



Manufacturing futures

A paper by the
Australian Business Foundation
for the NSW Business Chamber

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Executive Summary

Manufacturing matters to Australia...

even though it makes a smaller contribution to economic activity relative to services and other sectors...

the same applies to most industrialised countries.

Australian manufacturing is confronting fierce and growing global competition.

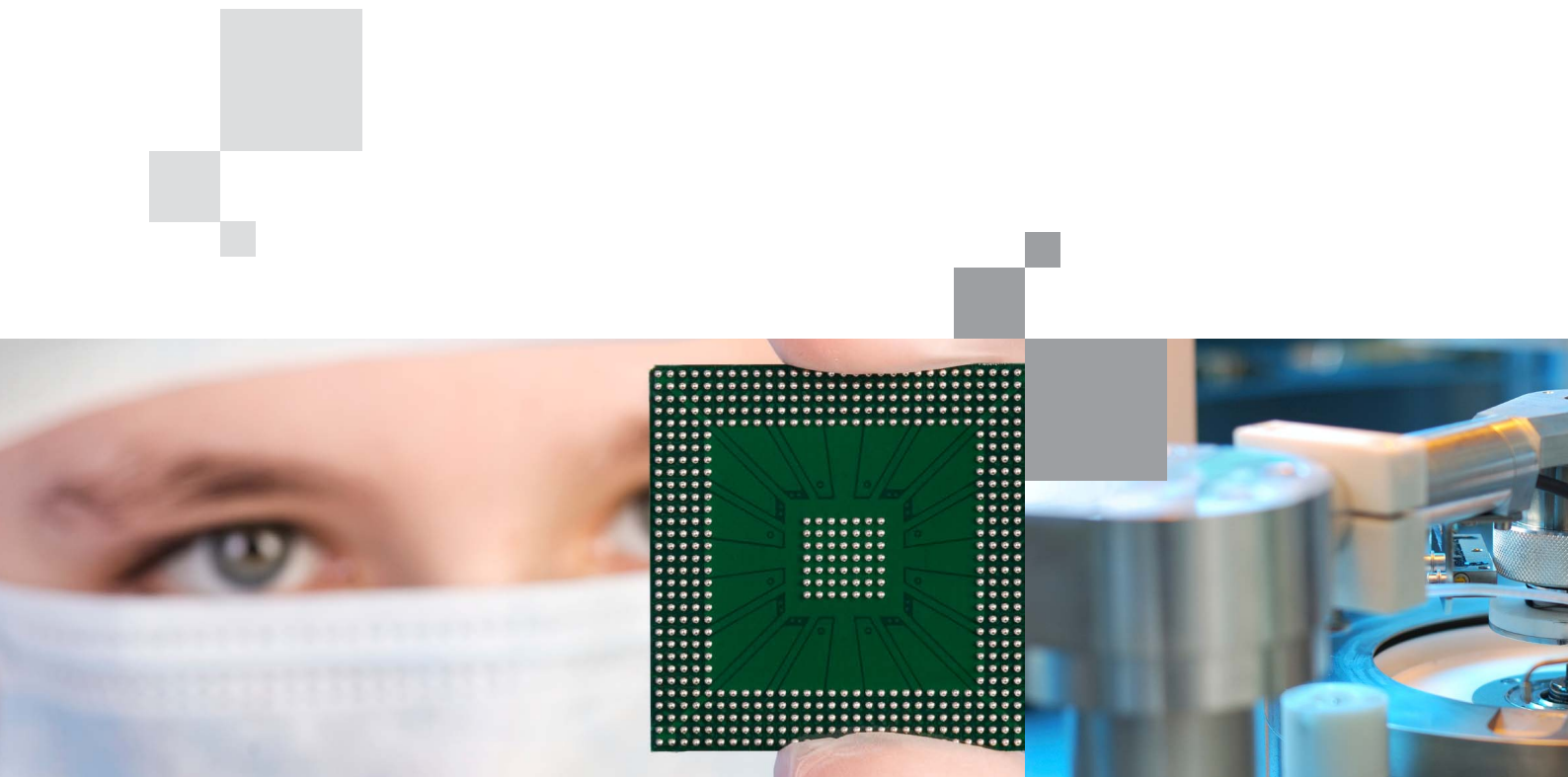
Manufacturing in Australia makes a vital and significant contribution to the economy.

The sector has been growing at an average rate of 0.9% for more than a decade, employs almost 1 million people, accounts for 8.7% of GDP, and for most of our high value exports.

But, manufacturing's relative contribution is declining. This is largely due to the higher growth rates of other sectors, especially mining and services. In line with the changing global economic landscape, this trend is observed across most other advanced economies.

Importantly, there is also evidence that manufacturing has a multiplier effect on the rest of the economy by driving jobs, investments and sales in other sectors.

It is a stark reality that Australian manufacturers will continue to be pressured by a more intensified competitive environment - from low cost manufacturing economies, the strong Australian dollar, import penetration, the softening of domestic demand, rising input costs, narrowing profit margins and increasing social and environmental expectations.



**Simultaneously,
the character of
manufacturing
itself is fundamentally
changing...**

and

**...the forces shaping
manufacturing's future
environment are
also shifting.**

Chief among the changes that are redefining manufacturing are the following:

- the disappearing boundary between manufacturing and services;
- new niches to be exploited through outsourcing and in wider and more distributed global value chains;
- new understandings of innovation based on smart problem-solving for customers which are accessible to all companies, not just those who can afford formal R&D and frontier technologies;
- manufacturing is no longer characterised by standardised mass production;
- intangible assets, like know-how and know-who, are increasingly important to the sustained success of manufacturing firms.

The key forces of change likely to shape the future environment for manufacturers are:

- More intensified competition.
- More complex and varied opportunities for doing business globally.
- Shift from mass production to customisation and personalisation.
- Growing importance of the low carbon economy.
- Changing skills needs and imperatives.
- Technology that transforms entire business models.
- Collaboration and connectivity that accelerates innovation and competitiveness.



Executive Summary

This 'morphing' of manufacturing opens up new prospects and opportunities for Australian manufacturers receptive and capable of riding the wave of change.

Don't under-estimate the whole range of green, 'cleantech' business prospects for first movers from the push for a low carbon economy.

Add services to products, which create innovative and valued new solutions for customers that others can't easily copy.

Enter and extend the reach of Australian manufacturers into international markets by capitalising on the variety of new niches in products and services available in unbundled global value chains, and the possibilities afforded by trends in offshoring, outsourcing and other multi-country collaborations.

Make use of the technologies which have lowered transport and communication costs and which are enabling previously-unimagined new approaches to doing business competitively anywhere in the world from Australia.



New angles on innovation and productivity are the key to profitability and longevity for Australian manufacturers.

There is a wealth of authoritative analysis and thinking that is questioning conventional understandings of innovation and productivity.

Innovation is more about problem-solving and learning than about scientific discovery, more about the customer than the producer, more about the marketplace than the laboratory and more about business transformation than technology.

Productivity is not about doing more with less, nor about working people harder for longer. Productivity improvement is not generally the result of greater capital investment to replace labour. Productivity does not equate with efficiency; it centres on innovation and transformation – of business capabilities, skills, technology and competitiveness.

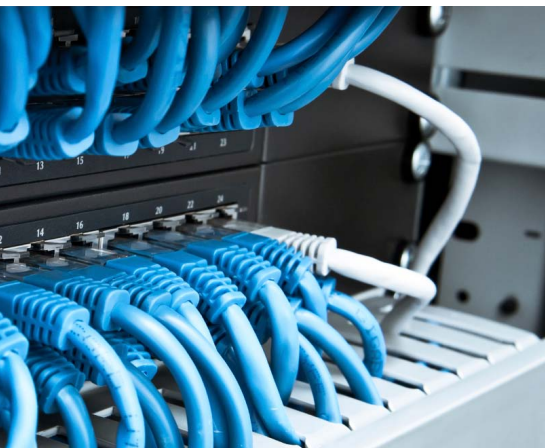
In practical terms, the productivity gains that matter to manufacturers come from increasing revenue, not just cutting costs.

Anticipating and better serving customer needs and creating skilled, high performance workplaces provide the key to the profitability and longevity of manufacturing.

Vital ingredients are problem-solving for demanding customers; organising people and operations for agility and flexibility; smart use of market and customer knowledge; and adapting existing technologies and processes to new uses.

Manufacturers can innovate on many dimensions, not just through R&D: new delivery and distribution channels; new attributes of their business offerings; new organisational arrangements; improvements in products and processes; more beneficial ways of managing customer relationships; and providing better customer experiences.

Innovation is the chief weapon in the 'productivity revolution' and the battlefront is where business enterprises and their workforces intersect with customers in the marketplace and the community.



Executive Summary

To secure their future, Australian manufacturers should act to...

- **Experiment with business innovations.**

Reviewing all the issues covered in this paper as a whole, three priority areas for action are suggested for Australian manufacturers.

Consider making innovative changes to the standard business model, i.e., in how firms create and capture value for their customers, their partners and themselves.

To help choose from the many options for business model innovation, try out disciplined experiments. More potent ways of engaging customers will be central to these business innovation experiments.

Improvise and learn about what works for the individual manufacturing enterprise.



- Invest in people and skills.

Manufacturers are challenged by skills shortages, growing competition for talent, wage pressures, and the need for continuous upskilling of the manufacturing workforce and management.

Intensifying competition and the changing models for business success in the manufacturing sector present even more urgent and critical skills imperatives.

Deepening and expanding the skills, capabilities and adaptability of manufacturing managers and workforces is essential for enterprises to profit from innovative manufacturing business models.

Manufacturing enterprises must urgently invest in the new constellation of skills required for high-performance and empowered workplaces. Not only technical skills, but creative thinking and problem solving and skills in global collaboration and partnering.

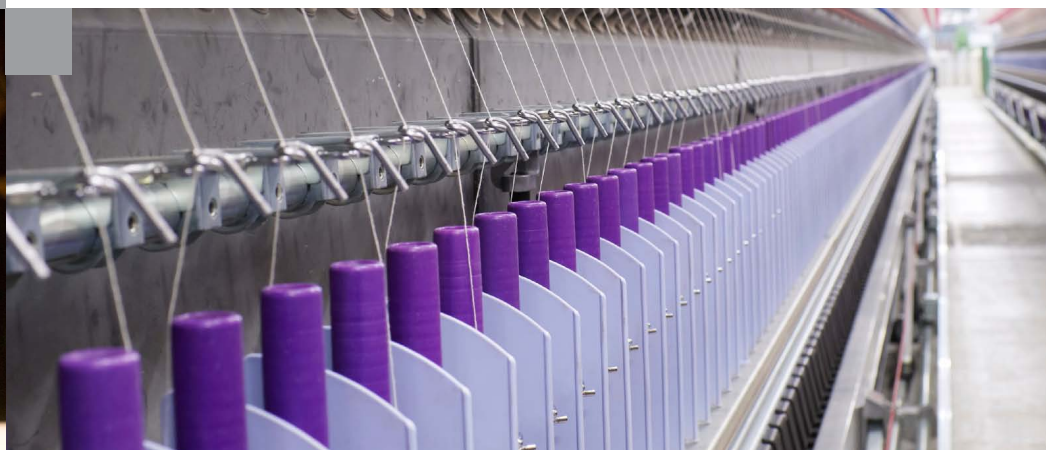
- Multiply knowledge connections.

In the modern era, manufacturing is not a solitary pursuit.

Being well-connected and highly proficient at collaboration is a key attribute allowing manufacturing enterprises to access and absorb knowledge and to transform it into new competitive capabilities.

In the global internet age, knowledge is an asset that can depreciate rapidly and needs to be continually refreshed. Flows of knowledge are critical and these only happen through people, their networks and relationships.

Being connected counts. Manufacturers must position themselves in rich webs of relationships and knowledge flows.



1 Introduction

The NSW Business Chamber has commissioned the Australian Business Foundation to research and prepare this paper on Manufacturing Futures.

The intent is to produce a status report from desk-based research on current thinking about Australian manufacturing's economic contribution, present circumstances and future prospects. This status report aims to pull together current understandings about manufacturing and its future as a platform for immediate action.

