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AUSTRALIAN COBOTICS CENTRE A safer, more efficient, globally competitive

manufacturing industry

Manufacturing in Australia is dominated by small to medium enterprises (SMEs). Many of these businesses are not in a position to adopt mass production manufacturing methods due to the small volumes and large variety of things they produce. Low-volume, high variability of product is considered a strength of these businesses as long as they can remain cost competitive. A combination of labour shortages, constantly improving health and safety considerations and the need for increasing efficiency of the manufacturing process are driving some of these SMEs to consider new ways of adopting collaborative robots (known as cobots).

The Australian Cobotics Centre is working to help SMEs adopt the use of cobotics. The Centre's research programs address both the technological advances and the human and design factors that need to be considered when adopting collaborative robotics. Through this research and its implementation, the Centre will support manufacturers in creating a digitally-capable workforce of the future and a safer, more efficient and globally competitive Australian manufacturing industry.

According to Jonathan Roberts (Centre Director, Australian Cobotics Centre), "Our five research programs and their projects have been designed to maximise collaboration

between industry partners and across the universities. The goal of the Biomimic Cobots Program is to allow collaborative robots to mimic humans in acquiring perception and awareness, learning, adaptation, and manipulation skills.'

"The Human-Robot Interaction Program addresses how humans are made aware of the movement and intentions of robotic systems, and will look at how to leverage multimodal interaction, including Augmented Reality and Virtual Reality, with robotic systems."

"The aim of the Designing Socio Technical Robotic Systems Program is to embed holistic design as a



critical factor in creating seamless integration of humans and machines working together to improve human work conditions and environments, and increase effectiveness and efficiencies in production, as well as workforce acceptance."

"The Quality Assurance and Compliance Program will develop tools for the specification, capturing, monitoring and evaluation of such a digital thread in human-robot and robot-human collaboration scenarios."

"The Human-Robot Workforce Program aims to answer research questions associated with: future skills and training needs; design and safety of jobs of the future;

About the Australian Cobotics Centre

Opened in August 2021, the Australian Cobotics Centre is funded for five years as part of the Australian Research Council's Industrial Transformation Research Program scheme. The Centre's aim is to create a safer, more efficient and globally competitive manufacturing industry. The Centre's objectives are to: improve the collaborative robotics capability within Australian manufacturing, and train researchers, engineers, technologists and manufacturing leaders with the skills and expertise needed to apply collaborative robotics technology. Headquartered at Queensland University of Technology (QUT), with two other locations at The University of Technology Sydney (UTS) and Swinburne University of Technology (SUT), the Centre is expected to build the human and technical capability needed to underpin Australia's global competitiveness in advanced manufacturing.

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managing workplace readiness for the successful implementation of collaborative robotics; and the benefits of greater workforce diversity and longevity," said Roberts.

"We've already completed a number of site visits to businesses and Weld Australia members who are interested in exploring the use of cobots in welding. These businesses stepped us through their existing operations, and we ran them through what other companies have implemented in terms of cobotics. What is clear from these site visit is that there are ample opportunities for cobots to make businesses more efficient and improve the conditions of staff undertaking welding. We can potentially make welders' job easier and better with cobots."

Case Study: MetalTech Industries Developing shop-floor capability of SMEs to adopt technology is essential for the growth of advanced manufacturing within Australia. The Cobotic Centre's industry partner, the ARM Hub recently worked with MetalTech Industries in Wacol to achieve just this.

ARM Hub's Mechatronics Engineer, Amelia Luu, worked alongside MetalTech Industries' lead welder to improve their jig design and co-bot program.

By working together they were able to augment his welding expertise with her knowledge of collaborative robot programming to trouble-shoot solutions and successfully perform small batch TIG welding of brackets

- a task that was previously unable to be fulfilled.

