



University of
South Australia

Inquiry into the state of Australia's manufacturing industry now and beyond the resources boom

Submission from the University of South Australia

Manufacturing is a significant contributor to the Australian economy – as a sector it accounts for the largest share of business activity, employment, and research and development. Manufacturing currently accounts for over 12% of the economy but this has fallen over the last 20 years from approximately 18%. This decline becomes even more significant when viewed in the context of the emerging manufacturing industries in countries such as China, where manufacturing constitutes 39% of the economy, Malaysia, where it constitutes 30%, and Indonesia where it constitutes 26% of the economy.

Australia cannot compete with China in terms of low-cost high –volume manufacturing. Australia therefore needs to build a niche in manufacturing based on:

- Process improvement (including the development of sustainable processes)
- New technology investment/innovative products; and
- Skill development to underpin a knowledge based industry which enhances productivity, overcomes skill shortages, and facilitates the sustainability of the industry.

While presenting major competitive challenges, the rise of manufacturing in China also offers opportunities for the Australian manufacturing industry. Australia's role as a provider of high value, innovative products, and advanced and sustainable processes complements the Chinese low-cost high-output model. China's rapidly expanding economy requires technologies in the areas of mining and energy, construction and building products, the environment and sustainability, and biotechnology and health – areas in which Australia conducts world leading research.

Advanced Manufacturing is a key focus of UniSA's research and teaching and learning activities. UniSA's strategic planning processes highlighted that our

industry partners in manufacturing were facing an increasing array of competitive forces and that UniSA needed to optimise its contribution to the future of manufacturing in Australia to help our partners meet these challenges.

University of South Australia

The University of South Australia (UniSA) is a modern, vibrant and successful institution built on more than a century's experience as a leader in teaching and learning and in fundamental and applied research. UniSA is the largest University in South Australia.

Researchers at the University of South Australia solve real world problems. Our distinctive research profile is based on our strengths in bringing together multidisciplinary teams coupled with our strong linkages with industry, government and the professions across Australia and internationally. Creating and applying knowledge is the major focus of research at UniSA. By concentrating on the end—users of research, UniSA approaches research topics in innovative and enterprising ways. Advanced Manufacturing is strongly represented at UniSA by the Ian Wark Research Institute (The Wark) and the newly established Mawson Institute for Advanced Manufacturing. The value these research concentrations hold for the manufacturing industry is outlined in greater detail below.

Education and training is another area in which the University of South Australia can add value to the manufacturing industry. The innovative provision of knowledge in advanced technologies and relevant skill development will increase the human capability of the manufacturing industry in South Australia and address the current high-end skills shortage. Such education and training is provided through UniSA's School of Advanced Manufacturing and Mechanical Engineering and by postgraduate degrees in research concentrations such as the The Wark and the Institute for Sustainable Systems and Technologies.

Ian Wark Research Institute

The Ian Wark Research Institute (The Wark™) is an internationally recognised leader in the field of particle and material interfaces. The Wark has established a strong reputation for solving complex industry problems through the application of excellent science and technology. A creative and flexible approach to research and development, enables The Wark to conduct a mixture of fundamental and applied research across a wide range of project areas of direct relevance to Australian industry. The Wark is actively involved with many sectors of Australian industry, including:

- Minerals and Mining
- Biomedical and Pharmaceutical
- Defence and Aerospace
- Automotive

Outcomes from this research are implemented in several ways, including improving existing processes within industry to deliver more cost effective and environmentally friendly solutions, to the generation of new technologies that enable industry partners to become world leaders and compete on a global platform.

Synonymous with The Wark are the ARC Special Research Centre for Particle and Material Interfaces - the leading centre in the science of particle and material interfaces in Australia and a leader in this field internationally; and the Australian Mineral Science Research Institute (AMSRI) – established to strengthen Australian technological and scientific leadership in particle science and engineering and support the kinds of innovations that improve energy efficiency, enhance frugal water use and waste management, devise improved minerals processing, and develop new and better materials.”

The Wark recognises the importance of a world competitive, viable manufacturing industry within Australia, and believes that the combination of microfluidics and nanofabrication offers the potential for the development of the next evolutionary break-through in manufacturing practices. Through appropriate investment, the Wark is ideally positioned to be a leader and key player in this field. The key components of this research are:

1. **Microfluidics Fabrication Facility** : This facility (part of the NCRIS nanofabrication initiative) builds further upon existing Wark expertise, and will be set up to service a wide range of research interests – materials science, biotechnology, chemical engineering, clinical and medical science, and pharmaceutical applications. The proposed facility will be hosted by The Wark, with links to the Mawson Institute of Advanced Manufacturing. The facility will be equipped for micro- and nanometre scale patterning of silicon, metals and polymeric substrates. Applications of this technology will include lab-on-a-chip (with continuous flow chemical operations and extraction/reaction rates 100 to 1000 times faster than during conventional processing), solvent extraction, pigment processing, genome research and pharmaceutical development and manufacturing.
2. **Surface Plasma Engineering**: This facility will further leverage existing expertise within The Wark, and aim to work at both the fundamental and applied levels in order to deliver innovative solutions and new technology to Australian industry. Capabilities would include coating substrates from the micron to macro scale with applications including optical coatings, aerospace and marine coatings and various biomedical assay devices. A unique feature of this facility would be the ability to work with industry partners developing and customising the technology for specific applications. Operating at the interface between science and engineering, this research theme will involve multi-disciplinary collaboration as an essential part of the design and engineering of new devices.

