base. Conversely, efficiency is the primary benefit for doing business online, from both a supplier's and customer's perspective.

Retaining customer loyalty is a key issue for online businesses selling to other businesses. Half of the businesses that purchased online in 2000 have already switched suppliers. The preference for returning to use the same supplier for eprocurement appears to be provisional on price, customer service and reputation.

Face-to-face relations have been found to be important among businesses selling expensive, higher-level goods and services, when targeting top tier customers that account for significant portions of revenue and among businesses in which employee job satisfaction is driven by customer relationship management.

7.3.3 Barriers and constraints

It is of some interest that recent US based research indicates that small companies are more likely than large ones to use the power of the Internet on their internal operations. Many large companies find barriers to e-business as a result of the "drag" of long time employees, competition between business units, leaders who *still* don't use computers and technical support staff that do not have the experience or capability to support both web projects and the needs of individual users.⁸⁷

⁸⁶ Redc Sherriff On-line

⁸⁷ Kanter, Rosabeth Moss, "You are Here", *Inc*, February 27, 2001, p. 87

In 15 years time, the influence of long time employees will be lessened through retirement and/or redundancy. However, competition between business units and barriers to sharing of information will continue in large organizations. These barriers *are not* technological – they are behavioural⁸⁸.

US small and emerging companies find that time is the most significant internal barrier to web success – they have many ideas, but find it difficult to keep up with demand. The most important constraints are external – finding on-line and offline partners for development, joint marketing, distribution and uncooperative suppliers. Many manufacturing companies find that vendors and suppliers are not ready to do business on the Internet.

Despite the opportunities created by the Internet, it is “no magic bullet” and cannot compensate for fundamental business weaknesses. The web provides a means to run businesses differently, but does not eliminate the need for sound judgement, financial discipline and face-to-face relationships. It demands that companies accept the same duality imposed on them by previous waves of revolutionary technology:

It requires a commitment to change, yet it builds on a foundation of enduring human experience. No machine regardless of sophistication can fully replace the human experience. People need people, and machines need people to be fully effective assets. The world now has more room for both to survive.⁸⁹

Lou Gerstner, CEO of IBM, has observed that the primary lesson to be learned from the shakeout of the Internet is that too many companies thought they were contributing to the creation of a “new” economy when in fact they were doing nothing new at all. Many Internet retailers proclaimed they were offering a “whole new business model” – when in fact their businesses were built on a centuries old value proposition, *lower price*⁹⁰.

Gerstner has said that the problem with many e-businesses was that they did not have a business and economic model that could sustain low price while generating returns and that the most important lesson is that e-business is just business, real business and real business is serious work.

7.3.4 Going forward

Recent history has demonstrated that businesses, and particularly small businesses, should not be “spruiked”

The businesses that will survive will be the ones that use the Internet to create fully integrated business models. This is a major challenge for small manufacturing businesses in that capital investments are required – with the attendant risks.

⁸⁸ See Davenport, Thomas, “the Politics of Information”, *Sloan Management Review*, 199x for a somewhat polemical assessment of barriers, and solutions, to the information sharing problem.

⁸⁹ Kanter, op.cit. p. 90.

⁹⁰ Moore, John Frederick, *Business 2.0*, February 2001.

The Internet has enabled the development of new business models through richer and deeper collaboration between businesses. It is in this respect that the impact on small manufacturing businesses is the most significant.

Many industry analysts believe that in 2001 and the years beyond will see a revolution in computing that could represent a multi-trillion dollar shift in the way companies conduct business.

into making large investments in e-commerce solutions.⁹¹ They need to be aware of what the Internet can, and cannot, do *at this stage*. What it will be able to do in 15 years is largely unknown.

Many small manufacturing businesses are using the Internet very effectively for communication and on-line collaboration. They are also using it for ordering and settlements, but they are also aware of the risks.

One of the greatest impacts of the Internet in a business sense is that it has facilitated communication *within* organizations, allowing for decentralisation of decision making but maintaining control through more effective communication of performance and business relevant information.

7.4 Business to Business (B2B) developments

7.4.1 Expected impact

The Internet has had, and will continue to have, a profound impact on the way business is conducted. Some observers have gone further and claimed that the year 2000 will be remembered not so much for the Y2K bug but for the year when business-to-business (B2B) e-commerce "hit it big".

It is expected that that intelligence driven e-market networks will become the de facto method by which most business will be conducted in the coming years. The basis for this prediction is that:

- By 2000, most companies had constructed internal computing infrastructures with e-mail, networking, manufacturing control, and many other applications to improve productivity
- The explosive growth of the Internet.

These factors have *made it possible* for companies to connect internal infrastructure into industry wide systems – allowing them to electronically buy and sell products, components and services.

B2B developments have a number of implications for manufacturing business strategies:

- Making products available on the Internet allows customers to choose among several sources – high margin products turn into low value commodities - companies must differentiate their products and services beyond mere price tags

⁹¹ The massive investment in information technology associated with the Y2K problem was driven by the Computer Hardware and Software companies. Many companies brought IT investment forward.

Research undertaken during this assignment has made it clear that e-commerce reinforces the need for companies to commit to personal selling strategies.

- While building a brand name is one way to provide differentiation, personal relationships between buyer and seller have never been more important in the business world
- As the mechanism of purchasing becomes increasingly automated, it will be up to a sales rep or a CEO to provide the hand holding and service needed to maintain customer loyalty. This will be particularly important in small business supplier relationships
- Business to business selling is still a personal activity – with negotiation and human interaction: it is actually a strategic advantage to have a personal relationship with a buyer.

7.4.2 B2B exchanges and electronic markets

Much has been written about B2B and the “explosion” of online business exchanges and electronic marketplaces – or “business webs”. There have been numerous books published on the topic of e-commerce and e-business and there are journals and magazines that are dedicated to providing information about these arrangements (eg, *Business Online*, *Electronic World*, *Business 2.0*).

One of the more respected works on the topic of e-commerce, *Digital Capital*⁹², identified two primary dimensions of business webs:

- Control – self organizing, where the market and its dynamics define the value and price of products, or hierarchical where a company designs and leads the integrated supply networks to produce preconceived products
- Value integration – value being the benefit that a user gains from a product or service.

From these dimensions, *Digital Capital* works on five basic categories of business web. These categories, together with key characteristics are identified below.

⁹² Tapscott, D. et al., *Digital Capital: Harnessing the Power of Business Webs*, Nichols Brierty, London, 2000

	Agora ("free and open market")	Aggregation	Value Chain	Alliance	Distributive Network
Main theme	Dynamic pricing	Selection and convenience	Process integration	Creativity	Allocation/distribution
Value proposition	Liquidity – converting products into a desirable price	Optimisation of selection, organization, price, convenience, matching and fulfilment	Design and delivery of an integrated product or service that meets a specific set of customer needs	Creative collaboration in aid of a goal shared across a community of contributors	Facilitate the exchange and delivery of information, goods and services
Customer role	Market player	Buyer	Value driver	Contributor	Sender/recipient
Knowledge focus	Timing Market intelligence	Market segmentation Supplier offerings Fulfilment	Innovation Supply chain management	Community Creativity Standards and roles	Network optimisation Visibility and transparency
Key process	Price discovery	Needs matching	Product design Supply chain management	Innovation	Distribution

Source: Tapscott, et al., *Digital Capital*, p.30

Many of the b-webs created over the last two years, have been independent entities, or "market makers", that offer a neutral ground for the purchase decisions. These b-webs can be industry, regional or "affinity" based and provide content and value-added services.

Some e-markets have been financed by heavy investments of venture capital. They have attempted to attract participants with the ability to find large numbers of buyers and sellers, reduce search costs, increase price transparency and provide better deals than by going through traditional channels.⁹³

The actual transactional volume through independent market makers has not, however, lived up to expectations. They have tended to focus on a single market and tend not to support global strategies. They have also not been attractive to large companies and often reflect a misunderstanding about the way business is actually conducted.

A recent US study has found that most organizations are only beginning to use the Internet for their procurement activities⁹⁴. According to the study, the slow adoption rate can be partly attributed to wariness on the part of companies moving away from tried and true purchasing methods, but a large part is also due to the on-line market places not being able to give organizations a compelling reason to purchase goods and services online.

Many large companies have formed their own proprietary exchanges. They offer benefits in terms of lowering procurement and marketing costs as well as extending business reach. These companies have often made large investments in enterprise systems and want to leverage those investments with their supplying partners – quite often small manufacturing businesses. There is

For businesses, particularly small businesses, an important issue is getting into these "private" market places.

⁹³ McKendrick, Joseph, "Old Economy Players Step Up: Industry Coalitions are Giving Independent E-markets a Run for Their Money" *Electronic Commerce World*, 10:11, November 2000, p.35

⁹⁴ Moore, John Frederick, "Reality Checks for B2B Exchanges", *Business2.Com Dispatch*, January 30, 2001.

The integration of business automation into e-commerce is evolutionary – not revolutionary. The Internet allows tying communications and transactions together. It is an integrating medium that makes it imperative to unify processes of information that in most institutions are splintered across an organizational landscape.

also a trend towards the establishment of private market places that are limited to hub companies and their suppliers.

Private market places are considered to be more suited to most transactions between companies than massive public exchanges. One strong buyer or supplier, who “owns” the marketplace, typically anchors such marketplaces. The marketplace electronically connects all trading partners who are encouraged/forced/ to do business electronically. The marketplace owner and the participants must all be deeply integrated.

Private marketplaces allow all participants to collaborate and share information. Most participants make big commitments to the e-commerce effort. It often involves migrating an existing client base to an online model - rather than from scratch, as many of the dot.com market places have been trying to do. It also points to the strength of the value-added business services model – providing demand generation, quality assurance and logistical services.

The outlook is that B2B exchanges will quickly evolve into a spider web of company centric intranets, or supply Webs, and specialised B2B exchanges for commodity type procurement (stationery, office supplies, hotel accommodation), banking and logistics. *Companies will find B2B exchanges useful for some aspect of their supply chain management, but will achieve more success if they and their partners are totally Web enabled across their enterprises.*

7.4.3 Implications for manufacturing

Jupiter Communications predicts that five industries will, within four years, conduct more than half their buying and selling on-line -

- Aerospace, defence
- Chemicals
- Computer/telecommunications equipment
- Electronics
- Motor vehicles/parts⁹⁵.

Significantly, these industries are commonly regarded as core manufacturing activities

For manufacturing, the attractiveness of the Internet has been in the possibility of immediate fulfilment – anybody could get any thing anywhere at anytime. Unfortunately, it has not turned out that way: popular consumer

⁹⁵ *Wired* 9.01, p156

products have been in short supply and difficult to obtain⁹⁶.

The Internet also allows for the integration of product design, promotions and delivery schedules across the supply chain. The capacity to achieve that integration will be a major criterion of success in an e-business environment – but the willingness to share information, particularly proprietary information, across the supply chain will ultimately determine how much value supply chain integration can contribute.

An assumption of just in time ordering and immediate delivery characterises the entire supply chain. Many customers value more highly timely delivery rather than product price. If one supplier makes a bad guess about demand for a component, the whole system breaks down. US studies indicate that for every week of delay in a product, the chance that a customer will cancel goes up by five percent.

For manufacturing companies, the Internet has made demand more erratic and harder to predict. E-commerce sites that take orders immediately are encouraging customers to place orders at the last minute and expect overnight fulfilment.

For many manufacturers with in-line ordering, sales are still being forecast on historical patterns and the judgements of sales people and purchase orders to suppliers are still being issued once a month.

The “back end” supply chain cannot handle the high, unpredictable, influx of orders coming from manufacturers sales via the web and suppliers are not getting the information they need from manufacturers.

Supply shortages are due to fundamental changes in supply and demand wrought by new business models, customer expectations and the Internet. Manufacturers and suppliers have not worked out how to deal with the changes. “We’re all writing the book as we go; nobody learned this in business school”⁹⁷.

So the first thing manufacturers have to do is face reality: in the Internet age, the supply crunch won’t go away. Certainly, they can’t expect suppliers, who have even less information about demand, to solve these problems. Pounding on suppliers when you get a big, unexpected order may be a natural reaction, but it’s counterproductive – you’ll just alienate important partners. Instead manufacturers need to totally overhaul their procurement processes. They need to find ways to get wired tightly with their suppliers, so that the suppliers at least know what the manufacturer knows.

The Internet created the problem – but can also resolve it. Purchase orders must be updated daily. Dell, for example, posts its manufacturing schedule on a private Web site for suppliers to access. Suppliers can grab the

⁹⁶ “Competing for Supply”, *Harvard Business Review*, February 2001, p.25.

⁹⁷ *Ibid*, p.26

In order to compete in a market with erratic demand, manufacturers will have to cater to suppliers.

production data in XML format. Suppliers must also be kept informed of product changes.

These developments envisage a fundamental change in manufacturer-supplier relationship. Demand in real time creates a pressure to respond faster than competitors. This will require closer, more trusting relationships with suppliers.

While a lot of the earlier activity in B2B e-commerce focussed on manufacturers being able to “beat up” on suppliers by forcing them to bid in reverse auctions, experience has demonstrated that this will not be a sustainable model.

Manufacturers in the future will band together with groups of suppliers to create private and semi-private exchanges in which they share detailed information about product parts and assembly as well as their own business processes. They are creating a “shared business infrastructure”.

The time and costs of achieving integration of internal enterprise systems as well as inter-operability of external systems are high and require significant investments. These investments may be quite significant for small business and a strategic approach will be essential. Small business will need competent, informed and independent advice.

Industry and professional associations and business networks will have an important role to play in providing independent and expert advice to small manufacturing businesses in evaluating e-commerce options.

Many large professional services organizations have linkages to software and hardware vendors and are keen to push the most advanced technology options and their consulting capability. Advocated solutions may be well beyond the needs (and the resources) of small manufacturing businesses. At the same time, small businesses going it alone may result in high risks, expense and loss of opportunity.

7.5 The future of e-commerce

For the first time in business history, e-commerce separated selling and purchase –

- Selling is completed when the order is received and paid for
- Purchasing is completed only when the purchase has been delivered - and actually not until it satisfies the purchaser's want.

While e-commerce demands centralisation, product delivery has to be totally decentralised. It needs to be local, detailed and accurate⁹⁸. This provides continuing

⁹⁸ Drucker, Peter, “Can E-commerce Deliver?” *The Economist: the World in 2000*, p106.

opportunities for small business operating at regional and local levels, providing agency and service functions.

The prospects for e-commerce on the Internet still depend on the ability to develop a viable “business proposition”:

The future impact of the Internet – and electronic commerce in general – will depend on the ability of firms to create business models which take advantage of the special characteristics of on-line delivery; and also provide transaction security for customers. The experience of earlier IT applications suggests that the prospects are extremely good⁹⁹.