The NSW Business Chamber has asked the Australian Business Foundation to distil recent research and reports into a coherent paper illuminating and making sense of the key contemporary issues and themes for maximising the future growth, productivity, profitability, longevity and competitiveness of Australian manufacturers.

Further, the paper aims to draw out from this review of local and international research a small number of key themes about the attributes Australian manufacturers will likely need to compete successfully and to sustain themselves in the future. Particular attention is paid to the role of productivity growth.

The paper on *Manufacturing Futures* is intended to provide guidance to manufacturers, their representatives and governments to accelerate the uptake of practical change, and exploit opportunities for growth. Specifically, the paper is a contribution to a signature initiative by the NSW Business Chamber to assist its manufacturing members to develop and improve their businesses, while strengthening the Chamber's position as a manufacturing advocate.

Australian Business Foundation

The Australian Business Foundation was established as an independent, not for profit spin-off company from the NSW Business Chamber more than a decade ago and tasked with researching and detecting the emerging issues likely to impact on Australian businesses 'ahead of the curve'.

The Australian Business Foundation is a unique collaborative research body at the centre of a vibrant community involving Australian and international scholars, policy makers, opinion leaders and business executives.

Its research has focused on business innovation and sustainability, emerging models of business competitiveness, and opportunities arising from a knowledge economy. The Foundation has produced research studies on Australian manufacturing innovation and on changing patterns of competitiveness in Australian manufacturing.

This paper on *Manufacturing Futures* has been authored primarily by Narelle Kennedy, the Chief Executive of the Australian Business Foundation, with significant research support from market analyst and international trade adviser, Rab Memari.

2 The contribution of Australian manufacturing

Manufacturing matters to Australia, even though it represents a smaller proportion of economic activity relative to services and other sectors. This is the case for most industrialised countries.

Overview

Manufacturing has played a critical role in the economies of developed countries for over a century, in many cases being one of the primary factors leading their development and modernisation. There are barely any examples of countries with high incomes and living standards that did not have a manufacturing sector accounting for a quarter to a third of economic output¹.

In Australia, the manufacturing sector makes a vital and significant contribution to the economy. The sector has been growing at an average rate of 0.9% since 1999-00, accounting for 8.7% of GDP as at December 2010, or \$111.1 billion². The sector also continues to be an important contributor to employment, employing almost 1 million people or 8.7% of the workforce, and exports, accounting for 36.1% of total exports³.

The Australian manufacturing sector has been increasingly integrated into global value chains, which have exerted competitive pressures resulting in the sector's gradual transformation by adapting to a continuously changing environment. Despite its remarkable resilience and strengths, manufacturing in Australia has been on a continuous decline as a proportion of the total economy since the middle of the twentieth century, largely due to the higher growth rates of other sectors, especially mining and services, and in line with the changing global economic landscape, a trend observed across most other advanced economies.

The Global Financial Crisis (GFC) had an especially negative effect on the manufacturing sector and the recovery is on a slower trajectory compared to other sectors. According to a survey conducted by the Department of Innovation, Industry, Science and Research (DIISR), the manufacturing sector is the most over-represented in terms of firms facing profit falls, lower employment and bankruptcy⁴ as a result of the crisis. Sectors that have closer linkages to the government and minimal exposure to financial and international markets were the least affected by the GFC.

Manufacturing also has a multiplier effect in its impact on the rest of the economy. The US Bureau of Labor Statistics has, for example, calculated that each dollar worth of manufactured goods creates another \$1.43 of economic contribution towards other sectors, the highest multiplier out of any sector. This is, for example, double the multiplier effect of services at \$0.71⁵. This provides an interesting metric demonstration of the importance of the manufacturing sector to the economy by creating jobs, investments and sales in other sectors.

To draw greater insight into the role and contribution of manufacturing to the Australian economy, it is informative to examine the following key indicators of the sector.

¹ See Australian Department of Industry, Tourism and Resources, May 2007. *Background Paper 2: Australian Manufacturing Sector Trends*, Commonwealth of Australia.

² Australian Department of Innovation, Industry, Science and Research March 7th 2011, *Manufacturing Fact Sheet*, <http://www.innovation.gov.au/Industry/Manufacturing/Pages/default.aspx>

³ From unpublished Department of Innovation, Industry, Science and Research background material.

⁴ Australian Department of Innovation, Industry, Science and Research, July 2010. *Manufacturing Sector: Overview of Structural Change - Industry Brief 2008-09*, Commonwealth of Australia.

⁵ King, H., 29th May 2010. Council of Industry, in a speech at the Council of Industry's Manufacturing Champions Award, May 29th, New York, <http://www.councilofindustry.org/documents/MfgChampionAwardBreakfastpressrelease.pdf> [Last viewed: 29 March 2011].

Output

Although manufacturing output has been experiencing steady real growth rates, growing at a rate of 4.9% on an industry gross value added basis between calendar years 2009 and 2010, its contribution towards overall GDP has been in decline. The Productivity Commission attributes around 30% of the declining share of manufacturing in GDP to “slower growth in manufacturing prices relative to prices of other goods and services”⁶. Increases in labour productivity as well as outsourced manufacturing have also contributed towards this trend.

The Commission goes further to identify two groups of manufacturing industries that have fared well over the long-term: *Manufacturing activities with strong links to Australia’s natural endowments of food, forests and minerals*, increasing from 36.5% of manufacturing value added in 1968-69 to just under 44% by 2000-01; and manufactures with *more differentiated products with higher skill and R&D intensities such as Medicinal and pharmaceutical goods, Photographic, scientific and medical equipment and, to a lesser extent, Electronic equipment*⁷.

Employment

The manufacturing sector is a significant contributor towards overall employment, with approximately 995,000 persons working in the sector as at the February quarter 2011. Employment in the manufacturing sector shrank by 0.4% (3,600 people) from November 2009 to December 2010⁸.

Over the last 20 years manufacturing employment has declined slightly, most of it attributable to labour productivity growth rates and significant falls in employment in the Textile, Clothing, Footwear (TCF) industry since the late 1980s⁹. The sub-sectors with highest employment growth rates have been Primary Metal and Metal Product Manufacturing, Transport Equipment Manufacturing and Food Product (see Figure 1).

Furthermore, the effects of import competition from developing economies and rising terms of trade have increased the importance of skilled labour, increasing educational requirements and changing the occupational mix of jobs¹⁰. This has “undercut low-skilled manufacturing in Australia and driven an increase in the returns on skilled labour relative to unskilled labour”¹¹.

⁶ Australian Department of Industry, Tourism and Resources, May 2007. *Background Paper 2: Australian Manufacturing Sector Trends*, Commonwealth of Australia.

⁷ Australian Department of Innovation, Industry, Science and Research, July 2010. *Manufacturing Sector: Overview of Structural Change - Industry Brief 2008-09*, Commonwealth of Australia.

⁸ Australian Department of Innovation, Industry, Science and Research March 7th 2011, *Manufacturing Fact Sheet*, <http://www.innovation.gov.au/Industry/Manufacturing/Pages/default.aspx>

⁹ Australian Department of Industry, Tourism and Resources, May 2007. *Background Paper 2: Australian Manufacturing Sector Trends*, Commonwealth of Australia.

¹⁰ Australian Department of Innovation, Industry, Science and Research, July 2010. *Manufacturing Sector: Overview of Structural Change - Industry Brief 2008-09*, Commonwealth of Australia.

¹¹ Australian Department of Industry, Tourism and Resources, May 2007. *Background Paper 2: Australian Manufacturing Sector Trends*, Commonwealth of Australia.

Figure 1. Total Manufacturing Employment by Industry, Original ('000)

	Nov 2000	Nov 2010	Annual Change Nov 09 to Nov 10
Manufacturing, nfd	24.2	67.5	-13.3
Food product	180.7	215.9	9.2
Beverage and tobacco product	24.8	22.3	-6.5
Textile, leather, clothing and footwear	87.2	41.8	-1.1
Wood product manufacturing	42.9	37.0	-9.2
Pulp, paper and converted paper product	26.0	16.7	2.53
Printing (including the reproduction of recorded media)	60.7	56.6	5.4
Petroleum and coal product manufacturing	11.9	7.2	1.5
Basic chemical and chemical product manufacturing	48.0	46.3	-3.7
Polymer product and rubber product manufacturing	42.8	31.4	-2.9
Non-metallic mineral product manufacturing	40.8	37.5	3.8
Primary metal and metal product manufacturing	71.9	93.8	12.8
Fabricated metal product manufacturing	100.4	53.7	-6.0
Transport equipment manufacturing	95.5	91.0	10.2
Machinery and equipment manufacturing	117.9	120.0	-7.4
Furniture and other manufacturing	84.4	55.6	1.1
Total manufacturing	1,059.9	994.4	-3.6
Total – All industries	9,010.8	11,395.4	402.8
Manufacturing share	11.8%	8.7%	n/a

Source: ABS, Labour Force, Australia (Cat No 6291.0.55.003)

Exports

The manufacturing sector in Australia has increasingly become integrated with global value chains, making it prone to fluctuations in global input costs and the Australian dollar. Manufacturing is now the second largest contributor to exports after having been overtaken by the mining sector. The manufacturing sector accounted for 40% of total exports and 88% of total imports in 2009-10, demonstrating the importance of manufacturing within Australia's international trade activities. Over calendar year 2010, Australian manufacturing exports increased by 2.4% to \$83.4 billion¹².

Manufacturing exports have been strong due to the internationally competitive nature of manufactures and the shift towards higher-value added products. However, the strong Australian dollar is having a constraining impact on manufacturers.

In 2008-09, around 62% of manufacturing exports were elaborately transformed manufactured (ETMs) products, with the rest being simply transformed manufactures (STMs)¹³. STMs are manufactures that have only been taken through one or two stages from their raw material state, whereas ETMs incorporate higher value added stages of manufacturing. This is in line with the manufacturing sector's transformation towards higher value added products.

¹² From unpublished DIISR background material.

¹³ Australian Department of Innovation, Industry, Science and Research, July 2010. *Manufacturing Sector: Overview of Structural Change - Industry Brief 2008-09*, Commonwealth of Australia.

Productivity

Manufacturing is a highly productive sector compared to other sectors. This is attributable to efficiencies it has gained through increased exposure to international competition, its effective adoption of technologies and high levels of labour productivity. Productivity in the manufacturing sector, as a measure of Gross Value Added (GVA) per hour worked, fell by 1.7% in 2008-09 from the previous year, compared to a slight increase of 0.1% across the overall market sector. However, from 1999-00 to 2000-10 the labour productivity in the manufacturing sector increased by 2.2% on average, compared to an average increase of 1.5% for the overall market sector¹⁴. Manufacturing's comparatively high productivity levels are a critical factor in its resilience and continued growth rates.

Research and development

Manufacturing is the primary source of technological innovation in the Australian business sector¹⁵. It had the highest expenditure on R&D in 2008-09, comprising 26% of the total, followed closely by mining at 25%. Much of Australia's higher value added activity is as a direct result of R&D activities of manufacturing firms. R&D expenditure was highest in the Transport Equipment sub-sector, followed by Machinery and Equipment. Fabricated Metal Products had the highest growth rate with an increase of 39.4%, followed by Basic Chemical and Chemical Products at 27.3%¹⁶.

Profits and investment

The strength and volatility of the Australian dollar, import penetration and rising input costs have put strain onto manufacturers' profit margins¹⁷. Gross operating profits in the manufacturing sector (that is, profits from the business' core operations rather than accounting for profits from other investments, interest and taxes) have grown at an annual compound growth rate of 4.6% in the ten years since 1998-99. Gross operating profits in the sector are, however, under pressure, having decreased by 19.4% in 2008-09 over the previous year primarily due to the GFC. More recently, gross operating profits rose by 3.2% in the year to the December quarter 2010, this compares to an increase of 14.7% for all other industries in the same period¹⁸. This disparity in relative growth rates can be attributed to changing commodity prices that are increasing profits for the mining sector and increasing input costs for the manufacturing sector.

¹⁴ Australian Department of Innovation, Industry, Science and Research, July 2010. *Manufacturing Sector: Overview of Structural Change - Industry Brief 2008-09*, Commonwealth of Australia; and from unpublished DIISR background material.

¹⁵ Australian Department of Industry, Tourism and Resources, May 2007. *Background Paper 2: Australian Manufacturing Sector Trends*, Commonwealth of Australia.

