

## 2018 PROGRESS REPORT



**Applying Industrie 4.0.**  
**Forward Thinking. Practical. Connected.**

## Imprint

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# Foreword

*The Plattform Industrie 4.0 is respected in Germany and around the world as an established network for forward thinking and practical solutions for the future environment for Industrie 4.0. The platform derives its strength from the desire of more than 300 stakeholders from more than 150 organisations to help shape the future. The participants from commerce, associations, trade unions, academia and politics formulate specific goals for the digital sector in Germany: in a 10-point plan, the members of the platform drew up recommendations in mid-2017 which need to be implemented if companies and residents in Germany are to become the world's leading providers and users of digitalised manufacturing.*

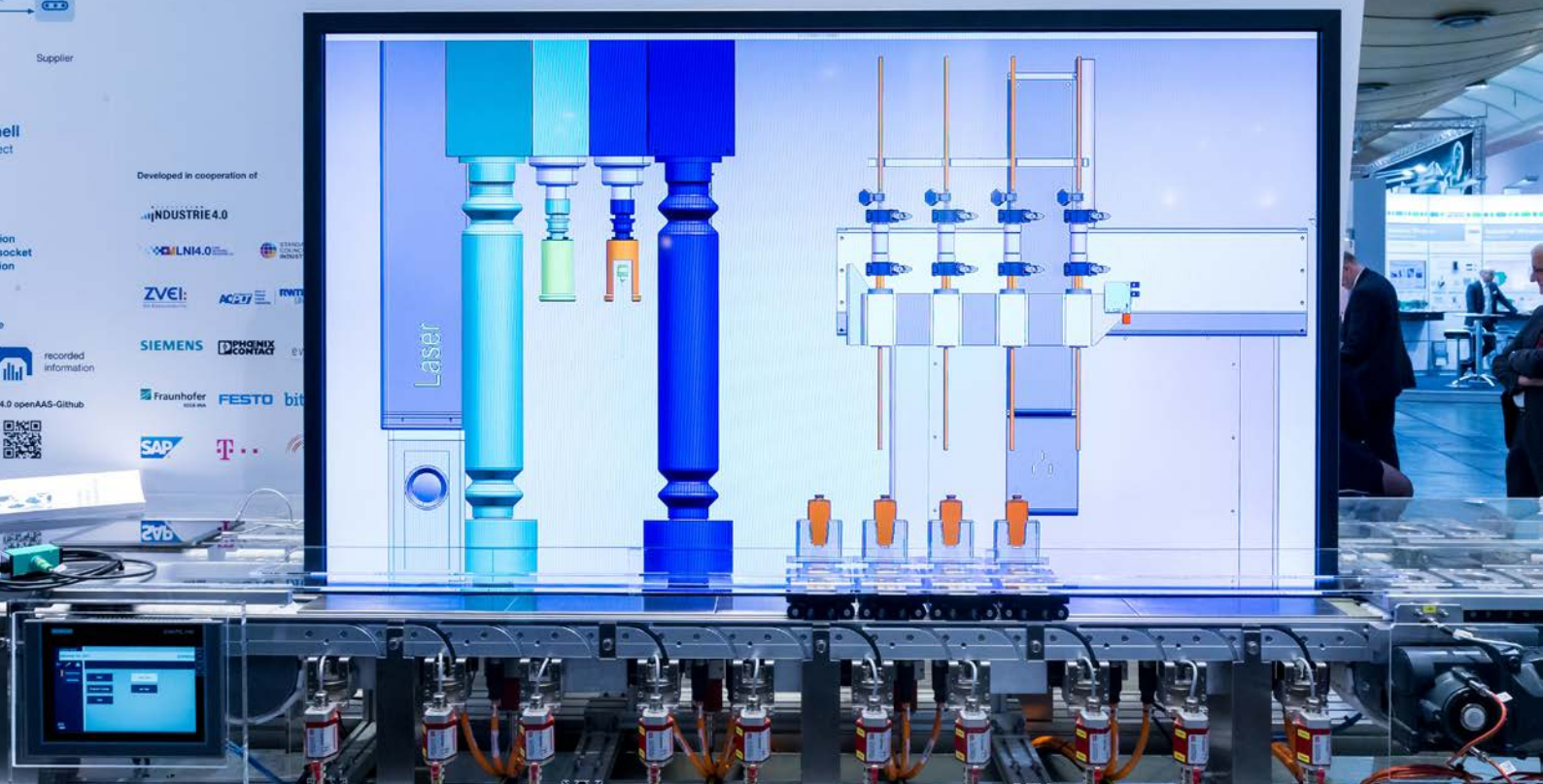
*The 2018 progress report provides an update on the work of the Plattform Industrie 4.0. The platform has set a benchmark with its work towards a uniform framework for global standards: its description of the Industrie 4.0 components and specification of the administration shell creates the basis for interoperability in digital production systems. By engaging in international cooperation, the platform is also bringing about global progress towards the goal. The experts are attracting attention in their own communities by providing practical recommendations on, for example, IT security training or the categorisation of antitrust issues.*

*As the issue has become increasingly significant for the industrial sector, the platform has set up a new working group on business model types in Industrie 4.0. A restructuring in the field of research and innovation has also commenced, and is reflected in a new orientation for the previous working group on research and innovation and in the academic advisory council, which has now been redesignated the Research Council and includes industrial representatives.*

*To a large degree, the success of the digital transformation will depend on SMEs looking for specific, practical support and orientation. Companies across Germany should be able to benefit from the platform's expertise. The Industrie 4.0 transfer network set up by the Economic Affairs and Research Ministries brings stakeholders together on a regional and thematic basis in order to leverage synergies. The network now needs to be fleshed out with expertise, ideas and projects, and the basic expertise in Industrie 4.0 needs to be processed so that companies can use it.*

*Plattform Industrie 4.0*

## INDUSTRIE 4.0-KOMPONENTEN – LIVE ERLEBEN INDUSTRIE 4.0-COMPONENTS LIVE EXPERIENCE



# Driving (international) standardisation

## The goals we've set ourselves

At the latest when it's time to take the next decision on what to invest in, companies will be facing the following problem: how do you digitalise production whilst maintaining operations and links with suppliers and clients if everyone is using different hardware and software? Manufacturing companies are facing one of the greatest challenges in this age of digitalisation: digitised industrial production is networking sectors – users and suppliers, IT and machines – which have so far adhered to different standards, or to no standards at all. A common, understandable language is needed to ensure interoperability and transparency in Industrie 4.0 standardisation in digital ecosystems. The needs of the various sectors and fields need to be thought and brought together. It is therefore necessary to set up a fundamental system which ensures the interoperability of all components.

## How we're reaching the goals

### Standardisation in the network

Industrie 4.0 is a joint effort – especially in the field of standardisation. The working group on “Reference architecture, standardisation and norms” (WG1) of the Plattform Industrie 4.0 is gradually developing the principles for open Industrie 4.0 standards. The three major sectoral associations, VDMA, ZVEI and Bitkom, are driving WG1's comprehensive conceptual work: The ZVEI (German Electrical and Electronic Manufacturers' Association) has mirrored the platform's structure, setting up an equivalent group to WG1 called “Models and Standards”. The VDMA (Mechanical Engineering Industry Association) is currently working together with the WG1 experts on companion standards for the OPC Unified Architecture (OPC UA) communication protocol. A uniform protocol creates the vocabulary for specific sectors and, with a set of practical instructions, becomes a standardised method of developing submodels. Bitkom (German Association for IT, Telecommunications and New Media) has worked on communication protocols and is processing the issue in its “Communication” sub-working group.

