STANDARDS
Australia

# INDUSTRY 4.0: AN AUSTRALIAN PERSPECTIVE

Recommendations Report to Australian Government – Department of Industry, Innovation and Science

March 2017

# Contents

# Foreword

*In the future, businesses will establish global networks that incorporate their machinery, warehousing systems and production facilities. This will only be possible if a single set of common international standards are developed.*

Industry 4.0 connects and merges production with information and communications technology allowing components and machines to autonomously manage production in a flexible, efficient, and resource-saving manner. Being a member of Prime Minister's Industry 4.0 Taskforce and leading its Working Group 1: Reference Architectures, Standards and Norms, we discovered that standardisation efforts will need to focus on stipulating the cooperation mechanisms and the information that is to be exchanged. It has generated significant interest internationally, prompting the development of standardisation initiatives such as Germany's Plattform Industrie 4.0.

As we met with stakeholders, it was apparent that the long-term productivity and global competitiveness of Australian manufacturing will be dependent on how well we transition into the fourth industrial revolution.

This report highlights key recommendations for Australia to gain opportunities created from Industry 4.0. It describes the current standardisation activities taking place where Australia will be able to participate and the importance of encouraging a cooperative approach with peer organisations, which is critical given the complexity of the initiative.

Australia needs to assess how it wants to approach Industry 4.0, including the establishment of appropriate projects to demonstrate the successful domestic development and deployment of reference architectures.

As we go to print, a Memorandum of Understanding for cooperation on Industry 4.0 and the future of manufacturing between Australia and Germany is being drafted. It aims to continue to nurture and develop the already mutually beneficial communication, innovation and cooperation pathways, including between Plattform Industrie 4.0 and the Prime Minister's Industry 4.0 Taskforce, and, where able, develop other opportunities for communication, innovation and cooperation.

**Dr Bronwyn Evans**
CEO, Standards Australia
Vice President – Finance, International Organization for Standardization

# Introduction

Standards Australia has a memorandum of understanding with the Australian Government, as the national standards body and a member of International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC), to represent Australia on matters of international standardisation. Standards reduce barriers-to-trade by establishing agreed international standards for products and services. Thus by encouraging interoperability, international standards are an important element for fostering growth, competitiveness and innovation.

Trends in manufacturing are moving towards seamless integration of physical and digital worlds in order to enable fast integration, feedback and control loops throughout distributed manufacturing infrastructures. The increasing adoption of information and communication technologies (ICT) in the manufacturing domain not only leads to more efficient and technologically sophisticated production systems, but also enables the implementation of innovative business models[1].

Australia's transition to an innovation-led economy means it is well-placed to take advantage of the opportunities presented by the future trends in manufacturing. Recently, the term 'Industry 4.0' was created to define a further developmental stage in the organisation and management of the entire value chain involved in the manufacturing



*The Prime Minister's Industry 4.0 Taskforce meeting at Parliament House.*

industry. This developmental stage requires an unprecedented degree of system integration across domain borders, hierarchy borders and life cycle phases. This will only be possible if international consensus-based standards are developed.

Australia recognises the importance of being an active participant in shaping a future interconnected world. To this end, the implementation strategy for Industry 4.0 in Australia is being developed by the "Prime Minister's Industry 4.0 Taskforce" in cooperation with various Australian industrial stakeholders. Standards Australia is a member of this "Prime Minister's Industry 4.0 Taskforce" and is leading Working Group 1 - Reference Architectures, Standards and Norms. In this capacity, Standards Australia was asked to consult with a number of national and international stakeholders and make recommendations for Australia to gain opportunities created from Industry 4.0.

1   International Electrotechnical Commission, 2015, Factory of the Future, p.17

Standards Australia makes the following recommendations:

1. Advocate for:
   a. national standards to be consolidated to an international level;
   b. efficient collaboration between international standardisation organisations;
   c. worldwide acceptance of a reference model enriched by open source reference implementation;
   d. a network of test centres accessible to SMEs; and
   e. standardisation to be taken into account from the very beginning.