¹⁶ Australian Department of Innovation, Industry, Science and Research, July 2010. *Manufacturing Sector: Overview of Structural Change - Industry Brief 2008-09*, Commonwealth of Australia.

¹⁷ From unpublished DIISR background material.

¹⁸ From unpublished DIISR background material and Australian Department of Innovation, Industry, Science and Research, July 2010. *Manufacturing Sector: Overview of Structural Change - Industry Brief 2008-09*, Commonwealth of Australia.

More efficient, deeper and innovative capital markets have also enabled more opportunities for business to invest, which benefits the manufacturing sector due to its capital intensive nature. This has been compounded by lower real interest rates leading up to the GFC. Furthermore, private new capital expenditure in manufacturing declined by 1.5% from 2007-008 to 2008-09¹⁹.

Manufacturing in NSW

Manufacturing is a vital component of the NSW economy with deep and long standing roots in the State. Manufacturing contributed \$32.8 billion in 2010 to NSW's economy, around 10% of total industry value added, which is forecasted to grow by 19% in 2020. Manufacturing in NSW has an important role in the overall Australian manufacturing sector, contributing around 32% of Australia's manufacturing output, the largest of any State, followed by Victoria²⁰.

NSW-based manufacturers include world leading and globally competitive firms, with manufacturing exports constituting 19.4% of total NSW merchandise and services exports, or \$11.7 billion. The skilled manufacturing workforce, despite skills shortages in certain areas, is a key competitive strength that will ensure the sector's ability to apply advanced information technologies and lean manufacturing techniques to improve productivity and remain competitive in Australia and globally. The NSW Business Sector Growth Plan also points out the sector's competitive strengths in design and development capabilities by being a "provider of training and employment for marketers, engineers and designers, including software and system designers".²¹

According to Access Economics, strong international competition will encourage NSW manufacturers to continue their transition to higher value and more complex manufacturing activities which embody new knowledge and technological change, eg green building materials, some forms of renewable energy, higher value added processed and semi-processed food. Continued innovation will be critical for the manufacturing sector to remain globally competitive as emerging economies shift in line with this trend as well.²²

¹⁹ Australian Department of Innovation, Industry, Science and Research, July 2010. *Manufacturing Sector: Overview of Structural Change - Industry Brief 2008-09*, Commonwealth of Australia.

²⁰ NSW Government, September 2010. *NSW Business Sector Growth Plan*, www.business.nsw.gov.au/innovation [Last viewed: 28 March 2011].

²¹ Ibid

²² Access Economics, August 2010. *The NSW economy in 2020 – A foresighting study*, a report for the NSW Innovation Council.

3 The changing face of manufacturing

Australian manufacturing is confronting fierce and growing global competition. Simultaneously, the character of manufacturing itself is fundamentally changing and the forces shaping manufacturing's future environment are also shifting.

Reports of the death of Western manufacturing are greatly exaggerated. These are the words of PricewaterhouseCoopers in their paper, *The Future of Manufacturing – Taking a Global Perspective* (2009). They advise against accepting the misconception of manufacturing in inevitable and terminal decline as the basis of future action.

There is a widespread belief in many high-wage countries that we 'don't make anything anymore'. According to this myth all manufacturing has either moved to China already, or soon will, with the rest of the world becoming purely service economies. This is factually incorrect.

Western manufacturing is neither dead, nor dying. It has survived over the past 30 years by delivering extraordinary improvements in productivity, combined with high levels of specialised skills built over decades that cannot easily be relocated wholesale somewhere else. And, the coming explosive growth of Clean Technologies and Renewable Energy offers a unique (albeit limited) window of opportunity for Western manufacturing to move beyond 'hanging on' against low-cost competition back to a real renewal.

Assessments from the Australian Department of Innovation, Industry, Science and Research, from both published and unpublished sources, show that Australia's manufacturing industry has continued recently to demonstrate strong growth. Performance has been positive across a range of indicators including output, exports and productivity.

While the overall contribution of manufacturing to GDP in Australia is declining relative to the services sector – as it is in all industrialised nations – its absolute contribution is increasing.

The relative decline is explained in part by increased productivity and the outsourcing of services by manufacturing firms. It also reflects changing consumer preferences as incomes increase and higher proportions of consumer income is spent on personal services, entertainment, travel, health and the like.

Manufacturing industry continues to make a vital and integral contribution to the Australian economy.

But fundamental changes are afoot. There is evidence that manufacturing is evolving to meet the challenges and realities of a knowledge-based economy.

Two key features of this hidden transformation underway in Australian manufacturing are:

- The increasing interdependence between manufacturing and other sectors of the economy, particularly services.
- How the knowledge economy operates in practice as a potent driver of new sources of business innovation and productivity for manufacturing.

Disappearing boundaries between manufacturing and services

The forces of globalisation that 'shrink the world', advances in technology and communications and the rise of outsourcing and distributed supply chains, are re-defining what it means to be a manufacturer. The classic definition of manufacturing as production, ie. the transformation of raw materials into finished products, is becoming increasingly inaccurate and outdated.

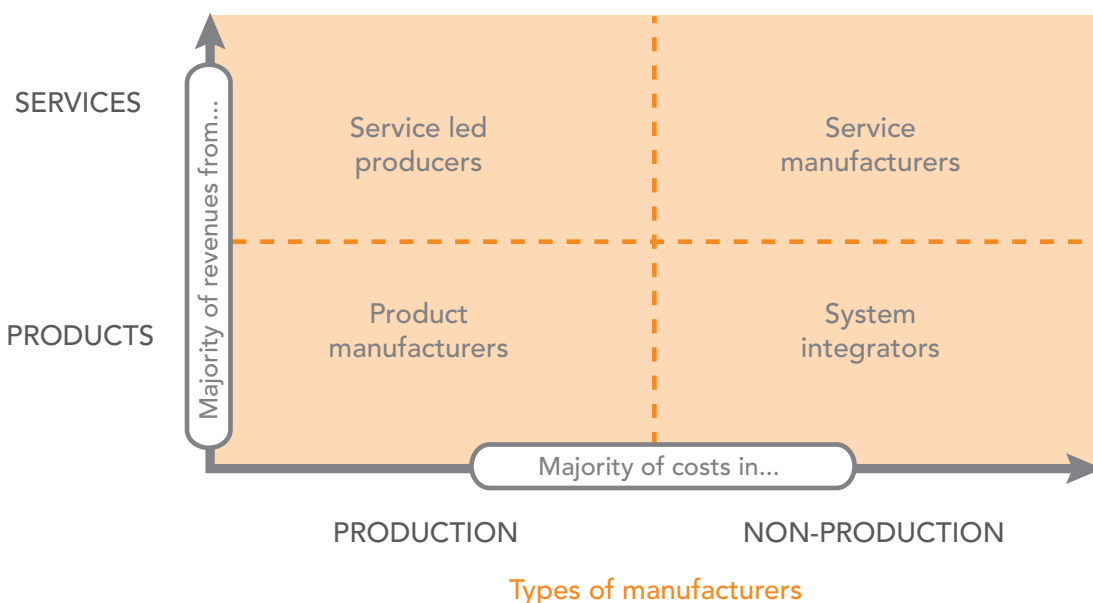
The Institute for Manufacturing at the University of Cambridge in its 2006 paper on *Defining High Value Manufacturing* offered the following extended definition of manufacturing:

... the full cycle of activities from research and development, through design, production, logistics and services, to end of life management.

On this definition, manufacturing and production are not the same. Production is only one activity of a manufacturing firm, and it may not even be its primary activity. The Institute for Manufacturing argues that a company is still a manufacturer if it has outsourced all of its production activities and is focusing on brand management or R&D.

They conclude that in *today's globally competitive landscape, manufacturers are inventors, innovators, global supply chain managers and service providers*. Manufacturers are now engaged not only in production, but in research, design and service provision. In essence, *manufacturing is the collection of activities that is required to develop, produce and deliver goods and services to customers.*

The Institute for Manufacturing has developed a framework for understanding the different ways manufacturing firms create value. It is based on two most basic and easily measured dimensions, cost and revenue. It is possible to group manufacturers on the degree to which their costs are derived from production, and their revenues from products or services. The Institute for Manufacturing's framework produces the following matrix.



This framework results in a more informed and useful description of the nature of manufacturing firms:

- Service led producers who provide customers with services based on a significant production capability.
- Product manufacturers who focus on generating value through production.
- Service manufacturers who have little or no production and generate value from services which are based around a product.
- Systems integrators who control the channel to customers and manage an external production network.

Manufacturing and services are increasingly and ever more tightly being bound together. This phenomenon is worth a closer look because it opens up new opportunities and new pathways to competitiveness and profitability for Australian manufacturers.

Considerable evidence of the interdependencies between manufacturing and services has been compiled internationally in a variety of academic, government-commissioned and private sector studies, including the Centre for Business Research at the University of Cambridge, specific research centres at the University of Sussex, Imperial College and the University of Brighton, the UK Business Department, Pricewaterhouse Coopers' manufacturing report, the OECD, the Ministry of Economy, Trade and Industry in Japan and the Singapore Trade and Industry Ministry.²³

The Minister for Trade and Industry in Singapore recently noted that the important consideration is not to make a choice between manufacturing and services, but to position themselves within the spectrum spanning manufacturing and services in order to take advantage of the growth opportunities there.

The Australian Business Foundation partnered in a 2002 ARC-funded research study led by Professor Jane Marceau and colleagues at the University of Western Sydney, investigating over 500 Australian manufacturing and related firms on their linkages between products and services.

The study sought to get a handle on a major international debate about whether manufacturing matters in modern economies. It concluded that current perceptions of the decreased importance of Australian manufacturing and the arrival of the 'service economy' are too simplistic. The headline findings uncover a rich dynamic between manufacturing and services in Australia and new capabilities that are emerging.

²³ See Japanese Ministry of Economy, Trade and Industry, 2002; BERR, 2008; Monetary Authority of Singapore, 1998; OECD – various; PwC, 2009; Coutts and Rowthorn, 2009; Davies, Brady et al, 2003.

- **Australian firms are successfully competing by creating fresh customised business offerings by linking products and services together in diverse ways to meet customer needs.**

Product-service packages were found to be widespread and diverse. Nearly 75% of the manufacturing firms surveyed as part of the study reported that they incorporated and sold services in their product offerings to customers.

Typically these included engineering, prototyping, design and testing services during the production process, and services like maintenance, training and information/help desks at or close to point of sale. This was the case across the board – from metal manufacturers to electronics firms to pharmaceutical companies.

Service firms were also adding value to physical products acquired from manufacturers by bundling them with a vast array of services. Typical cases include computer and telecommunications companies selling total solutions of hardware, customised software, finance, technical support and upgrades. Another example is that of the hospital surgical supplies provider now sourcing a variety of products and linking them into packages which have just the right number of sutures, instruments and so on for a given surgical procedure.

Large scale, complex and unique construction or infrastructure projects (like building, owning and operating an airport or a sports stadium) provide yet another example of the mixing of products and services to deliver an entire, highly customised, once-off or small batch project.

Marceau et al found several key factors shaping these product-service packages, including:

- the increasing power of the client and demands for customisation;
- the shift towards outsourcing;
- new products, especially radical or risky ones, generating customer demands for information, training, help desks and similar services;
- efforts to capture distant markets through collaborations with local servicing companies; and
- compliance with regulatory requirements stimulating new services in areas like design, technical and quality assurance, training and environmental impact assessments.

- **This emerging pattern of product-service linkage is a sign of Australian firms getting smarter and transforming themselves to provide not just products or services, but solutions to customers.**

Firms are blending and bundling products and services to:

- retain their customers;
- add value, while reducing costs and risks; and
- differentiate themselves by expanding and customising their offerings and looking for niches which give them long-term advantage.

It is a smart move to add services to products because it is less risky to develop new services than new products. Services have ever-expanding boundaries and are not constrained by what the product can be first seen to do. Provision of services means that firms do not have to retool or invest in expensive and untried technologies. It is in effect a risk management strategy.

It is also a competitive response so that firms can succeed in an increasingly volatile and globalised business environment of cheaper products, shorter product cycles, faster business imitations and saturated markets.