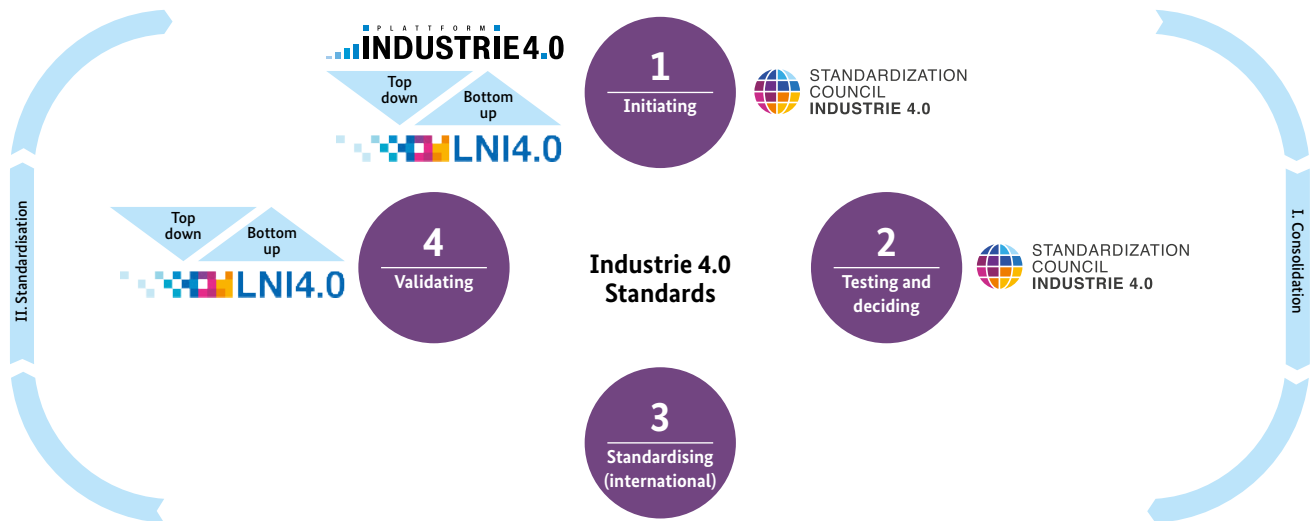


Figure 1 – Industrie 4.0 standardisation process via the three partner platforms, Industrie 4.0, LNI 4.0 & SCI 4.0

© Labs Network Industrie 4.0

Further to this, the Plattform Industrie 4.0 has a partnership with Labs Network Industrie 4.0 (LNI 4.0) and the Standardisation Council Industrie 4.0 (SCI 4.0) to manage the transfer from the technology to international Industrie 4.0 standards. This interplay results in a fast-response process consisting of strategy and concept, testing and standardisation. LNI 4.0 helps companies to try out their use cases in test beds. The tests are subsequently considered in greater detail by the sub-working group “Cutting Edge Projects” of the Plattform Industrie 4.0’s WG1. The sub-working group ensures that the findings from the tests

are fed back into the work of the platform – not least in order to detect gaps in standardisation and identify relevant requirements.

The collaboration with SCI 4.0 makes it possible to pool the findings and interests of German industry and to advocate them to consortia and international standardisation bodies. The Plattform Industrie 4.0 will continue to build on this success in future and is intensifying the cooperation with its partners.



The “**Standardisation Council Industrie 4.0**” was set up by the Plattform Industrie 4.0 in 2016. It was launched by Bitkom, DIN, DKE, VDMA and ZVEI. The Council works independently from the platform and is attached to the DKE (German Commission for Electrical, Electronic & Information Technologies of DIN and VDE).



**Labs Network Industrie 4.0** is a partner of the Plattform Industrie 4.0. The findings from the test centres are mirrored in the platform’s working groups and other bodies, thus enabling progress on standardisation in Germany (LNI 4.0; lni40.de).

## Defining principles for standardisation

At national level, standardisation needs to become operational on both a cross-sectoral and a sector-specific basis. The answer to this is uniform and open Industrie 4.0 standards. These deliver interoperability and ensure that different systems and all components in digital ecosystems work smoothly together. The working group on “Reference architecture, standardisation and norms” of the Plattform Industrie 4.0 is gradually developing the principles for open Industrie 4.0 standards.

## The Administration Shell – a multifunctional tool

The Plattform Industrie 4.0 has been working on how to standardise the administration and use of data since it was first set up and can look back on a successful year: the reference architecture RAMI 4.0 developed by it has been published as DIN SPEC 91345 in line with the procedural rules governing a Publicly Available Specification (PAS). Working from RAMI 4.0, WG1 has described the “asset administration shell” – thus laying the key groundwork for connected industrial manufacturing. This is because the RAMI 4.0 model only works if all the participants in Indus-

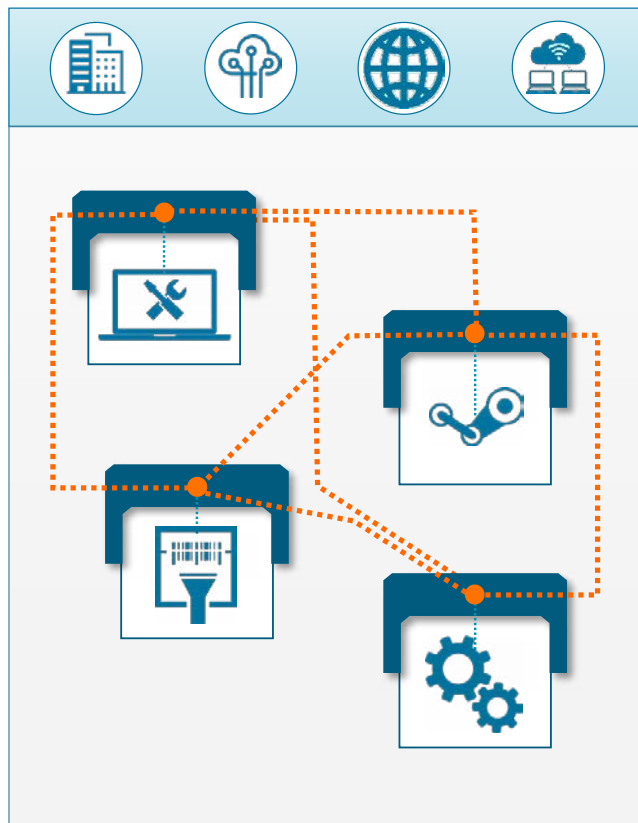


Figure 2 – Industrie 4.0 component

© Plattform Industrie 4.0/Anna Salari, designed by freepik

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*We are on the final straight and are coming closer and closer to a generally valid language for Industrie 4.0. It is a building block to make machines, equipment and products compatible in the digital industrial world – and that is precisely the goal that WG1 has set itself.”*

Kai Garrels, head of the Working Group “Reference architecture, standardisation and norms” (WG1)

trie 4.0 can understand and communicate with one another. This is what drives the concept of the **administration shell**: it is the interface between the physical object (the asset) and the Industrie 4.0 communication. In the administration shell concept, each relevant asset is assigned its own administration shell – its digital image – so that it can be integrated into the connected system of Industrie 4.0 manufacturing.

