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Speech to WoodTECH 2018:

Industry 4.0 and Australia's Manufacturing Future

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An Industry 4.0 Overview – Setting the Scene for Australia's Manufacturing Future. This will cover the major technology trends relevant to manufacturing in general and how the wood processing and wood manufacturing industries can adopt.

Good morning all. It's great to be here at the key conference for a core part of the manufacturing sector. Today I'm going to talk to you about Industry 4.0 and the opportunities it presents for the wood processing and wood manufacturing industries. I'm going to talk about what you can do to make the most of this, and the help that is available. But we can't really talk about the future of industry without considering where industry is today. So let's start with some stocktaking.

The manufacturing context

My organisation, the Australian Industry Group, has been representing manufacturers of all sizes for nearly 150 years. A lot has changed in that time.

- Australia has gone from a small British colony with restrictive migration to a multicultural success story; Ai Group's members employ people with backgrounds from all over the world, from the CEOs on down.
- Industrial relations has moved from centralized wage-setting to more flexible enterprise bargaining and individual contracting. Ai Group has represented employers in every forum from the old Commonwealth Court of Conciliation and Arbitration to today's Fair Work Commission.
- Trade has gone from sky-high protection and Imperial Preference to low tariffs and more global interconnections. Ai Group's members compete and cooperate in markets and supply chains that span the world.

Changes to population, work and trade have changed the conditions for manufacturing. And manufacturing itself has changed too. One way to think about this is as a series of industrial revolutions: waves of business innovation, disruption and growth triggered by unlocking the full potential of new technologies.

The first industrial revolution in the 18th and 19th centuries centred on steam. Industrial machines could grow in size and power well beyond the limitations of the muscles, rivers or winds that previously drove them. Steam trains and steam

ships extended and intensified trade and industrial supply chains.

The second industrial revolution in the late 19th and early 20th centuries centred on electricity. Factories electrified their machines and their lighting and began true mass production, often of products that themselves required electricity to use.

The third industrial revolution in the late 20th and early 21st centuries centred on computers and automation. Computer Aided Design, programmable machinery and limited but powerful industrial robotics enabled a new combination of precision and reproducibility in large scale production.

After all this change, what is the state of manufacturing in Australia?

It's very different to what it was. But it is much better than many think.

Manufacturing accounted for just under 30 per cent of GDP in the late 1950s and early 1960s, its peak on that measure. Today, after half a century of faster growth by the services sector, manufacturing accounts for 5.8% of GDP. Nonetheless the sector's absolute output has grown strongly for most of that time. We're making more things, and better, than ever before. But our economy as a whole is doing so much more that the manufacturing share is smaller.

The Global Financial Crisis was a big shock to manufacturing, but a brief one in Australia. The extraordinarily unfavourable exchange rates that followed were much more challenging. Since the normalization of our currency's value in 2014-15 industry has gone from strength to strength. Ai Group gathers data every month from businesses across the country for our Performance of Manufacturing Index. The PMI has now shown the sector in expansion mode for 23 consecutive months.

Manufacturing employed more than 16% of Australian workers in the mid-1980s. But the sector has become more capital-intensive and less labour-intensive, and the wider population and workforce have grown strongly. The manufacturing share of employment averaged just 7.2% in 2017. But the reduction is far from inevitable. Manufacturing added nearly 50,000 jobs over the past year, more than any sector except health and construction. It's now at 7.5% of the workforce.

There are challenges to this current burst of prosperity. But they are not as big as you might fear.

The reemergence of China as a major global economy fostered the impression in recent years that manufacturing was destined to simply pack up and head overseas, drawn by low wages and growth-oriented regulation. But the ground is shifting beneath our feet. The seemingly endless flow of new rural workers into China's cities has ended, with a painful demographic transition underway. Workers' expectations are much higher, with strong

wages growth over many years now seeing wage levels higher than the poorer parts of Europe. And public tolerance for growth-at-all-costs has ebbed sharply, inspiring an increasingly vigorous clampdown on pollution and emissions of all sorts.

China is seeking to shift gears, to move up value chains and prosper in advanced capital-intensive manufacturing. They may well succeed. But there is no natural reason why a high-wage, high skill, high quality of life economy like Australia cannot succeed too. With manufacturing jobs and investment 're-shoring' to advanced economies in North America and Europe, a prosperous future for manufacturing in Australia is there to be won.