- 3. Direct Write and NScribe Facilities:** This facility will enable cutting edge research in the area of electronic circuit design and deposition. Through the acquisition of a Maskless Mesoscale Material Deposition (M3D) machine, it will be possible to deposit metallic inks at the micron level onto flexible substrates so as to create electrical circuits. The low temperature of the deposition process will enable the development of previously incomprehensible devices such as flexible, conformable, wearable antennas with applications in every day consumer electronic devices to military equipment. The facility will be developed in partnership with the South Dakota School of Technology that is a recognised world leader in this field and is currently funded by the NSF and the Department of Army.

Mawson Institute for Advanced Manufacturing.

In 2003 the University invested in a review of its structures and resources and, through a consultative approach, developed a new and exciting direction for manufacturing with the support of the South Australian Government. Together the State Government of South Australia and the University are establishing the Mawson Institute for Advanced Manufacturing to act as a focal point for the support and development of manufacturing in Australia. The SA State Government is contributing \$8 million over 3 years to significantly boost our manufacturing-related research infrastructure. UniSA will also contribute \$6.7 million to this infrastructure initiative. This funding provides an important initial boost for the new Mawson Institute and we are now developing strategies to build the momentum of the new directions of the Institute.

The Mawson Institute for Advanced Manufacturing (Mawson Institute) was established to create a world class centre of excellence in advanced manufacturing R&D in South Australia which supports the development of industry with programs in research, training and service to industry. The Mawson Institute creates new collaborations between UniSA's leading researchers in Science, Engineering and Information Technology.

The Mawson Institute Mission:

To conduct groundbreaking research in advanced manufacturing systems, product and process innovation and their integration into Australian manufacturing enterprises through collaborative research, education, training and technology diffusion.

UniSA's three research concentrations contributing to the Mawson Institute are:

- Centre of Advanced Manufacturing Research (CAMR)
- Ian Wark Research Institute (The Wark) and
- Advanced Computer Research Centre (ACRC)

The Mawson Institute will bring a new approach to manufacturing R&D and the provision of associated services, it will concentrate on,

1. Research & Development - High level of research capability targeted at the key issues and technological barriers limiting manufacturing industry, with new paradigm technologies being developed at the interface of engineering, science and information technology
2. Education & Skill Development - The innovative provision of knowledge in advanced technologies and appropriate education and skills development of the next generation of engineers and scientists for manufacturing industries.
3. Service to Industry - The active pursuit of linkages with industry and the efficient provision of technical services.

The Mawson Institute will provide strong and effective linkages with industry to ensure active pathways for technology transfer and skill enhancement, including with SMEs.

The Mawson Institute will focus on three manufacturing sectors where UniSA has significant science leadership and success and where SA manufacturing has competitive capabilities. These are: Automotive, Defence (Aerospace) and Biomedical.

Collaboration between the three core research concentrations contributing to the Mawson Institute will create synergies and multidisciplinary teams capable of tackling complex R&D problems.

Conclusion:

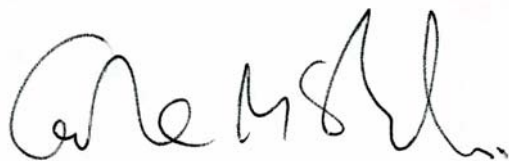
The competitive pressures facing Australian manufacturing industry increasingly require organisations to focus on their competitive advantage. Manufacturing activities based in Asia (and in particular in China most recently) have created significant competitive pressure based on price coupled with increasing quality performance. Australian manufacturing organisations need to compete where they can find new competitive advantages. UniSA believes it can contribute to competitive advantages through advanced technology development for both process and product improvement, facilitation of improved technology transfer and leading edge education and skills development to provide enhanced human resources, equipped for the new paradigms facing the industry. While lower cost operations in Asia have an important competitive advantage on price, we will be working with Australian manufacturers to build on our other competitive advantages.

A number of Australian manufacturing organisations have established links with related organisations in the Asian region and are able to optimise their operations through these relationships. UniSA is also strongly engaged with tertiary institutions in the Asian region through its transnational education activities, research links and substantial alumni base from international students studying in Australia. Our research activities in Australia are informed by our extensive knowledge of the region and our ability to engage with established partners.”

The facilities proposed in this briefing will give Australian researchers access to modern nanofabrication and manufacturing techniques. This is vital in enabling Australia to remain globally competitive not only in terms of research and development capabilities, but also in terms of generating intellectual property that could result in paradigm shifts in manufacturing methods and processes. Various research and technology problems in materials science, biotechnology, communication, electronics, health and defence activities could significantly benefit from having these techniques available locally.

The University of South Australia and the South Australian Government are taking the initiative to support the future of manufacturing industry through the creation of the Mawson Institute for Advanced Manufacturing and the support of Australian Mineral Science Research Institute and the Commonwealth Government’s support of the ARC Special Research Centre for Particle and Material Interfaces. Each of these initiatives provides an important initiative for building our manufacturing capabilities “beyond the resources boom”.

The University would welcome the opportunity to discuss these initiatives with the inquiry, to reinforce our objectives for the future and to explore ways in which the University’s impact on Australian manufacturing industry can be further strengthened.



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