For example, the administration shell of a drill will give the actual asset a unique ID, properties and capabilities in the virtual world – and is thus the asset’s own “website”. As a type of standardised communication interface in the network, it makes it possible to access all the information about the asset and, for example, to execute the order “drill a hole 3.5 mm in diameter 4 mm deep at position 4”.

The actual asset, such as the drill, a component or a product, and its administration shell together form the



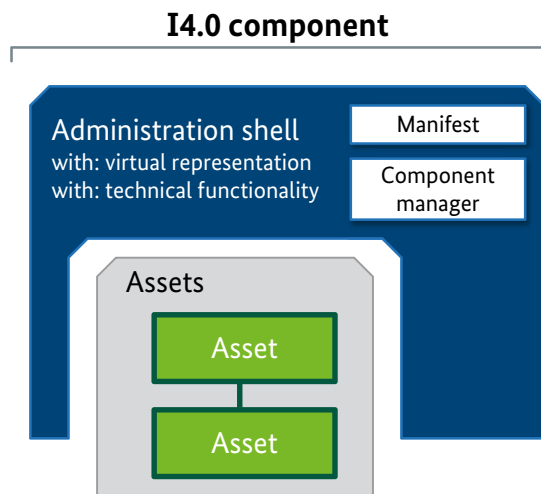


Figure 3 – Assets connected via the administration shell

© Anna Salari, designed by freepik, model of the administration shell  
© ZVEI SG Modelle und Standards

**Industrie 4.0 component.** Products, equipment and processes are connected via information and communication technology – the real production world is coming closer and closer to the virtual IT world. Industrie 4.0 components can communicate with each other both within a factory and between different companies.

If Industrie 4.0 components are to share information with one another, they need a common language. Building on the **interaction model**, the Plattform Industrie 4.0 has developed this in the last few months. The basic concept of administration shells and their elements was defined last year. In order to enable the interoperability of interactions between administration shells or their assets, administration shells must be able to communicate about the content of their submodels and the resulting potential interactions.

The Plattform Industrie 4.0 presents the concept of the language for Industrie 4.0 components by explaining the structure of the vocabulary and the information structure for the exchange of data. Taking the interaction model of “awarding a contract” as an example, it shows how these interact and illustrates the rules for an interaction. In this way, it is rolling out the administration shell concept and enabling it to be applied.

## Supporting global interoperability

Value chains in Industrie 4.0 are not confined to individual companies or countries. So Industrie 4.0 standards and secure IT must not stop at national borders. National solutions are not the answer. But how does one go about developing joint, global solutions – especially in view of the different interests?

The experts of the Plattform Industrie 4.0 have spent a lot of time over the last few months travelling the world, and have made plenty of progress on pushing ahead with the global dialogue on standards. In successful cooperation with other countries, the Plattform Industrie 4.0 has been mapping the internationally recognised pre-standard RAMI 4.0 (IEC PAS 63088) with the various nationally developed reference architectures. At the same time, it is feeding major elements from Germany, such as the administration shell and the Industrie 4.0 component, into international standardisation.



- **USA:** The Plattform Industrie 4.0 and the U.S.-based Industrial Internet Consortium have been engaged in successful cooperation since March 2016. Last year saw a white paper in which the two leading reference architectures – Industrial Internet Reference Architecture (IIRA; Industrial Internet Consortium; USA) and the reference architecture model for Industrie 4.0 (RAMI 4.0; Plattform Industrie 4.0, Germany) – were presented and compared in detail. 2018 will see a further deepening of the bilateral cooperation. This will include relevant organisations like NIST and ANSI, and also consortium-based platforms like the OPC Foundation.



- **Germany, France and Italy:** There was also a breakthrough at European level. In the summer of 2017, the Plattform Industrie 4.0 upgraded its bilateral coopera-

tion with its counterparts Alliance Industrie du Futur from France and Italy's Piano Impresa 4.0 to establish trilateral cooperation. In this context, a shared action plan was adopted, and three working groups are focusing on standardisation and reference architectures, SMEs and testbeds, and policy. Meetings were held in all three countries, and workshops took place in, for example, Frankfurt and Brussels. Work also commenced on a first joint publication, "Structure of the Administration Shell" for Industrie 4.0/smart manufacturing, which was launched at the 2018 Hannover Messe trade fair.



- **China:** On 3 and 4 December 2017, the working groups RAMI/IMSA, Predictive Maintenance, IT Security/Functional Safety, Network Communications/Edge Computing and Use Cases marked the start of intensive cooperation. At the meeting in Hangzhou, China, the final reports on harmonisation of the German reference architecture model RAMI 4.0 with IMSA, its Chinese equivalent, and the IT Security Standards White Paper were drafted, and were published in time for the 2018 Hannover Messe trade fair. The start of work on mapping relevant Industrie 4.0 standards of both countries is also important, as it permits a comprehensive and complete picture of the respective standardisation situation.

Both sides stated that they wished to continue to work closely together in the relevant technical committees of ISO and IEC as well as the joint ISO/IEC bodies (e.g. ISO/IEC JWG 21).



- **Japan:** In the context of a joint agreement on future cooperation between the Plattform Industrie 4.0 and Japan's Robot Revolution Initiative, the initiatives have set up a joint strategy for international standardisation in the field of the Internet of Things and Industrie 4.0. Now that both countries have undertaken an initial harmonisation of their reference architectures, the focus is on joint use cases with a view to studying and identifying technical requirements for the broadening and new development of standards. The report on the analysis and development of joint use cases was published for the 2018 Hannover Messe trade fair.

In the future, it will be necessary to keep building on the Plattform Industrie 4.0's role as a global pioneer and visionary on standardisation and IT security. The administration shell concept is another key building block in this strategy. Work will focus on disseminating this concept around the world and implementing joint international examples of usage. The aim is to grant mutual access to test centres and thus to intensify global cooperation.



*It makes a lot of sense to enable the interoperability of Industrie 4.0 systems based on these reference architectures. The joint white paper between the Plattform Industrie 4.0 and the Industrial Internet Consortium marks a good first step in this direction."*

Thomas Hahn, Chief Software Expert, Siemens AG, Plattform Industrie 4.0

## Working Group “Reference architecture, standardisation”

HEADED BY Kai Garrels, ABB Stotz-Kontakt GmbH

### RESULTS IN 2017

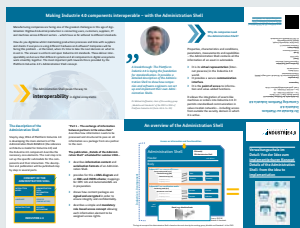
- ▶ RAMI 4.0 is a DIN standard (DIN SPEC 91345) and an international pre-standard (IEC PAS 63088).
- ▶ Alignment of RAMI 4.0 with other reference architectures, e.g. USA, France and China
- ▶ Concept of the Industrie 4.0 administration shell and interaction model
- ▶ Placing the Plattform Industrie 4.0 concepts in international bodies via a close partnership with the Standardisation Council Industrie 4.0 and the Labs Network Industrie 4.0.

