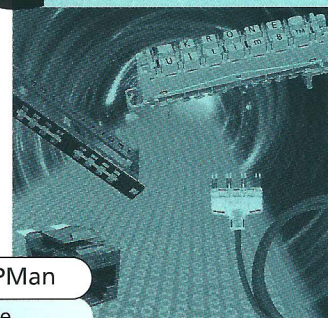


# SMART ICT MANUFACTURING

## FOR A SMARTER AUSTRALIA



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### The Wake-Up Call

A recent international survey<sup>1</sup> undertaken by PricewaterhouseCoopers management consulting services has concluded that Australian manufacturers generally are failing to embrace key IT-based technologies, and that more investment is needed if Australian manufacturers are to compete effectively on a global basis.

The findings of this report follow the release of the November 2000 report of the Prime Minister's Science and Engineering Innovation Council (PMSEIC)<sup>2</sup>, which determined that Australia ranks very poorly compared to other countries in its Information and Communications Technology (ICT) industry base. This, according to the report, was because Australia's ICT manufacturing base is not as large as most OECD countries on a per capita and value of production basis. (It should also be noted that total Australian manufacturing now contributes only some 11.9% of GNP compared to other OECD countries, where levels in excess of 20% are more the norm.) The PMSEIC report has detailed the following facts including:

- ICT value added is 4.1% – last of 18 OECD countries surveyed. The average is 7.4%. This reflects Australia's bias towards wholesale, telecommunications and computing services and smallest manufacturing industry share of total industry of 18 countries.
- ICT employment is 2.6% of the national total – 5th last. The OECD average is 3.4%.
- Export/import ratio for electronic industry goods – 4th last of 28 OECD countries.
- Export/import ratio for office machinery and computers – 8th last of 28 OECD countries.
- Australia's ICT R&D/GDP for business sector is 4th last out of 17 OECD countries surveyed.

The OECD rates Australia as a low ICT intensity country

because of Australia's low value added and employment rankings, but it was ranked medium for trade activity (i.e. largely importing) and R&D intensity. Australia's ICT sector as a proportion of the economy (as measured by employment) is 2.8%, which is below the OECD average of 3.4%.

While Australia is not commonly perceived as a competitive manufacturer of ICT goods, the local industry recorded a turnover<sup>3</sup> of \$3.2 billion in 1998–99. The contraction in ICT manufacturing from \$4.8 billion in 1995–96 does not reflect a loss of competitiveness. Rather, it is due to rationalisation by a number of foreign-owned firms of their Australian manufacturing operations (for example, Alcatel Australia and Ericsson Australia) in response to the global trend to outsourcing production and component procurement. In Australia, however, this situation has led to the growth of contract manufacturers such as GPC Electronics, AEMS etc, as well as the presence of international players such as Solelectron and SCI. These companies are now positioned to capitalise on servicing niche markets worldwide, based on their ability to access and integrate clever design and agile supplier capabilities in Australia.

The PMSEIC report also outlined key characteristics of Australia's ICT industry, which include:

- Australia exports about 38% of Australian ICT goods production after excluding re-exports.



- Manufacturing employment is only 5% of total ICT employment.
- Overall ICT R&D intensity is only 5%, still ahead of total business sector at about 2% and manufacturing at almost 4%. In 1997, the ICT sector contributed around one-fifth of total business enterprise R&D.
- Telecommunications services were the largest industrial component of value added, contributing 52%. Other ICT services contributed over 40% and manufacturing only 8%.

The PMSEIC report concluded that the impact of decisions by a relatively small number of large, foreign-owned firms highlights a structural weakness in the Australian ICT industry. The dominance of multinational corporations (MNCs) also has a significant impact on R&D levels in the ICT private sector.

The message from the PMSEIC report to government must certainly be that there is an urgent need to develop policies and strategic frameworks to build up Australia's ICT production base, particularly in manufacturing. Comprehensive tariff protection is a creature of the past for most Australian manufacturers (now 5% for most sectors except the automotive industry, where 15% currently prevails for the major automotive companies and lower levels for the component manufacturers). Now the challenge for Australian manufacturers is to adopt smart practices so that they can continue to compete in world markets.