Energy prices are a serious concern to most Ai Group members.

Industrial gas prices rose from their long term average of \$3-4 per gigajoule to hit more than \$20/GJ in 2017, driven by exports and scarcity. With more gas hitting the market prices fell – but only to \$10/GJ, and there is every chance that international oil and gas price trends will see local gas prices rise again in coming months.

Electricity prices were dragged upwards by gas prices, a trend intensified by the greater dependence of the system on gas generation following the closure of big old coal generators. Wholesale prices more than doubled from 2016 to 2017. The futures prices are dropping 15-30% from their peak over the next few years as more supply comes on stream, mostly

renewables. But prices are not returning to where they were, and political chaos and policy uncertainty is holding back further investment that would take more pressure off prices.

Energy is a big challenge, no doubt about it. But as painful as it is when a cost doubles, the effect on businesses varies widely. Manufacturers are not all equally energy intensive.

- For the machinery and equipment sector, we estimate the increase in electricity and gas prices is equivalent to 0.1% of their sales revenue and 0.3% of their value added. That is noticeable, but outranked by other factors.
- For primary metals and metal product manufacturers, the price rise would equate to 4% of sales and 24% of industry value added. That would be a hammer blow, though the longer term contracts typical in this sector have warded it off for many so far.
- The wood products sector is in between, with price rises equivalent to 1.1% of industry value added. That is big enough to do something about, but does not need to be a death sentence.

While recent convulsions in Canberra over energy provide little confidence that these issues are going to be sorted out soon, there is much that industry can do for itself. That includes the sorts of innovative contracts with large scale renewables projects recently signed by Bluescope Steel and Orora;

investing in your own energy supply, as Liberty Onesteel is doing; or the range of energy efficiency opportunities highlighted in a recent practical guide jointly published by Ai Group, the CEFC and the Energy Efficiency Council. In the longer term we still have reason to believe that Australia can construct a new advantage in energy costs.

So if China doesn't own the future of manufacturing and energy prices don't rule us out, what is the future that we are reaching for?

This brings us squarely to Industry 4.0. We can have a bright future if we compete for it, and this is how we can compete.

Introducing 4.0

Industry 4.0 is one label for the next wave of change to transform manufacturing – the fourth industrial revolution. Other labels include advanced manufacturing, digital manufacturing or the Industrial Internet of Things. What they all get at is that this latest transition is about digitalization and interconnection. In the third industrial revolution we improved manufacturing with computers and robotics, but in the fourth we are:

- embedding processing power in everything;
- getting data out of everything;

- connecting everything; and
- using the data and the connections and the embedded intelligence to make processes and products more flexible, useful and efficient.

The core technologies of Industry 4.0 are not new – microchips and wireless networks have been with us for some time. What is different is that these capabilities are now so cheap and simple that they can be made ubiquitous. Intelligence and connectivity can be integrated as standard in every machine in a factory, every piece of supporting infrastructure, and every product that goes out into the marketplace.

Let's review some of the core technologies that are changing manufacturing.

The industrial internet of things connects manufacturers' capital equipment and individual devices to two-way networks so they can communicate their status and receive instructions – not just with human operators but with each other. And products continue this communication out in the field. Rolls Royce's jet engines send home terabytes of performance data from around the world every day. Tesla's electric cars receive over-the-air system updates and performance improvements every few weeks.

Big data and analytics takes the oceans of data from the industrial internet and fishes in it for actionable insights.

Models fed with enough data can predict where equipment failures are likely to occur and when maintenance interventions are most urgent. Decisions can be made based on information that is dense and real time, not sparse meter readings and intermittent customer feedback.

The cloud accelerates all this by increasing the effective computing power and services available to any piece of equipment, just by having basic control and communications functionality. You don't need to add a full-spec computer system to every device in your factory if they can all access a powerful global network of server farms.

Cyber security is an essential part of all this. If every device is networked, every device needs to be secure against unauthorized access and mischievous control. We've seen the Stuxnet computer worm bring Iran's nuclear infrastructure to a halt in 2010, ruining centrifuges by targeting industrial control systems. Without effective and evolving cyber security, ubiquitous connection means universal vulnerability.