2. Form collaborative partnerships with Plattform Industrie 4.0[2] and other Industry 4.0 standardisation initiatives such as the Industrial Internet Consortium[3].

3. Explore the creation of a national strategy to advance the strategic, conceptual and organisational treatment of the topic of Industry 4.0.

4. Select Australian use cases to test against RAMI4.0 (Reference Architecture Model Industrie 4.0) and contribute to the body of work that is being done in Plattform Industrie 4.0. The best environment for the coordination of these projects would be the Advanced Manufacturing Growth Centre.

5. Provide Australian expert advice in the development of Industry 4.0 standards through representation at all relevant committees and working groups (such as ISO/IEC JTC 1/SC 41) at the international standards organisations and form Australian mirror committees to those where appropriate.

6. Leverage international and regional meetings as an opportunity to work with countries to increase their capacity to participate in the international standards development process, to help improve awareness of the benefits of international standards and to help them adopt and use ISO and IEC international standards in their country.

7. Incorporate Working Group 1: Reference Architectures Standards and Norms into the existing innovation infrastructure, such as the Advanced Manufacturing Growth Centre. This would ensure the sustainability of Australia's Industry 4.0 efforts to date.

Standards Australia would like to acknowledge and thank the Prime Minister's Industry 4.0 Taskforce, Advanced Manufacturing Growth Centre, Plattform Industrie 4.0, Industrial Internet Consortium, German Institute for Standardization, German Commission for Electrical, Electronic and Information Technologies of DIN and VDE, German Federal Ministry for Economic Affairs and Energy and others who were very generous with their time and knowledge.

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2  Plattform Industrie 4.0 is a German initiative and brings companies, associations, the academic community, trade unions and policy makers together to coordinating the digital transformation of industry.

3  Industrial Internet Consortium is a global, member-supported organisation that promotes the accelerated growth of the Industrial Internet of Things by coordinating ecosystem initiatives to securely connect, control and integrate assets and systems of assets with people, processes and data using common architectures, interoperability and open standards to deliver transformational business and societal outcomes across industries and public infrastructure.

# The Australian Perspective

## Standards Australia Industry 4.0 CEO Forum

Standards Australia hosted an Industry 4.0 CEO Forum in September 2016 where some of Australia's leading companies, industry bodies and research institutions met to discuss the need for a common set of standards for the emerging fourth industrial revolution that will facilitate new production systems[4]. The expert panel agreed that the fundamental objective is to capitalise on the progress achieved in information and communications technologies and that expected in the near future for the benefit of manufacturing enterprises. This will lead to the emergence of dynamic, real-time optimised, self-organising value chains, which will give rise to disruptive global effects and a highly dynamic environment. Industry 4.0 will change the nature of global manufacturing in ways that create opportunities for Australian businesses to participate in global supply chains.



*Standards Australia Industry 4.0 CEO Forum*

Australian manufacturing has a bright future if it focuses its efforts and takes advantage of its strengths. We are home to many of the creative and service-oriented skills that are now in demand. Our traditional disadvantage of distance from major markets is becoming less relevant in the digital age. Most importantly, we have a community of entrepreneurs, governments, research institutions, investors and others that are focused on driving growth and customer satisfaction by building great businesses and exporting our ingenuity to the world[5].

The panel agreed that for Industry 4.0 to be successful there is a requirement for:

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4   Standards Australia, Advanced Manufacturing Growth Centre, Siemens Australia and New Zealand, Robert Bosch Australia, Engineers Australia, CSIRO, Communications Alliance, University of Technology Sydney, Austroads, Asialink Business and Business Council of Australia.

5   Advanced Manufacturing Growth Centre, Sector Competitiveness Plan 2017 – Taking Australian Ingenuity to the World, p.3.

(a) national standards to be consolidated on an international level; (b) efficient collaboration between international standardisation organisations; (c) worldwide accepted reference model enriched by open source reference implementation; (d) network of test centres accessible to SMEs; and (e) standardisation to be taken into account from the very beginning.