One Australian case example is a Sydney-based subsidiary of a US multinational, a modern high performing company that both sells and services planetary gearboxes to customers mostly in the mining, agriculture and construction industries in Australia and offshore.

The case study company told the story of its efforts to ensure its survival and growth in a climate of intense competition, of customers with little loyalty buying on price and the company's profitability becoming increasingly marginal.

The company changed their approach, transforming themselves from a manufacturer of a single product to a unique and customised total package service provider. They first added value to their gear boxes with new features and capabilities. They then engaged further with their customers in understanding the end uses of the gearbox and became involved in problem-solving and design. They then added services to the package, including maintenance and upgrades.

Their journey proved successful, though not easy. It required a cultural shift in management, sales team changes, major efforts to win customer confidence, a commitment to forming alliances and reorganisation of the capabilities of the business so they could consistently offer a high quality total package of solutions to customers.

- **Competing by linking products and services drives Australian firms to be more innovative and knowledge-intensive.**

Devising new product-service packages stretches the technical, managerial and marketing capabilities of firms, resulting in distinctive know-how and intelligence which in turn, drives their innovation and competitiveness.

Innovation through product-service packaging has far reaching effects on business competitiveness as the firms involved tend to:

- collaborate with others, including customers, at home and abroad and so, increase their level of knowledge or technical proficiency;
- retain customers and thus spend less energy on recruiting new ones;
- generate new skills inside their enterprise, notably through different mixes of technical and market-related skills; and
- be flexible in reorganising their operations to suit and satisfy customer needs.

Such innovation, because it does not always require R&D investment, often goes unrecognised in official statistics and in popular understanding of innovative behaviour in firms.

- **Manufacturing remains central to much productive activity and is not in decline, just changing configuration to increase the levels and variety of services.**

Marceau's study holds a warning against making public policy or business strategy decisions based on a simplistic view of manufacturing in decline and services on the rise.

The lessons for business from this, irrespective of their sector of the economy, are:

- Collaborate with other firms and organisations, like research and education bodies.
- Increase the number and broaden the range of services you offer.
- Stay close to customers.
- Re-think the internal organisation of your firm's activities.
- Invest in new skills.

So, the blurred boundary between manufacturing and services is being manifested in these new hybrid business offerings that solve customer problems in more imaginative and valued ways. This in turn, results in more competitive capabilities in the enterprises involved, adding to the resilience of Australian manufacturing.

Knowledge driving innovation and productivity

To better understand the morphing of manufacturing, it is important to appreciate the reality and potency of the knowledge-based economy. This is not just the province of the technology whizz kids or the science elites. Its key feature is not high technology, but the smart application of knowledge. This use of knowledge to transform the capabilities of an enterprise is a decisive factor both in generating maximum commercial value in individual businesses and in driving long run economic and productivity growth for the nation.

In short, know-how and know-who is more important than what you own and make. The knowledge and relationships that firms have are increasingly significant in how they can deliver value to customers and make money from their businesses.

Businesses succeed in a knowledge economy not by "building a better mousetrap", but by using their brains, know-how, intelligence and connections.

Intangible assets can create wealth too. Firms and nations can capture value not only from exporting products and services, but also from leveraging capabilities and ownership of global assets and intellectual property.

For example, the Bishop Technology Group does more than export its world-class, technologically advanced steering components for motor vehicles; it holds over 180 patents and successfully licenses its technology to corporations throughout the world. As a result of Bishop's proficiency at leveraging its intellectual property, over 20% of all passenger cars produced globally each year incorporate some element of Bishop steering technology.

Another example is the case of Australian SME, Aeronaut Automation (previously known as Aeronaut Sails) which changed its business from sail making to the manufacture of cutting machines for industrial and technical fabrics in response to customer demand and the difficulty in sourcing reliable and high quality cutting machines. They capitalized on their own superior industry and user knowledge to create an entirely new and successful business model, one which served to replace imported machinery.

Low on research, high on knowledge

In papers for the Australian Business Foundation by international innovation researcher Professor Keith Smith on *Innovation and the Knowledge Economy in Australia* and in subsequent writings, he cautions against equating knowledge and innovation just with research and development.

Professor Smith puts the case that low and medium technology industries, many in mature and traditional sectors like manufacturing, are in fact, knowledge-intensive, innovative and growing steadily. For example, food processing, metal products, wood and timber products, chemicals, printing and publishing, transport, mechanical engineering, mining, hospitality industry, health, financial services and the like.

These industries are low on research, but high on knowledge. Their knowledge takes the form of market research, design skills, customer relationships, engineering development, in-house training and operational skills from new capital goods. Their knowledge also comes indirectly, from their associations with universities, researchers, industry and professional organisations, standards bodies, consulting engineers and the like.

The knowledge behind the innovation in so-called low-tech, low-R&D industries is not visible in current innovation indicators.

Their innovation comes from learning, re-use of knowledge and experimentation (eg. by prototyping and trial production), not from the discovery of entirely new scientific or technical principles or inventions.

The installation and operation of new machines and equipment is knowledge-creating, because it results in new capabilities. Similarly, firms can purchase licences to use protected knowledge created or discovered by others, or can explore and learn about markets and consumer preferences by investing in market research and other intelligence-gathering exercises.

Furthermore, firms can gain the benefit of new knowledge through their association with others, eg. personnel movements, inter-firm cooperation, strategic alliances, links to professional and regulatory bodies and so on.

GPC Electronics is case example of a manufacturing firm growing and competing successfully with global competitors through the smart application of distinctive knowledge in project and supply chain management and in customer relationships.

GPC Electronics in Penrith is one of the largest contract electronics manufacturers in Australia. It designs, manufactures and markets interconnected products and related services for the electrical power, automotive, consumer, communication and contract electronic manufacturing industries, with an impressive client list that includes Nortel, Toshiba, Ericsson, Siemens, NEC and Alcatel. They provide manufacturing solutions at low overall cost and risk to their clients.

Like many Australian enterprises, GPC realises that it could never compete in a globalised, fast-paced world economy as a high-volume, low cost producer. GPC needed to distinguish its products and services by harnessing knowledge, in particular, market and industry knowledge, market intelligence, process knowledge and supply chain knowledge. GPC competes by its superior use of knowledge, particularly about industry and market trends, customer needs and competitiveness drivers.

GPC's managers characterise the relationship with a customer as a partnership, from which develops a deep and detailed understanding of the customer's business priorities, strategic imperatives and competitive environment. This close-contact, collaborative approach allows GPC to gain a key strategic advantage over its often larger global competitors, because it understands and can respond even anticipate, its customers' needs more effectively.

They describe their model as making their customers more competitive by managing complex business issues. Their approach to outsourcing rejects the traditional model that relies on cheap labour and the relentless driving down of costs. Rather, GPC's outsourced offerings are based on understanding what makes their customers competitive in the marketplace and tailoring their manufacturing and business processes accordingly. This could be helping their customers in winning greater market share, minimising working capital, fast time to market, reducing overall cost, capturing high margins, response to a fast changing market, short lead-time opportunities, or many others.

Knowledge as a competitive edge

Knowledge and its use can give companies a decisive competitive edge. Today assets are mobile, so knowledge that makes you distinctive really counts – market intelligence, 'ownership' of customers, tacit know-how and skills. Knowledge is not just from R&D, but from learning. Fundamentally different business strategies, based on innovation and knowledge, are vital for a competitive edge. It involves applying knowledge to better meet market and customer demands. The knowledge driving innovation comes from learning by doing, learning by using technology and equipment and learning by interacting with others.

Invariably, business enterprises do not steal a march on their competition just because they invent a better product or a new generation technology. They survive and attract the resources to grow and sustain their enterprise by how well they organise and deliver business offerings that provide a solution someone is prepared to pay for.

Firms create competitive advantage by perceiving and discovering new and better ways to compete and bringing these to market. This involves innovation, but it is innovation that can occur in a number of dimensions: new delivery and distribution channels; new attributes of their business offerings; new organisational arrangements or changes to products and processes; new ways of managing customer relationships and providing better customer experiences.

Innovation shifts competitive advantage when rivals fail to perceive the new way of competing or are unwilling or unable to respond. The most potent forms of innovation that make it difficult for rivals to compete are business model innovation and organisational or managerial innovation. Business model innovation happens when firms find a whole new recipe for business success that changes the game. Managerial or organisational innovation occurs where resources and people are deployed more imaginatively in ways that depart from traditional practices and forms and that achieve better results.

In short, competing through innovation and knowledge present new sources of productivity for manufacturing firms, when they understand and activate wider concepts of innovation. Innovation, contrary to popular perceptions and much government policy, is more about problem-solving and learning than about scientific discovery, more about the customer than the producer, more about the marketplace than the laboratory and more about business transformation than technology.

This is the yardstick against which to judge the nature of change underway in Australian manufacturing.

Transforming businesses and workplaces is the key to manufacturers unlocking innovation and enhancing their productivity. Innovative managers and workplaces become more productive by transforming the capabilities of their businesses: finding imaginative new ways of problem-solving; collaborating with customers, suppliers and even competitors; adapting existing technologies and processes to new uses; and devising fresh solutions to meet the needs of demanding customers.

Innovation should be seen as a means to an end, not an end in itself. And the end is: generating new sources of enduring competitive advantage. Innovation in its market-led, close to customer form, involves the change and dynamism that can give manufacturing businesses a lasting competitive edge.

4 Future manufacturing

Given the changing nature and dynamics of manufacturing outlined earlier, this section draws on recent research to identify the possible shape of the future environment for manufacturing firms.

Canvassing the literature on 'manufacturing futures' uncovers considerable commonality around the themes of globalisation; changing demographics, skills and workplaces; challenges of climate change and resource use; technology advances; business model transformations; and new configurations of manufacturing industry driven by different demands, customers, competitors and the geopolitical landscape.

In this paper, particular attention has been paid to the operating environment, markets, skills, technology and business models Australian manufacturers are likely to confront in the foreseeable future. There is a focus on what is known about enhancing productivity growth to maximise the profitability and longevity of manufacturing firms.

Given this lens and with an eye to identifying the attributes that Australian manufacturers will likely need to compete successfully and sustain themselves in the future, the following seven forces for change are highlighted:

- More intensified competition.
- More complex and varied opportunities for doing business globally.
- Shift from mass production to customisation and personalisation.
- Growing importance of the low carbon economy.
- Changing skills needs and imperatives.
- Technology that transforms entire business models.
- Collaboration and connectivity that accelerates innovation and competitiveness.

These forces for change are each described in the following sections.

More intensified competition

Notwithstanding manufacturing's significant economic contribution, it is facing more intense and increasing competitive pressures. Chief among these are the rise of low wage, low cost manufacturing economies, increasing levels of global competition and the effects of a strong Australian dollar. Further pressure comes from moves to introduce a price on carbon, the first of many similar calls given community expectations for greater environmental sustainability and social responsibility. These, in turn, will weigh on the strategies, operations and investment decisions of manufacturing firms.

A strong and volatile Australian dollar, import penetration and rising input costs are likely to continue to squeeze profit margins and reduce the competitiveness of Australian manufacturers for the foreseeable future, notwithstanding solid demand for domestically-focused manufacturers servicing the mining and resources industries.

This picture is reinforced in the Performance of Manufacturing Index for February 2011 from the Australian Industry Group and PwC. While this Index showed a moderate monthly improvement in the performance of the manufacturing sector, many respondents remained cautious about the business outlook. The primary reasons they cited inhibiting the manufacturing sector were softening of domestic demand, the level of the Australian dollar, strong overseas competition and bad weather.

Increased wages and input costs, coupled with moderate increases in selling prices, resulted in a narrowing of profit margins in February. New South Wales and Victoria were the only States recording a contraction in manufacturing in February and Western Australia experienced the strongest expansion. Generally, the Textiles, Clothing and Footwear sub-sectors experienced the most significant declines.

More complex and varied opportunities for doing business globally

Increasing globalisation is not a new phenomenon, but the current wave of globalisation is resulting in unprecedented changes to how businesses define and access markets and how they organise themselves to operate and compete profitably. The International Monetary Fund describes globalisation as *the process through which an increasingly free flow of ideas, people, goods, services and capital leads to the integration of economies and societies*.²⁴

Globalisation has been accelerated by increasing openness to international trade, the recent spectacular economic rise of emerging economies like China and India, and rapid technical progress especially in information and communications technologies, which has lowered transport and communications costs and increased the range of goods and services that are now tradeable internationally.