Many business commentators see the development of Internet based e-commerce as the beginning of a new business era. Older companies with established brands and distribution channels risk damaging their established business models when they pursue an Internet strategy. They find it difficult to decide on the best way to use the channel.

The London Business School has forecast, that by 2007, in North America and Europe, the following percentages of total sales will be conducted on-line in some form or another:

- 10 percent for retail banks, travel agents, airlines and mail order clothing
- 30 percent for music, books and newspapers
- 15 percent for groceries
- 10 percent for cars and whitegoods¹⁰⁰.

These proportions are by no means overwhelming.

There is a current realisation that the commercial possibilities of the Internet are, for many businesses, more hypothetical than real. Security and privacy are major issues for both customers and companies. There is a lack of compatibility between methods of processing Web transactions.

Nonetheless, e-business has the potential to save a huge amount of money over the next ten years in *supply chain* management costs.

7.6 Use of the Internet and information technologies by small business in NSW

Information from the 1998 Business Longitudinal Study provides information about the number of firms using the

The Internet is a means of communication, and as has been discovered with the dot.com crash, it cannot sustain business models that are not viable under normally accepted commercial criteria.

The time tested principles of starting an offline business apply equally to an on-line business – a business can only be sustainable if it has customers.

⁹⁹ Crainer, Stuart, *Key Management Ideas, 3rd Edition*, Financial Times Publishing, London, 1998, p. 67

¹⁰⁰ Ibid

Internet. Information for all NSW firms is provided in Table 10.

Table 12: Businesses using the Internet, 1998

	Micro	Other Small	Total Small	Medium	Large	Total
	%	%	%	%	%	%
Proportion of all firms using computers	69.9	82.0	73.8	93.5	100.0	75.2
Proportion of all firms using the Internet for:						
. Email	22.4	27.1	23.9	54.5	83.1	26.1
. Gathering information	20.8	25.6	22.4	48.2	76.7	24.2
. Data transfer	9.0	12.4	10.1	26.0	49.5	11.3
. Marketing	4.5	13.4	7.4	29.7	54.1	9.0
. Selling	1.2	5.7	2.7	11.5	12.8	3.3
. Purchasing	5.0	7.5	5.8	16.4	16.9	6.5
Proportion using the Internet for any purpose	25.2	31.1	27.1	58.9	88.9	29.4

Source: *Portrait of Australian Business*

The data indicate that just fewer than 70 percent of micro businesses use computers – compared to 100 percent for large businesses.

The data also indicate a very low level of application of information technologies within small businesses. To the extent that business will be increasingly undertaken through electronic Business-to-Business (B2B) transactions and networks, this low level of take-up is a matter of concern.

Businesses that are not able to use the Internet as a channel of communication for marketing, purchasing and sale will be disadvantaged in the future.

The Internet is still only one channel of communication. Businesses should not rely on it for all of their communication, marketing activities

7.7 Other channels of communication

There has been a tendency for consultants and people in government to embrace the Internet as a means to disseminate information and create awareness of policies, programs and government activities. Quite often this reflects a provider rather than a user perspective.

At the moment, the Internet is cumbersome and time consuming if searching for specific information. Marketers have recognised it as one channel and use it to complement other channels.

Other important channels of communication include:

- “Face to face” meetings and gatherings of managers and operators at through business and industry networks
- Industry briefings, forums and conferences
- Articles and features in national and international business and trade journals and magazines
- Radio and television briefings and commentaries (eg the *Small Business Show*)
- Industry and professional association networks.

These channels will become *increasingly* important for small manufacturing businesses in the future. The evidence is that people are reading more books and magazines than ever before. Significantly, many of these are purchased through the Internet.

Communications strategies must be based on an understanding of the way small business managers receive and interpret information. This must target both "reader" and "listener" categories. It must also take into account language and cultural issues.

Investment in computer and communications capacity and capability is a business decision that must be assessed on the basis of cost and return. It is in this area that small business owners and managers seek independent and expert advice.

7.8 The attributes and characteristics that small business will need to develop

Looking forward, owners and managers of small business manufacturing will need to develop a deep understanding of what electronic commerce and the Internet can and cannot do for their businesses.

First and foremost, business owners and managers need to understand that the Internet is a means of communication – it allows for the transmission of digitised information very quickly over long distances. It allows for close collaboration between suppliers and customers – but at the same time requires development of a much closer relationship with customers.

8 The Organizational Environment

Contemporary thinking is that businesses will need the ability and willpower to constantly develop and deploy new products that respond to changing customer needs. It requires an organization with the flexibility and competitive energy of a kid playing a video game rather than the analytical consistency of a grand master trying to hang on in a three-day chess match.

Goshal, Sumantra and Bartlett, Christopher A., *The Individualized Corporation*, Harper Collins, New York, 1997, p.73

New forms of business organization will involve fundamental changes in the way business is undertaken

In this Section of the Report attention is focussed on trends and developments in relation to the organization of small business manufacturing firms over the next 10 to 15 years. These developments relate to the emergence of cooperation and collaboration between businesses, and between businesses and research organizations.

New forms of business organization arrangements will develop on a regional, national and global basis. They will involve fundamental changes in the way business is undertaken – and will be driven by technological change, international competitiveness and the finance of innovation.

8.1 The relationship between large and small businesses

8.1.1 The changing role of large firms

Small and medium firms have been of more significance in stimulating growth in labour intensive and service industries. Increasingly, however, small firms are becoming involved in applied research, product development and specialised contract manufacturing for larger firms.

Firms in traditional industries such as textiles, food, tobacco, and iron and steel have been progressively replaced in the top 200 firms by more R&D intensive firms.¹⁰¹ Large firms tend to be concentrated in capital-intensive industries, such as chemicals, pharmaceuticals, office machinery, electronics and aircraft. The firms that are surviving in these industries are now becoming increasingly “knowledge” intensive.

The essential role of large firms has been to drive technological advance. They have performed this through:

- The commercialisation of new technologies on a global scale and then the maintenance and enhancement of their potential
- Making the primary investment in physical and human capital necessary to exploit new technologies

¹⁰¹ Chandler, 1997

- Providing the corporate infrastructure and organization fundamentals to enhance existing technologies and develop new ones.

These trends will continue. They will be offset to some extent by developments in the Internet based “new” economy as discussed previously.

Large firms have discovered that they cannot maintain in-house all of the skills, capability and expertise required to meet their business needs. Small firms are also vital ingredients in clusters and networks organised around large firms in capital-intensive industries, particularly in manufacturing. Governments have also facilitated the clustering of activity by making available infrastructure for collective use (roads, airports, ports, etc).

Small manufacturing businesses, with lower overheads, allow for smaller production runs and specialised manufacture close to the customer or where there is a high level of technical competence and capability. These factors are becoming increasingly important as companies outsource just about everything - except what they see as their “core competencies”. This creates opportunities for small businesses in Australia with its small and regionally distinctive market.

8.1.2 From “small” business to “big” business?

The tendency towards new forms of work organization, involving cooperation and collaboration between small businesses and large businesses will continue. Small businesses, including manufacturing businesses, have little incentive to become big businesses:

- The costs, and risks, of taking on “permanent” employees
 - Employment on-costs (workers compensation, payroll tax, superannuation, leave, holidays, etc), which can double the wages cost
 - Complexities and difficulties associated with termination for unsatisfactory performance
- Office technologies have removed the need for many specialised support jobs
- Economies of scale in large scale factory production are difficult to capture
- Time and cost of meeting taxation and regulatory requirements
- A perceived unwillingness for unskilled workers to make long term commitments, engage in training and skills enhancement

The basis of inter-company collaboration is global as well as regional. Moreover, the “virtual” or “hollow” corporation, whilst large in terms of sales, may still be a small business in terms of numbers of employees.

- A preference to acquire specialised support and technical services on a procurement/contract basis as and when required rather than build in-house capability (and the growth in the market for this capability)
- A growth in the “flexi-hire” sector allowing businesses to hire support and technical staff as and when required with third parties taking the risk.

As indicated throughout this Report, small businesses will tend to work more in networks and alliances with other small businesses and larger businesses.

There should be no presumption that successful and viable small businesses want to, or need to, become large businesses. There will only be a few Microsofts, Intels and Ciscos: these companies will rely on an effective network of innovative small companies to work with them on a collaborative basis.

8.1.3 The demise of the multi-divisional corporation?

There is a view in the management literature that there is a major shift in which the historical advantage of the large corporation is no longer assured.

The uncertainty of markets, the importance of niches and innovations in increasingly more affluent societies, the creation of new flexible technologies and communications systems (including the Internet) and the growth of well educated workers and managers have created a major break in the organization of work and its division between small and large companies.¹⁰²

In France, which has been one of the best performing economies over the past decade, small to medium businesses have been growing at a faster pace than larger businesses. Similarly, in Italy, the dynamic sectors are dominated by small businesses. These trends reflect a movement away from the design principles of economies of scale and scope, popularised in the writings of Alfred Chandler Jnr.¹⁰³

New business models reflect a much greater commitment to cooperation and collaboration *between* large and small businesses as well as between universities and research organizations. This is a major departure from the “old” economy where technological innovation was the province of large businesses and there was a presumption that successful small businesses would inevitably become large businesses.

8.1.4 The future of the factory

Manufacturing has traditionally been associated with factories – and large factories at that. However, changes

¹⁰² Bowman, Edward and Kogut, Brice, *Redesigning the Firm*, Oxford University Press, New York, 1995.

¹⁰³ Chandler, Alfred Jnr., *Scale and Scope, The Visible Hand*,

in business structures in parallel with changes in electro-mechanical technology, may result in the decline of the era of very large factories and the associated “company towns”.

The following forces are at work:

- The economic size of plants can be smaller than at present
 - Technologies allow for smaller units to be economically viable – eg “mini” steel mills
 - Product specialisation and small production runs do not require large factory based economies of scale
 - Any economies of scale in production might be offset by the time and cost of building large units
 - Components are sourced from a wide range of suppliers and acquired on a JIT basis – made possible by developments in information technology, transportation and logistics
 - There are difficulties in finding (and remaining in) acceptable locations for large establishments (on social, economic and environmental grounds)
 - There are difficulties of running them once built (including industrial relations issues).
- Developments in plant construction and design, together with technical advances, has made small and medium size plants competitive with the “giants”
- Small plants have advantages in both cost and management – people prefer small units, easier for motivation and generating team spirit, learning by doing
- Smaller plants allow for better management of risk through less upfront capital commitment, greater flexibility in production, smaller batches to meet needs of particular markets and testing new products in new locations without disruption to major product lines

Factories will continue to exist, but it is likely that there will be fewer people working in them. Moreover, large companies have realised that they do not have to “own” a production facility to be able to effectively manage it through contracts and alliances.

Smaller, independently owned production units often have capabilities that large companies do not have (and do not want). Smaller units are often able to re-tool for small batches much more quickly and economically. Large companies are increasingly “outsourcing” manufacturing to specialised companies.

8.2 Outsourcing and opportunities for small business manufacturing

Outsourcing involves “purchasing” a part of business activity and operations from a third party under a contract arrangement. Businesses have always acquired specialised capability from firms that can provide

specialisation and economies of scale. Outsourcing now occurs extensively in traditional “back office” and “support” operations (accounting, information technology, legal services, human resources, etc) as well as in manufacturing and product development.

There is a challenge for management, however, to understand when and why traditional organizations will persist and when it will be appropriate to outsource and acquire capability outside the formal (and legal) boundaries of the firm.

In manufacturing every product is created through a chain of value-added activities. A piece of that chain can be outsourced, if three conditions are met:

- The attributes of what is to be outsourced must be capable of being specified
- The technology to measure those attributes must be reliably accessible
- If there is any variation in what an alliance partner or supplier delivers, the impact on the rest of the system needs to be known and manageable.

It is necessary to “plug into” the chain with predictable effect – this places a premium on accurate, relevant, and timely information. The flexible, virtual organizations that visionaries are seeing for the 21st century will work only when there is necessary and sufficient information to allow markets to work¹⁰⁴.

Computer manufacturers outsource production to suppliers as well as new product development to start-ups it subsequently acquires.¹⁰⁵ But, as companies move into more performance demanding tiers of their markets, eg optical fibre networks, they are being forced to integrate and perform many of the product design and manufacturing activities internally. They have to become less virtual to compete.

Managing the competitive advantage swings between integration and non-integration is difficult. But when good managers accurately frame what needs to be done they can be very effective.

Organizational form and structure will be developed as technological progress interacts with the evolving needs of customers.

8.3 Business cooperation, collaboration and strategic alliances

8.3.1 Business to business collaboration

Over the last 10 years global manufacturing companies have tended to increase their focus on developing a select group of intellectual and knowledge skills and then leverage these against multiple products through external sourcing to develop dominating product market

¹⁰⁴ This may mean allowing time for markets to develop – as well as providing stability and continuity in the rules.

¹⁰⁵ A contemporary example is the Radiata deal between Cisco, Macquarie University and CSIRO.

A number of larger businesses have realised the dilemma with open sourcing and are now arranging to source from a limited number of suppliers, but with an expectation that small supplying businesses will commit to innovation. This also provides an opportunity for small businesses to collaborate to build the necessary capacity and capability.

positions. This strategy is undertaken on a global basis, and involves:

- Identifying those few core knowledge and service activities that the company has, or in which it can develop, a continuing strategic edge and a long-term stream of new products to satisfy future customer demands in a global context
- Moving away from a vertically integrated, centrally directed, multinational corporation to systems of partnerships and strategic alliances across national borders - mass customisation, on a global basis, requires that manufacturing and service support is located as close to customers as possible¹⁰⁶.

While the traditional forms of economic integration, trade and the multi national company, will continue to grow, the dynamics are shifting to partnerships and alliances based neither on the commodity nexus of trade nor on the power nexus of multinationals.¹⁰⁷ As indicated, alliances will be of critical importance for small businesses, particularly those wishing to enter global markets.

Numerous management and organization commentators have observed trends towards the devolution of large, permanent corporations into flexible, temporary networks of individuals. Many individuals are working in what the ABS refers to as “non-employing” or “own account” businesses¹⁰⁸.

Large companies (in both the manufacturing and construction sectors) are increasingly acquiring manufacturing inputs through tender and periodic contract arrangements rather than long term sourcing through electronic and Internet based B2B exchanges.¹⁰⁹ They have benefited from this process by driving prices down, but they have removed the incentive for small business to grow in capacity and capability. A loss of a key contract can be devastating for a small business¹¹⁰.

As indicated in the previous Section of this Report, large businesses have also found that the open competitive tender system for suppliers has driven out innovation as small businesses weigh up the costs and risks of investment in new manufacturing capability – and actually being in the market.

¹⁰⁶ IBM, Microsoft, Intel, GE, for example, have literally hundreds of alliances throughout the world.