Work will need to be done to coordinate collaboration at the international level but it will be imperative for opening up the way towards truly global standards and ensuring all stakeholders speak the same language. Being an active participant in shaping a future interconnected world will require Australia to maintain its global frontline efforts to develop international standards for the emerging fourth industrial revolution. Of particular importance are collaborative partnerships with Plattform Industrie 4.0 and other initiatives focused on the transformation of manufacturing towards a modern manufacturing model involving an industry with a high-end value chain.

The Prime Minister's Industry 4.0 Taskforce has been instrumental in elevating the importance of Industry 4.0 in Australia and positioning Australia as a valuable contributor and strategic partner internationally. However, in order to take advantage of the opportunities presented by the future trends in manufacturing a national strategy to advance the strategic, conceptual and organisational treatment of the topic of Industry 4.0 should be created.

> "
> The reality is that the term 'manufacturing' covers a much broader range of activities beyond production and Australia has significant potential to grow its manufacturing sector to become more globally competitive."
>
> —*Dr Jens Goennemann, Managing Director, Advanced Manufacturing Growth Centre*

The panel discussed the opportunities, challenges as well as potential responses from industry and government.

## Opportunities and Challenges

Industry 4.0 will impact business models, value creation processes and products. Increasing complexity leads to new value systems. In transitioning to Industry 4.0, Australia needs to drive innovation, productivity and competitiveness by focusing on areas of competitive strength and strategic priority.

There is danger in trying to apply Industry 4.0 principles to all industrial sectors prior to making any significant and demonstrable impact on a small number of strategic ones. The sectors identified in the Industry Growth Centres Initiative[6] can be a starting point for Australia's transition into smart, high value and export focused industries. They are positioned to lift the capability of the sector, boost productivity and skills, create jobs, reduce regulation and engage with international opportunities.

Standardisation is of central importance to the success of Industry 4.0 because it will involve networking and integration of several different companies through value networks. This collaborative partnership will only be possible if a single set of common standards is developed. A reference architecture is required to provide a technical description of these standards and facilitate their implementation. In order to contribute to the development of standards, appropriate technical experts from Australia need to be engaged in relevant international standards development committees.

Industry 4.0 will eliminate the issue of distance to potential markets, often cited as a challenge for Australian companies. Australian manufacturers can reduce the cost and improve the value of the products they sell on global markets, and they can also improve their competitiveness by shifting their focus towards the highest-potential markets and playing to our national strengths. Some manufacturing sub-industries under-serve a number of key export markets, including markets for intermediate goods[7]. Industry 4.0 will create an environment allowing for such creative solutions where a company partners with European groups and starts by using the Australian test bed ecosystem to develop, pilot and validate its design and then has this design and manufacturing process exported to Europe (or USA, Japan, Korea) for assembly.

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> It all comes back to the definition of 'manufacturing'. What we end up exporting may not be a finished product, it may be a software package for a machine in another country."
>
> —*Jeff Connolly, CEO, Siemens Australia and New Zealand*

One of the key challenges will be communicating the benefits and impacts of this transition in manufacturing to the workforce and wider community, including reinvigorating engagement with various levels of the education sector – from secondary to technical and tertiary. The reality is that the term 'manufacturing' now covers a much broader range of activities than those performed in traditional factories. Today, manufacturing centres on complex research and design work in the preproduction phase. There are also many value-adding post-production opportunities in the form of ongoing services. This means that a significant amount of relevant activity might not be sufficiently captured and counted in analysis of the manufacturing sector.

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7    Advanced Manufacturing Growth Centre, Sector Competitiveness Plan 2017 – Taking Australian Ingenuity to the World, p.9

## Industry and Government Responses

A uniform vision for Industry 4.0 is necessary in order to provide a target against which a comprehensive gap analysis can be performed and a strategy created. Without this, Australia will lose its ability to make complex and innovative products and services and consequently miss out on accessing opportunities associated with major infrastructure procurement such as rail, shipping and defence projects. It relates to the evolving definition of 'manufacturing'. What Australia ends up exporting may not be a finished product, it may be a software package for a machine in another country. The test bed infrastructure is the environment for SMEs to examine the value and benefits that they can derive from Industry 4.0. The Advanced Manufacturing Growth Centre is the ideal vehicle to facilitate this transformation and begin the process of aligning diverse stakeholders around this national challenge and global opportunity.