This combination of factors shape new global labour markets and open up more varied ways of doing business globally through off-shoring, outsourcing, and other multi-country strategies, including the relocation of some activities abroad. These processes are likely to intensify in the future.

One particularly significant effect is the growth of distributed global value chains, where different stages of the production process are being unbundled around the world. This includes *not only the fabrication of physical components, but the accompanying knowledge-intensive services, such as research and development, inventory management, quality control, and other professional and technical services*.²⁵

The UK Department of Business Enterprise and Regulatory Reform goes on to describe this phenomenon and its effects cogently as follows:

The result has been an increase in both outsourcing, which typically involved switching from in-house provision to purchasing intermediate goods and services from outside specialist providers, and off-shoring, whereby firms purchase intermediate goods and services from foreign providers or transfer particular tasks to a foreign subsidiary.

The phenomenon of off-shoring has given rise to the term 'global value chain', whereby different businesses add value by different processes or activities at each stage of production. In this respect, the traditional production model whereby firms were responsible for all stages of the production process of a particular product has changed. Many manufacturers now choose to specialise on particular steps in the production process, such as design, research and development or sales and marketing, either within individual geographic locations or through participation in (a) sort of stylised global value chain.

²⁴ Quoted in BERR (2008)

²⁵ BERR (2008)

The growth of global value chains present both opportunities and challenges for Australian manufacturers. The key challenge is the entry of additional firms competing in the global economy and their ability to specialise in high value-added manufacturing and related service activities, not just in traditional low-cost production.

The opportunities come from the prospect of increased sales through successful specialisation, management of wider networks of distributors and resellers to help meet local demands in new foreign markets, and reduced costs through more efficient outsourcing.

There are benefits for both multinationals and small and medium sized enterprises. The global reach of multinationals allows for coordination of production and distribution across many countries, and shifting activities according to changing demand and cost conditions. For SMEs, global value chains provide niche opportunities to expand into international markets and extend their business activities across borders for a multi-country presence, without the need for 'full-service' international trade operations.

New manufacturing – shift from mass production to customisation and personalisation

The disappearing boundary between manufacturing and services, evidenced earlier in this paper, is an early warning signal of a fundamental shift in manufacturing itself. From the Industrial Revolution, mass production has been synonymous with manufacturing, emerging from the cottage industries and subsistence agricultural economies that preceded it.

Manufacturing is now no longer about mass production, but about providing solutions for customers that are tailored to their needs and even personalised. There is a shift to a new manufacturing, not mass produced and standardised products, but customised and personalised goods and services. Manufacturing industry is responding to intensified global competition by differentiating itself by shifting away from traditional business strategies of selling particular products to a new model where the sale of products is combined with associated services making the manufacturing companies more attractive, helpful, and valued by customers.

One of the five global megatrends, A Personal Touch, identified in the CSIRO's global foresight project captures this element of the future environment for Australian manufacturers.²⁶ The CSIRO report comments on the rapid growth of the services sectors in Western economies; the blurring of boundaries between products and services which generate new business models; and a second wave of productivity-enhancing innovation that is market and customer-centred and based on customers being fully engaged in decisions about the business offering they purchase and consume. It involves tailoring and targeting services.

The CSIRO reports that in 1970 the services sector represented 55% of the Australian economy. Today it is over 75%.

One of the aspects pushing this trend is the increase in computer power and the rise of the internet in recent decades. Information is increasingly accessible to both individuals and companies.

²⁶ CSIRO Foresight project reported on in Hajkowicz and Moody, CSIRO, 2010.

This development has provided marketers with the opportunity to customise products for demanding customers increasingly overwhelmed with choice.

As companies and organisations know more about their customers they can provide services that they already know are right for them.

J. Robins is now the only volume producer of women's shoes remaining in Australia. They are succeeding with a business model that combines mass customisation and lean manufacturing. J. Robins can meet the changing demand for designer fashion shoes with rapid supply of high quality shoes to the specifications of their retailer customers in a fraction of the time it takes offshore producers to supply. Key to this is the combination of flexible teams of multi-skilled workers, use of high quality German and Italian machinery and superior supply chain and customer relationship management processes.²⁷

The import of this fundamental shift for manufacturers is that it requires new and different business relationships and models. Mass customisation, together with flexible specialisation and lean manufacturing, have changed the nature of relationships of firms with their customers, suppliers and partners. As Mark Dodgson and Peter Innes note in their 2006 study of Australian Innovation in Manufacturing:

Mass customisation entails producing in both volume and to the requirements of individual customer needs. Flexible specialisation particularly involves smaller firms in evolving production networks. Lean production involves the elimination of waste in a production system, in part from highly efficient supply chain integration, through mechanisms such as just-in-time delivery – often on an international scale. The key features of all these approaches are the production of high volume and high variety, maximised efficiencies and minimised costs, combined with continual and rapid innovation.

The story is one of manufacturers benefiting from increased opportunities for outsourcing from global value chains and from their growing recognition of the importance of user-centred, open source approaches. This allows them to create and tailor innovative business offerings that anticipate needs and solve customer problems.

In short, new manufacturing has the potential to create new business growth and value from the re-design of business relationships and models necessitated by forces of change that include:

- greater trends to outsourcing and specialisation;
- niche customised products and services, not standardised mass production;
- customers making production decisions and employees who are also entrepreneurs;
- hybrid business offerings that merge both products and services; and
- one dimensional buyer-seller relationships giving way to diffuse and changing economic webs of buyers, partners, alliances, stakeholders, suppliers, distributors and resellers.

²⁷ Cited in Don Scott-Kemmis (2011)

Growing importance of the low-carbon economy

There are divergent opinions about the implications for Australian manufacturing industry of the increased demand for environmental sustainability through higher environmental standards, regulation for resource efficiency, establishing a price on carbon, options for emissions trading schemes and the relative utility of market mechanisms and direct action and awareness programs. But, there is unanimity that action by manufacturers to achieve environmental sustainability, resource efficiency and a lower carbon footprint is both an urgent and necessary business priority.

The CSIRO's global megatrend, *More from Less*, and the book by James Bradfield Moody and Bianca Nogrody, *The Sixth Wave – how to succeed in a resource limited world* argue that we are on the cusp of the next wave of innovation based on a transformation from a world heavily addicted to the consumption of resources to one where resource efficiency is paramount. Economic growth will be decoupled from resource consumption and waste production. Resources will be valued and priced on the basis of a shift in the assumption that resources are cheap and plentiful to resources being seen as scarce and valuable.

The European Commission's scenarios for the Future of Manufacturing in Europe 2015-2020²⁸ are centred around the concept of sustainability. Their scenarios for successful sustainable manufacturing are found to depend on the alignment of consumer behaviour and market demand for green products, prevailing public values, and acceptance of policies and business action on sustainability and technological advances and their effective execution. Societal and organisational factors count more than technology alone in shaping the future for sustainable manufacturing.

According to Capgemini's study of how 150 manufacturers in eight countries see 'manufacturing in 2020', they are uncertain about what actions to take on green issues, but agree that urgent action is necessary in the face of political and societal pressure around emissions reduction.

There is a consistent thread of argument in the commentary and research that the new focus on climate change, greener supply chains, waste reduction and resource efficiency opens up a whole new range of 'cleantech', low carbon prospects for manufacturing firms.

The evidence suggests that the most viable way for manufacturers to develop and pursue 'green economy' opportunities is to focus on green products and services in areas where the country already holds a competitive advantage. In the UK, design and production of clean technologies and renewable energy generation, like tidal energy, are seen as the best bets. While in Australia, opportunities are identified in solving water scarcity and allocation problems such as the Murray-Darling Basin, or in technologies for the minerals and mining industries for the more efficient exploration, extraction and use of high grade ore deposits.

Changing skills needs and imperatives

The 2010 Global Manufacturing Competitiveness Index by Deloitte and the US Council on Competitiveness is a report based on a survey and some interviews of more than 400 CEOs and senior manufacturing executives worldwide. The report's headline finding is that access to talented workers capable of supporting innovation is the key factor driving global

²⁸ European Commission (2003)

competitiveness at manufacturing companies – well ahead of ‘classic’ factors typically associated with competitive manufacturing, such as labour, materials and energy. The availability of talented people extends to scientists, researchers, engineers, production workers and technical personnel.

The 2011 Environmental Scan report from Manufacturing Skills Australia documents the recent experiences of manufacturing enterprises based on interviews, site visits, surveys, feedback and industry research, with a particular interest in skills, education and training issues.

Among the key findings of the 2011 Environmental Scan were the following:

- Competition for skills with the resources sector is a major issue for manufacturing and is affecting the willingness of enterprises to engage in training.
- Skills shortages are already intensifying and are expected to become worse than ever before. This is set against the backdrop of an ageing workforce and inadequate numbers of people entering the manufacturing workforce.
- While rebuilding after the Queensland and Victorian floods will create short-term opportunities for many manufacturing enterprises, it will also further intensify skill shortages and complicate workforce planning.
- Many enterprises report that the downturn has made them leaner and more efficient – however, for most it appears that intentions in 2010 to upskill and develop the workforce were not actualised. It seems that enterprises held onto employees as a top priority during 2010 and employees were more reluctant to follow other opportunities. However, this is starting to change and anxiety about attracting and retaining skills is on the rise.

New skills needs

In short, skills shortages, growing competition for talent, consequent wage pressures, and deficiencies in responding to the need for continuous upskilling of the manufacturing workforce and management are enduring issues for Australian manufacturing. But over and above these fundamental concerns, intensifying competition and the changing models for business success in the manufacturing sector present even more urgent and critical skills imperatives.

Deepening and expanding the skills, capabilities, and adaptability of manufacturing managers and workforces is essential to profit from new manufacturing business models. Even more in the future, manufacturers will compete and succeed by their proficiency in innovating by the smart application of knowledge and providing valued solutions to the needs and problems of demanding customers. This requires new constellations of skills in manufacturing enterprises.

As globalisation drives down the costs of manufacture, the industries that harness and deploy creativity and tacit knowledge best will generate new sources of competitive advantage and productivity. This covers not only expertise in high level technical, scientific, and engineering disciplines and in new and emerging technologies, but the ability to build the firm’s intangible assets that are increasingly decisive to competitiveness and sustainability. These require skills in areas such as design, software and other aspects of

product development, brand-building, improvements in business processes, market intelligence and customer relationship management, training, problem framing and problem solving, collaboration and partnering. Further, strong management and leadership skills are vital for the operation of global value chains and for motivating and making the most effective use of the skills of the workforce to deliver high value added products and services.

Innovation and Business Skills Australia (IBSA) with the Society for Knowledge Economics prepared a paper on *Enterprise Innovation* for a Canberra summit in June 2009 in which they compiled a body of evidence about best practice management and workforce skills to enhance productivity through innovation and continuous learning at the level of the enterprise.

They highlighted the concept of 'learning organisations' that encourage interactions between people with diverse skills and competencies, delegate problem-solving, sanction informed risk-taking and discretionary effort, experiment with new offerings and services and are generally more responsive, flexible, and agile in their operations and relationships.

Workforce changes

A further dimension of change is occurring in the composition and aspirations of the workforce. Both workers and patterns of work are changing. With an increasingly mobile global workforce, language and inter-cultural skills will become more important, as will managing different attitudes to and expectations of work from younger generations of workers.

Manufacturers can be expected to confront structural changes such as the growth of part time jobs and contractual work; a changing industry mix with the rise of services; altered demand for different types of skills especially for knowledge workers with problem-solving, conceptual and interpersonal skills; more flexible working arrangements; and demographic shifts creating new cohorts of workers with different perceptions and aspirations for their working lives – the global generation, career-step employees and free agents, portfolio or self-determined careerists, and older, 'wisdom' workers and mentors. Moreover, tougher standards are increasingly being expected of businesses if they are to become employers of choice based on their social, ethical, health and safety and environmental records.

Finally, manufacturing has a perception problem that impacts on its skills and people. The Manufacturing Alliance of the Australian Manufacturing Workers Union and the Australian Workers Union summarised it as follows in their 2009 paper, *A Country That Makes Things*:

In part the problem relates to stereotype 'perceptions' of manufacturing as 'an old smokestack industry', or a 'dirty' industry with boring repetitive tasks and one with little by way of high paying jobs or career paths.