### GOALS FOR 2018

- ▶ Establish RAMI 4.0 as a lingua franca for Industrie 4.0
- ▶ Identify gaps in standardisation
- ▶ Work on and deepen key issues
- ▶ Implement use cases in testbeds



### New publications:



#### Details of the Administration Shell: from the idea to Implementation

April 2018 | Factsheet



#### Relationships between I4.0 Components – Composite Components and Smart Production – Continuation of the Development of the Reference Model for the I4.0 SG Models and Standards

April 2018 | Working paper

<http://bit.ly/2HgP5fL>



#### Specifics of the Administration Shell: How companies can use and manage data in Industrie 4.0 on a standardised basis – an application scenario

April 2018 | Factsheet

<https://bit.ly/2okDxA9>



#### What criteria must Industrie 4.0 products meet? (only available in German)

April 2018 | Working paper

<http://bit.ly/2HO6Ns6>



#### Language for I4.0 components – communication structure and submodel “Tender” (only available in German)

April 2018 | Discussion paper

<http://bit.ly/2qO7J7D>





# Defining IT security as a quality asset

## The goals we've set ourselves

Data are the oil of the 21st century, and storing and processing them generate added value. Unlike oil, data are highly volatile: special attention must be paid to this characteristic in the form of a risk analysis. Security<sup>1</sup> delivers measures to reduce the known risks and must be built into digitalised manufacturing from the outset. It makes a major contribution to the success of the business and makes tomorrow's sales possible. Any company unable to demonstrate its security capabilities will find it difficult to obtain orders, loans or insurance. So this means that security is a key "enabler" for Industrie 4.0 in value creation networks.

For this to work in practice, a holistic approach is needed. The Plattform Industrie 4.0 is working on anchoring security as a quality asset – in global standardisation processes and in vocational training.

## How we're reaching the goals

### Defining IT security as a quality standard for Industrie 4.0

A machine equipped with adequate security measures does not manufacture more quickly or efficiently than an unprotected machine. So security has often tended to play a subordinate role for manufacturers and users.

The Plattform Industrie 4.0's experts are advocating a different perspective:

- In modern value chains, clients, suppliers and manufacturers are constantly sharing data.
- How can I be sure that my data are not being altered and that my expertise isn't being extracted without permission?
- What security measures has my business partner, client, supplier put in place in his organisation, processes, products?

1 IT security and security are used synonymously.



The core issues of the Working Group “Security of networked systems” (WG3) are secure communications for Industrie 4.0, identification and authentication in value creation networks, ensuring the integrity of data, systems and processes, and trustworthiness and the level of trust.

WG1 and WG3 work closely together to anchor security aspects in the fundamental architecture of Industrie 4.0. The WG “Security of networked systems” drew up the security requirements for the administration shell of the Industrie 4.0 components. Recently, the two working groups undertook a joint analysis of what security requirements are needed for cross-company communications and a secure implementation of OPC UA for operators, integrators and manufacturers for secure in-house communications. A continuation of work on cross-company communication and specific examples in a demonstrator are on the agenda for 2018. At the same time, gaps in standardisation and technology from the security point of

view are being fed into the standardisation and research roadmap. Smaller companies in particular can benefit from the working group’s guidelines on “IT Security in Industrie 4.0 – action fields for operators”, which helps firms roll out the technical and organisational requirements for digital and connected manufacturing.

Alongside the work on the fundamental technical concepts and the interfaces for standardisation, the WG describes the requirements for security-compliant corporate organisation and staff training in the Industrie 4.0 context. The results are being produced in cooperation with the Working Group “Work, education and training”, and are described in the relevant chapter (Shaping work and training for Industrie 4.0).



## Strengthening IT security internationally

The platform is engaged in a close dialogue with its partners from China, Europe, Japan and the U.S. The activities have crystallised in two areas:

- **Japan:** In a working paper, the Plattform Industrie 4.0 and its Japanese counterpart, the Robots Revolution Initiative, describe their common understanding of IT security in Industrie 4.0. The partners formulate five key principles for Industrie 4.0 security: Firstly, a structured approach should be planned (1), followed by a risk analysis (2) and the design of a robust security system (3), and then commissioning (4) and regular maintenance of the system (5). Both sides recommend the development of security standards to boost the global protection of users and clients. The standards should make reference to the afore-mentioned principles and undergo the internationally agreed standardisation processes (ISO or IEC bodies).
- **USA:** WG3 has been working with the Industrial Internet Consortium (IIC) since 2016. In the context of a joint demonstrator of “JoinTaskGroup 5 (JTG5) – Security Collaboration”, more than 20 companies presented

cross-company cooperation and the exchange of security-relevant information between companies at Hannover Messe 2017 in order to illustrate the Plattform Industrie 4.0 and IIC approaches.

”

*We need viable, global solutions for IT security in Industrie 4.0. That is the only way to establish the necessary trust between partners in value creation networks. We are working to anchor security at all levels in the consciousness and skills-set of the companies and to make it a key quality mark.”*

Michael Jochem, head of the Working Group  
“Security of networked systems” (WG3)




### Securing Global Industrial Value Networks

synchronising international approaches



14 and 15 May 2018, Berlin

**OUTLOOK:** On 14 and 15 May 2018, the Federal Ministry for Economic Affairs and Energy and the Plattform Industrie 4.0 are holding an international conference on “Securing Global Industrial Value Networks – Synchronising international approaches”. The conference brings international experts together with decision-makers from government and business to inject transparency into the various international approaches and necessary standards. The two-day conference will commence with an insight into the fundamental IT security requirements and national regulatory activities. The discussions on the second day will focus on technical aspects required in a connected and secure value creation network.



Further information and, following the conference, a documentation can be found here: [www.plattform-i40.de/](http://www.plattform-i40.de/)

## Working Group “Security of networked systems”

HEADED BY Michael Jochem, Robert Bosch GmbH

### RESULTS IN 2017

- ▶ Presentation of a security demonstrator with the IIC at Hannover Messe 2017
- ▶ Formulation of:
  - requirements for secure communication in Industrie 4.0
  - requirements for the secure use of OPC UA to communicate in Industrie 4.0 scenarios
  - prerequisites for the integrity of data, systems and processes
- ▶ proposal for roles with specific skills profiles in company organisations to implement security requirements

### GOALS FOR 2018

- ▶ Specifying in greater detail the basic requirements for the integrity of data, services and systems as a basis for trust in value creation networks
- ▶ Drafting the requirements for a security-appropriate corporate structure in the I4.0 context
- ▶ Active support for a demonstrator for the secure use of OPC UA
- ▶ Consolidation of (inter-)national cooperation
- ▶ Identifying/closing gaps standardisation and technology in the standardisation roadmap and research roadmap