The government, in negotiating Bilateral or Regional Trade Agreements, can leverage future trends in manufacturing and insights identified by industry and include relevant additions related to international standardisation in the agreement to position Australia for success.

The Australian Government is already ahead by establishing the Industry Growth Centres Initiative, Prime Minister's Industry 4.0 Taskforce, and supporting Standards Australia's work in Industry 4.0. These have translated into actions with partnerships to advance smart manufacturing such as the Advanced Manufacturing Growth Centre's recent contribution of $250,000 to support growth projects at the Industry 4.0 TestLab at the Manufacturing Futures Research Institute (MFI) at Swinburne University of Technology. The new institute will link research centres and researchers with industry, business and community to maximise research impact in industrial automation, industrial internet, new manufacturing processes for new generation materials, and design-driven manufacturing innovation. It will help manufacturers harness Industry 4.0 opportunities.

# Importance of Standardisation in Industry 4.0

The core strength of International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC) is their decentralised, professional, member-based system for developing international standards. It is through the national members, such as Standards Australia, that the organisations can identify and serve the needs of markets and society, engage a broad variety of stakeholders, disseminate standards and support their implementation. National bodies that are members of ISO or IEC participate in the development of international standards through technical committees established by the respective organisation to deal with particular fields of technical activity. Other international organisations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. It is important that national members adopt and use international standards as national standards because it is only by developing a common global approach that the benefits of standardisation can be fully realised.

The fundamental purpose of Industry 4.0 is to facilitate cooperation and collaboration between technical objects, which means they have to be virtually represented and connected[8]. Industry 4.0 requires an unprecedented degree of system integration across domain borders, hierarchy borders and life cycle phases. A neutral reference architecture model is essential for further standards work. Germany's Plattform Industrie 4.0 proposed one such model: Reference Architecture Model Industrie 4.0 (RAMI4.0), the objective of which is to set a comprehensive framework for the conceptual and structural design of Industry 4.0 systems. RAMI4.0 describes a reference architecture model in the form of a cubic layer model[9] which provides an architecture for technical objects (assets) in the form of layers, and allows them to be described, tracked over their entire lifetime and assigned to technical and/or organisational hierarchies. It also describes the structure and function of Industry 4.0 components as essential parts of the virtual representation of assets.

Standards Australia recently met with the German Institute for Standardization (DIN) where various collaboration options were discussed including how Australia can play a distinctive role by providing Australian use cases and therefore contributing to the body of international work that is being done in Plattform Industrie 4.0. To address this, both Prime Minister's Industry 4.0 Taskforce and Advanced Manufacturing Growth Centre are well-placed to select use cases and test against RAMI4.0, recording the effect on the company. Some initial suggestions for test cases are in autonomous mining and shipbuilding. In order to build on the knowledge, it is important for other countries to

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8   Reference Architecture Model Industrie 4.0 (RAMI4.0) DIN SPEC 91345, Deutsches Institut für Normung e.V. (German Institute for Standardization).

9   The DIN SPEC 91345 has been developed according to Publically Available Specification procedure and will serve as a working document for international standardisation.

undertake a similar approach by participating in the standards development process and testing those standards for specific applications.

Industry 4.0 has generated significant interest internationally, prompting standardisation initiatives at ISO, IEC, ISO/IEC JTC 1 (ISO/IEC Joint Technical Committee for Information Technology), W3C (World Wide Web Consortium), ITU-T and IEEE (Institute of Electrical and Electronics Engineers), and also initiatives such as Plattform Industrie 4.0 and the Industrial Internet Consortium (IIC). Standards Australia manages Australia's participation at ISO, IEC and JTC 1 and given the importance of Industry 4.0 has made further efforts to engage and collaborate with other relevant initiatives.