¹⁰⁷ Drucker, Peter, *Managing for the Future: The 1990s and Beyond*, Plume: New York, 1993, p. 17

¹⁰⁸ The significance of “non-employing” businesses was referred to in Section 2.1 where it was noted that in 1998-99 there were 423, 400 non-employing businesses (130,500 in NSW) involving 658,300 proprietors – 10 percent of the non-agricultural private sector workforce. Many of these businesses find engaging employees is too costly and risky to their business.

¹⁰⁹ B2B exchanges have also come to the attention of anti-competitive bodies in the US

¹¹⁰ Large businesses often prefer their suppliers to have a number of contracts – thereby reducing their own risk.

In small business, investment decisions tend to be made when there is a new long-term contract and an expectation of continuity in the business opportunity. Many such investments are funded on a leasing deal and financed out of cash flow. However, a lack of capability may be a barrier in the tender process. Small businesses are addressing this issue by participating in business networks and joint tendering for large projects where a depth and breadth of capability (critical mass) can be generated.

These trends are consistent with the broader trends in business structure discussed earlier.

8.3.2 Industry and business “clusters”

Clusters of business and commercial activity have always existed around the world. They have enjoyed shared physical infrastructure and linkages between businesses, an employment pool and contact with client bases. Firms within clusters have tended to be fiercely competitive, which has been seen to result in greater efficiencies and opportunities for sustained growth. This is reflected in the Michael Porter analysis¹¹¹.

Industry clustering is now being heavily influenced by technological considerations. This reflects a changing technical bias towards “intangible capital”, notably R&D, but also the need to develop the inter-personal networks required for effective cooperation and collaboration that facilitate the development of strategic alliances.

In the “new” economy manufacturing companies are relying to an increasing extent on alliances and partnerships with small technology based research and manufacturing businesses. For example, in the pharmaceutical industry, global pharmaceutical companies rely on small biotechnology start-up companies for research and clinical trials – often in association with a teaching hospital. Biotechnology is also increasingly concerned with information technology and applications that develop through alliances with small firms.

A similar situation occurs in computer and telecommunications manufacture where companies such as Microsoft, Intel, Cisco, and Sun have alliances with small technology firms for research and development. A number of these are in Australia and have close links with Universities.

A more recent development has been the clustering of business activity on the basis of what appears to be the *infinite* availability of information. The volume of information is such that no manager, particularly in a

The clustering of industrial enterprises has been shifting towards the industries that are capital intensive and knowledge intensive.

¹¹¹ Porter, Michael, *The Competitive Advantage of Nations*,

The information revolution has also resulted in a growth in the number of people who manipulate, interpret, package and present it. Notwithstanding the growth of the Internet, the exchange of ideas involving tacit knowledge still needs face-to-face contact.

small business, can keep up to date with it, even in a quite narrow field. Despite this limitation, governments, industry associations and companies insist on building new web sites, portals and search engines that provide massive amounts of information, made possible by search technologies, but which are difficult to review and interpret¹¹².

Businesses, particularly small businesses, need filters to separate quality information from junk and to apply judgement to what remains. This process is starting to unfold as small companies build links with universities and business professionals (accountants, lawyers, consultants) in "clusters" of high technology firms. Specialist advice has flourished in these environments, particularly in technical and investment advice, where experienced and well-known fund managers and experts provide judgement – not information. Good judgement will continue to be highly valued – gigabytes of marginally useful information will not.

Silicon Valley, the North East of the US and the emerging cluster at Cambridge (UK), have achieved major economic significance as "clusters" not only on account of the technologies, but also on account of the ability for information to be given meaning and context¹¹³. It is no accident that these locations are richly knowledge intensive.

The Boston area has 80 university campuses. Stanford University in Silicon Valley where there are many venture capital firms and high technology investors. There is an exceptionally close and unique interaction between these three groups of people (technology entrepreneurs, university based researchers and venture capitalists).

Physical locations are required for sales, marketing and senior management. For other functions, location in a university town or district leveraging off knowledge capabilities appears to be a strong trend. Electronics and the information industries tend to move people away from the centre of cities to knowledge intensive clusters of capability.

8.3.3 Interactions between businesses and universities

To exploit opportunities, businesses have to collaborate across sectors, regions and with education institutions. The following forces are at work:¹¹⁴

¹¹² Many sites and search facilities are equivalent to electronic encyclopaedias. However, the more specific an information requirement, the less useful the Internet becomes. The Internet is, after all, a communications device.

¹¹³ See Saxenian, A, 199x, *Regional Advantage*, and numerous other accounts of the workings of the Silicon Valley information and business networks.

¹¹⁴ Great Britain. Parliament, Secretary of State for Trade and Industry, *Our Competitive Future: Building the Knowledge Driven Economy*, Cmnd 4186, London, 1998

The importance of developing strong business-university relationships cannot be over-emphasised in terms of the opportunities for small business, technology based, manufacturing industry development and growth.

- Few companies have all the skills needed to develop technologically complex products and to market their services effectively
- Businesses are increasingly involving suppliers in product design, development and delivery
- Businesses collaborate to solve shared problems while still competing intensely
- Networks that link businesses to universities and research institutes are an important source of innovative ideas in all industries
- Successful businesses adopt cooperative approaches to employment relations and other industry wide issues.

The linkages between small manufacturing businesses and universities are particularly strong– but in some sectors, receive comparatively little attention as many take place outside the formal Cooperative Research Centre framework and other government funded initiatives¹¹⁵. The relationships include:

- Company research managers providing casual teaching in specialist disciplines
- Company directors and managers being involved in faculty and advisory panels
- PhD student work experience in a technology based company
- Collaborative research projects
- Joint business ventures
- Alumni linkages¹¹⁶

A number of advanced technology manufacturing firms have alliance arrangements with universities to provide credibility to both the product and their business.

The desired state of university-business interaction should recognise the importance of these relationships in the national innovation system and should reflect relationships that:

- Promote a shared understanding of the contribution of universities and business enterprises to economic and social development
- Encourage cooperation and collaboration in the creation of knowledge and the transfer of skills
- Facilitate the movement of people between the two sectors for short and extended periods
- Encourage partnerships in the commercialisation of research outcomes

¹¹⁵ The CRCs tend to be dominated by comparatively large companies and have tended to focus on science, discovery and applied research rather than product development and subsequent commercialisation. Because of this focus, small business has not been attracted to the CRC model.

¹¹⁶ The MIT relies extensively on its Alumni as a source of support and for collaborative ventures.

The NSW Government should take action to support the development of university-business knowledge networks through a program that supports product development research and businesses with potentially commercialisable technologies.

- Acknowledge the importance of flexible networks and informal interactions between university personnel, business people and government officers
- Acknowledge the needs of different industry sectors through the development of relevant and appropriate business models and frameworks.

Governments and research funding organizations can facilitate this process by providing information and assisting in starting networks of cooperation and collaboration.

The NSW Government can take a major lead in facilitating university-small business relationships as a basis for developing and applying manufacturing and other knowledge based technologies. One area that requires attention is the lack of support for product development research for small business. Small businesses rarely have the resources to develop patents into products that can be sustained in a commercial environment.¹¹⁷

8.3.4 Collaboration and strategic alliances in NSW

There are already many examples where Australia based manufacturing companies are in strong strategic alliances with US, Japanese and European companies in the global supply chain. Some of these alliances also have an important R&D component. For example, Bishop Steering Technology, winner of a 2000 Australian export award, supplies steering technology to 20 percent of the passenger cars produced every year around the world. The winning citation states:

Bishop is continuously seeking to forge additional offshore business alliances in the research and development field. Traditionally Bishop has licensed its intellectual property to the major global suppliers of automotive steering gears. The majority of these licenses have multi million dollar sales and assets. Because of its strength in intellectual property Bishop's global royalty receipts and machine sales grew rapidly.

Bishop retains offices in Europe, Asia Pacific and North and South America.

The recent surge in Australian exports is associated with smaller manufacturing businesses taking advantage of the Internet¹¹⁸ and the lower value of the Australian dollar relative to the US dollar.¹¹⁹ It is also associated with the managers of small companies taking the initiative and

¹¹⁷ There is support, under the COMET program, for commercialisation of the technology – but not for the development of the technology. R&D START is only available on a 50:50 basis.

¹¹⁸ For example, Chekioroff Foods, markets Australian bush spices throughout the world via the Internet. See AFFA Case Studies.

¹¹⁹ Brenchley, Fed, 2001, "Trading Aces" *The Bulletin*, January 30.

Large businesses, Business Enterprise Centres and universities should be encouraged to support the development of networks and alliances through the provision of advice and briefings regarding opportunities and access to facilities

establishing relationships in overseas markets with distributors and retailers. These relationships call for continuity, quality, consistency, reliability and volume.

The Australian wine industry is often cited as an exemplar of developing a robust export capability through collaboration and alliances. The meat processing industry has learned from its poor performance in Asian markets and is now doing much better.¹²⁰ Other segments of the food industry are now marketing high quality and innovative products into the US and Europe. Many small businesses contract manufacturing operations domestically and internationally to provide for sustainable volumes to meet export requirements.

Large businesses and universities also have a role to play in encouraging the development of networks and facilitating the development of alliances through the provision of advice and briefings regarding opportunities and access to facilities.

8.3.5 Regional collaboration

While many small businesses have embraced the global economy and have effectively accessed the mass markets of Europe, North America and Asia, the regional development strategies of many regions in NSW still have a commodity focus and reflect internally focussed community development approaches.

There is a number of science and technology based “clusters” in NSW that involve a high degree of business interaction and collaboration between large and small enterprises, research organizations and universities. These include:¹²¹

- South East Sydney – including the Universities of Sydney, NSW, UTS, the Australian Technology Park, and a number of technology based firms in Camperdown, Five Dock, Mascot, Rosebery, Waterloo and Rozelle.
- North West Sydney – including Macquarie University, a number of CSIRO Divisions and a very large number of technology based firms in an area covering North Sydney, Chatswood, North Ryde, Meadowbank and Hunters Hill.
- South Western Sydney – including the University of Western Sydney and numerous technology based firms are located in the Homebush, Canterbury, Kingsgrove, Hurstville Fairfield areas

¹²⁰ The meat industry provides an example of the need to move from a commodity exporter, marketed through industry/government agencies such as the Meat and Livestock Corporation, where producers did not take “ownership” of the final product, to one where brands and quality certification have become an essential aspect of marketing.

¹²¹ A list of the companies included in these areas is provided at Appendix ..

- Hunter region – Newcastle University
- Illawarra region – Wollongong university
- NE NSW Region –Southern Cross University and the “Cellulose Valley”
- Southern and South East NSW – Canberra based universities, Charles Sturt University

There is substantial potential for science and technology clusters to emerge at the University of Sydney at Orange.

Governments sometimes seek to influence cluster activity by town planning and development control instruments and environmental regulation. Some “technology park” initiatives have been less than successful.

Attracting regional investment is a highly competitive enterprise. Regional managers require skills in establishing relationships with corporations, investors and potential businesses.

While there is an implied level of cooperation and collaboration as a result of collocations, few regional clusters have taken a collective approach to business development opportunities. The Hunter and Northern Rivers Regions are notable exceptions. They have demonstrated that it is possible to develop a global focus through a process of regionally based cooperation and collaboration. The Hunter Net consortium, for example, recently arranged a successful marketing mission to South East Asia.

Hunter Net has undertaken a regional “capability audit” to identify the capacity and location of specialised production machinery and equipment as well as skilled personnel. This knowledge is used to exploit opportunities in joint tendering and collaborative manufacturing. Businesses in the region also work closely with the University and the TAFE in developing opportunities.

In other regions, development strategies are based on economic models rather than business models that have proved to be successful overseas. There is little difference between marketing a region and marketing a company. There must be a focus on building relationships and alliances – as distinct from simply defining and asserting “competitive advantage”.

Many regional strategies contain large numbers of actions – but too few resources. Quite often they are targeted at internal stakeholders rather than potential investors. They contain information that a region would like to provide – rather than information that potential investors would need to know to make an investment choice.

Looking forward, and in the context of the knowledge economy, regional development will be associated with the “science and technology” based clusters. Both universities and government agencies must work together to maximise opportunities arising from the

commercialisation of technologies through spin-off companies and support for technology based businesses.

8.4 The attributes and characteristics that small businesses will need to develop

Small businesses will need to develop competencies and capabilities in alliance management, accessing professional capabilities, developing relationships with universities and other research organizations and working with new models of business organization.

Small manufacturing businesses should direct their attention to developing their capacities and capabilities in a number of areas:

- *Alliance competence* - in the emerging business environment, businesses will need to develop “alliance “competence – that is, a capacity to work in cooperative and collaborative arrangements based on reciprocity and trust. The management of alliances is anything but easy. They require extreme, and often totally unaccustomed clarity in respect of objectives, strategies, policies and relationships. Alliance problems often emerge as they become more successful.¹²²
- *Identifying and accessing professional support capabilities* - small manufacturing companies need access to efficient and effective specialised manufacturing and support including finance, transport, logistics, promotion, sales and transport. These will be sourced through strategic alliances and partnerships, as a way of sharing risk, as well as conventional market mechanisms.
- *Developing relationships with universities and research centres* – small manufacturing businesses can work with university researchers to develop process and product technologies to a stage where they can be protected by intellectual property rights – assistance may be supported by government programs, although other arrangements can be instituted (eg, PhD project supervision)
- *New models of business organization* – new ways of doing business will need to be explored with a sharing of risk and reward between parties. Universities and research organizations will not be able to continue to say that “business must understand the value of research and development”, but provide no leadership in how it might be paid for.
- *Participation in business networks* – businesses should explore every opportunity to participate in regional and national business networks as a basis for sharing information and knowledge about market opportunities, technology developments and business practices.

Industry Associations could probably do more to focus on opportunities for small business – but at the same time small businesses must support at least one, if not

¹²² Ibid

more, of the professional and business associations relevant to their industry sector.

9 Training and Skills Development

The likelihood that people will remain with a single company for their working lives has already disappeared in North America and much of Europe and Australia.

As manufacturing becomes more knowledge intensive, there will also be new challenges for management and people. Knowledge workers provide a large proportion of the services component of manufacturing.

Development and application of advanced manufacturing technologies in the future will require a highly competent pool of engineers and scientists – sometimes referred to as “knowledge workers”. The shortage of people with ICT skills has been a matter of concern, as has the shortage of scientists and technicians in a wide range of technologies.

While policies have been put in place to increase the supply of people trained in these areas, the current workplace environment and culture will encourage people to seek employment in larger businesses which are seen to provide job security and opportunities for career advancement.

9.1 Trends and developments

New patterns of work are emerging that reflect a trend towards “portfolio” working: self-employed people working for two or more companies on a contract or fee for service basis. This suits companies that need older workers. Data for NSW confirm a very significant self-employed and non-employing business base.

This includes research and development, product innovation as well as support functions. However, to remain effective, knowledge workers will have to keep their skills and knowledge up-to-date - in the same way the community expects medical practitioners to be abreast of current practice.