Beyond the core, other digital technologies are changing manufacturing too.

Additive manufacturing or 3D printing is not just about rapid prototyping anymore. While it is not likely to replace mass subtractive production in the near future, 3D printing can produce tailored and customized products more cheaply and quickly than traditional methods. And it can enable product

structures and designs that would not be possible any other way. 3D printing with a wood-based filament has been available since 2012.

Augmented reality is starting to increase the capabilities of manufacturer. Overlaying useful data and instructions on a worker's field of view has been with us for decades – in multimillion dollar jet fighter cockpits. But relatively cheap, light goggles now make it easier than ever. Low skill workers will more easily be able to follow complex instructions. High skill workers will have easier access to more information – for instance, superimposing wiring and structural plans on a piece of equipment they are maintaining.

Autonomous robots are moving well beyond the industrial robots of the past, which performed a limited range of functions and needed to be separated from human workers for safety. Fully automated “lights out” facilities are increasingly common, where robots work unsupervised and without lighting, heating or airconditioning bills. Taking a completely different tack, “collaborative robots” or “cobots” work directly with people to increase their productivity, without requiring major upfront investment in redesigning the workplace or programming robots for all the tasks needed to fully replace workers.

Simulation is a powerful extension of the connected factory. If you have full real time data about your products and processes,

you can model them and test improvements in the simulation before trying them in reality. Failing fast is even better when you can learn from the failure without real-world production snarls or angry customers.

How to pursue Industry 4.0

Industry 4.0 is still a new concept to many in Australia, and discussions typically focus on describing it. But businesses around the world are ahead of us. We need to move at a fast clip from saying what it is, to understanding what we can do with Industry 4.0.

It should be clear by now that Industry 4.0 and advanced manufacturing are not the domain of a few self-consciously high-tech businesses making microchips or aircraft. These are technologies that can help transform any manufacturer, and indeed every sector of the economy. Ai Group firmly believes that every manufacturer can realistically aim to become an advanced manufacturer.

Making the most of these technologies involves more than buying kit and learning how to use it. Innovating your business model can be just as important. Rolls Royce extended their role and their business model well beyond the factory gate, moving from sellers of engines to providers of propulsion services: they get paid for the outcomes and value-adding services they provide, not just for the hardware that goes out their door.

Nespresso revolutionized both the coffee machine and instant coffee markets by borrowing a business model from the shaving and personal printing industries.

There are a few things that businesses should keep in mind when pursuing Industry 4.0.

First, be open. There is much that is new under the sun. Look at the full range of technologies that are available to your business, talk about them with vendors, and be ready to experiment with smaller scale trials and incremental additions to your equipment and systems. Your current practices, indeed your whole current business model, may not be the best for the future. What else is possible?

Second, be rigorous. Cross check the fine words of solutions vendors by talking to their competitors and your peers. Think clearly about the underlying business problems you are trying to solve, rather than jumping straight to particular solutions that may not speak to your actual needs. And consider carefully the new needs you will have as your business adopts industry 4.0 technologies. Do your employees have the right skills – not just the operators who will have different machines, but support staff and managers? Are your own suppliers and customers making similar moves, and will your systems talk to theirs?

Third, look for help. There is a lot of information, advice, collaboration and support available in different forms for

would-be advanced manufacturers. Indeed, there is so much that it can be confusing. Ai Group and others are working to increase coordination – more on that shortly – but let me list some of the resources you can access.

Ai Group itself is doing a lot.

- Our Industry Transformation web page hosts a wealth of information for members about 4.0, skills, workplace relations issues and links to frequent webinars and other events we host.
- We are a leading provider for the Entrepreneur's Programme, which is lifting the capability of businesses across Australia.
- The Digital Business Kits we provide online offer SME manufacturers information on building their digital capability.
- We are also running a range of short courses across the country. These courses focus on *Digital Strategy for Managers in Industry 4.0*, covering *What is Industry 4.0?* and *Strategy for Digital Transformation*. These programs are designed to develop industry 4.0 capability and strategy inside each business.