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We need to develop timely and relevant materials, including use cases, as foundational materials for technical committees developing standards in this area."

*—Gavin Smith, CEO Robert Bosch Australia*

## International Organization for Standardization (ISO)

In June 2015 a strategic advisory group (SAG) was established on Industry 4.0/Smart manufacturing. The SAG was established in response to a recognised need for a joint future approach in the field of Industry 4.0/Smart manufacturing. The IEC and the ITU-T were invited to join the SAG and the mandate of the SAG was set to deliver the following:

- To provide a definition of, and give an overview on, available standards, use cases and current work related to Industry 4.0/Smart manufacturing

- To identify possible gaps where additional standards are needed

- To make recommendations on actions to be taken by Technical Management Board (TMB)

- To monitor other national, regional and international activities and suggest cooperation mechanisms with partner organisations, especially with IEC and ITU-T

The SAG had industry representatives nominated by the following TMB members: Standards Australia (Australia), DIN (Germany), AFNOR (France), ANSI (USA), NEN (Netherlands), SNV (Switzerland), JISC (Japan), SAC (China) and BSI (UK) plus an industry representative from JTC 1/WG 10 Internet of Things, as well as IEC and ITU-T representatives. In the final report, the SAG Industry 4.0/Smart manufacturing made ten key recommendations, one of which is cooperation with other organisations through the creation of an ISO Coordinating Committee with the name "Smart Manufacturing". The ISO Coordinating Committee would have the following terms of reference:

- To enable the sharing of information among those ISO Technical Committees involved in Smart Manufacturing;

- To identify new work or identify harmonisation areas of existing standards as early as possible and to optimise the use and sharing of resources for the development of standards or further harmonisation of existing standards in Smart Manufacturing;

- To facilitate communication and coordination between technical committees and encourage joint development activities where appropriate, and where relevant expertise is distributed across several groups, both within ISO and with other organisations such as IEC;

- To serve as the ISO focal point for interfacing with Smart Manufacturing in peer bodies including the IEC, ITU, and other recognised organisations, including consortia; and

- To develop timely and relevant materials, including use cases, as foundational materials for committees working in the area of industrial Smart Manufacturing.



## International Electrotechnical Commission (IEC)

The IEC/SMB/SG 8 Industry 4.0/Smart Manufacturing was established to provide recommendations for an IEC strategy addressing manufacturing automation that will focus on ensuring real time needs of the manufacturing enterprise are sustained to achieve safe, secure and energy efficient factory operations. It aims to pursue an architecture for smart manufacturing that will enable it to function as a smart application within a broad IoT environment; and to leverage the adoption of current and next generation technologies to achieve safe and secure factory operations. Subsequently, the IEC-SEG 7 was created to implement recommendations of IEC/SMB/SG 8 with the scope of:

- Expand on the market relevance and business drivers, identified in the SG 8 report, taking into account other SDO initiatives and national programs;

- Provide an inventory of existing standards and current standardisation projects under the management of IEC, ISO and other SDOs;

- Invite the cooperation of ISO, JTC 1/WG10, IEEE, consortia, and other organisations to assist in mapping smart manufacturing activities that are closely related, and to participate in the activities of the proposed Systems Committee (SyC);

- Expand on the definition of common value chains within a smart manufacturing enterprise, as identified in SG 8, and identify associated use cases which will assist in determining the state of the art in the industry, and the identification of potential gaps where IEC standardisation is needed with respect to smart manufacturing;

- Establish an initial roadmap of smart manufacturing standardisation, architecture and prospective standardisation and conformity assessment projects to be conducted by the SyC member TCs and partners;

- Deliver a dashboard to cross reference the project work items to documented use cases within particular value chains to assist standards developers, and industry stakeholders to navigate the domain; and

- Make a recommendation to the SMB on the proposed SEG's transition into a SyC outlining the proposed SyC structure, membership, principles of operation and deliverables of the SyC which are supportive of the individual goals and deliverables of the participating stakeholder Technical Committees.