In knowledge work, responsibility for productivity is placed on the individual – they have to manage themselves. As continuing innovation has to be part of their work, it requires continuing learning and continuous teaching. Small businesses may find it difficult to provide support for ongoing learning as a result of both the up-front cost and the risk that people once trained will move on. Again, this is a business risk that requires managing.

In this environment a knowledge worker is treated as an asset rather than as a cost. Knowledge workers tend to want to work for a particular business rather than “having” to work to generate an income. The growth of on-line recruitment and placement agencies has increased workforce mobility. Skilled workers can identify employment opportunities much more easily and act accordingly.

Knowledge workers do not necessarily seek long term employment commitment to a business. They are

Retired knowledge workers with marketable skills are going back to work - but not necessarily full-time.

looking for a “relationship” that involves continuous learning and challenge. For these reasons, small business managers must make it attractive to recruit and retain skilled and competent people. Money is not always the driver, although access to equity (shares) and sharing in business success (bonuses) is becoming an important issue.

Going forward to 2010-15, when baby-boomers will be retiring, increasingly fewer will be blue-collar workers. So most will be able to work well into their 70s.

In this environment people will have to take greater responsibility for their own training and professional development. Business owners will be called upon to counsel and assist and jointly fund training and development – possibly in collaboration with professional associations.

9.2 Training delivery and knowledge transfer in NSW

In Australia the Business Longitudinal Study has collected information on training levels, content and providers. Data is not available specifically for small business manufacturing – but is available for small and large firms generally. The information in Table 13 indicates that it is large firms that make the relatively larger commitment to training, although, overall, the level of training commitment is increasing slowly.

Table 13: Changes in training levels by firm size and industry, 1996-97 - 1997-98

	Increased %	Decreased %	No Change %	No Training %	Total No. of Firms No. ('000)
All Firms					
Small – NSW	6.4	1.5	49.6	45.1	172.1
Large – NSW	34.3	2.2	58.4	5.1	13.1
Total – NSW	8.4	1.5	47.4	42.7	185.2
Total – Australia	12.8	1.4	43.0	42.8	541.1
Manufacturing firms					
NSW	17.0	5.1	42.1	35.8	19.4
Australia	15.1	3.1	46.9	35.0	55.1

Source: *Portrait of Australian Business*

Manufacturing recorded a proportionately greater increase in training activity – but 35 percent of manufacturing firms in NSW and Australia provided no training at all. On the basis of the small firm data, this lack of training commitment would be concentrated in small firms. Even so, 45.1 percent of small firms in NSW provided no training at all.

In all firms the most prevalent form of training is on-the-job training, although it is least concentrated in small firms. This is indicated in Table 14.

Table 14: Training methods by firm size and industry, 1997-98

	Proportion of Firms Providing -				Total No of Firms with Training No. ('000)
	Structured Training %	On the Job Training %	Seminars, Workshops, Conferences %	Job Rotations %	
All Firms					
Small – NSW	32.7	72.8	40.7	14.1	93.8
Large – NSW	68.4	90.2	61.1	44.9	12.5
Total – NSW	36.9	74.8	43.0	17.7	1063
Total – Australia	40.9	76.8	47.0	21.0	309.5
Manufacturing firms					
NSW	34.9	76.9	44.0	35.2	12.4
Australia	42.0	78.1	38.1	36.0	35.8

Source

There are significant differences between small and large firms in the fields of training provided. Large firms make a higher commitment to management training, computer training and occupational health and safety training. Training for small firms is more dispersed among training categories. This is indicated in Table 15.

Table 15: Fields of training by firm size and industry, 1997-98

	Proportion of Firms Providing -						Total No of Firms with Training No. ('000)
	Management Training %	Professional Training %	Training for Computer Specialists %	Trade and Apprenticeship Training %	Health and Safety Training %	Other Training %	
All Firms							
Small – NSW	21.6	12.9	18.2	19.6	13.3	29.3	93.8
Large – NSW	45.7	31.4	41.4	31.3	45.4	58.8	12.5
Total – NSW	24.4	15.0	20.9	21.0	17.1	32.7	1063
Total – Australia	24.7	18.8	20.8	20.3	23.0	37.5	309.5
Manufacturing firms							
NSW	23.8	12.2	28.1	26.6	34.3	41.8	12.4
Australia	23.0	16.2	23.3	32.3	35.2	40.4	35.8

Source: *Portrait of Australian Business*

The range of training providers also differs between large and small firms. Small firms place substantial reliance on employees and owners, while large firms supplement this with other delivery methods, including industry and professional associations, TAFE and universities. The level of participation of small business in TAFE and university-based training is quite small. This is indicated in Table 16.

Table 16: Training providers by firm size and industry, 1997-98

	Proportion of Firms Using -									Total No of Firms No. ('000)
	Employees or Owners for On the Job Training	Employees or owners for structured training	Professional Associations	Industry Associations	Equipment manufacturer or Supplier	Private Training Consultant	TAFE	University	Other	
	%	%	%	%	%	%	%	%	%	
All Firms										
Small – NSW	70.6	20.6	13.3	16.9	18.0	4.5	19.8	2.7	8.2	93.8
Large – NSW	85.8	34.8	42.2	47.6	35.3	28.6	41.5	19.6	2.4	12.5
Total – NSW	72.4	22.3	16.6	20.5	20.0	7.3	22.4	4.7	7.5	1063
Total – Australia	72.7	22.4	23.3	26.5	24.1	12.7	18.6	5.7	5.7	309.5
Manufacturing firms										
NSW	69.2	16.4	18.3	23.5	36.8	14.2	27.6	5.1	1.3	12.4
Australia	72.9	26.5	19.5	24.3	32.7	15.2	28.5	5.4	2.6	35.8

Source: Portrait of Australian Business

The development of workplace skills and competencies in manufacturing is recognised as vital for future development. Public policies appear, however, to lack a strategic direction with numerous funding bodies and mechanisms of delivery.

The information on training for small business, and by implication, small business manufacturing, suggest that more can be done in this area.

One of the most significant issues for small business is access to competent and qualified training providers. There is a need to ensure that providers come to the “shop floor” and address specific business issues. These arrangements can be facilitated through regional business networks.

One of the more important developments has been the integration of University and TAFE teaching and learning approaches – at the UTS, University of Western Sydney and in the regions. This mechanism should be further developed and encouraged and its availability widely disseminated.

The accreditation of skills development programs should be closely monitored to ensure that people are not misled or wasting their time.

Every effort should be made by government and industry associations to encourage small manufacturing business owners, managers and employees in small business manufacturing to have access to, and be encouraged to participate in, industry training programs.

9.3 Management development and education

The last five years has seen an explosion in “management advice” literature. A significant proportion is sold in airport newsagencies and bookstores. The general themes seem to be:

- Define goals and try to achieve them

Management is a practice, and skills are often best updated through “learning by doing”. It is important that managers are aware of new management practices and techniques, but are not put in a position where they are inundated with untried and/or inappropriate “solutions”.

- Maximise winning and minimise losing
- Minimise the generation of negative feelings
- Remain objective.

The assumptions and presumptions obtained in these management “cook books” are rarely tested. Some are overly simplistic and will give managers the entirely wrong idea.

Unfortunately, the state of management education and training in Australia has been neglected. Management courses and programs are based on US teaching, suitable for large businesses. They are often heavily oriented to human relations and skills development. There are very few courses targeted at small business in entrepreneurial management that focus on running a successful (profitable) business.

Managers should seek continuous learning and education in areas such as risk management, finance, marketing, commercial law, business planning, and R&D management

One of the most effective ways of learning and encouraging management development is through mentoring and technology transfer. Business associations have a major contribution to make in this area.

Management education in Australia, particularly in relation to small business, requires urgent review and development to ensure that programs are relevant and appropriate to needs and requirements. Above all, it needs to be *practice based*.

It is essential that management development courses and programs involve management practitioners to the greatest extent possible (as occurs in medicine and law) and should not be accredited and assessed on academic merit alone.

9.4 Access to specialised advice

The management environment is being subjected to increasing complexity in terms of compliance with taxation, accounting, corporate reporting and environmental regulations. In addition, expertise is also required to enter new markets and sell products that meet regulatory requirements. Small businesses cannot contemplate having all-important capability available internally.

Industry and professional associations provide useful starting points for matters concerned with workplace relations and statutory compliance. A number of associations also assist with building networks, market access, and accessing specialised capability.

A critical issue for small manufacturing businesses is knowing when to seek expert advice and how to access it. Without prior knowledge, the task can be daunting. However, unless expertise is sought errors can be made and opportunities lost.

Unfortunately, the larger accounting firms, which have the knowledge and expertise to assist small innovative businesses, have a major focus on large business – the “big end” of town. A number of firms have strong “entrepreneurial practices” that aim to assist technology based firms gain access to finance – including venture capital.

Smaller professional services firms, which are also small businesses, are often better suited to assisting smaller businesses. Many of these firms have strategic alliances with the larger firms and direct clients when issues become complex and global connections may be required.

In general, however, small accounting firms concentrate on compliance and taxation work and while their work in this area is of major benefit, their capacities and capabilities in advising on management issues outside the general accounting framework, such as product development, market access, etc, is limited.

9.5 The attributes and characteristics that small businesses will need to develop

The attributes and characteristics that business owners and managers will need to develop over the next 15 years include:

- *Managing “knowledge workers”* - as knowledge becomes more important as a strategic resource, businesses will have to become adept at managing people who bring specialised knowledge to the work place which, in turn, is a part of a company’s strategic asset base
- *Project management* - business owners may find that they have to spend time assembling project teams to undertake specific tasks and assignments, sourced through networks and contracts, rather than holding people in permanent employment. This requires a new set of management skills
- *Continuous learning* – a commitment to continual learning has become essential for owners, managers and employees to be effective in the business and industry environment
- *Willingness to embrace change* - One of the most critical attributes that businesses will need to develop is a capacity to embrace change. Change is inherent in the process of innovation. Unless firms are committed to innovation there is every likelihood that they will be left behind
- *Locating and accessing professional advice* – as the business environment becomes increasingly complex, small business managers will need to find competent, expert and knowledgeable professional advice to assist in all aspects of business development.

Small business owners and managers will need to acquire a range of skills and capabilities in the area of management to take them forward over the next 15 years

10 The Institutional and Regulatory Environment

Notwithstanding efforts to remove “red tape” the burden of compliance on small business is actually increasing rather than decreasing.

The institutional and regulatory environment has received a great deal of attention in government reviews and reports over the last ten years. Much of this has been based on a premise that small businesses are, collectively, significant employers, and removal of institutional and regulatory impediments would make the employment decision easier.

10.1 Compliance

The Australian corporations law has strict requirements in relation to the issue of prospectuses and the penalties for misrepresentation are heavy. Some have argued that this prevents entrepreneurial businesses obtaining access to capital.

There is also an extensive range of statutory obligations in the environmental, economic and social arenas that requires businesses to administer and report on. These matters have been reported on extensively elsewhere.¹²³

10.2 Taxation

Change in the structure of business taxation is an ongoing activity. Small business needs to be aware and informed about the implications of change and have the opportunity to provide input concerning impact and meeting obligations

Much has been written about the impact on small business of the Goods and Services Tax and the Business Activity Statement. Businesses that keep good records and have access to good professional advice have managed to meet their obligations. However, this has come at a cost.

The main problems with the new tax system relate to the impact on liquidity and on business performance - where it has not been possible to pass the tax increases on to final consumers. There is also a problem in the perceived fairness, as many micro-businesses have opted out of the new system.

Globalisation and the Internet have had a major impact on a country's capacity to raise revenue. Businesses are able to arrange their financial affairs in a way that best meets their requirements with the implication that countries will not be able to retain substantially different taxation regimes over the longer term. The OECD is currently looking at possibilities for taxation of business transactions on the Internet.

¹²³ See for example *More Time for Business*.

Many small businesses will continue to arrange their operations to stay below the payroll tax thresholds.

Notwithstanding the progressive reduction in company taxation in Australia, the high rates of personal taxation will continue to have a major disincentive effect on the risk-reward balance in building a business over the next several years. This applies as businesses owners seek to take funds out of companies for their own personal living expenses, or to companies that operate as proprietorships.

Payroll tax is a major constraint in small business growth – and impacts on manufacturing where there are high levels of direct wage or contract employment. Unless alternative revenue sources are found, State governments will continue to rely on payroll tax as one of their main revenue sources.

Local government, constrained in raising rate revenue, is continually looking for new ways to raise revenue from businesses. Developer charges and local government business taxes will have a tendency to increase in incidence – unless checked by State government.

10.3 Employment costs

For many years small business managers and operators, particularly in manufacturing, have voiced concern over the high costs of employment as a result of a range of wages-related on-costs. These include

- Workers compensation insurance
- Compulsory superannuation

In the area of workers compensation there are opportunities for the State to strengthen the system by rewarding management for reducing risks. The experience rating system should be the subject of continual review.

10.4 Workplace relations

There is a great deal of information about the lack of flexibility and complexity in work place relations and the associated risks of taking on “permanent” employees. Termination provisions, occupational health and safety, equal opportunity and discrimination provisions have made employers highly risk averse.

Managers in small business do not have the time to become familiar with complex industrial relations procedures and therefore run the risk of dealing with litigious employees.

Owners prefer to work with people they can trust - which is tending to occur increasingly through business to business contract and alliance arrangements. These

Workplace relations management is becoming increasingly complex for small business owners – and will remain a strong disincentive to take on additional employees

arrangements are driven more by considerations relating to sharing risk than by tax management.

Many small businesses will not employ people directly, preferring to rely on contract arrangements and sourcing through labour hire companies. Employment through contracting organizations is prominent in office support, financial systems and information technology.

Small businesses have expressed concern about the impact of cost recovery in their capacity to access government provided professional services, advice and inspection services.

10.5 Government cost recovery

The costs of acquiring services from government which have been traditionally provided free or at minimal cost is increasing as Agencies seek to finance activities directly from “users” rather than financing them through the taxation system.

The main areas of concern (including some which have already been referred to in this Report) are:

- Austrade – fee for service for market advice
- CSIRO – cost recovery on R&D services
- AQIS – food inspection.

In other countries, including our major trading competitors, these costs are borne by government.

Government agencies setting charges in a non contestable market environment have an obligation to ensure that inefficiencies, such as excessive corporate overheads, are not built into the costing algorithm.

At the local government level, Councils are seeking to recover the costs of inspections and approvals directly from applicants. This trend will continue as Councils find it difficult to raise revenue through traditional “capacity to pay” mechanisms such as property rates. Businesses tend to be impacted on both counts, however – as they are perceived to have high capacity to pay and are extensive users of local government services.

Full cost recovery mechanisms are being introduced into more areas by the Commonwealth and will accelerate in pace over the next few years. Cost recovery and “user pays” strategies create an incentive for improvement in service quality.