Setting security as a quality asset

### New publications by WG3:



**Secure implementation of OPC UA for operators, integrators and manufacturers**  
(only available in German)

April 2018 | Discussion paper

<http://bit.ly/2HA4DP5>



**Security of the administration shell**  
(only available in German)

April 2017 | Discussion paper

<http://bit.ly/2F0QpRX>



**Integrity of Data, Systems and Processes as the Core Element of Networking and Digitalization**

April 2018 | Discussion paper

<https://bit.ly/2oiO7Ie>



**Facilitating International Cooperation for Secure Industrial Internet of Things/ Industrie 4.0**

March 2017 | Working paper with the Robot Revolution Initiative

<http://bit.ly/2vu4RT3>



**Secure communication for Industrie 4.0**

June 2017 | Discussion paper

<https://bit.ly/2wtXGHW>



**Usage Viewpoint of Application Scenario Value-Based Service**

April 2018 | Discussion paper

<http://bit.ly/2Hi6QeT>







# Shaping law for Industrie 4.0

## The goals we've set ourselves

In the legal context as well, data are becoming a valuable and much sought-after commercial asset. In the public debate, the focus tends to be on the collection and use of personal data. In the manufacturing sector, this aspect is of relevance, with one difference: data produced about and by machines can be systematically evaluated on a large scale via big data analytics. The smart evaluation generates new possibilities to boost efficiency and competitive advantages, including new business models. This begs the question: can “analogue” law keep pace with the rapid developments of digitalised industry? The platform hosts a dialogue between lawyers and practitioners. Existing regulatory provisions, e.g. on contracts, data protection, IT security, product liability, data ownership and labour law, still need clear legal foundations in the Industrie 4.0 context. Our work covers the legal aspects of the implementation of Industrie 4.0.

## How we're reaching the goals

### Data are a valuable assets – who owns data from machines?

The experts of the Working Group “Legal Framework” (WG4) have issued several publications addressing ownership of data from machines. The developments in the use of machine-generated data are so dynamic that any legislation assigning the ownership of such data to a specific economic actor might impede innovation. The Working Group believes that contract-based solutions are more appropriate here, particularly as agreements on the use of data and confidentiality are already common practice in industry.



## Market power, data ownership and the flow of information – cartel law in the age of Industrie 4.0

In many cases, the scope for making smart use of data only manifests itself when the data from more than one company are combined. Competitors can become partners, and partners can become competitors. This situation raises new questions about data ownership and the scope and admissibility of cooperation.

The experts of the Plattform Industrie 4.0's WG4 looked at the impact of Industrie 4.0 on cartel law in greater detail last year. How should the "data market" be defined in terms of cartel law? When does the collection or use of data breach cartel law? Where does data ownership result in market power and misuse of market power? Who is allowed to cooperate with whom, and under what conditions, in Industrie 4.0? And how should platforms be regarded and, if necessary, regulated in the context of competition law?

The Working Group concludes that current cartel law basically offers an appropriate and adaptable legal framework for Industrie 4.0 issues.

Measures should be taken in some areas in order to boost legal certainty for market participants. According to the Working Group, these include the development of economic methods to assess the various effects in the field of digital markets, some additions to the Act against Restraints of Competition, and the drafting of guidelines. WG4 also calls for the reduction in state-imposed barriers to free movement of data across borders and for the promotion of voluntary contract-based regulation.

For example, when it comes to assessing the sharing of data on digital platforms in terms of cartel law, it can be useful for the cartel authorities to publish guidelines. The authorities can give the platform and system operators and the participants guidance in the form of pointers about possible required conduct.



*The developments are taking place in leaps and bounds, and the possible ways to use data are virtually unlimited. For this reason, contract-based solutions are often preferable to legislation. The Working Group aims to provide ongoing legal support to make Industrie 4.0 legally secure for SMEs."*

Dr Hans-Jürgen Schlinkert,  
Head of Working Group "Legal Framework"

Finally, a new block exemption regulation for horizontal inter-company cooperation<sup>2</sup> should be introduced to provide the necessary legal certainty for cooperation between companies. Block exemption regulations are part of the EU's competition rules. They regulate exceptions from the ban on anti-competitive agreements between companies, decisions by associations of companies, and similar cartel-like conduct.

In the case of vertical cooperation between companies<sup>3</sup> there is the risk that the customer will find it more difficult to switch supplier. Here, technical standardisation ensuring basic interoperability can help.

2 "Horizontal cooperation" means that two companies at the same stage in the value chain work together, e.g. a manufacturer works together with another manufacturer.

3 "Vertical cooperation" means that two companies at the different stages in the value chain work together, e.g. a manufacturer works together with a supplier.

## Working group “Legal framework”

HEADED BY Dr Hans-Jürgen Schlinkert, thyssenkrupp AG

### RESULTS IN 2017

- ▶ Work on 17 dossiers on priority legal issues
- ▶ Drafting of recommendations for action resulting from this work

### GOALS FOR 2018

- ▶ Analysis of the significance of blockchain for current legislation
- ▶ Holding of conference on legal framework together with other lawyers
- ▶ In-depth consideration of AI at that conference
- ▶ Supportive formats for SMEs



Legal certainty for SMEs

### New publications:



**Cartel law in the light of Industrie 4.0**  
(only available in German)

April 2018 | Working paper

<http://bit.ly/2Hfl177>





# Analyzing new trends

## The goals we've set ourselves

The Plattform Industrie 4.0 has succeeded in bringing together companies, trade unions, policy-makers, associations and academics. This cooperation is to be systematically broadened to cover new issues. The consideration of new technology and new prospects is an ever-present agenda item for the platform, and is resulting in new structures.

What trends will emerge and play a role in digital industry? It is difficult to answer this question today, and this creates uncertainty. Observing trends and analysing new technologies offers gives companies some orientation and helps them keep tabs on new developments. For this reason, the Plattform Industrie 4.0 is monitoring technological and commercial trends. It has successfully repositioned itself for this task over the last few months.

## How we're reaching the goals

### Development of the data and platform economy

The possibilities for digital business models appear unlimited – so they are still hard for many business people to grasp; people are slow to implement new business ideas.

It is necessary to understand and make conscious use of the transformative power of new digital business models. The Plattform Industrie 4.0 is therefore pooling its expertise in a new Working Group. The WG "Digital business models in Industrie 4.0" (WG6) is establishing a uniform terminology, disclosing the principles underlying digital business models, and making them accessible to SMEs in particular. There are many different questions: Where does Germany stand in terms of Industrie 4.0 and smart services? How can we arrive at a common understanding of the issue? How can a typology of new business models be described? What best practices already exist? What is the economic significance of new business models, and what policy environment do we need to foster successful data-driven business models?

“

*The German economy needs to embrace digital business models. This is because, in the long term, competitiveness cannot be achieved solely via increases in efficiency. We want to work together with businesses, academia, associations and the social partners to develop proposals on how industry can take the step from the experimental digital phase to value-creating innovations.”*

Prof. Dr Svenja Falk, head of Working Group “Digital business models in Industrie 4.0”

## Working Group “Digital business models for Industrie 4.0”

HEADED BY Prof. Dr Svenja Falk, Accenture Dienstleistungen GmbH

### GOALS FOR 2018

- ▶ Taking stock of the debate about Industrie 4.0 and smart services in Germany
- ▶ Developing easy-to-understand terminology about digital business models in industry
- ▶ Identifying use cases and testbeds
- ▶ Drafting information and recommendations for action for SMEs



A positive policy environment for new business models



## 5G technology scenario

Industrie 4.0 needs open eyes and ears to identify changes in the world of connected industry. This is also part of the work being done by the Plattform Industrie 4.0. For example, the Working Group “Technology and Application Scenarios” (WG2, previously “Research and Innovation”) has spent the last few months studying and developing a scenario about the potential and new challenges arising from the decentralised control, analysis and optimisation of (mobile) production resources using 5G technology.