There is a lot going on beyond Ai Group too:

- The Advanced Manufacturing Growth Centre (AMGC) shares member expertise and can co-fund sector-significant technology adoption projects up to 50%.
- The Innovative Manufacturing Cooperative Research Centre (IMCRC) connects industry and leading university researchers to conduct multi-year research projects, and backs them with Commonwealth matching funding.
- One of IMCRC's initiatives is the Futuremap tool, an excellent online self-assessment system that walks your business through the concepts and capabilities of industry 4.0, business model innovation and leadership development. Futuremap workshops help businesses clarify their current performance and identify areas for improvement.
- The Universities are much keener to work with you than they used to be. Changes to the Commonwealth's formula for funding research now give weight to industry collaboration, not just academic publication and PhD production. Melbourne University, Swinburne, RMIT, QUT, UTS, Flinders and more have set up facilities to work directly with manufacturers and showcase key technologies.

- There is also a growing set of formal Industry 4.0 Test Labs, established to a common set of principles developed by the former Prime Minister's Industry 4.0 Taskforce. The first, at Swinburne, will focus on autonomous 3D printing of parts. But many more are taking shape across Australia and New Zealand.
- And the CSIRO remains an essential partner in innovation, not just in its manufacturing division but also in the Data61 data innovation group.

While this is a lot of support, there should be more and we can do better. Reaching the potential of Industry 4.0 in Australia will require concerted efforts by industry, civil society and every level of government.

In April 2016 the Federal Government established the Prime Minister's Industry 4.0 Taskforce to broaden awareness of Industry 4.0 and accelerate the pace of its diffusion. Part of the initial effort was to build official and ongoing links between Australian industry and the German Platform Industrie 4.0. The Taskforce has achieved this, but also much more.

Workstreams have been established under expert leadership to advance standards, innovation, security, work, education and training and Test Labs.

Major reports and recommendations for action have been developed on standards and the test labs I mentioned.

The Industry 4.0 higher apprenticeships project – a partnership between Siemens, Swinburne and Ai Group has been overwhelmingly successful and has generated significant interest across the country. Further rollout is planned for 2019 and Ai Group is currently working with companies and sourcing candidates to help this get underway.

But ultimately the future of industry is the responsibility of industry and the stakeholders we work with. It is therefore highly appropriate that the good work of the Prime Minister's Taskforce will continue in a new form as the **Industry 4.0 Advanced Manufacturing Forum**. While this initiative retains strong relationships and engagement with government, the Forum is convened by Ai Group, and works closely with:

- the Advanced Manufacturing Growth Centre,
- the Innovative Manufacturing Cooperative Research Centre (IMCRC),
- AustCyber,
- Engineers Australia,
- Standards Australia,
- Swinburne University and
- the Australian Manufacturing Workers Union.

I chaired the first meeting of the new-look 4.0 Forum last month, and it is already developing a vigorous agenda to advance industry and ensure that stakeholders work together effectively.

I've talked about what industry can do for itself and the support that is available. I will finish with a couple of further thoughts about the role of government.

Government is neither the first resort nor the final arbiter for the fate of manufacturing in Australia. What happens in board rooms and on shop floors is more central. But public policy can play a role, for good or ill, in whether we succeed.

But there are at least three things that government can do to make success more likely.

The first is to keep manufacturing in the economic story government presents to itself and the nation. Too often Treasuries have written the sector off and focused on mining and services. But resources cycles highlight the value of a diverse economy, and expectations of decline will be self-fulfilling if they lead smart young people to steer away from a career in manufacturing.

Secondly, those smart young people will be in shorter supply unless we invest effectively in skills. Debates about curricula, structure and funding for schools, vocational education and training and universities should not be a playground for culture

warriors of the left and right. They are central to the economic future of Australia.

Finally, government needs greater stability. Nationally we are edging out Italy and Japan for the number of Prime Ministers we've burned through this decade. Policy swings wildly from one election to the other – most egregiously in energy and climate. Long term planning by business becomes more difficult when government priorities are overturned with every change of personalities. Consensus and bipartisanship are in danger of becoming dirty words for parties looking for short-term brand differentiation.

Let's see what progress can be made on the public front. Industry can only make its voice heard, not make the decisions. What we can do is look clearly at the opportunities of Industry 4.0, and seize them through experimentation and investment. I am confident that we will rise to the challenge.