10.6 Privacy

Proposed privacy legislation will have a major impact on small business

The *Privacy Amendments (Private Sector) Act 2000* will come into effect on December 21 2001. Small businesses will have until December 2002 to determine whether it is exempt from the legislation.

The Act will regulate the way private sector organizations can collect, use, keep secure and disclose personal

information and includes the collection of personal information online. The Act will also mean that consumers will now have the right to know why a private sector organization is collecting their personal information, what information it holds about them, how it will use the information and who else will get the information. Consumers will also be able to see this information, seek correction and make a complaint if they think their information is not being handled properly.

The objective of the Act is to establish a single national scheme through the adoption of codes devised by private sector organizations based on the National Privacy Principles (NPPs) for the appropriate collection, use, correction, disclosure and transfer of personal information by the private sector.

Private sector organizations or industry sectors will need to develop privacy codes based on the legislation that are then approved by the Privacy Commissioner. In instances where an organization or industry does not put a privacy code in place the (NPPs) will apply.

10.7 Government procurement

In the emerging national and global market place, small business should not expect to receive preferential treatment.

There is a perception however, that many government agencies would prefer to deal with larger companies and overseas suppliers than individuals, or consortia of small businesses. This is a reflection of the way in which purchasers manage risk.

Small businesses placing tenders through networks and consortia for government contracts need to ensure that purchaser risk is minimised through:

- Robust, transparent and accountable alliance management arrangements
- A support infrastructure and management capability
- A capacity to meet and deliver on *all* tender specifications.

With government agencies being increasingly required to base performance on “value for money” small businesses must be able to demonstrate capability in a competitive environment.

Small businesses rely heavily on government contracts. In the past, local businesses and small businesses in particular, had preferential treatment.

There is a number of initiatives that small business will need to take in improving relationships with government

10.8 Attributes and characteristics that small businesses will need to develop

In the evolving institutional and regulatory environment, small business manufacturing owners and operators will need to develop competencies and capabilities in a number of areas:

- Awareness of obligations and commitments under an increasing range of Commonwealth, State and local government legislation and regulation
- An understanding of how to use new and developing electronic linkages to Government business information.

11 Directions in Government and Industry Support for Small Business

Governments have a very high expectation of small business, and, would like to do as much as possible to encourage them.

Government objectives of international competitiveness, economic growth and national prosperity can only be achieved by *business decisions* to invest in new technology and innovation, expand production and enter new markets.

To that end, many public policies and industry programs are directed towards encouraging people to establish businesses and for existing businesses to take on more employees.

Thus, in a public policy context, governments have a responsibility to create an environment in which business can grow and prosper.

11.1 Issues for small business

Business decisions to invest inevitably involve detailed consideration of factors relating to cost, risk and return.

Many small businesses lack the resources to improve performance beyond day to day survival. Much of the focus of industry policy at the business level is therefore directed towards assisting the growth and development of small businesses with potential for viability by reducing costs and “sharing” or “managing risk” to encourage positive investment decisions and sustained economic performance.

The critical issue is that policy addresses *business issues* and decision frameworks that managers and entrepreneurs adopt in taking decisions to invest in existing and emerging businesses or in particular locations. Unacceptable cost and risk profiles arise in a number of areas, including:

- Inability to capture all of the returns from investment in research and development
- Possible failure of a new technology and product to meet demand expectations
- Costs of creating new production capacity
- Possible inability to employ sufficient numbers of qualified people
- Access to and cost of finance
- Inability to access overseas markets.

Government decisions to support business in these circumstances fall into the category of what economists term “merit goods” – a particular form of “market failure”. Such decisions are made when there is considered to be a consensus of collective responsibility for governments to act in order to achieve particular goals and objectives.

As indicated, these outcomes generally relate to achieving international competitiveness and world-class standards.

11.2 What does small business expect from government?

Many small business survive and prosper without government support

The question is rarely asked about what small businesses expect, if anything, from government. There are thousands of small businesses that receive nothing from government in the way of loans, grants, subsidy, preference or other forms of support and assistance.

Small business should expect government to provide:

- A commercial environment that protects rights in intellectual property
- Certainty of legal status of companies and other corporate entities
- A stable and independent financial framework that provides security of exchange
- An international trade policy that works toward removing tariffs and quotas and “technical” barriers to trade
- Quality and reliable infrastructure (whether publicly or privately provided) - including transport, telecommunication and energy
- An education, science and technology framework that provides depth in technical skills and basic research capability, and supports industry development
- A foreign direct investment strategy that builds alliances and linkages to the nation’s distinctive capabilities – particularly in relation to small technology based firms
- An independent and credible system of enforcement and compliance

Beyond this, small businesses want to run their enterprises in an efficient and profitable way. *Small business owners, committed to an ethic of free enterprise, do not seek government handouts.* They may require advice and assistance on how to run their businesses better and exploit opportunities – particularly internationally. They may also need an incentive to invest in high-risk ventures involving substantial investment in research and development.

11.3 NSW Government support for small business

11.3.1 Business Enterprise Centres

Business Enterprise Centres have been playing a major role in the development of business networks in NSW.

State and Regional Development provides funding to 50 Small Business Advisory Centres across the State to deliver business information services to start-up and micro businesses in New South Wales.

Most of the Small Business Advisory Centres are Business Enterprise Centres (BECs) that are independent, non-profit, community-based organizations established under a company structure with boards of directors to provide free and confidential advice and assistance to existing and potential small business owners and operators.

Additional services offered include:

- Provision of training workshops (including the New Enterprise Incentive Scheme for some BECs)
- Assistance in doing business plans
- Access to business information, both in print and electronically
- Networking and numerous other business-related activities.

Arrangements for joint tendering are being facilitated in NSW through the Business Enterprise Centre Program. Technology and electronic networking will further enhance developments in this area.

Business Enterprise Centres form a sound base for the development of further initiatives to encourage and facilitate network formation and to provide a “one-stop-shop” for government funded support and assistance for small to medium businesses.

11.3.2 Regional development boards

There is a complex infrastructure of regional development organizations funded by Commonwealth, State and local governments

The State government supports regional development boards in the regions across the State. The performance of these boards varies considerably. Many exist alongside other development committees and networks established by local government and Commonwealth agencies.

Many regional organizations appear to have very similar objectives (for example, Department of Employment, Workplace Relations and Small Business funded Regional Consultative Committees have functions similar to State Regional Development Boards).

In some regions it is difficult for an outsider to discern how all of the various boards or committees, taken

together, create value for businesses. Much of the problem relates to the functional structure of these organizations – and the consequent potential for duplication and overlap.

The challenge for development boards is to adopt an integrating strategy in the regions and to ensure that all networks are pulling in the same direction.

Regional Boards have the potential to take a strong role in manufacturing industry development, including support for and facilitation of business networks in collaboration with other support infrastructure.

Most boards, committees, regional organizations, etc, have developed websites. Many are out of date and in some cases the development organization no longer exists.

11.3.3 Business development programs

The Department of State and Regional Development provides a range of specific programs to support the growth of small and medium enterprises. These are listed below.

Program	Purpose
Aboriginal enterprise development program	To encourage Aboriginal Torres Strait Islander small business people to utilise DSRD services and expertise. The Department has appointed an Aboriginal Business Development Project Officer. The Aboriginal Business Link Program enables Aboriginal businesses to qualify for other DSRD programs, and to link to mainstream trade shows and marketing activities.
Business expansion program	To encourages small businesses to plan strategically for their future. The program subsidises specialist consultants to provide independent professional advice on strategic management issues where this is of direct benefit to NSW. The Program is available to a range of small firms that meet the scheme's financial viability and growth prospects criteria.
Business migrant information and referral service	To help migrants with business skills to establish viable enterprises in NSW. It provides prospective business settlers with access to literature and advice on establishing and operating a business in the State. DSRD has established the service to boost business start-ups, increase investment, create employment and encourage innovation among business skills class migrants.
Export advisers	To encourage and assist companies based in regional NSW to take advantage of export opportunities. They draw on DSRD and the collaborative resources of Agsell, Ausindustry, Austrade, the Department of Foreign Affairs and Trade to advise regional businesses thinking of exporting. The Program places advisers in strategic areas of NSW to give hands-on advice and guidance to regional businesses. Advisers are located in the Bathurst, Nowra, Tamworth, Griffith/Wagga and Coffs Harbour/Grafton areas.
Innovation advisory centres	To provide a dedicated service to inventors and innovators through offering expert advice on developing new ideas commercially. Centres provide a range of services to help enterprises transform ideas into marketable products and processes. They also help small businesses access a range of information and programs which encourage the uptake of innovative practices.
Women in business mentor program	To promote the professional development of female entrepreneurs through improving their access to assistance, networks and training. The Program aims to enhance the growth and viability of businesses owned by NSW women and establish a pool of role models for other businesswomen.
Youth enterprise education	DSRD sponsors several programs and awards that educate young people about business development.
Exporters Network	The Network is a growing group of NSW companies who recognise the need to increase NSW exports and the benefits this can bring to themselves, the community and the State of New South Wales. The Network provides a range of services to NSW small to medium sized enterprises designed to meet their particular needs.

The programs are, in large measure, functionally and category driven – rather than being driven by specific business needs. The result is that gaps emerge when

The key issue for the future is to leverage these programs with business and industry associations and the Commonwealth and formal and informal business networks.

needs do not exactly fit the eligibility criteria. Nonetheless, the Department is performing well with very limited resources. Other States allocate considerably more to business development programs.

11.4 Commonwealth Government business support and assistance for small business

In addition to State government programs, some of which are funded by the Commonwealth, there is what appears to be a plethora of specific purpose programs aimed at assisting small business. The overall contribution to small business success is by no means clear.

Commonwealth government programs with an impact on small business manufacturing include:

Functional area	Program
Information Technology And Electronic Commerce	Information Technology Online Programme Building on IT Strengths Programme The Testing and Conformance Infrastructure Program Endorsed Supplier Arrangement Program
Employment And Training	New Enterprise Improvement Scheme (NEIS) Australian Job Search New Apprenticeships
Research and development	Strategic Partnerships with Industry, Research and Training Research and Development (R&D) Start Program Research and Development Tax Concession Technology Diffusion Program
Export Facilitation Programmes	Austrade Export Market Development Grants Scheme and the Export Access Program TradeStart Export Finance and Insurance Corporation
Enterprise Development Programmes	AusIndustry Commercialising Emerging Technologies (COMET) Program
Targeted Assistance Programmes	Regional Assistance Programme - Small Business Incubators Small Business Enterprise Culture Program Indigenous Small Business Fund Regional Tourism Program Flood Relief Assistance Regional Solutions Program Family and Community Networks Initiative
Equity finance	Innovation Investment Fund Program Renewable Energy Equity Fund Pooled Development Funds Program

Descriptions of these programs can be found on the websites of the agencies concerned.

The plethora of programs provides incentives for third parties and brokers to seeking funding on the basis of commissions and success fees. The practice is quite common in the R&D tax concession.

11.5 The need for rationalisation

Most Commonwealth programs are functionally and dollar driven. They do not address specific business opportunities and needs. They are also submission driven and require a large commitment of time and resources to put submissions forward – as well as in examination and review by public servants.

There is a risk that business support programs go to those who have the time and inclination to seek government support and assistance rather than to those who have a genuine business need. Very small businesses cannot afford the time to complete the application process for programs such as R&D Start.

In other public policy and program areas significant improvements have been made by establishing “one-stop-shops” for people and organizations to access government programs. A single application form has also been adopted. The Natural Heritage Trust has had several years experience in this area.

The Department of State and Regional Development should support the principle of a “one-stop-shop” for managing all government support and assistance programs for small to medium businesses. It should be delivered through a *non-government* shop front, such as the Business Enterprise Centres.

Many really successful small businesses have made it without government support and assistance. Owners and managers do not want to be seen to taking a government “hand out” and/or are unwilling to have the government involved in their business affairs. Yet it may well be these businesses that can provide the sort of external benefits that government funding seeks to achieve.

The most valuable contributions from government to small manufacturing businesses are likely to be in areas where there is an apparent or potential market failure – such as in research and development and international trade and market access on account of diseconomies of small scale

It is important that government does not support a culture where businesses seeking to set up or expand expect a government grant or loan. Assistance should be on the basis of development of public-private partnerships, where there are both public and private returns.

11.6 Industry and business association support and assistance

The 1998 Business Longitudinal Study data indicate that membership of industry and business associations are quite low, particularly among small businesses. This is indicated in Table 17.

Traditionally, industry associations have represented employers before the Commonwealth and State industrial relations commissions and tribunals. Associations now provide a substantial amount of information and advice to their members on industrial

For the future, government agencies need to think whether they are really helping and where they can make a difference with the limited resources they have available.

Industry and business associations should seek to increase the proportion of small business members with a view to providing information and advisory services, developing alliances and networks and technology transfer.

issues and obligations. Many small business owners would source this information from Commonwealth and State Industrial Relations Agencies.

Industry Associations have more recently become involved in representation to Governments on industry policy matters – including taxation, trade and research and development. Associations also provide secretariat services and training programs. It is understood that many associations are looking at ways they can more effectively meet the needs of small business.

**Table 17: Membership of an industry or business association
1997-98 by firm size and industry**

	Proportion of Firms Belonging to an Association	
	%	Total No of Firms No. ('000)
All Firms		
Small – NSW	23.9	172.0
Large – NSW	58.3	13.1
Total – NSW	26.3	185.2
Total – Australia	28.4	541.1
Manufacturing firms		
NSW	27.9	19.4
Australia	28.1	55.1

Source: Portrait of Australian Business

Trends and developments in manufacturing referred to in this Report create an opportunity for industry and business associations to develop new roles and responsibilities.

Small to medium businesses would be assisted by associations becoming more involved in activities such as:

- Technology transfer by encouraging and supporting access to and visits from leaders in manufacturing process and product technologies
- Facilitating and supporting alliances – locally and internationally
- Education, training and awareness in alliance management.