5G can offer a lot of benefits to industry: the technology offers real-time capability, it can transport data at high speeds, and it meets industry’s availability requirements. Also, it can connect a large number of senders and recipients (scalability). Unlike the largely technology-neutral application scenarios published in 2016, the first technology scenario considered by the Plattform Industrie 4.0 is

focused on the potential and challenges of a specific technology. In the case of 5G, the main issue is to implement Industrie 4.0 using new wireless interfaces and services. At the same time, the scenario reveals potential new business models resulting from the interaction of different interest groups and industries in several sectors, including mechanical engineering, microelectronics and mobile communications for digital factories.

In future, WG2 will continue its work on existing application scenarios and develop new ones. In a dialogue with other sectors and economic actors, it is studying new issues and evaluating them in terms of their relevance to the work of the Plattform Industrie 4.0, and is thus giving a fresh boost to the working groups. Thanks to this cross-cutting approach, key aspects like artificial intelligence in Industrie 4.0 and blockchain will be considered, to generate cross-WG value.

## Working Group “Technology and application scenarios”

HEADED BY Johannes Kalhoff, Phoenix Contact GmbH

### RESULTS IN 2017

- ▶ Continuation of the Industrie 4.0 research roadmap
- ▶ Presentation of the Industrie 4.0 research agenda
- ▶ Further development of the ten application scenarios
- ▶ Development of the technology scenario Mobile controlled manufacturing/5G for digital factories

### GOALS FOR 2018

- ▶ Exploration of new issues for the platform in a dialogue with external communities
- ▶ Identification of relevant technological and economic trends
- ▶ Development of further technology and application scenarios
- ▶ Boosting the work of the other WGs



Horizontal dialogue  
between all WGs

### New publications:

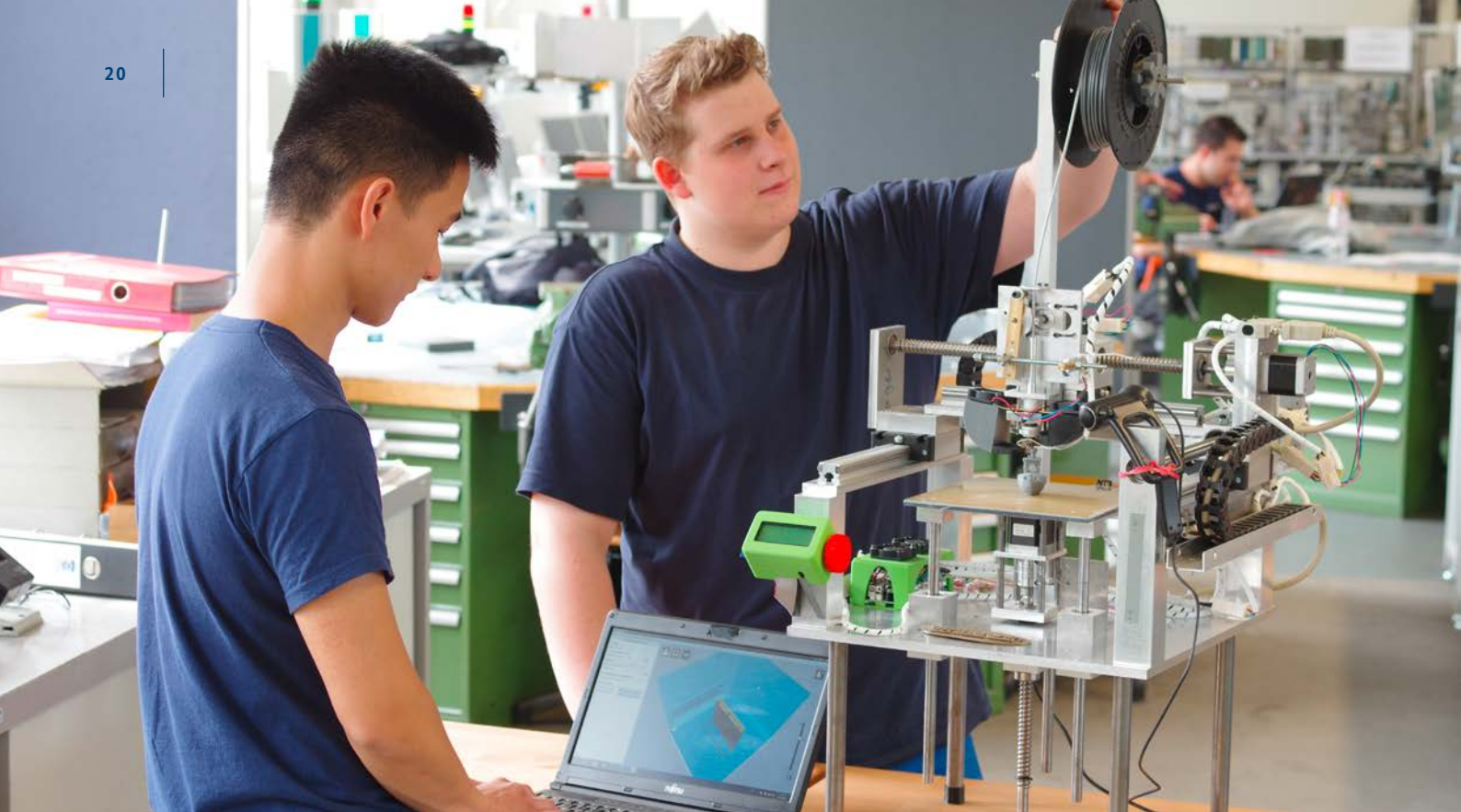


**MCP: Mobile Controlled Production/5G for Digital Factories**

February 2018 | Factsheet

<https://bit.ly/2NvjSZo>





# Shaping work and skills for Industrie 4.0

## The goals we've set ourselves

Industrie 4.0 is changing the skills that employees need to offer. It is merging IT, electrical engineering and mechanical engineering. This means that vocational training needs to become increasingly interdisciplinary. Also, the media, resources and forms of instruction used to teach the employees are changing. Agile support systems and new product development processes are changing the way people work together and the existing labour structures. In this situation, it is important to design the way people are trained and the way their work is organised – no easy tasks, because employees have a variety of needs. The Plattform Industrie 4.0 puts the focus on people, and tries to find practical solutions for companies – working in close dialogue with the social partners.

## How we're reaching the goals

### Skills and the organisation of work in IT security

Workers, engineers, IT specialists, executives: they are the driving forces of Industrie 4.0. If they are to be able to develop and safely control the digital processes, they will need interdisciplinary skills. Often, digitalisation is mainly considered from the technical viewpoint. Concepts for IT security, for example, tend to regard the human being merely as a potential source of error. The Plattform Industrie 4.0 is putting this right.