Such perceptions are unhelpful in attracting young Australians into the industry. It also makes it difficult for manufacturing to attract and keep the best and brightest people to build a career in an Australian manufacturing firm or even start a new manufacturing business.

Beyond that, the old-fashioned image of manufacturing does not do justice to the industries and workers who currently drive such a significant sector of our economy. Nor does it reflect the modern, innovative and sustainable future for manufacturing that is already taking shape.

Technology transforms entire business models, as well as products and processes

Advances in technology have long been acknowledged as a key contributor to the health and survival of manufacturing firms, and remain so. The introduction of the latest plant and equipment has increased the productivity of many manufacturers as well as reducing set-up times and costs. Access to and take-up of new and changed technologies, either through investment in R&D or through technology transfer strategies, are central to the ability of manufacturers to survive in an increasingly competitive environment.

But the transformative effects of technology are no longer centred just on the production process and advances in next generation products. New technologies can transform the organisational capabilities of firms, the nature of their competitive strengths, and their entire model for doing business profitably over the long term.

Innovation technologies

Dodgson, Gann and Salter (2005) identify a new class of technologies which they term 'innovation technologies'. These include simulation and modelling, visualisation, rapid prototyping and virtual reality immersion environments, together with developments in e-business, logistics and other operations technologies. They argue that such advanced technologies are the tools of innovation – reducing the cost, increasing the speed and improving the processes of innovation and experimentation by manufacturers.

Siemens in its recently released report on *Picture the Future 2030*²⁹ pointed to technology and innovation as the key to productivity growth, specifically the effects of digitisation and the greater power to manage and process information at ever decreasing costs.

Mark Dodgson and his colleagues make the case that these ICT-based innovation technologies allow manufacturers to design more elaborate products and services through collaboration, experimentation and simulation. There are firms that now have virtual collaboration rooms where engineers from anywhere around the world can come together to design a product in 3D. Latest developments even allow for 3D printing, digitally producing physical products and prototypes.³⁰

Business model change

Such new technologies, more importantly, can be essential tools for manufacturers to identify and execute new ways of creating and capturing value from meeting customer needs. In other words, these technologies enable innovation in business models. A business model is the 'recipe' for how an enterprise creates value for customers, partners and itself, based on its distinctive and superior skills and competencies. New technologies can change one or more of the elements where value gets created and captured by the firm - namely, customer relationships, the value proposition for customers, distribution channels, core skills and know-how, collaboration with partners, cost structures, the configuration of the business, financial and organisational processes, the revenue model.

Sometimes, business model innovation changes the game like online travel and accommodation services such as Wotif and Webjet impacting on retail travel agents;

²⁹ Siemens (2011)

³⁰ The Economist, 10 February 2011

low-cost airlines like RyanAir or Jetstar against full service airlines; customised computer production from Dell; Apple's design and marketing alternatives to MP3 players and mobile phones; JB Hi-Fi's new mixture of discount and branded products as a value retailer to the youth market; the shift to digital photography services instead of the production of film by companies like Kodak.³¹

Mastery of technology-enabled business model innovation provides an edge for manufacturers as it creates a distinctive source of competitive advantage that is difficult for others to imitate or erode.

Don Scott-Kemmis' current study on Australian business model innovation for the Australian Business Foundation highlights several case examples of Australian manufacturers innovating in their business models. For example, Ballina-based Kimberly Kampers serves the off-road travelling and camping needs of 'grey nomads' with a customer-focused, design-led, supply chain business strategy. Their formula for success mixes their investment in design capability and patents; lean manufacturing processes and high level customer value (eg ease of use, good resale value, environmentally friendly features); flat organisation structure and team-based, highly trained workforce; and extensive use of integrated design and manufacturing software and IT systems.

Another case is Beacon Lighting with its business model focused on strong product design and quality control, closely-managed outsourced manufacturing, customer engagement and continuous investment in new business developments such as specialised new lines of business in solar power offerings or lighting advice services.

A 2005 global survey of over 4,000 senior managers in 20 sectors by the Economist Intelligence Unit reinforced the role of information technology as a strong driver of business model innovation into the future. The majority of respondents thought that information technology (the internet, digitisation and communications) would be a key factor in the capability of firms to effectively develop and implement new business models over the next five years and beyond.

IBM's 2006 Global CEO Survey found that given the pace of globalisation and technology advances, CEOs were placing more attention on innovation in their business models:

Leaders frequently define their businesses in terms of the products and services they take to market and naturally focus their innovative energy there. But with technological advances and globalisation presenting so many new opportunities – and threats - CEOs are now giving business model innovation as prominent a place on their agendas as products/services/market innovation and operational innovation.

In summary, advanced technologies supporting innovation in products, processes and business models have the potential to transform the profitability and the competitiveness of Australian manufacturers.

³¹ Don Scott-Kemmis (2011) – to be published by the Australian Business Foundation in May 2011

Collaboration and connectivity accelerates innovation and competitiveness

Related to the earlier trend of mass customisation and personalisation of products and services is the rise of user-centred and open source approaches to business development. Firms access critical knowledge about opportunities, changing markets and customer needs and preferences from outside the firm. How well firms are connected into latest flows of knowledge and how proficient they are at collaborating to turn this knowledge into fresh competitive capabilities is key to their innovation, productivity and profitability.

Knowledge flows, not knowledge stocks

There is an extensive body of literature and case examples of open-source innovation, where customers are close to being the top source of knowledge for innovation in business enterprises.³² The 'wisdom of crowds' is also harnessed through use of social networking media and engagement of 'lead users' to provide a virtual R&D team outside the firm for new business offerings that satisfy often previously unrecognised market needs and niches. See for example, Proctor and Gamble's 'connect and develop' initiatives, Lego's community of users in new product development, IBM's involvement of global staff, customers, family and stakeholders in an Innovation Jam and Deloitte's Intensive Learning Campaigns of 'action learning' sessions between cross-disciplinary staff teams and prospective clients.

Therefore, it is vital that manufacturers capitalise on this force for change by positioning themselves as key contributors in rich networks of relationships and knowledge flows. Being connected counts.

John Hagel III and John Seely Brown, authors and practitioners on knowledge management, innovation and strategy, presented to the World Economic Forum in Davos in 2006 where they argued that "who we know is more important than what we own":

Traditional business strategies are delivering diminishing returns... We need to harness the potential for innovation, rather than simply focusing on our existing assets and cost-cutting initiatives. As change accelerates, our stocks of physical assets and knowledge depreciate at a more rapid rate. Flows of new knowledge become critical to competitive success and these flows occur only in the context of relationships. Successful strategies will depend on privileged positions in rich networks of relationships.

Hagel and Seely Brown note that creative business activity (that results in both learning from the "productive friction" of multiple and diverse parties and in more imaginative and valued business offerings) is shifting beyond the boundaries of the firm and is spanning national boundaries as well. They point to the twin trends of open innovation ('learning from the edge') and more distributed modular global networks where centres of specialisation for business processes are found across many locations and mobilised in different combinations as needed. This is a similar concept to Robert Reich's "global webs of enterprise" where business activities are geographically and functionally distributed as virtual business units that cross the boundaries of both firms and nations where it makes sense to do so.

People factors

The Australian Business Foundation's book of 14 papers by 26 expert authors, *Inside the Innovation Matrix: Finding the Hidden Human Dimensions* makes the case for the pivotal

³² Chesbrough (2003); Eric von Hippel (2005); Cosh et al (2005); Australian Business Foundation (2008)

role of people as innovation carriers – their networks, collaborations, knowledge flows, interactions and tacit knowledge – and how innovation itself is a potent competitive force that drives productivity.

A number of contributors to the Innovation Matrix collection of expert papers substantiate the critical contribution of connectivity and relationship-building between enterprises and between business enterprises and other economic actors.

For example, John Bessant, Professor and Chair of Innovation Management at Imperial College London summarised a wealth of international academic scholarship about the concept of “learning networks”.

John Bessant cites research on learning networks that show that shared and cooperative inter-firm learning greatly assists enterprises to organise and manage the acquisition and absorption of new knowledge and to transform it into competitive capabilities. The value of action or experiential learning comes from the participation of others in the process of challenge and support. It also marshals the benefits of ‘comrades in adversity’, of working together to tackle complex and open-ended problems.

Bessant cites various examples of effective learning networks, such as Toyota’s active supplier association, Marsh & Shaw’s study for the Australian Business Foundation on collaborative learning experiences in the Australian wine industry, and supply chain learning networks in the Dutch and UK food industries, the construction sector and in the aerospace industry.

Economist and urban planner, Marcus Spiller explores the role of knowledge-intensive advanced business services as agents of innovation, critical to the creation and diffusion of ideas and problem-solving in other business enterprises. For example engineering, IT and technical advisors, design services, specialised legal and human resources services, financial brokers and venture capital services.

To achieve their potential as innovation agents with other businesses, these advanced business services are dependent on trust-based relationships, which in turn, rely on face to face contact, personal referrals and recommendations and mastery of local business cultures and mores.

Spiller therefore puts the case for creating geographic clusters of advanced business services, as their innovation catalyst effect depends on physical proximity.

John Steen, Sam Macaulay and Tim Kastle of UQ Business School share their scholarship on social network analysis as a powerful tool to understand, measure and manage innovation networks. They argue that innovation in modern economies is less about discovery, and more about making new connections throughout the value chain.

Their evidence-based intelligence suggests some networks support innovation better than others, and it revolves around analysing the number, depth, distance and flow of connections. To paraphrase, it turns out that “friends of friends” matter – the more friends you have and the more diverse sets of friends they have, the greater the innovative performance and competitive advantage.

In the next section, we reflect on the implications of these potent forces for change confronting manufacturers and link them to prescriptions for productivity growth, including what can be expected of government policy makers.

5 The productivity challenge

New angles on innovation and productivity are the key to profitability and longevity for Australian manufacturers.

Productivity and innovation

Innovation is the chief weapon in the 'productivity revolution' and the battlefield is where business enterprises and their workforces intersect with customers in the marketplace and the community.

In its *Venturous Australia* report, the Review of the National Innovation System emphasised the point that "the miraculous alchemy of innovation occurs close to the customer". The core of market-driven business innovation is responding with agility and intelligence to deliver well-executed new products and services that better solve customer problems and/or meet market needs and preferences. The focus for innovation-led productivity must shift from action to increase the supply of knowledge (from researchers and scientists) to the smart absorption and use of knowledge by enterprises to meet the demands of customers and communities.

In the context of a decline in Australia's productivity over the last decade after a surge in the 1990s, perhaps the most important factor determining the future success and growth of Australia's manufacturing sector will be its ability to sustain and increase its productivity growth rate. As Saul Eslake and Marcus Walsh of the Grattan Institute point out in their recent study, *Australia's Productivity Challenge*:

... higher productivity growth offers the best means of ensuring the survival of businesses and jobs in sectors of the economy likely to be adversely affected over the next decade by some of the side-effects of the present 'resources boom'. Although the resources boom will generate substantial income and wealth for Australia, and Australian citizens, it is also likely to result in a higher exchange rate for the Australian dollar, which will undermine the competitiveness of trade-exposed sectors of the Australian economy, such as manufacturing...

In fact, as manufacturing accounts for a disproportionately large amount of total imports (almost 90%), its level of productivity directly affects Australia's trade balance with wider economic consequences. Labour productivity in the manufacturing sector has performed strongly compared to other sectors, resulting in a relative higher rate of decline in manufacturing's contribution to employment compared to output.

It is important to be clear about what constitutes productivity improvement in an economy. Too often the indices of productivity are confused with the determinants of productivity. Traditional measures of productivity such as output per hours worked (labour productivity) or output per unit of labour and capital used (multi-factor productivity) are the score card. That is, they show the productivity outcome of an economy, but not what actually drives these results.

Research for the Australian Business Foundation by Cambridge Professor and Director of the UK Innovation Centre, Professor Alan Hughes³³ about the sectors contributing most to Australia's notable high productivity growth period of the 1990s found that it was the high technology users, not the high technology producers that were key. The business transformations and new capabilities behind their productivity gains come from their use of enabling technologies like information and communications technologies, strong management capabilities and capitalising on the benefits of regulatory reform.