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Other

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United States

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Appendix 1: Industries in NSW that have a dominant position relative to rest of Australia

Industry classification	Characteristic	Data	Employment	Industry Value-added (\$m)	IVA per employee (\$'000)	Number of businesses
FOOD BEVERAGE AND TOBACCO MANUFACTURING						
Meat And Meat Product Manufacturing						
Poultry Processing	Distribution of Chicken Meat Production	38.9%	6691	373.3	55.8	55
Bacon, Ham and Smallgood Manufacturing	Location of Establishments	30.7%	1760	129.0	73.3	51
Dairy Product Manufacturing						
Milk and Cream Processing	Location of Milk Processing	35.6%	993	83.6	84.2	8
Ice Cream Manufacturing	Location of Ice Cream Establishments	28.8%	807	107.4	133.1	20
Oil and Fat Manufacturing	Location of Management Units	39.4%	840	121.0	144.1	22
Flour Mill And Cereal Food Manufacturing						
Flour Mill Product Manufacturing	Location of Establishments (per cent)	\$49.3 b	1191	151.9	127.5	17
Cereal Food and Baking Mix Manufacturing	Location of Cereal Foods Establishments (Per Cent)	40.1%	2201	368.8	167.6	64
Bakery Product Manufacturing						
Cake and Pastry Manufacturing	Percentage of Locations by State	29.1%	2285	95.9	42.0	86
Other Food Manufacturing						
Confectionery Manufacturing	Location of Confectionary Establishments by State	32.2%	1272	Np	Np	39
Prepared Animal and Bird Feed Manufacturing	Distribution of Industry Establishments (per cent)	27.7%	1723	262.5	152.4	60
Food Manufacturing n.e.c.	Location of Establishments (per Cent of Total)	32.7%	5263	364.3	69.2	159
Beverage And Malt Manufacturing						
Soft Drink, Cordial and Syrup Manufacturing	Percentage of locations by State	32.5%	2042	259.9	127.3	48
Spirit Manufacturing	Location of Establishments	31.3%	np	Np	Np	4
Tobacco Product Manufacturing	Location of Tobacco Establishments (No.)	3	np	Np	Np	2
TEXTILE, CLOTHING, FOOTWEAR AND LEATHER MANUFACTURING						
Textile, Fibre, Yarn And Woven Fabric Manufacturing						
Cotton Textile Manufacturing	Distribution of Employment	30.8%	789	45.5	57.6	18
Textile Product Manufacturing						
Made-Up Textile Product Manufacturing	Proportion of Establishments by State	33.4%	1603	65.5	40.8	253
Clothing Manufacturing						
Women's and Girl's Wear Manufacturing	Percentage of Locations by State	44.3%	3600	158.7	44.1	508
	Percentage of Employment by State	48.7%				
Leather And Leather Product Manufacturing						
Leather and Leather Substitute Product Manufacturing	Percentage of Employment by State	32.2%	169	9.0	53.5	34
WOOD AND PAPER PRODUCT MANUFACTURING						
Log Saw milling and timber dressing						
Log Saw milling	Percentage of Locations by State	30.8%	1156	70.4	60.9	100
Wood Chipping	Proportion of Total Establishments by State	32.4%	141	32.1	228.4	5
Other Wood Product Manufacturing						
Plywood and Veneer Manufacturing	Proportion of Total establishments - 1998	31.9%	441	22.6	51.3	10
Fabricated Wood Manufacturing	Proportion of Total Employment - 1998	33.0%	1000	87.1	87.1	28
Wooden Structural Component Manufacturing	Locations of Wooden Structural Component Manufacturing	37.4%	6117	263.7	43.1	724
Paper and Paper Product Manufacturing						
Paper Bag and Sack Manufacturing	Percentage of Locations by State	40.0%	247	19.7	79.5	11

Industry classification	Characteristic	Data	Employment	Industry Value-added (\$m)	IVA per employee (\$'000)	Number of businesses
PRINTING, PUBLISHING AND RECORDED MEDIA						
Printing and services to printing						
Printing	Printing Locations by State	37.0%	14282	772.2	54.1	1134
Services to Printing	Proportion of Total Number of Establishments by State	36.3%	2100	114.8	54.6	298
Publishing						
Newspaper Printing or Publishing	Proportion of total establishments	37.1%	12221	996.4	81.5	200
Other Periodical Publishing	Other Periodical Publishing Establishments by State	46.2%	4339	314.0	72.4	155
Book and Other Publishing	Book and Other Publishing Establishments by State	39.4%	3158	199.0	63.0	166
Recorded Media Manufacturing and Publishing	Distribution of Industry Locations (per cent)	43.1%	1409	233.7	165.9	43
PETROLEUM, COAL, CHEMICAL AND ASSOCIATED PRODUCT MANUFACTURING						
Petroleum and Coal Product Manufacturing n.e.c.	Estimated Industry Turnover by State	33.0%	115	29.0	251.4	9
Basic Chemical Manufacturing						
Industrial Gas Manufacturing	Industry Spread	26.5%	np	Np	Np	2
Inorganic Industrial Chemical Manufacturing n.e.c.	Industry Spread	31.4%	1300	167.9	129.1	23
Other Chemical Product Manufacturing						
Paint Manufacturing	Industry Spread by Location	37.2%	2123	182.2	85.8	50
	Industry Spread by Employment	38.4%				
Medicinal and Pharmaceutical Product Manufacturing	Industry Spread by Location	48.0%	6802	880.7	129.5	67
	Industry Spread by Employment.	49.0%				
Pesticide Manufacturing	Industry Spread	35.9%	838	172.7	206.1	13
Soap and Other Detergent Manufacturing	Industry Spread	37.0%	1813	245.8	135.6	58
Cosmetic and Toiletry Preparation Manufacturing	Industry Spread	44.0%	3307	205.0	62.0	62
Ink Manufacturing	Industry Spread by Location.	46.0%	232	29.6	127.9	16
Chemical Product Manufacturing n.e.c.	Distribution of Employment	46.8%	1437	141.7	98.6	68
Plastic Product Manufacturing						
Plastic Blow Moulded Product Manufacturing	Industry Turnover	35.8%	1030	134.1	130.2	27
	Industry Employment	37.8%				
NON-METALLIC MINERALPRODUCT MANUFACTURING						
Ceramic Manufacturing						
Clay Brick Manufacturing	Distribution of Industry Employment by State	29.6%	1021	111.3	109.0	16
	Distribution of Industry Establishments by State	33.6%				
Ceramic Product Manufacturing	Distribution of Employment by State & Territory	60.4%	489	44.0	89.9	10
Cement, Lime, Plaster and Concrete Product Manufacturing						
Cement and Lime Manufacturing	Distribution of Establishments by State & Territory	41.7%	465	Np	Np	8
	Distribution of Employment by State & Territory	29.0%				
Plaster Product Manufacturing	Distribution of Establishments by State	31.0%	641	90.8	141.7	26
	Distribution of Employment by State	33.4%				
Concrete Slurry Manufacturing	Production by State	31.0%	1949	202.5	103.9	102
	Distribution of Establishments by State	34.1%				
	Distribution of Employment by State	34.8%				
Concrete Pipe and Box Culvert Manufacturing	Distribution of Industry Establishments By State	32.6%	371	Np	Np	12
Concrete Product Manufacturing n.e.c.	Distribution of Establishments by State	28.4%	1336	169.4	126.7	99
Non-Metallic Mineral Product Manufacturing n.e.c.	Distribution of Establishments by State & Territory	32.2%	1920	209.9		133

Industry classification	Characteristic	Data	Employment	Industry Value-added (\$m)	IVA per employee (\$'000)	Number of businesses
METAL PRODUCT MANUFACTURING						
Iron And Steel Manufacturing						
Basic Iron and Steel Manufacturing	Iron and Steel Products Industry Turnover by State	62.0%	11334	1289.9	113.8	57
Iron and Steel Casting and Forging	Percentage of Turnover by Revenue	41.0%	1862	154.7	83.1	71
Steel Pipe and Tube Manufacturing	Steel Pipes and Tubes Turnover by State	49.0%	1966	138.9	70.6	26
Basic Non Ferrous Metal Manufacturing						
Aluminium Smelting	Estimated Aluminium Turnover by State	\$38.0b	1965	449.6	71.8	11
Structural Metal Product Manufacturing						
Structural Steel Fabricating	Percentage of Revenue by State	30.0%	6167	452.3	73.3	371
Architectural Aluminium Product Manufacturing	Architectural Aluminium Industry Turnover by State	\$32.0b	3971	206.8	52.1	350
Structural Metal Product Manufacturing n.e.c.	Structural Metal Product Manufacturing	\$38.0b	2165	129.1	59.6	214
Sheet Metal product Manufacturing						
Metal Container Manufacturing	Percentage of Industry Turnover by State	\$36.0b	1520	120.2	79.1	43
Sheet Metal Product Manufacturing n.e.c.	Percentage of Industry Turnover by State.	\$34.0b	3713	203.1	54.7	332
Fabricated Metal Product Manufacturing						
Metal Coating and Finishing	Metal Coating and Finishing Industry Turnover by State	31.0%	2217	120.5	54.3	244
Fabricated Metal Product Manufacturing n.e.c.	Fabricated Metal Product Establishments by State	35.0%	7185	290.3	40.4	761
MACHINERY AND EQUIPMENT MANUFACTURING						
Other Transport Equipment Manufacturing						
Shipbuilding	Distribution of Establishments by State/Territory	26.5%	1417	124.5	87.9	21
Aircraft Manufacturing	Distribution of Establishments by State/Territory	31.7%	5428	534.5	98.5	101
Photographic and Scientific Equipment Manufacturing						
Medical and Surgical Equipment Manufacturing	Distribution of Industry Establishments (per cent)	37.1%	2138	153.8	71.9	263
Professional and Scientific Equipment Manufacturing n.e.c.	Distribution of Industry Establishments (per cent)	34.2%	1433	95.4	66.6	60
Electronic Equipment Manufacturing						
Electronic Equipment Manufacturing n.e.c.	Distribution of Industry Establishments (per cent)	35.9%	5953	436.3	73.3	197
Electrical Equipment and Appliance Manufacturing						
Electric Cable and Wire Manufacturing	Distribution of Industry Establishments (per cent)	43.8%	2042	161.9	79.3	25
Battery Manufacturing	Geographic Location by State	50.0%	196	np	Np	5
Electric Light and Sign Manufacturing	Geographic Spread of Establishments	37.7%	2399	Np	Np	84
Electrical Equipment Manufacturing n.e.c.	Proportion of total Establishments - 1998	36.2%	5403	279.4	51.7	228
OTHER MANUFACTURING						
Prefabricated Building Manufacturing						
Prefabricated Building Manufacturing n.e.c.	Prefabricated Building Manufacturing Establishments	31.3%	193	12.6	65.5	23
Furniture Manufacturing						
Sheet Metal Furniture Manufacturing	Sheet Metal Furniture Industry Turnover by State	\$37.0b	2263	114.8	50.7	93
Miscellaneous Manufacturing						
Manufacturing n.e.c.	Distribution of Turnover by State	43.1%	1649	100.8	61.1	188
	Distribution of Employment by State	37.6%				
Total dominant industries						
TOTAL STATE			297015	22902	77.1	15044
Proportion in Dominant Sectors						
Source: IBIS Information Ltd						

Appendix 2: Companies headquartered in NSW in industries that have a dominant position in Australia

Classification	Company headquartered in NSW	Revenue 000's	Total assets 000's	Npat 000's
FOOD, BEVERAGE AND TOBACCO MANUFACTURING				
Poultry Processing	Chickadee Foods Pty Ltd	91751		
	Cordina Chicken Farms Pty Ltd	72500		
	Inghams Enterprises Pty Limited	966000	1077270	
Bacon, Ham and Smallgood Manufacturing	MQF Pty Limited	137148		
Cereal Food and Baking Mix Manufacturing	Kellogg (Aust) Pty Ltd	451324	328231	38562
	Ricegrowers' Co-operative Limited	695475	530541	29612
Cake and Pastry Manufacturing				
Confectionery Manufacturing	Darrell Lea Chocolate Shops Pty Ltd	79798		
	Wrigley Company Pty Limited	102114	60304	13916
Prepared Animal and Bird Feed Manufacturing	Ridley Corporation Limited	1017673	797698	14508
Food Manufacturing n.e.c.	Burns Philp & Company Limited	1524100	1417900	65900
	Cantarella Holdings Pty Ltd	65096		
	Sara Lee Coffee & Tea (Australia) Pty Ltd	255857	232936	8487
	Smith's Snackfood Company Limited	426137		
Soft Drink, Cordial and Syrup Manufacturing	Coca-Cola Amatil Limited	3933800	8789100	123500
Spirit Manufacturing	United Distillers & Vintners (Aust) Limited	237643	220237	25390
Tobacco Product Manufacturing	British American Tobacco Australasia Limited	2973066	1290988	77475
TEXTILE, CLOTHING, FOOTWEAR AND LEATHER MANUFACTURING				
Women's and Girl's Wear Manufacturing	Supre Pty Limited	93094		
Leather and Leather Substitute Product Manufacturing	Oroton International Limited	65057	30151	4802
WOOD AND PAPER PRODUCT MANUFACTURING				
Wood Chipping	Harris-Daishowa (Australia) Pty Ltd	60227	44952	5983
Fabricated Wood Manufacturing	D & R Henderson Pty Ltd	65000		
Wooden Structural Component Manufacturing	Corinthian Industries (Holdings) Pty Ltd	129115		
	Stegbar Pty Limited	146534		
PRINTING, PUBLISHING AND RECORDED MEDIA				
Printing	Diamond Press Australia Pty Ltd	103000		
Printing	Penfold Printing Limited	58333	33896	1817
	CCH Australia Limited	87414	158239	11026
Book and Other Publishing	Reed Elsevier Australia Pty Limited	177542	141258	3139
	Thomson Corporation (Australia) Pty Limited	133975	166045	-12618
	EMI Group (Australia) Holdings Pty Ltd	131278	224691	1296
Recorded Media Manufacturing and Publishing				
PETROLEUM, COAL, CHEMICAL AND ASSOCIATED PRODUCT MANUFACTURING				
Industrial Gas Manufacturing	BOC Gases Australia Limited	801942	1166015	76161
Paint Manufacturing	Akzo Nobel Industries Limited	170244		
Medicinal and Pharmaceutical Product Manufacturing	Abbott Australasia Pty Limited			
	Alphapharm Pty Limited	297119	124304	27249
	AstraZeneca Pty Limited	515309	363239	30156
	Baxter Healthcare Pty Limited	207989	159234	18376
	Merck Sharp & Dohme (Australia) Pty Limited	666209	523241	37444
	Novartis Australia Proprietary Limited			
	Pan Pharmaceuticals Limited	48586	149664	12209
	Pfizer Pty Limited	231962	235409	3197
	Pharmacia Australia Pty Limited	194933	114898	8491
	Roche Products Pty Limited	248225	203184	2379
	Schering-Plough Pty Limited	113673	87347	3041
Cosmetic and Toiletry Preparation Manufacturing	Estee Lauder Pty Limited	178395		
	Sabre Group Limited	52500	35465	4712