Recommendations for companies and policy-makers are presented in the platform's "Qualifizierungs-Leitfaden für Betreiber" (Training guidelines for operators) of the "Work, education and training" Working Group, and the brochure on "Industrie 4.0 security in vocational and advanced training" of the "Security of connected systems" Working Group. These two working groups have pooled their expertise in an interdisciplinary team of experts: recommendations regarding organisation and skills for Industrie 4.0 will follow in the course of this year.



### Shaping Industrie 4.0 in the dialogue between the social partners

Employers and employees have a lot of uncertainties to cope with as they try to design forward looking ways to organise work. One thing is sure: it is vital for employers and employees to work together as equals as they design the working environment of tomorrow in order to arrive together at better results and solutions. The principle of co-determination, as is practised in many places in Germany, has proved a successful model, as is shown by a collection of examples from the “Work, education and training” Working Group (WG5). Companies are taking a variety of approaches: from the digitalisation congress in which staff are directly involved, to the learning and research factory which enables individual workers to experience the new working environment. Management and works councils are working closely together and are not shying away from contentious debates. The Working Group initiates

regular social partner dialogues focusing on a constructive debate about contentious issues and lines of conflict. A summary of the dialogue-based approach and practical examples from companies was published at the beginning of the year to provide some guidance for the social-partner-based approach.

### Putting the emphasis on the human being: changes in work and skills requirements due to new technologies

Humans have always used technology to help them do their work. However, employees are now encountering a new quality and complexity in their interaction with technology, e.g. due to language recognition and artificial intelligence. Entirely new fields of activity are emerging in the companies; existing processes are being enriched from additional information supplied by the assistance systems,

”

*The human being remains the driving force in the world of Industrie 4.0. Working from this premise, we are looking into how skills and work structures need to change in organisations so that connected industry can be implemented safely.”*

Michael Krammel, head of the sub-working group on organisation and skills

and responsibilities are shifting. Data glasses, augmented and virtual reality, language and gesture recognition and artificial intelligence offer an opportunity to adapt jobs to the individual needs of the employees. Building on the assumption that cooperation between people and machines can offer added value for all sides, WG5 is taking up the issues that need to be addressed in order to design a sustainable and appropriate use of new technologies: How can jobs be adapted to take account of the changing processes in the use of assistance systems? What restrictions derive from the evaluation of user data from the assistance

systems? How can artificial intelligence be used sensibly for in-house learning processes? The Working Group takes a systematic approach to these questions, and is illustrating them in 2018 with initial practical experience made in companies.

## Working Group “Work, education and training”

HEADED BY Konrad Klingenburg, IG Metall until 03/2018, since then headed by Martin Kamp, IG Metall

### RESULTS IN 2017

- ▶ Boosting the understanding of corporate training projects via visits to Bosch, KUKA, Festo and Airbus
- ▶ Developing a common understanding of training issues (e.g. updating of course requirements)
- ▶ Consideration of the order-controlled production scenario and aspects of work and training

### GOALS FOR 2018

- ▶ Making the focal issue of “Artificial intelligence and learning in the operational context” understandable and relevant for companies
- ▶ Highlighting the opportunities and significance of agile working
- ▶ Making contributions to “Future worlds of work” for the 2018 Year of Science
- ▶ Developing a strategy for the acceptance of Industrie 4.0 in companies



**Acceptance and networking**  
for Industrie 4.0 amongst employees

**Social partner dialogues at the Digital Summit and the Hannover Messe trade fair**  
**New publications:**



**Shaping work with an order-controlled production scenario (only available in German)**

April 2018 | Working paper

<http://bit.ly/2LncRsl>



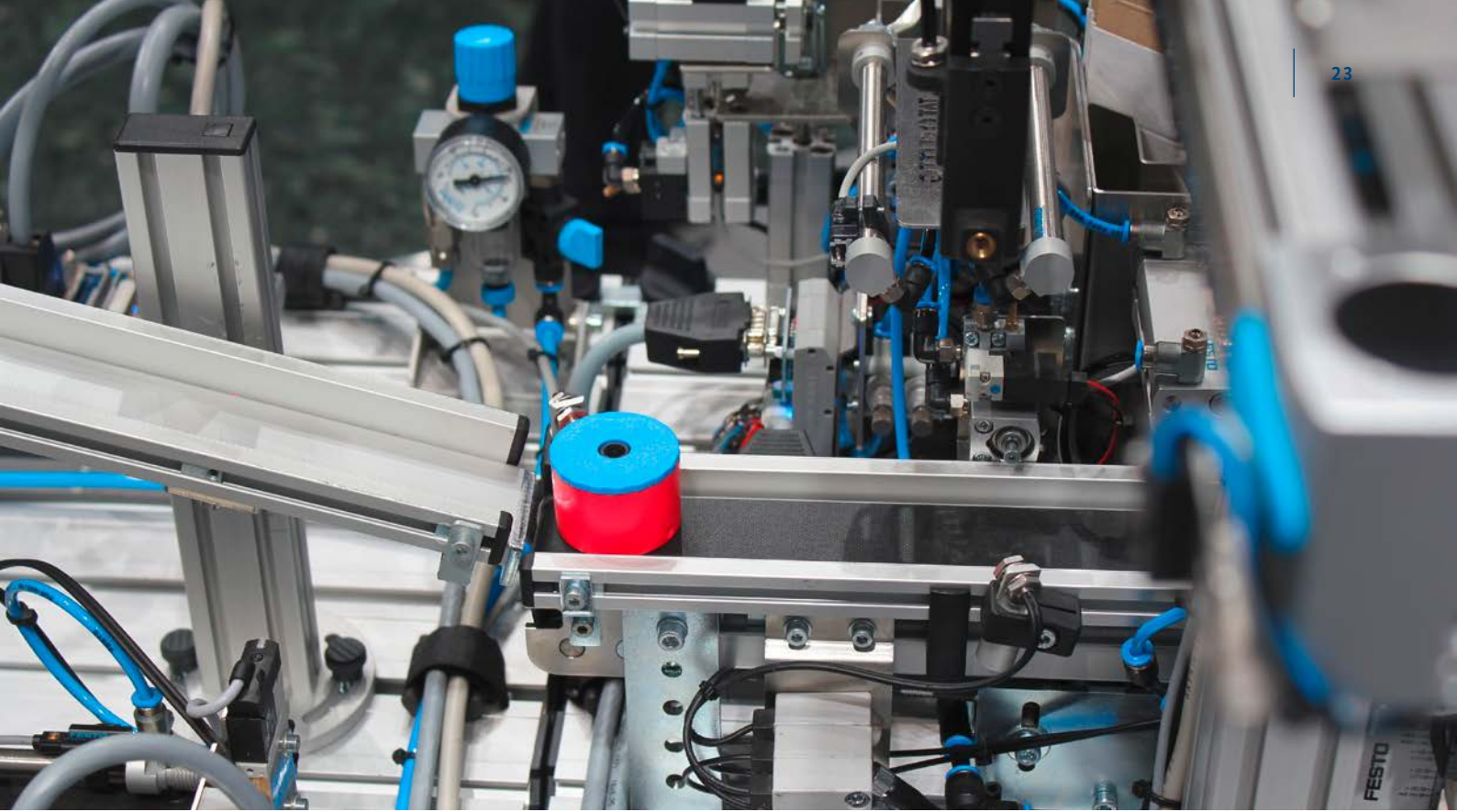
**Shaping Industrie 4.0 together – contribution by the social partners to work, initial and advanced training (only available in German)**

December 2017 | Working paper

<http://bit.ly/2F2E148>







# Supporting with practical implementation tools

## The goals we've set ourselves

Industrie 4.0 will only be a complete success for Germany if SMEs achieve their digital transformation. SMEs generate more than half of the value added and provide more than 60% of all jobs in industry. Many SMEs have become established world market leaders in their specific manufacturing sector. They are indispensable suppliers and drivers of innovation for the competitiveness of Germany's economy. The platform is therefore aiming to help companies embrace the fundamental principles of Industrie 4.0.