Although cobotic welding systems are commercially available and are increasingly in demand to address skills shortages, the user interfaces and variable support services postcommissioning, can be problematic for new users and traditional manufacturers - particularly when compared to the traditional machining systems (like CNC cutters and benders) that manufacturers are used to.

With the support of ARM Hub, MetalTech Industries' adoption of advanced technology will enable digital capability growth, skills expansion and increased production.

Industry Assistance Package

Weld Australia is offering its members the opportunity to become Secondary Partners under the Weld Australia umbrella.

According to Geoff Crittenden (CEO, Weld Australia), "Together, the Australian Cobotics Centre and Weld Australia are offering practical solutions to industry that flow from the research undertaken at the Australian Cobotics Centre. By participating in the program, companies can expect benefits like access to subsidised advanced manufacturing technology designed to solve specific manufacturing problems, enhanced productivity, increased safety, and minimised employee turnover."

Secondary Partners have the opportunity to jointly develop a specific project that provides value to their organisation without having to fund the associated research and development costs. It also provides access to workforce training and development to enable the implementation of cobotic and associated technologies.

As a Secondary Partner, you will receive:

- A planning workshop delivered by the Australian Cobotics Centre team to identify the project scope, outcomes and milestones
- A resulting proposal that outlines the project and any subsequent 'translation' projects that may be implemented
- A proposal that shows how the research applies to your project

Funding provided by the Secondary Partner will cover costs associated with equipment for prototyping solutions, the PhD scholarship of the student working with the organisation, and site visits. The Secondary Partner will also be responsible for directly procuring any equipment that might be required for the final solution.

There are also a range of other associated benefits, including: access to a network of industry partners with which to share experiences and resources that drive value-delivering technological and workforce changes; linkages to a network of suppliers who can assist with automation; and access to worldclass research and infrastructure and facilities.

Further Information

For further information, or to become a Secondary Partner, contact Geoff Crittenden (CEO, Weld Australia) via email: ceo@weldaustralia.com.au

"Open innovation is a distributed innovation process based on purposively managed knowledge flows across organisational boundaries, using pecuniary and nonpecuniary mechanisms in line with each organisation's business model."

Open Innovation Network

One of the most unique features of the Australian Cobotics Centre is its open innovation practices.

This Open Innovation Network is key in supporting the Centre's to increase the collaborative robotics capability and train researchers and industry, both within the Centre and beyond. The group:

- Brokers peer-to-peer collaboration and business knowledge transfer between Partner Organisations arising from Centre programs and outcomes • Delivers industry-focused workshops for Centre students, researchers and Partner Investigators to explore wider industry application
 - Offers demonstration events and workshops for Partner Organisations and manufacturing industry stakeholders to showcase Centre outcomes

For more information, visit:

australiancobotics.org/open-innovation-network



COBOTICS SURVEY RESULTS Advanced technology, production challenges, and critical job roles

The Australian Cobotics Centre conducted a survey of Weld Australia members in January and February 2022. The survey focused on cobotics knowledge, interests and requirements, as well as the workforce and technology challenges being faced by industry. 41 responses were received from all over Australia, with the majority of respondents located in Queensland and Victoria. Most survey respondents indicated that they operate in the manufacturing, mining, oil and gas, or power generation sector.

Advanced Technology

When asked about their use of advanced technology, 39% of respondents indicated that they do not have advanced technologies in their workplace. Nine had robots, two had cobots, five used virtual reality, and five used augmented reality. One stated that they use automated welding and forming, and one uses straight line welding gantries and track welders.

When it came to implementing advanced technology, the survey revealed a range of attitudes. 14% of

respondents said their organisation had not considered implementing robotic or cobotic technology, while another 12% were undecided on its implementation. 7% had previously tried integrating advanced technology in their operations, but were unsatisfied with the results. Another 21% would like to implement cobots but either had barriers, or didn't know where to use them.

Fifteen respondents did not have any relationships with engineering firms to assist in implementing new production methods. A further



two had previous, but not current, relationships with engineering firms. Fourteen had current ongoing relationships with engineering firms or were engineering firms.