> **"**
> The reference architecture is the core piece. If we want to influence the development of standards then we need to recruit Australian technical experts to those international standards development committees."
>
> —*Professor Ian Burnett, Dean, Faculty of Engineering & Information Technology, University of Technology Sydney*

The IEC recently released its Factory of the Future White Paper which assesses the potential worldwide needs, benefits, concepts and preconditions for the factory of the future. It identifies the business trends in related technologies and markets, as well as their impact on data, people, technologies and standards. Nimble, adaptive and intelligent manufacturing processes will be the measure of success. The combination of "virtual" and "real" in order to get a full view of the complete value chain will allow factories to produce products more rapidly, more efficiently and with greater return using fewer resources. The Factory of the Future White Paper was developed by the IEC Market Strategy Board (MSB) in cooperation with the Fraunhofer Institute for Manufacturing Engineering and Automation IPA.

## ISO/IEC Joint Technical Committee 1 (JTC 1)

JTC 1 was created by the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) to provide a single, comprehensive standardisation committee in which to address international ICT standardisation. With over 2600 published standards developed under the broad umbrella of the committee and its 20 subcommittees, JTC 1 makes a huge impact on the ICT industry worldwide[10]. In November 2016, JTC 1 established a Subcommittee SC 41 to undertake standardisation in the area of Internet of Things and related technologies. Standards Australia will be seeking stakeholder interest and facilitating the participation of Australian technical experts in this new area of standardisation.

The work of the ISO/IEC JTC 1/WG 10 and its Subgroup Rapporteur Group (SRG) 7 on Cyber Physical Systems (CPS) for IoT was folded into the new SC 41. Study Report of ISO/IEC JTC 1/WG 10 SRG 7 on Cyber Physical Systems (CPS) for IoT was finalised in January 2017.

## Relevant ISO and IEC Committees:

| | |
|---|---|
| ISO/IEC JTC 1 | Information technology |
| ISO/IEC JTC 1/SC 7 | Software and systems engineering |
| ISO/IEC JTC 1/SC 17 | Cards and personal identification |
| ISO/IEC JTC 1/SC 27 | IT Security techniques |
| ISO/IEC JTC 1/SC 32 | Data management and interchange |
| ISO/IEC JTC 1/SC 37 | Biometrics |
| ISO/IEC JTC 1/SC 38 | Cloud Computing and Distributed Platforms |
| ISO/IEC JTC 1/SC 40 | IT Service Management and IT Governance |
| ISO/IEC JTC 1/SC 41 | Internet of Things and related technologies |
| ISO/TC 10 | Technical product documentation |
| ISO/TC 10/SC 10 | Process plant documentation |
| ISO/TC 39 | Machine tools |
| ISO/TC 39/SC 10 | Safety |
| ISO/TC 184 | Automation systems and integration |
| ISO/TC 184/SC 1 | Physical device control |
| ISO/TC 184/SC 4 | Industrial data |
| ISO/TC 184/SC 5 | Interoperability, integration, and architectures for enterprise systems and automation applications |
| ISO/TC 211 | Geographic information/Geomatics |
| ISO/TC 261 | Additive manufacturing |
| ISO/TC 292 | Security and resilience |
| ISO/TC 299 | Robotics |
| IEC TC 65 | Industrial-process measurement, control and automation |

# From National to Global Initiatives

Standards Australia participated in the Pre-G20 Standardisation Conference in October 2016 where CEO, Dr Bronwyn Evans, was a panellist in the Industry 4.0 workshop. One of the key themes that emerged from discussions at the Pre-G20 Standardisation Conference is the need to transition from national to global initiatives. This means bringing together international standards organisations, consortia and other entities to develop and agree on a uniform reference architecture model for structuring further standards work.