These value-adding, smart practices will need to include:

- Adopting ICT-driven products and services,

- Embracing new technologies with a commitment to higher levels of R&D, and
- Exploring strategic alliances with other companies and organisations, particularly those located in overseas markets, e.g. within the APEC economies.

### Adopting Smart, ICT-Driven Practices

Opportunities to use smart or ICT-driven products and services in manufacturing include the following:

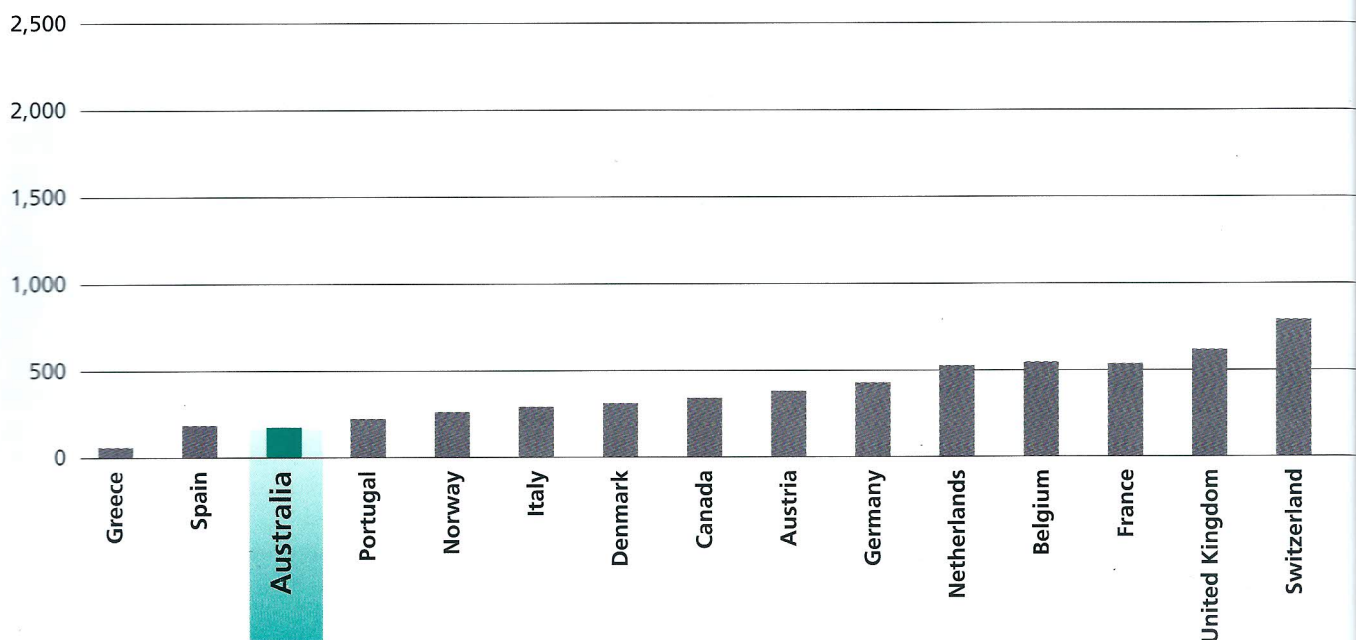
- Manufacturing execution systems
- Integrated supply chain management
- Product data management
- Computer-aided design and manufacturing
- Rapid prototyping
- Advanced planning/scheduling
- Barcoding and computerised maintenance management
- 'Follow the sun' – Internet collaboration strategies
- Electronic trading (and e-business generally)

In addition, manufacturers of traditional electrical products such as electrical heavy equipment, appliances, lighting, etc are now realising that the addition of ICT systems to their products is another way of addressing the smart manufacturing challenge. The Wilson Transformer Company and Nu-Lec Industries are typical examples of companies adopting this approach in the manufacture of innovative, heavy electrical equipment.