³³Hughes and Grinevich (2007)

Productivity improvement is not generally the result of greater capital investment to replace labour. Productivity is not about doing more with less, nor about working people harder for longer. Contrary to conventional wisdom, productivity does not equate with efficiency; it centres on innovation and transformation – of business capabilities, skills, technology and competitiveness.

Accessing and adopting technology will continue to be a primary contributor towards productivity growth in manufacturing. But, ensuring the right organisational structure, culture, finance and managerial skills will be critical in enabling manufacturers to continuously respond to technological changes fast, efficiently and effectively.

Management and productivity

There is substantial evidence pointing to the increasing role of managerial skills and teams in achieving productivity gains. A joint study by Stanford University and Columbia University³⁴ demonstrates the critical role of teams due to the increasingly complex and challenging manufacturing environment, requiring a group of highly skilled individuals to solve complex problems to increase productivity. The European Central Bank³⁵ goes further to say that “both labour productivity and total factor productivity changes are mostly driven by firm learning”, emphasising the importance of a firm’s ability to operate in a knowledge intensive environment.

Managerial practices in Australian manufacturing have been found to be mediocre in an international comparison study reviewing management skills in manufacturing firms and the clear link between the quality of management and enterprise productivity. This is reported in a 2009 multi-university research study led by UTS Professor Roy Green benchmarking the management practices of 439 medium and large manufacturing firms in Australia against the results of a 16 country study by the London School of Economics and McKinsey and Company.³⁶

The study found that while Australian management practices are not in the top rank of performance worldwide, they are also not among the worst. Some Australian manufacturing firms are as good as any in the world, but there is still a substantial ‘tail’ of firms that are mediocre, especially in their approach to people management. This was found to be a key differentiating factor between Australia and better performing, more innovative countries.

The study also shows that the quality of management practices has a measurable impact on labour productivity. It concluded that a cost-effective way of improving the productive performance of Australian manufacturing firms is to promote a transformation in the calibre of the management and leadership of these organisations.

The Australian and foreign economic and regulatory environment will also continue to affect manufacturers’ productivity, through factors such as: ease of investments, foreign trade activity, domestic and international technology spill-overs and efficient capital markets. Furthermore, labour issues, such as industrial relations policy, skills and immigration policy will determine the adequate supply of highly skilled and flexible workforces to meet changing demands of manufacturers.

³⁴ Boning et al, 2007.

³⁵ Giannangeli and Gomez-Salvador, 2008.

³⁶ Study undertaken for the Australian Department of Innovation, Industry, Science and Research by a research team from University of Technology Sydney, Macquarie Graduate School of Management and the Society for Knowledge Economics and reported in *Management Matters in Australia: Just How Productive Are We?* (2009)

The increased interaction with other sectors, especially services, can boost productivity through collaborative arrangements such as integrated supply chains and technology absorption. The collaborative use of knowledge-intensive services will, for example, play a greater role in the manufacturing process, providing direct productivity increases through increased innovation activity, and knowledge and technology transfer.

This view of the importance of business innovation to productivity has been endorsed in public statements by the Productivity Commission³⁷ and is a central feature of the recommendations put by Saul Eslake and colleagues at the Grattan Institute in their *Australia's Productivity Challenge* report.

Manufacturing and innovation

If innovation is central to productivity growth, it is useful to take a reality check on how far Australian manufacturing firms are innovating. This has been done in a report on Australian Innovation in Manufacturing by Professor Mark Dodgson and Dr Peter Innes of the University of Queensland Business School as part of an international comparison survey.

In section 2 of this paper, evidence was cited of the significant investment by manufacturing firms in R&D and technological innovation. Dodgson and Innes, however, interviewed a sample of Australian manufacturing firms to develop a more finely-grained view of the nature of innovation in these enterprises beyond the aggregates of R&D expenditure and new products.

Their key findings were as follows:

- Firstly, innovation is defined as the successful application of new ideas – in products, processes, organisation and business models. Examples of the application of new ideas in products and services is teleservicing; in production and operations, it includes using automated equipment and robotics; in organisation, the use of outsourcing and teamwork.
- A critical dimension on which to analyse innovation is the way it supports competitive strategies in firms in a coherent way. Competing on innovation provides an alternative to competing either primarily on quality (which is a given) or on price (being eroded by low cost suppliers globally). This requires appropriate integration of innovations in products, operations and organisation overall.
- The study identified three particular innovation challenges confronting manufacturers in terms of
 - new technologies;
 - new internal organisational and work practices for agility; and
 - new business relationships and models with customers, suppliers and partners.
- Overall, Dodgson and Innes paint a picture of Australian manufacturers investing in innovation to gain operational improvements in existing businesses, rather than preparing to deal with a shifting competitive environment.

³⁷Productivity Commission (2002)

- The innovative practices most evident in this sample of Australian manufacturing firms involved production efficiencies. They focus on reducing the costs in production and assembly and balancing the investments in technology and organisational changes needed to respond to customer demands quickly and effectively. Dodgson and Innes also highlighted the restructuring and redesign of jobs and the encouragement of teamwork and employee consultation, as innovation activities performed well by Australian manufacturing firms.
- The key shortcomings in the approach to innovation by this sample of Australian manufacturers involved little evidence of investment in advanced technologies for product design, techniques for organising new product development, effective linkages with innovation-demanding customers, and the relative importance being placed on packaging of services around product offerings. Australian manufacturers in this study have short-term planning horizons and are not adopting the continuous improvement processes that drive sustained incremental innovation as a deliberate business strategy.
- Dodgson and Innes conclude that the Australian manufacturers in this study generally fail to appreciate and employ innovation as a decisive competitive strategy. Unlike their European counterparts, there is little evidence that these manufacturers see innovation as a tool to transform the way they do business or to respond proactively to the problems or the opportunities presented by an increasingly globalised knowledge-intensive marketplace.

In the face of this understanding of innovation-led productivity, manufacturing businesses themselves must be the prime architects of their own future. But, in the modern era, what role can public policy play in securing a productive and sustainable manufacturing sector?

Policy perspectives

There is extensive debate within OECD countries around the future role of manufacturing. Is manufacturing something that all advanced economies require to ensure the health of the overall economy or is it a sector continually marginalised that will inevitably shift towards low-cost developing countries?

The declining share of GDP represented by manufacturing has been a trend across developed economies. This has primarily been due to the rise of the services sector, offshoring of production and increases in productivity. Developed countries raise issues such as terms of trade, capital control measures, tariff and non-tariff barriers, foreign exchange mechanisms, intellectual property rights, national standards and free trade agreements as important factors affecting the competitiveness of their manufacturing sectors. Developing countries (responsible for increasing proportions of global production) are also now a more significant force in international forums where trade and commercial policy affecting manufacturing is considered, e.g. the WTO, UN and World Bank Group, and their representation in the G20 shifts the balance from the G8 industrialised nations. This demonstrates the shifting global economic order that is directly affecting the global manufacturing sector and its implications for both developed and developing countries.

Consequently, given these structural changes affecting manufacturing, policy responses differ. There is the non-interventionist approach that views manufacturing's relative decline

as simply economic evolution and a positive consequence of the economic development of advanced economies. Other policy responses seek to protect and support manufacturing for its disproportionate contribution to the tax base, to middle class jobs and higher wages, and to the skills and knowledge base of the nation. Others recognise the futility of seeking to turn back the tide of industries in decline, but favour action to speed up the sector's transition to other more profitable and fast growing economic activities.

Framing contemporary manufacturing industry policy presupposes an understanding of the seismic shifts that are playing out in the structure of manufacturing itself, in its competitive environment and therefore in the prescriptions for productivity in the future.

Productivity hinges on manufacturing firms transforming themselves and innovating to deliver more competitive products, services and solutions that serve paying customers worldwide.

To secure productivity outcomes, manufacturing industry policy must act to boost innovative practices directly in business enterprises and workplaces and at the point they engage with markets and customers.

But this direct engagement with business enterprises can prove problematic with policy makers, who are often more comfortable with intervention to influence framework conditions based on the rationale of 'market failure'. Action is limited to work on macroeconomic stability, openness to trade, deep financial systems, competitive markets, labour market flexibility and low taxes.

A credible alternative 'systems thinking' policy framework is offered in a 2010 joint paper from the University of Queensland's Department of Economics and the Centre for Business Research at the University of Cambridge by Mark Dodgson, Alan Hughes, John Foster and Stan Metcalfe. The authors argue that there is a strong body of scholarship and evidence showing that innovation contributes to economic growth in an evolving, dynamic process of collaboration and knowledge-sharing across a system that involves business enterprises, researchers, government, customers and other institutions and actors. This is a system with multiple contributors and connections that allows for variations in the conditions and frameworks for innovation. Despite this evidence, they comment that most innovation policies are uniform, static, dominated by the USA's model of commercialisation of public sector research and entrepreneurship and justified only on the grounds of 'market failure' where price signals are distorted and resources misallocated.

The authors point out that 'markets' are imperfect constructs by definition when you are dealing with innovation. Markets don't prosper in conditions of uncertainty where players can't evaluate risk. Innovation is by definition uncertain and risky. There are unknowables and there are failures. Innovation is about improvisation and learning. These conditions call for an alternative logic than market failure to inform and guide government action on innovation, based on understanding how systems work and how systems failures can occur.

Maximising benefits in conditions of uncertainty in complex, evolving situations provides the logic for more contemporary and relevant innovation policy. This means policy action that encourages enterprises in their efforts to create and share knowledge, forge multiple connections and collaborations, continually learn and detect market and community

changes and engage in serial business experiments to absorb, combine and reuse knowledge to solve customer problems and meet needs creatively.

Yesterday's industry policy is today's innovation policy and becomes tomorrow's policy to enhance productivity. The question is not whether or not policy should be aimed at keeping Australia as a country that makes things. Rather, the issue is how Australia will position itself in mobile and volatile global value chains through effective economy-wide partnerships between industries, governments, and other community stakeholders.

6 Platform for action

To secure their future, Australian manufacturers should act to:

- Experiment with business innovations.
- Invest in people and skills.
- Multiply knowledge connections.

This paper on *Manufacturing Futures* aims to summarise a small number of essential themes evident in the latest thinking on the position and future shape of Australian manufacturing. These themes focus on the attributes that successful manufacturing firms will likely need to compete and prosper. They also serve to guide those supporting the manufacturing sector to identify and accelerate action on the most potent areas for practical change and growth.

Headline insights

To this end, reflecting on the issues as a whole covered in this paper, the headline insights are:

Manufacturing matters

While under considerable and growing competitiveness pressure, it is a misconception that manufacturing is in inevitable and terminal decline. Similarly, popular perceptions of the decreased importance of Australian manufacturing and the arrival of the 'service economy' are too simplistic. In absolute terms, manufacturing continues to represent a substantial segment of Australian output, employment, exports and productivity and there is evidence of multiplier effects and important interdependencies between manufacturing and both the resources and services sectors.

Opportunities from the 'morphing' of manufacturing

On a number of critical dimensions, the fundamental character of manufacturing is changing. These changes offer unprecedented ways for Australian manufacturers to create new value for customers and generate and sustain new sources of revenue and profit for themselves.

Chief among the shifts that are redefining manufacturing are the following:

- the disappearing boundary between manufacturing and services;
- new niches to be exploited through outsourcing and in wider and more distributed global value chains;
- new understandings of innovation based on smart problem-solving for customers which are accessible to all companies, not just those who can afford formal R&D and frontier technologies;
- manufacturing is no longer characterised by standardised mass production;
- intangible assets, like know-how and know-who, are increasingly important to the sustained success of manufacturing firms.

Forces for change

There are common threads in the literature about what is likely to shape the future environment for manufacturers. These can be summarised as: globalisation; changing demographics, skills and workplaces; challenges of climate change and resource use; technology advances; business model transformations; and new configurations of manufacturing industry driven by different demands, customers, competitors and the geopolitical landscape.

This paper identifies seven key forces for change operating now and likely to accelerate in the foreseeable future for Australian manufacturers. They are:

- More intensified competition.
- More complex and varied opportunities for doing business globally.
- Shift from mass production to customisation and personalisation.
- Growing importance of the low carbon economy.
- Changing skills needs and imperatives.
- Technology that transforms entire business models.
- Collaboration and connectivity that accelerates innovation and competitiveness.