Production Challenges

Respondents were asked to indicate their most difficult production challenges. 56% of respondents indicated that efficiency was a challenge, and 48% indicated that quality control was a challenge. Other common challenges included supply chain issues and worker safety.

Respondents identified several ergonomically or environmentally challenging tasks that may be a target for cobots to assist workers, includina:

- Grindina
- Overhead welding
- ٠ Polishing
- Cutting
- Material handling and processing
- Repetitive manual handling
- Heavy lifting
- Radiography weld inspections

Critical Job Roles

Organisations were asked to identify challenges associated with attraction, retention, training, diversity, and health and safety. The key challenge was identified as finding and recruiting skilled workers.

Training staff in new skills and processes and maintaining accuracy



in jobs subject to human error were also identified as major challenges.

A wide range of critical job roles were identified, with welding highlighted as the most critical. Other critical roles included project managers, supervisors, and staff with knowledge of welding and health and safety standards.

Implementing New Technology

When asked to indicate the relative importance of factors when implementing new technology. 34% of respondents stated that the design and setup of the workshop is very important. Training staff in new skills, and the cost of the technology were also identified as very important. Addressing employee concerns related to operating new technology, safety, quality and job security was also identified as critical to implementation.

The Australian Cobotics Centre's research programs take a holistic approach to managing these challenges by addressing the design and human factors that arise when Cobotics are introduced to the workplace. The research programs aim to improve collaborative robotics capability within Australian manufacturing in ways that also help to attract, retain and develop workers for the future of manufacturing.

Source: Laundon, M., Williams, P. and Hearn, G. (2022) Australian Cobotics Centre Survey of Weld Australia Members Summary Report, Queensland University of Technology and Australian Cobotics Centre.

Further Information

If you'd like further details, or are keen to get involved in the Australian Cobotics Centre visit: australiancobotics.org

Superior Quality and Repeatability The integration of cobots into production processes is proven to deliver superior quality outcomes and higher repeatability. Any process that improves weld quality and repeatability is worthwhile. Welding is not just a commodity, or a simple, straightforward process. When welds fail, the results can be disastrous. A poor quality weld can be hugely expensive, and can cause massive damage, injuries, and even fatalities.

The use of robots and cobots has the power to improve safety for welders and manufacturing workers. As automation reduces routine, dangerous manual work, workplace injuries are expected to drop by as much as 11%. For instance, the use of robots and co-bots (particularly in confined spaces) helps to remove welders from immediate exposure to welding fumes, ultraviolent radiation, heat and sparks.

A move towards the use of robots and cobots will unburden the average Australian of two hours of the most tedious and manual work each week. Approximately 62% of low-skilled workers will experience improved job satisfaction, and wages for non-automatable work will increase by around 20%. Introduction of cobots into production lines allow businesses to make better use of human skill and innovation, with machines taking over mundane tasks so that employees can focus on critical thinking, quality and creativity.

The Benefits of Cobots

Cobots are specifically designed to share the work space with human beings, making automation easier for businesses of all sizes, particularly SMEs. Cobots are generally versatile, lightweight, require relatively little space, and are much easier to program than their industrial counterparts. They can also capture large volumes of data that can be deployed in areas such as predictive maintenance.

Improved Productivity and Profitability

Robots and cobots play an essential role in creating lean manufacturing processes, helping reduce or eliminate redundancies, errors, bottlenecks and waste. The right type of technology can help eliminate workflow delays and duplications and accelerate entire processes through the automation of individual tasks.

Growth in Domestic and Export Markets

With increased productivity, quality and repeatability, manufacturers are able to leverage new domestic and export markets. Increases in productivity enable manufactures to deliver on changing customer needs and mass customisation, while maintaining a sustainable competitive advantage.

Safer Working Conditions

Greater Job Satisfaction