Classification	Company headquartered in NSW	Revenue 000's	Total assets 000's	Npat 000's
Ink Manufacturing	Coates Brothers, Australia Pty Limited	57433	35455	409
Chemical Product Manufacturing n.e.c.	Dow Corning Australia Pty Limited	72082	33290	-7878
	National Starch & Chemical Pty Ltd	62847		
	Nuplex Operations (Aust) Pty Limited	178806	129891	-8656
NON METALLIC MINERAL PRODUCT MANUFACTURING				
Cement and Lime Manufacturing	Australian Cement Holdings Pty Ltd	452147	473943	59720
Concrete Slurry Manufacturing	Metromix Pty Limited	66727		
METAL PRODUCT MANUFACTURING				
Basic Iron and Steel Manufacturing	Australian Steel Mill Services Pty Coil Steels Group Pty Limited	66251 87164	48251	9119
Aluminium Smelting	VAW Australia Pty Limited	70822	73951	8903
Structural Steel Fabricating				
Fabricated Metal Product Manufacturing n.e.c.	Avatar Industries Limited	227554	69833	-18771
MACHINERY AND EQUIPMENT MANUFACTURING				
Shipbuilding	ADI Limited	552122		
Aircraft Manufacturing				
Medical and Surgical Equipment Manufacturing	ResMed Holdings Limited Sulzer Australia Pty Limited	103550 49870	96479 41458	20903 1538
Professional and Scientific Equipment Manufacturing n.e.c.	Thomson Marconi Sonar Pty Limited	121321	141638	8683
Electronic Equipment Manufacturing n.e.c.	BAE Systems Australia Holdings Limited Cochlear Limited	417173 146243	185987 93771	-13440 20167
Electric Cable and Wire Manufacturing	Metal Manufactures Limited Pirelli Cables Australia Limited	 309837	 201706	 5270
Electrical Equipment Manufacturing n.e.c.	Asea Brown Boveri Pty Limited HPM Industries Pty Ltd Lincoln Electric Company (Australia) Pty Limited	1178737 217531 63045		
			54592	-1068
OTHER MANUFACTURING				
Sheet Metal Furniture Manufacturing	Dexion (Australia) Pty Limited	77947	40068	-261
Manufacturing n.e.c.	Oldfields Holdings Limited	37215	37453	1380

Source: IBIS Information Ltd

Appendix 3: Industries and companies in NSW with growing exporting capability

Industry sector	Company headquartered in NSW	Revenue 000's	Stage in Industry Cycle	Level of Technological Innovation
FOOD, BEVERAGE AND TOBACCO MANUFACTURING				
Meat Processing	Skyfarm (Forbes) Pty Limited	107,670	Decline	Low
	Yolarno Pty Ltd	280,000	Decline	Low
	Fletcher International Exports Pty Ltd	84,520	Decline	Low
	Northern Co-operative Meat Company Limited	57,351	Decline	Low
	Nippon Meat Packers Australia Pty Limited	499,094	Decline	Low
Ice Cream Manufacturing			Decline	High
Flour Mill Product Manufacturing			Decline	Low
Confectionery Manufacturing	Wrigley Company Pty Limited	102,114	Decline	Low
	Darrell Lea Chocolate Shops Pty Ltd	79,798	Decline	Low
Beer and Malt Manufacturing	Lion Nathan Limited	1,947,700	Decline	Low
	Lion Nathan Australia Pty Limited	1,006,639	Decline	Low
TEXTILE, CLOTHING AND FOOTWEAR MANUFACTURING				
Rope, Cordage and Twine Manufacturing			Growth	Low
Knitting Mill Product Manufacturing n.e.c.			Decline	Low
Clothing Manufacturing n.e.c.			Mature	Low
Footwear Manufacturing	J Robins & Sons Pty Ltd	56,924	Decline	Low
PETROLEUM, COAL, CHEMICAL AND ASSOCIATED PRODUCT MANUFACTURING				
Organic Industrial Chemical Manufacturing n.e.c.			Mature	Low
Paint Manufacturing	Akzo Nobel Industries Limited	170,244	Mature	Low
Medicinal and Pharmaceutical Product Manufacturing	Pan Pharmaceuticals Limited	48,586	Growth	High
	Schering-Plough Pty Limited	113,673	Growth	High
	Baxter Healthcare Pty Limited	207,989	Growth	High
	Novartis Australia Proprietary Limited		Growth	High
	Alphapharm Pty Limited	297,119	Growth	High
	Pharmacia Australia Pty Limited	194,933	Growth	High
	AstraZeneca Pty Limited	515,309	Growth	High
	Merck Sharp & Dohme (Australia) Pty Limited	666,209	Growth	High
	Roche Products Pty Limited	248,225	Growth	High
	Pfizer Pty Limited	231,962	Growth	High
Soap and Other Detergent Manufacturing	Abbott Australasia Pty Limited		Growth	High
			Mature	Low
NON METALLIC MINERAL PRODUCT MANUFACTURING				
Glass and Glass Product Manufacturing	O'Brien Glass Holdings Pty Limited	123,916	Mature	High
Clay Brick Manufacturing			Mature	High
MACHINERY AND EQUIPMENT MANUFACTURING				
Motor Vehicle Manufacturing			Mature	High
Shipbuilding	ADI Limited	552,122	Mature	Low
Boatbuilding			Mature	Low
Aircraft Manufacturing			Growth	High
Photographic and Optical Good Manufacturing			Mature	High
Medical and Surgical Equipment Manufacturing	ResMed Holdings Limited	103,550	Growth	High
	Sulzer Australia Pty Limited	49,870	Growth	High
Professional and Scientific Equipment	Thomson Marconi Sonar Pty Limited	121,321	Growth	High

Industry sector	Company headquartered in NSW	Revenue 000's	Stage in Industry Cycle	Level of Technological Innovation
Manufacturing n.e.c.				
Telecommunication, Broadcasting and Transceiving Equipment	VeCommerce Limited	29,821	Mature	High
	Logical Networks Limited	70,409	Mature	High
	Alcatel Australia Limited	611,980	Mature	High
	Nortel Networks Australia Pty Limited	644,746	Mature	High
OTHER MANUFACTURING				
Jewellery and Silverware Manufacturing			Mature	Low
Toy and Sporting Good Manufacturing			Decline	Low

Source: IBIS Information Ltd

Appendix 4: Industries and companies headquartered in NSW with a global orientation

Industry classification	Company Headquartered in NSW	Revenue 000's	Stage in industry life cycle	
FOOD, BEVERAGE AND TOBACCO MANUFACTURING				
Cereal Food and Baking Mix Manufacturing	Kellogg (Aust) Pty Ltd	451324	Mature	
	Ricegrowers' Co-operative Limited	695475	Mature	
Biscuit Manufacturing	Arnotts Limited	782062	Mature	
Confectionery Manufacturing	Darrell Lea Chocolate Shops Pty Ltd	79798	Decline	
	Wrigley Company Pty Limited	102114	Decline	
Soft Drink, Cordial and Syrup Manufacturing	Coca-Cola Amatil Limited	3933800	Decline	
TEXTILE, CLOTHING AND FOOTWEAR MANUFACTURING				
Wool Scouring	Chargeurs Wool Australia Pty Limited	293418	Growth	
Wool Textile Manufacturing	Macquarie Textiles Group Limited		Growth	
WOOD AND PAPER PRODUCT ,MANUFACTURING				
Wood Chipping	Harris-Daishowa (Australia) Pty Ltd	60227	Mature	
Wooden Structural Component Manufacturing	Corinthian Industries (Holdings) Pty Ltd	129115	Mature	
Pulp, Paper and Paperboard Manufacturing	FCP Mills Holdings (Australia) Limited	503685	Growth	
Solid Paperboard Container Manufacturing	Tetra Pak Manufacturing Pty Limited	188409	Decline	
Paper Product Manufacturing n.e.c.	Dalton Packaging Pty Limited	75110	Growth	
Paper Product Manufacturing n.e.c.	Kimberly-Clark Australia Pty Limited	768851	Growth	
PRINTING, PUBLISHING AND RECORDED MEDIA				
Printing	Diamond Press Australia Pty Ltd	103000	Mature	
Printing	Penfold Printing Limited	58333	Mature	
Book and Other Publishing	CCH Australia Limited	87414	Mature	
	Reed Elsevier Australia Pty Limited	177542	Mature	
	Thomson Corporation (Australia) Pty Limited	133975	Mature	
	EMI Group (Australia) Holdings Pty Ltd	131278	Growth	
PETROLEUM, COAL, CHEMOCAL AND ASSOCIATED PRODUCT MANUFACTURING				
Petroleum Refining	Caltex Australia Limited	3152936	Decline	
Industrial Gas Manufacturing	BOC Gases Australia Limited	801942	Growth	
Synthetic Resin Manufacturing	Nuplex Industries (Aust) Pty Limited	219496	Mature	
Medicinal and Pharmaceutical Product Manufacturing	Abbott Australasia Pty Limited		Growth	
	Alphapharm Pty Limited	297119	Growth	
	AstraZeneca Pty Limited	515309	Growth	
	Baxter Healthcare Pty Limited	207989	Growth	
	Merck Sharp & Dohme (Australia) Pty Limited	666209	Growth	
	Novartis Australia Proprietary Limited		Growth	
	Pan Pharmaceuticals Limited	48586	Growth	
	Pfizer Pty Limited	231962	Growth	
	Pharmacia Australia Pty Limited	194933	Growth	
	Roche Products Pty Limited	248225	Growth	
	Schering-Plough Pty Limited	113673	Growth	
	Cosmetic and Toiletry Preparation Manufacturing	Estee Lauder Pty Limited	178395	Mature
		Sabre Group Limited	52500	Mature
Ink Manufacturing	Coates Brothers, Australia Pty Limited	57433	Decline	
Rubber Tyre Manufacturing	Goodyear Australia Limited	131710	Decline	
NON-METALLIC MINERAL PRODUCT MANUFACTURING				
Glass and Glass Product Manufacturing	O'Brien Glass Holdings Pty Limited	123916	Mature	
Cement and Lime Manufacturing	Australian Cement Holdings Pty Ltd	452147	Mature	
METAL PRODUCT MANUFACTURING				
Basic Iron and Steel Manufacturing	Australian Steel Mill Services Pty	66251	Mature	
Basic Iron and Steel Manufacturing	Coil Steels Group Pty Limited	87164	Mature	

Industry classification	Company Headquartered in NSW	Revenue 000's	Stage in industry life cycle
Aluminium Smelting	VAW Australia Pty Limited	70822	Mature
MACHINERY AND EQUIPMENT MANUFACTURING			
Automotive Component Manufacturing n.e.c.	TRW Australia Limited	109287	Mature
Shipbuilding	ADI Limited	552122	Mature
Medical and Surgical Equipment Manufacturing	ResMed Holdings Limited	103550	Growth
	Sulzer Australia Pty Limited	49870	Growth
Professional and Scientific Equipment Manufacturing n.e.c.	Thomson Marconi Sonar Pty Limited	121321	Growth
Computer and Business Machine Manufacturing	Compaq Technologies (Australia) Pty Limited	252370	Decline
	Gateway Pty Ltd	116568	Decline
	IBM Australia Limited	3102255	Decline
	Keycorp Limited	158440	Decline
Telecommunication, Broadcasting and Transceiving Equipment	Alcatel Australia Limited	611980	Mature
	Logical Networks Limited	70409	Mature
	Nortel Networks Australia Pty Limited	644746	Mature
	VeCommerce Limited	29821	Mature
Electronic Equipment Manufacturing n.e.c.	BAE Systems Australia Holdings Limited	417173	Growth
	Cochlear Limited	146243	Growth
Electric Cable and Wire Manufacturing	Metal Manufactures Limited		Growth
	Pirelli Cables Australia Limited	309837	Growth
Electrical Equipment Manufacturing n.e.c.	Asea Brown Boveri Pty Limited	1178737	Mature
	HPM Industries Pty Ltd	217531	Mature
	Lincoln Electric Company (Australia) Pty Limited	63045	Mature
Mining and Construction Machinery Manufacturing	Joy Manufacturing Co Pty Ltd	141145	Mature
Lifting and Material Handling Equipment Manufacturing	Clark Equipment Australia Pty Ltd	65763	Mature
	Crown Equipment Pty Limited	149310	Mature
	KONE Elevators Pty Ltd	167065	Mature
	Mannesmann Dematic Pty Ltd	71898	Mature
	Otis Elevator Company Pty Ltd	246488	Mature
	Schindler Lifts Australia Pty Limited	115006	Mature
Commercial Space Heating and Cooling Equipment Manufacturing	Carrier Air Conditioning (Holdings) Limited	264722	Mature
Industrial Machinery and Equipment Manufacturing n.e.c.	Aristocrat Leisure Limited	279276	Mature
	IGT (Australia) Pty Ltd	48100	Mature
	MTU Australia Pty Limited	56782	Mature
	USF Filtration Pty Limited	444040	Mature

Source: IBIS Information Ltd

Appendix 5: NSW innovative manufacturing companies

Companies in the ABL/ISR Innovation database

Company	Main Business Activity	Source of success
Marathon Tyres	Tyre manufacturing and sale	
Miranda Wines	Wine production	
Parle Foods	Food Harvesters and machinery. Food production and processing	
Stratos Seating	Vehicle seating for cars, trucks and other vehicles	
Mine Site Technologies	Radio technology products for the resource and industrial sectors	
Woodland	Home Heating products and gas barbeques and grills (Beefeater range; Heritage combustion heaters)	
Axolotl	Metal based finishing product	
De Bortoli Wines	Winemaking	
Earth Images	Herbal Beverages	
Electro Optic Systems	Laser ranging and tracking systems – Aerospace	
Ampcontrol	Electrical and electronic engineering equipment and systems	
Soft Edges	Made to measure swimwear	
Keycorp	Electronic equipment - computing	
Bishop Technology	Power Steering valves, rack and pinion gear assemblies, electronic/electro hydraulic power steering and high precision production equipment	
Nightingale Press	Educational Publisher	
Biotech Australia	Biotechnology products manufacturing and pharmaceuticals	
Cochlear	Hearing implants/devices	
SCITEC	Networked systems, products and services	
Quantum Technology	Products that provide access to information with impaired vision	
Polartechnics	Probes for the detection of cervical cancer and melanomas	
Peptech	Peptide bases drugs and delivery	
Jtech	Design and manufacture of telecommunications products	
Hypertec	Designs and manufactures memory and PC enhancement products	
ResMed	Design and manufacture of medical equipment for sleep disorders	
International Animal Health	Biological control products	
Prmducts		
Yamba Welding and Engineering	Specialist Engineering Fabricators	
Sustainable Technologies	Sustainable energy products and innovations	
D&K Copeman Engineering	Engineering fabricator – lifting devices	
Broens Technology	Toolmaking and Engineering	

NSW winners/nominees Australian export awards, 2000

Company	Main Business Activity	Source of success
Bishop Technology	Power Steering valves, rack and pinion gear assemblies, electronic/electro hydraulic power steering and high precision production equipment	
Hydramatoc	Manufacturer of specialised drilling and boring equipment used to install roof support bolts in underground mines and tunnels	
Engineering Pty Ltd	Manufacture, design and assemble manual and electronic automatic transmission. It is one of only two independent automatic transmission manufacturers in the world	
BTR Automotive		
Nugan Quality Foods	Fruit processing, wine making, olive processing	