Productivity rules

Productivity growth is essential for a viable and high-performing manufacturing sector. But the productivity gains that matter to manufacturers come from business transformation and innovation, not just from efficiencies and cost-cutting, nor from the intensification of work.

Manufacturers can unlock these transformative productivity improvements by creating increased value for customers and capturing part of this value. In financial terms, it means growing topline revenue relative to costs. This is an essential and under-recognised element of productivity, beyond the productivity gains that can be achieved by efficiencies alone. Innovation is the means to this end of achieving productivity benefits that come from transforming the operations and capabilities of a business enterprise and its ability to meet the needs of paying customers in a superior way.

Transforming businesses and workplaces is the key to manufacturers unlocking innovation and enhancing their productivity. Innovative managers and workplaces become more productive by transforming the capabilities of their businesses; finding imaginative new ways of problem-solving; collaborating with customers, suppliers and even competitors; adapting existing technologies and processes to new uses; and devising fresh solutions to meet the needs of demanding customers.

Innovation empowers new approaches to manufacturing

A wider angle on innovation – being more about the customer than the laboratory and more about business transformation than technology – empowers manufacturers to be bolder and more expansive in their choices of business strategy and activities.

Manufacturers can do more to make innovation a distinctive competitive strategy to drive profitability and longevity in the face of faster and greater global competition.

Innovation in agile work practices, better business relationships and novel business models is vital. There are many dimensions on which manufacturers can innovate: new delivery and distribution channels; new attributes of their business offerings; new organisational arrangements; improvements in products and processes; more beneficial ways of managing customer relationships; and providing better customer experiences.

The end result is that manufacturers are empowered with more choices and greater flexibility in how they structure and execute competitive lines of business and sustain future growth. Innovation provides the power for Australian manufacturers to succeed against the odds.

Priorities for action

Australian manufacturers would be well-served to focus on three attributes or areas for action:

- Experiment with business innovations.
- Invest in people and skills.
- Multiply their knowledge connections.

Experiment with business innovations

Innovation has been described by researcher Don Scott-Kemmis as a series of continuous business experiments in creating and capturing value. What motivates enterprises to experiment is their assessment of the risk versus the rewards – how likely it is that the enterprise can capture the benefits and extract value from experimenting. The answer lies in the effects of the experiment on the enterprise's particular formula for success, in other words, its business model.

Making innovative changes to a business model allows an enterprise to transform itself and its ability to create and capture value. An enterprise can create or secure its particular competitive advantage by innovations in its business model. This is because it is difficult for others to replicate all the elements of value creation and appropriation and their distinctive combination.

Business model innovation is fruitful ground for manufacturers seeking to differentiate themselves and to gain a distinctive and lasting competitive edge.

Perhaps the most immediate, tested and practical business model change open to manufacturers is to add service to their products, thereby providing new tailored and valued solutions to customers. Some, like the Singaporean Trade and Industry Minister, see the space between products and services as a new area of economic endeavour and growth opportunities for nimble and intelligent firms to specialise in and make their own.

This paper has described the many opportunities and sources of prospective business innovation for Australian manufacturers, derived from the fundamental changes underway in manufacturing and its future competitive environment. The prescriptions for success,

however, are neither obvious nor easy for any individual manufacturer. So, the starting point is an organised effort to undertake a series of deliberate strategic and operational experiments, testing and learning from potential business model changes for their particular enterprise in real time.

Individual manufacturers, as a first step, could engage with customers to trigger possible business innovations to give them a lasting competitive edge. There are lessons from what others have done. For example, earlier the paper summarised the case of GPC Electronics, which learns from its customers to build its distinctive business edge. As a contract electronics manufacturer, GPC rejects the industry norm of competing on cheap labour and low costs. Rather, GPC competes by understanding what drives the competitiveness of their customer and by tailoring GPC's products and associated services to ensure it adds to their customer's performance. Staying connected to their customer and understanding market and industry trends is vital to GPC's success.

Kimberly Kampers, a case example in Don Scott-Kemmis' business model innovation study for the Australian Business Foundation, focuses on providing a product of high value especially to their 'grey nomad' customers. What constitutes high value features of their product is researched and well-understood. Kimberly Kampers provide a greater level of customer option choice, but within a limited product range. They succeed because they consult with and understand their customers. They provide customers with a better experience, not an open-ended choice of products.

The lesson from these two examples and the wider literature is to make customers part of an enterprise's virtual in-house R&D and production team. Social media, customer loyalty and feedback schemes, prizes for problem-solving, customer to customer 'extreme users' clubs, action learning teams, are all vehicles to bring customers inside the circle and to embed and engage them in the business. The end result is not just a flow of new ideas for business innovations, but increased knowledge and 'ownership' of customers that is decisive to competitive success in footloose, globalised economies.

Invest in people and skills

The evidence is in on how decisive the quality and competence of people working in manufacturing are to the success of manufacturing firms and the sector as a whole.

Skills shortages exacerbated by the growth and competition from the resources sector is invariably the highest top of mind issue for Australian manufacturers. This priority concern has been substantiated in the 2011 Environmental Scan by Manufacturing Skills Australia, particularly that:

- skills shortages are intensifying and expected to get worse than ever before, especially with an ageing and static manufacturing workforce; and
- competition for skills with the resources sector is a major issue and one affecting the willingness of manufacturers to train and upskill their workforce.

As outlined earlier in this paper, the 2010 Global Manufacturing Competitiveness Index by Deloitte and the US Council on Competitiveness puts access to talented and innovative workers as a top factor driving manufacturing's global competitiveness. Innovation and

Business Skills Australia's Canberra summit in 2009 recommended priority action for firms to invest in continuous learning and diverse, multidisciplinary skills in its workforce. A joint study by Stanford University and Columbia University³⁸ demonstrated the vital role of teams of highly skilled individuals in solving manufacturing's increasingly complex problems, with enhanced productivity outcomes. The European Central Bank³⁹ has taken the view that both changes in labour productivity and total factor productivity are mostly driven by learning by firms.

The importance of skills to manufacturing's success goes beyond relieving the shortage of technical and professional skills, or even deficiencies in the numbers of maths, science, and engineering graduates. The Australian Industry Group in its 2007 report on industry agility marshalled the evidence from sources including its own research, the OECD, the Boston Consulting Group and the Business Council of Australia to show the importance of skills in knowledge capture, management and transfer, as well as conceptual skills like creative problem-solving and diagnostic thinking.

The quality of management and leadership skills at the enterprise level is increasingly recognised as key to how well enterprises can manage and secure pay-offs from their business innovations. Management capabilities are also directly connected to the productivity performance of enterprises. The IBSA and SKE paper on *Enterprise Innovation* (2009) cites a series of studies to substantiate this, eg. Black and Lynch's (2003) study on *What's Driving the New Economy? The Benefits of Workplace Innovation*; two projects in 2003 and 2005 by the UK Work Foundation on *Cracking the Performance Code*; and Watson Wyatt's study in 2008/09 entitled *WorkUSA Survey*. Their evidence shows that improving management practices and workforce skills and engagement is decisive to improving both innovation performance and productivity.

This is borne out in recent Australian research, notably the multi-university benchmarking study of Australian manufacturers' management practices with a 16 country study by the London School of Economics and McKinsey referred to earlier. It pointed to middle-range performance by Australian manufacturers that detrimentally affects labour productivity. Particular deficiencies in people management were reported. This was recommended as a critical area for change that would flow onto productivity improvements.

Further, it has been observed that Australia seems to assign lower priority to programs for lifelong learning and continuous upgrading of the skills of the workforce post formal education, than is evident in many other countries.

At the same time, one constant element in successful business model innovation is the right team of skilled, well-trained, agile and empowered workers, proficiently recruited, managed and deployed with flexibility by their managers.

The literature also emphasises the importance of these teams of skilled and well-managed workers operating in organisations that continuously refresh their knowledge and learn. The *Enterprise Innovation* paper described the features of these 'learning organisations' as ones that attract and use people with diverse skills and competencies, delegate problem-solving, sanction informed risk-taking, encourage discretionary effort, experiment with new business offerings and customer services, and are generally more open, responsive and nimble in their operations and relationships.

³⁸ Boning et al, 2007.

³⁹ Giannangeli and Gomez-Salvador, 2008.

There are a myriad of suggested pathways for individual manufacturers and their representatives to act to create such high-performing workplaces. Workforce development programs in other countries offer ideas for Australian manufacturers to consider. For example, Ireland's National Workplace Strategy – Workplaces of the Future, Finland's Workplace Development Program, New Zealand's Workplace Productivity Program, Canada's Workplace Skills Initiative, and the UK Innovation Department's 'Train to Gain' program. These programs focus on practical initiatives to improve management and leadership skills, provide access to informal learning networks, and encourage workplace best practice projects. Current recommendations by Skills Australia to link workforce skills programs with business innovation programs across Australian Government departments seek to achieve the same ends.

Action to upskill and manage the manufacturing workforce is key. Manufacturing firms need to be in a position to anticipate and respond to fast-changing new business opportunities and models. Readily-available, skilled and agile people that are motivated and empowered to design and implement new approaches to business are indispensable to Australia's manufacturing future.

Multiply knowledge connections

This paper has made the case that these days knowledge is power for the competitiveness and sustainability of Australian manufacturing. Further, in the modern era, manufacturing is not a solitary pursuit. Being well-connected and highly proficient at collaboration is a key ingredient for absorbing knowledge and transforming it into new competitive capabilities for manufacturing enterprises.

While stocks of knowledge are important, flows of knowledge are critical to competitive success. Knowledge only flows when manufacturers are highly connected and as innovation analysts, John Hagel and John Seely Brown contend, when they occupy "privileged positions in rich networks of relationships".

Australian business has a relatively poor track record at collaboration compared to OECD countries, according to recent data on the innovation activities of Australian firms from the Australian Bureau of Statistics and the Commonwealth Department of Innovation, Industry, Science and Research.

"Clumps, not clusters" was how Leon Gettler commented in his column in *The Age* on 12 January 2010 on the absence of significant manufacturing clusters in Australia. He characterised this as "pioneers exploring opportunities in an empty space".

Therefore, it is critical that manufacturers be assisted to forge new webs of connections, partnerships and collaborations. While access by enterprises to information has never been easier, faster or cheaper because of ubiquitous information and communications technologies, access to usable knowledge still relies on engagement with people and the depth of their relationships and connections.

Deliberate and disciplined efforts are required to encourage the collaborative, trust-based relationships needed for knowledge-sharing and capability-building. It is through such collaborations that enterprises are put in touch with the know-how, resources, technologies, skills and opportunities that are a prerequisite for the growth of their businesses. Action is needed to embed businesses in a rich and diverse innovation 'eco-system' from which competitive success is seeded, shaped and continually refreshed.

Help wanted

The three calls to action for manufacturers to experiment with business innovations, invest in people and skills, and multiply knowledge connections should also guide the priorities for their representatives and for government policy and programs.

Initial ideas for manufacturing advocates and public policy makers to foster this platform for action include:

- Creating *learning opportunities for manufacturing leaders* to understand more about business model innovation and managerial innovation and how to experiment with new approaches to make step changes in their ability to innovate and grow as globally competitive Australian manufacturers.
- *Establishing active communities of practice*, both geographically and virtually, for manufacturing firms to share knowledge, problems, best practices, and to collaborate in cross-organisation and cross-disciplinary business problem-solving exercises. The UK program, PeerAssist, provides one role model.
- Activating a *new Workplaces of the Future skills agenda* based on increasing and embedding the capabilities needed for innovation-led productivity growth in Australia. This should bring together all the social partners with a track record of insights and ideas on this subject – trade unions, educationalists, industry bodies, government officials and advisers, researchers and community interest groups.
- Redesigning *public and private sector business support programs for manufacturers to focus on innovation*, not just on business improvement. That is, these programs should increase the ability of manufacturers to continually generate new sources of distinctive and enduring competitive advantage, rather than facilitating necessary but ultimately 'status quo' efficiencies and routine improvements.
- Advocating and *reinventing manufacturing industry policy* as an integral part of Australia's mainstream productivity agenda.

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