Australian software developers are amongst the best in the world. Organisations such as Software Engineering Australia (SEA) are developing programs which will

Per Capita ICT Production of OECD Countries 1997

Source: Adapted from OECD data



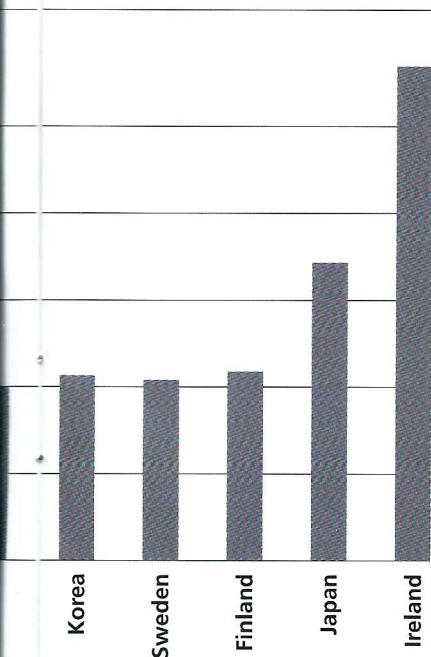


encourage greater industry take-up of the resources and services that are available in Australia.

Australia is also a leader in the rapid development of product prototypes, with considerable expertise and experience developed through organisations such as the Queensland Manufacturing Institute (QMI). Rapid prototyping enables manufacturers such as HPM Industries and Krone Australia to considerably reduce the lead-time between product design and production, allowing the product to be brought to market ahead of overseas competitors.

The computer-driven manufacturing environment offers opportunities to compete within the ideal level playing field, where the determinant for success relates to the design skills available to the manufacturer.

The Australian automotive industry and its component suppliers are at the forefront of utilising smart manufacturing processes. These offer opportunities to incorporate levels of ICT componentry, as new models increasingly rely on computer-driven circuitry and include communication-driven features such as access to Internet, global satellite systems, entertainment, etc).



### Embracing New Technologies

The development of new technologies presents new opportunities for smart manufacturing in Australia in areas such as:

- Photonics
- Wireless

- New materials
- Automation
- Robotics
- Microelectronics
- Smart card integrated circuitry
- Nanotechnology
- Micro-machining
- Sensor and imaging
- Software
- Intelligent systems
- Toolmaking

Co-operative Research Centres (CRCs) such as Australian Photonics and the CRC for Intelligent Manufacturing Systems, as well as many university-based research centres and various CSIRO divisions, will be at the

forefront of developing much of the R&D to realise these opportunities. An example of the innovative work being carried out by the CSIRO is the joint ANU/CSIRO Virtual Environments Laboratory in Canberra and the Interactive Virtual Environments Centre in Perth, where research work focuses on the potential for the use of advanced ICT 'virtual environments' technologies in manufacturing. Potential applications include collaborative design, process planning, assembly planning and training, and tele-operation.

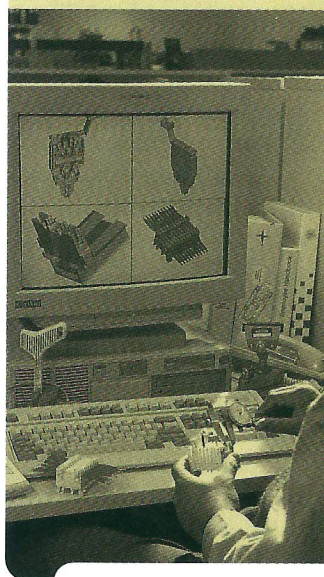
However, much effort will need to be directed towards attracting the Australian venture capital community to play a significant role in these future developments. The recent purchase of Sydney-based Radiata Communications, owners of an innovative dual-chip system for wireless data

communications, by Cisco Systems for a reported \$567 million, is evidence that Australian-generated intellectual property has real value in world markets. But it also highlights the need for Australian industry to provide available manufacturing capacity and distribution networks to meet rapidly developing market opportunities.