Australia's initiatives in Industry 4.0 stem from the Prime Minister's Industry 4.0 Taskforce, created to support Australia's transition to a new economy and connect the nation to the fourth industrial revolution. The Taskforce is also a direct outcome of the recommendations from the Australia-Germany Advisory Group, established to build closer ties between Australia and Germany and identify opportunities for increased trade and investment.

Standards Australia highlighted that although Prime Minister's Industry 4.0 Taskforce is structured to mirror Plattform Industrie 4.0, our intent is not to duplicate work. Rather, Australia can bring its unique perspective to the work from local use cases in sectors where Australia is a leader such as autonomous mining applications.



*Industry 4.0 Workshop, Pre-G20 Standardisation Conference, Berlin, Germany.*

The German G20 Presidency aims to take concrete steps to create appropriate conditions and remove possible obstacles in order to seize the opportunities of digital technology. With respect to digitalisation, the G20 should use this as an opportunity to work with countries to increase their capacity to participate in the international standards development process, to help improve awareness of the benefits of international standards and to help them adopt and use ISO and IEC international standards in their country. One of the main benefits of standards is that they facilitate trade and their use can play a key role in harmonisation of regulations. In addition, it is important to ensure that the objectives are prioritised by developing a work program that extends until 30 November 2017, when Germany's G20 Presidency ends.

The Pre-G20 Standardisation Conference outcomes from the workshops will be included in the G20 ministerial declaration in the form of an annex. Standards Australia endorses the proposed objectives:

- Work with international forums and consortia needs to be intensified in order to ensure interoperability in Industry 4.0. National standardisation activities need to be harmonised with those at international level.

- Cooperation at the international level between industrial nations, and developing and threshold nations is absolutely essential for opening up the way towards truly global standards and ensuring all stakeholders "speak the same language". This will include identifying which standards organisations - and which standards projects - are relevant, as well as who is to be responsible for what. Standards work relating to Industry 4.0 should be as effective as possible, and the number of standards should be limited to a manageable size. Existing national standards should be consolidated at an international level.

- Agreeing on a uniform reference architecture model for structuring further standards work is extremely important. Flexible standardisation combined with open source implementation should be used to ensure further strategic, conceptual and organisational developments. An interoperable and safe IT architecture model based on international standards should be set up.

- Practical tests carried out in test centres and international clusters must be supported and coordinated to a greater extent. SMEs need to be more involved in the standardisation process.

- To take advantage of the benefits of standardisation carried out at an early stage of development, aspects of standardisation must be integrated into national and international research projects, suitable standards work at the R&D stage are initiated, and standardisation is taken into account from the very beginning of any development work.

> **"**
>
> The German initiative, Plattform Industrie 4.0, has achieved so much because it is a country initiative. We need to have the same here."
>
> —*Jeff Connolly, CEO, Siemens Australia and New Zealand*

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## About Standards Australia

Founded in 1922, Standards Australia is an independent, not-for-profit organisation, recognised by the Commonwealth Government as the peak non-government Standards development body in Australia. It is charged by the Commonwealth Government to meet Australia's need for contemporary, internationally-aligned Standards and related services. The work of Standards Australia enhances the nation's economic efficiency, international competitiveness and contributes to community demand for a safe and sustainable environment.

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# Appendix A – Stakeholder Consultations

### International Organization for Standardization (ISO)
12 – 13 September 2016 (ISO General Assembly)
Beijing, China

### Standards Australia Industry 4.0 CEO Forum
28 September 2016
Sydney, Australia

### German Institute for Standardization (DIN)
3 October 2016
Berlin, Germany

### Pre-G20 Standardisation Conference – Industry 4.0 Workshop
6 – 7 October 2016
Berlin, Germany

### International Electrotechnical Commission (IEC)
10 – 14 October 2016 (IEC General Meeting)
Frankfurt, Germany

### Joint Technical Committee 1 (JTC 1) Plenary
7 – 11 November 2016 (JTC 1 Plenary)
Lillehammer, Norway

### Standardisation Council I4.0
12 January 2017
Sydney, Australia

### Industrial Internet Consortium (IIC)
3 February 2017
Sydney, Australia