Manufacturing companies in NSW that have received venture capital investment

Investee	Investor	Equity \$m
Seed		
Hydrocool	Australian Technology Group	0
Mass Technologies	Zernike Australia	0.3
Australian Surgical Services	Aegis Partners	0.5
Start-up		
Powerline	Australian Innovation	0.2
Biovend	Momentum Funds Management	0.22
Powerline	Australian Innovation	0.25
Nicrosol Technology	Aegis Partners	0.3
DHT Technologies	Foundation Capital	0.46
Expansion		
Garden King	Accord Capital Investors	0.1
Bells Pure Ice	Westpac Development Capital	0.4
North Star Resources	Shield Equities	0.55
MCK	AMP Life	0.8
International Foam Technologies	Nanyang Management	1
MCK	AMP Business Development Funds	1.4
Bluegum Group	Allen & Buckeridge	1.7
MCK	GS Private Equity	1.8
Reinhart International	Allaway Hawker Williams	2.5
MBO		
Australian Electronic Mfg	Pacific Equity Partners	28.5

Appendix 6: Technology based manufacturing “clusters” in NSW

Company	Suburb	Postcode
Bowater Tutt Industries Pty Ltd	Sydney	2000
Burns Philp & Company Limited	Sydney	2000
CSR Limited	Sydney	2000
Sydney East		
Australian Graduate School of Engineering Innovation Limited	Eveleigh	2006
Australian Centre of Advanced Risk & Reliability Engineering Ltd	Sydney	2006
Centre for Advanced Materials Technology	Sydney	2006
The Warren Centre for Advanced Engineering	Sydney	2006
Sydney Institute of Technology	Ultimo	2007
Designamite Pty Ltd	Surry Hills	2010
ABB Engineering Construction Pty Ltd	Potts Point	2011
Polartech Limited	Sydney	2011
Alcatel Australia Limited	Alexandria	2015
IPL Datron Pty Limited	Alexandria	2015
Mine Site Technologies Pty Ltd	Alexandria	2015
Hypercom Pty Ltd	Beaconsfield	2015
Sagem Australasia Pty Ltd	Waterloo	2017
Kramar Sportz Pty Ltd	Rosebery	2018
Magic Door Industries Pty Ltd	Mascot	2020
CWP Design Pty Ltd	Bondi Junction	2022
Toren Consulting Pty Limited	Bondi Junction	2022
Institute for Manufacturing Management & Technology	Kensington	2033
Associated Controls (Australia) Pty Ltd	Hillsdale	2036
Krusscrete International Pty Ltd	Rozelle	2039
Macquarie Medical Systems Pty Ltd	Leichardt	2040
Axis Industrial & Graphic Design	Balmain	2041
Studio Naar Pty Limited	Balmain	2041
Sky Solutions Limited	Five Dock	2046
Applied Explosives Technology Pty Ltd	Camperdown	2006
Centre for Applied Polymer Science	Sydney	2006
Energy Research Development & Information Centre	Sydney	2006
UNESCO Centre for Membrane Science & Technology	Sydney	2006
Sydney North		
Air Pollution Control Equipment Manufacturers Association	North Sydney	2060
Airborn Electronics	North Sydney	2060
Amdahl Australia Pty Ltd	North Sydney	2060
Australian Pharmaceutical Manufacturers Association Inc	North Sydney	2060
Du Pont (Australia) Limited	North Sydney	2060
Eicon Technology Pty Ltd	North Sydney	2060
ETP Pty Ltd	North Sydney	2060
Koppers Australia Pty Ltd	North Sydney	2060
Mikoh Corporation Limited	North Sydney	2060
NCR Australia Pty Limited	North Sydney	2060
Nokia Australia Pty Ltd	North Sydney	2060
Simsmetal Limited	North Sydney	2060
Technology Industries Export Group	North Sydney	2060
Kimberly-Clark Australia Pty Ltd	Milsons Point	2061
Medical Innovations Ltd	Artarmon	2064
Signature Mouthguards Pty Limited	Artarmon	2064
Warman International Limited	Artarmon	2064
P-E International Pty Ltd	St Leonards	2065
Storage Technology of Australia Pty Ltd	St Leonards	2065
Ausonics International Pty Limited	Lane Cove	2066
Building Automation	Lane Cove	2066
Cochlear Limited	Lane Cove	2066
Eycon Lens Laboratories Pty Ltd	Lane Cove	2066
Scitec Limited	Lane Cove	2066
Sirius Technologies Ltd	Lane Cove	2066
BOC Gases Australia Ltd	Chatswood	2067
Cincom Systems of Australia Pty Ltd	Chatswood	2067
IDENTIX Australia Pty Ltd	Chatswood	2067

Company	Suburb	Postcode
JNA Telecommunications Limited	Chatswood	2067
Keycorp Ltd	Chatswood	2067
Medical Industry Association of Australia Inc	Chatswood	2067
Nortel Australia Pty Limited	Chatswood	2067
Optimum Filters Pty Ltd	Castlecrag	2068
Biotech Australia Pty Limited	Roseville	2069
Actionlaser Pty Ltd	Lindfield	2070
La Mont Medical (Australia) Pty Ltd	Lindfield	2070
CI Technologies Pty Limited	Pymble	2073
Flavourtech Pty Ltd	Pymble	2073
SSA Pacific Pty Ltd	Pymble	2073
Jeffery Electronic Control Pty Limited	West Pymble	2073
Amalgamated Instruments Co Pty Ltd	Hornsby	2077
Auto-Bake Pty Ltd	Hornsby	2077
Nulite Systems International Pty Ltd	Hornsby	2077
Statronics Power Supplies	Hornsby	2077
Archer Enterprises Pty Ltd	Forestville	2087
Sydney Inner West		
Design Edge	Hunters Hill	2110
Beckman Instruments (Aust) Pty Ltd	Gladesville	2111
Electrologic Pty Ltd	Gladesville	2111
Goodman Fielder Limited	North Ryde	2113
AWA Limited	North Ryde	2113
Bioquest Ltd	North Ryde	2113
Bishop Steering Pty Ltd	North Ryde	2113
ERG Telecommunications Pty Ltd	North Ryde	2113
Food Science Australia	North Ryde	2113
Gradipore Limited	North Ryde	2113
Honeywell Holdings Pty Ltd	North Ryde	2113
Hypertec Pty Ltd	North Ryde	2113
Intergraph Corporation Pty Ltd	North Ryde	2113
Johnson & Johnson Medical Pty Ltd	North Ryde	2113
MD Research Company Pty Limited	North Ryde	2113
Millipore Australia Pty Ltd	North Ryde	2113
Philips Components Pty Limited	North Ryde	2113
ResMed Limited	North Ryde	2113
Rockwell Systems Australia Pty Ltd	North Ryde	2113
Schering - Plough Animal Health	North Ryde	2113
Sony Australia Limited	North Ryde	2113
Stanilite Electronics Pty Ltd	North Ryde	2113
AAP Communication Services Pty Ltd	Noth Ryde	2113
Jtec Pty Ltd	Meadowbank	2114
Siemens Plessey Electronic Systems Pty Ltd	Meadowbank	2114
Elanco Animal Health Pty Ltd	West Ryde	2114
CHK Engineering Pty Limited	Ermington	2115
Biotel Pty Ltd	Rydalmere	2116
Callington Haven Pty Ltd	Rydalmere	2116
Famill Interface Technology Pty Ltd	Rydalmere	2116
Mitsubishi Electric Australia Pty Ltd	Rydalmere	2116
Quantum Technology Pty Ltd	Rydalmere	2116
Transfield Technologies Pty Ltd	Rydalmere	2116
Waters Australia Pty Ltd	Rydalmere	2116
Layson Pty Ltd	Pennant Hills	2120
Measuring & Control Equipment Co Pty Ltd	Thornleigh	2120
Sensor Technologies Pty Ltd	Thornleigh	2120
IBM Australia Limited	West Pennant Hills	2120
CSIRO Division of Telecommunications & Industrial Physics	Epping	2121
Australian Electronic Manufacturing Services Pty Ltd	Silverwater	2128
Robotic Automation Pty Ltd	Silverwater	2128
Anzol (NSW) Pty Ltd	Mortlake	2137
Kindkoni Pty Ltd	Mortlake	2137
Digital Equipment Corporation (Australia) Pty Ltd	Rhodes	2138
Sydney North East		
Olsson Film Services Pty Ltd	Dee Why	2099
A L Franklin Pty Ltd	Brookvale	2100
Abberfield Technology Pty Ltd	Brookvale	2100
Binary Engineering International Pty Ltd	Brookvale	2100
Cellabs Pty Ltd	Brookvale	2100
Milpharma Pty Ltd	Brookvale	2100
Polycure Pty Ltd	Brookvale	2100

Company	Suburb	Postcode
Q Engineering Services Pty Ltd	Brookvale	2100
Ricoh Office Automation P/L	Brookvale	2100
Yeo-Kal Electronics Pty Ltd	Brookvale	2100
Colby Packaging Systems Pty Ltd	Terrey Hills	2084
Allergan Australia Pty Ltd	Frenchs Forest	2086
Apple Computer Australia Pty Ltd	Frenchs Forest	2086
Apscore International Pty Ltd	Frenchs Forest	2086
Leonhard Kurz (Australia) Pty Ltd	Frenchs Forest	2086
Supaflo Technologies Pty Ltd	Frenchs Forest	2086
Zimmer Australia Pty Ltd	Frenchs Forest	2086
Mulch Mat Products Pty Ltd	North Manly	2100
Biocycle Pty Limited	Warriewood	2102
Neomedix Systems Pty Ltd	Warriewood	2102
Newport Scientific Pty Ltd	Warriewood	2102
Optical Systems Design Pty Ltd	Warriewood	2102
Sydney South West		
Arnotts Limited	Homebush	2140
Quality Semiconductors Australia Pty Ltd	Homebush	2140
Ozone Manufacturing Pty Ltd	Silverwater	2141
Siemens GEC Communications Systems P/L	Silverwater	2141
Southcorp Water Heaters Australia Limited	Silverwater	2141
Loc-A-Bloc Industries Pty Ltd	Regents Park	2143
Monocure Pty Ltd	Auburn	2144
MSA (Australia) Pty Ltd	Girraween	2145
Novartis Crop Protection Australasia Ptd Ltd	Pendle Hill	2145
Fibreglass Material Services Pty Ltd	Seven Hills	2147
Transfield Reinforced Plastics Composites	Seven Hills	2147
Van Gelder-Stubbeng Pty Ltd	Seven Hills	2147
Integrated Spectronics Pty Ltd	Baulkham Hills	2153
Wyeth Australia Pty Ltd	Baulkham Hills	2153
Rhone-Poulenc Rorer Australia Pty Ltd	Baulkham Hills Business Centre	2153
Fort Dodge Australia Pty Limited		
Inertia Fire Systems Pty Ltd	Castle Hill	2154
J C Ludowici & Son Ltd	Castle Hill	2154
Premier-Fosters Australia Ltd	Castle Hill	2154
Liquip Sales Pty Ltd	Smithfield	2164
Thermoline Scientific Equipment Pty Ltd	Smithfield	2164
Duratec Pty Ltd	Wetherill Park	2164
BTR Automotive Asia-Pacific	Fairfield	2165
Relay Monitoring Systems Pty Ltd	Fairfield	2165
Torin Industries Pty Ltd	Chipping Norton	2170
ABB Transmission & Distribution Limited	Moorebank	2170
GIST - Brocade	Moorebank	2170
Joyce Corporation Ltd	Moorebank	2170
Philips Traffic & Engineering Systems Pty Limited	Moorebank	2170
RF Devices Pty Ltd	Hoxton Park	2171
ETP Semra Pty Ltd	Canterbury	2193
Hawker De Havilland Limited	Bankstown	2200
Ceramic Engineering Pty Ltd	Marrickville	2204
TRW Products Limited	Marrickville	2204
Ulco Engineering Pty Ltd	Marrickville	2204
Utilux Pty Limited	Kingsgrove	2208
St George Appliances Pty Ltd	Peakhurst	2210
Brook Compton Betts Pty Ltd	Revesby	2212
Email Kitchen & Bathroom Products Pty Ltd	Revesby	2212
Arthur Yates & Co Pty Ltd	Milperra	2214
Kirby Refrigeration Limited	Milperra	2214
Maxitherm Boilers Pty Ltd	Milperra	2214
Sydney South East		
Geo Instruments Pty Ltd	Ramsgate	2219
Munusu Pty Ltd	Mortdale	2223
Fimlab Engineering Pty Ltd	Miranda	2228
Rosbert Australia Pty Ltd	Taren Point	2229
Faith Technical Services Pty Ltd	Engadine	2233
Tetley Manufacturing Ltd	Lucas Heights	2234
North Coast		
Bio-Care Technology Limited	Somersby	2250

Company	Suburb	Postcode
Albany International Pty Ltd	Lisarow	2251
Parbury Technology	Wyong	2259
Banlaw Pty Ltd	Caves Beach	2281
Cowan Manufacturing Pty Ltd	Warners Bay	2282
CCI Engineering P/L	Islington	2296
Key Centre for Teaching & Research in Bulk Solids Handling & Particulate Technologies	Callaghan	2308
Australian Magnet Technology Pty Ltd	Raymond Terrace	2324
Britax Asian Pacific Lighting & Electrical	Taree	2429
New England		
Blue Bark Instruments Pty Ltd	Tamworth	2340
Jakab Industries Pty Ltd	Tamworth	2340
Fundamental Golf & Leisure Ltd	Armidale	2350
Irricrop Technologies Pty Ltd	Narrabri	2390
W E Smith Engineering Pty Ltd	Boambee via Coffs Harbour	2450
Illawarra		
Illawarra Communication Pty Ltd	Wollongong	2500
Centre for Steel Manufacturing & Processing	Wollongong	2522
Industrial Automation Research Centre	Wollongong	2522
Research Centre for Advanced Materials Processing	Wollongong	2522
University of Wollongong	Wollongong	2522
Thermal Ceramics Australia Pty Ltd	Unanderra	2526
Innovation & Continuous Improvement Technologies Research Centre	Campbelltown	2560
Broens Toolmaking Pty Ltd	Ingleburn	2565
Narellan Truck Wheel Align Pty Ltd	Narellan	2567
Instone Air Services Pty Ltd	Camden	2570
Tycan Australia Pty Ltd	Mittagong	2575
Blue Circle Southern Cement Ltd	Berrima	2577
South East		
Electro Optic Systems Pty Limited	Queanbeyan	2620
Lintek Pty Ltd	Queanbeyan	2620
Sustainable Technologies Australia Limited	Queanbeyan	2620
Macquarie Textiles Group Limited	Albury	2640
Riverina Refrigeration Pty Ltd	Leeton	2705
US Filter	Windsor South	2756
3M Australia Pty Limited	St Marys	2760

Source: *Technology Directory of Australia, 1999*