To be really 'smart', Australian industry will also need to examine the opportunities for manufacturing production machinery. Currently the vast majority of production machinery in Australian manufacturing plants is sourced from Europe, USA and Japan.

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*Photo of rapid prototyping computer application courtesy of Krone Australia*



## Smart Manufacturing in the ICT Sector

### Electronics

Electronics is the key enabling technology within the ICT industry sector. As such, it enables a huge range of innovation in a great variety of customer industries. It is increasingly being recognised as the smart, value-adding industry of the future<sup>4</sup>. In the Australian Electrical and Electronic Manufacturers' Association and Australian Telecommunications Industry Association reports<sup>5</sup>, the electronics industry is defined as:

*"...products with embedded information technology, electronics and communications, industrial and consumer products with electronic and information systems embedded within them, and electronic components."*

The electronics industry is of critical importance to a modern economy. It provides significant inputs to industries such as telecommunications, information technology, motor vehicles, defence, aerospace, broadcasting, smart appliances, entertainment and medical devices. The electronics industry now represents a broader perspective than the traditional concept of manufacturing only, to encompass:

- Hardware research and development
- Component, product and system design
- Software design and development
- Components supply
- Manufacturing
- Logistics including transport and delivery through to assembly and final distribution.

In identifying the scope and composition of the Australian electronics industry, it becomes clear that a broad range of diverse elements combine to comprise this all-encompassing and all-important technological sector.

Key specific electronic-based technologies include radio frequency and microwave engineering, signal processing, integrated circuit design (microelectronics), electronic control systems, systems and software engineering, mobile and satellite communications, and electronic warfare. The electronics industry value chain also comprises marketing, R&D, design, prototyping, testing, manufacture and support.

### Photonics

Photonics (the science of light) is another key enabling technology in the ICT industry, an emerging technology that will provide new opportunities for smart manufacturing of photonics products and supporting electronic componentry.

Australia currently has a 1.2% share of the global photonics market, with the joint venture of 28 companies and organisations embracing the Australian Photonics CRC contributing approximately 90% of the underlying R&D.

Within the next decade, R&D conducted through Australian Photonics, its Redfern group and other spin-off companies is estimated to generate 18,000 additional skilled jobs and an annual turnover of almost \$2.5 billion.

Mr Kevin Kalkhoven<sup>6</sup>, recently retired chief executive of JDS Uniphase, has likened the development of the photonics industry to that of the electronics industry. He has said that the photonics industry now is somewhere between the development of the valve and the transistor, with a long way to go to reach the photonics equivalent of the level of microprocessor integration. Kalkhoven is convinced that the photonics products of the future will be based on new material sciences and integration. Kalkhoven believes that manufacturing automation will play a key role in the growth of the photonics industry, and that this represents a real opportunity for Australia.

Encouraging developments in smart manufacturing are emerging at the Australian Technology Park (ATP) in Sydney. In February 2001, Senator The Honourable Richard Alston, Minister for Communications, Information Technology and the Arts, visited the site of the new factory of Kadence Photonics Pty Ltd at the ATP. Kadence Photonics is a startup photonics manufacturing company founded by Dr Peter Hill and his business partner, Mrs Maggie Alexander. Hill and Alexander met through the Australian Graduate School of Engineering Innovation (AGSEI) where Alexander is Associate Lecturer in Business Process Improvement and where Hill took the Masters of Engineering Practice in Business and Technology.

Together they have raised seed investment capital to manufacture sub-components for the photonics industry using advanced robotic technologies. A COMET grant has also been awarded to Kadence Photonics to commercialise some of its inventions. The company's unique production and business processes will enable high-quality, high-volume manufacture of fibre optic sub-components.

During their inspection of the Kadence Photonics facility, Senator Alston and his party were treated to an automotive robot doing a rendition of the tune 'Colonel Bogie March' on a xylophone, demonstrating the agility of industrial robots. (see photo page 11)

### The Role of Government

The Commonwealth Government could facilitate the growth of smart ICT manufacturing by accepting that competitive advantages in high-technology industries can be created. The strategies adopted by small to medium-sized successful overseas countries, such as Israel, Singapore, Taiwan, Korea, Canada, Finland, Sweden, Ireland and Scotland, are simply to attract MNCs to establish manufacturing plants, to build the national skills base, and to strengthen the R&D base (including training capability) in key areas.

Therefore the government could be more proactive by:





Centre front, left to right: Dr Tom Forgan (founder of the ATP), the Minister, Senator The Hon Richard Alston, and Dr Peter Hill.

- Adopting a proactive approach to address the structural imbalance of the national economy, having regard to supporting free and open trading opportunities within the WTO framework. This would need to include the related delivery of industry development plans for new and emerging industry sector areas, particularly where market failure can be demonstrated. Government could facilitate a more judicious balance of sophisticated, capital-intensive manufacturing, recognising the opportunity to attract multinationals to invest in major manufacturing plants.
- Facilitating the immediate development of a national strategy for the growth of the Australian electronics industry and, with time, the Australian photonics industry.
- 'Talking up' the importance of developing a balanced capability of new smart and advanced, sophisticated, capital-intensive manufacturing in Australia, and breaking down the view of manufacturing as merely an 'old economy' industry.
- Contributing to the development of essential test-bed infrastructure and advanced broadband networks which will hasten the use of ICT-driven applications in manufacturing.
- Providing incentives for the development and commercialisation of new ICT-based technologies and practices that can be applied to existing manufacturing operations.

### The Role of Industry Associations

Technology-driven industry associations such as AEEMA (the peak industry body representing infrastructure

providers for Australia's electrical, electronic and ICT industries) can facilitate the growth of smart manufacturing by:

- Promoting the importance of developing a balanced capability of new smart manufacturing in Australia, and undertaking programs that showcase the best of what Australian ICT manufacturing has to offer.
  - Raising awareness amongst its members of the opportunities available for adopting new technologies and practices by organising seminars, workshops, etc, and by providing members with information that is readily accessible through the internet.
  - Encouraging networking, technology transfer, and collaborative efforts amongst its manufacturing members which might lead to a higher level of integration of ICT into manufactures, thus increasing the 'value add' of their production.
  - Facilitating the linkages of its members with R&D organisations (e.g. CSIRO, CRCs, universities, and advanced manufacturing centres), and with education and training providers, including TAFE colleges.
  - Lobbying government to implement programs that encourage higher levels of R&D, innovation and skills-based training amongst its members.
  - Working with governments at all levels to create a better environment for new industry development and growth.
  - Developing international linkages (eg, within the APEC economies) which can facilitate collaborative, new product development based on smart manufacturing strategies.
- With these objectives in mind, AEEMA is now developing its programs around three core areas: R&D, smart manufacturing, and linked convergent services. AEEMA is committed to working towards re-establishing Australia as one of the world's smartest manufacturing nations. What is needed to achieve this goal, however, is a realisation by government, the business community and the public at large, that real and sustained wealth can only be achieved by those nations committed to achieving high levels of ICT 'value add'. This means sustaining a high level of manufacturing in the overall GNP mix. **TBR**

- 1 Jorgensen Karsten, *Industry's wake-up call*, Plantline, February 2001.
- 2 Australia's Information & Communications Technology (ICT) Research Base, Prime Minister's Science, Engineering and Innovation Council (PMSEIC), 30 November 2000.
- 3 Australia's Information & Communications Technology (ICT) Research Base, Prime Minister's Science, Engineering and Innovation Council (PMSEIC), November 2000.
- 4 A Strategic Plan for the South Australian Electronics Industry to the Year 2005, October 2000.
- 5 Australian Electronics Industry: *Key to Smart Technologies*, August 1999.
- 6 AEEMA Photonics Industry Forum, November 2000.