If, in addition to this, digital value creation networks grow together and Industrie 4.0 becomes rooted throughout the business community in Germany, there will be a need for cross-sectoral approaches which ensure that production can be a smooth process from the machine to the customer. For that reason, the platform is seeking to engage in dialogue with neighbouring sectors and other transfer-driving stakeholders via information services, expert dialogues and conferences.

## How we're reaching the goals

### Offering support via the 4.0 SME transfer network

SMEs don't have to feel their own way into the digital age – there are numerous stakeholders offering them support in the form of information, workshops, advice and much more. These services are abundantly available, and information can be found in (too) many places. At first glance, it is difficult for companies to find their way. In the summer of 2017, the Economic Affairs and Research Ministries launched the Industrie 4.0 transfer network. It aims to intensify the dialogue between all the parties offering support to SMEs, and to provide transparency about what is available, in order to ensure rapid and effective support for companies.

The transfer network includes Industrie 4.0 initiatives of the Länder, the SME centres of excellence supported by the Economic Affairs Ministry, the associations Bitkom, VDMA and ZVEI, the chambers of industry and commerce, the Research Ministry, the Economic Affairs Ministry, LNI e.V., and of course the Plattform Industrie 4.0. The network is



currently being launched. Initial networking is taking place and ideas for synergies developed. These include an expert dialogue between the Plattform Industrie 4.0 and centres of excellence, the production of explanatory material about issues like standardisation or legal aspects, a better dissemination of examples of best practice, the establishment of a network of experts for workshops and conferences.

The Plattform Industrie 4.0 is providing organisational assistance to the transfer network. At the same time, the Plattform Industrie 4.0 has its own transfer activities, such as the Industrie 4.0@Mittelstand series of events, which is run together with the chambers of industry and commerce and invites companies around Germany to share expertise, and the Industrie 4.0 Compass, which helps companies access the network's services.

### Sectoral dialogue: the example of Chemicals 4.0

Value chains are turning into value networks. The next key step for the digitalisation of the economy will greatly depend on agreements on standards and the formation of networks.

At the 2017 Digital Summit, BASF, SAP, Pepperl+Fuchs, SAMSON and Endress+Hauser presented the first Industrie 4.0 solution for the chemical industry. The solution is founded on RAMI 4.0 and the Industrie 4.0 component – two concepts from the Plattform Industrie 4.0. The display

by companies from the chemical industry, measurement and control technology, sensor technology and information technology, offers a prototype of how data of individual control valves and flow meters can be collated centrally and then processed for different users. The simultaneous evaluation of all sorts of data makes it possible to undertake prospective maintenance of the equipment and thus creates a new, service-oriented business model.

Boosted by these initial fruits of cooperation, the platform will continue to identify interfaces and find common solutions in a dialogue with different sectors.

”

*Industrie 4.0 solutions help us to plan and implement our chemicals production in a more forward looking way.*

Rolf Windecker,  
process manager at BASF





# The Plattform Industrie 4.0 at a glance

## Orientation for SMEs

### Industrie 4.0 map: examples of applications and use cases

The Plattform Industrie 4.0's nationwide online map depicts well over 300 examples of Industrie 4.0 in practice. These show where Industrie 4.0 is already part of day-to-day operations in Germany. Also, the map depicts 67 test centres where companies can research, test and develop their Industrie 4.0 applications. In addition, companies can find 62 non-commercial information and advice services, with contact points, and thus take the next step towards implementing in-house Industrie 4.0 solutions.



### Industrie 4.0 Compass: roadmap for the digital transformation

The Industrie 4.0 Compass offers orientation and a rapid overview. To enable companies to gain a rapid overview of the host of Industrie 4.0 support services, the Compass

offers a structured and systematic categorisation of the available services. Numerous services from centres of excellence, regional networks, Länder initiatives and many other transfer providers have been listed over the course of a year – and the list is being constantly updated.





### Industrie 4.0 online library: digitally processed expert knowledge

The online library offers the findings and guidelines produced by the platform, as well as publications by the

platform's partners. More than 100 publications are available as free downloads. They range from introductory documents about Industrie 4.0 to highly specialised contributions towards discussions, from recommendations for action and studies through to guidelines.

The image shows a large exhibition stand for the 'Plattform Industrie 4.0: Wegweiser und Begleiter von KMU' (Guidance for SMEs). The stand features a blue header with the title and a blue box labeled 'Online-Bibliothek'. Below the header, there are two rows of book covers. The top row is divided into two sections: 'STANDARDS VERNETZTER SYSTEME' (Networked Systems Standards) and 'FORSCHUNG DER DIGITALISIERUNG' (Research on Digitalization). The bottom row is divided into two sections: 'SICHERHEIT IM INTERNET DER DINGE' (Security in the Internet of Things) and 'RECHTSFRAGEN DER SM' (Legal Questions of SMEs). A QR code is displayed on the stand, with text indicating that all publications are available for download from the Plattform Industrie 4.0's online library. The text also provides the URL [www.plattform-i40.de/I40/Online-Bibliothek](http://www.plattform-i40.de/I40/Online-Bibliothek) and mentions that the content is also available in English. A man in a suit is seen from the back, looking at the stand.

**PLATTFORM INDUSTRIE 4.0:  
WEGWEISER UND BEGLEITER VON KMU**  
Guidance for SMEs

**Online-Bibliothek**

**STANDARDS VERNETZTER SYSTEME**

**FORSCHUNG DER DIGITALISIERUNG**

**SICHERHEIT IM INTERNET DER DINGE**

**RECHTSFRAGEN DER SM**

All publications are available for download from the Plattform Industrie 4.0's online library:  
[www.plattform-i40.de/I40/Online-Bibliothek](http://www.plattform-i40.de/I40/Online-Bibliothek)

Also available in English

## International activities

### Global solutions: The Plattform Industrie 4.0 as an international hub and stimulator of debate



By definition, Industrie 4.0 is a cross-border phenomenon, and this is good reason for the platform to operate not only within Germany, but also on a European and a global basis. Taking a joint approach to the cross-border opportunities and challenges linked to digitalisation is at the heart of the approach taken by the Federal Government and by the Plattform Industrie 4.0. The platform addresses forward looking issues in numerous examples of bilateral and multilateral cooperation, and it helps to drive international debates on the digital transformation of manufacturing.

The focus for the members of the platform is on a sharing of expertise. The aim is to co-ordinate open, interoperable and secure standards and reference architectures. The harmonisation of RAMI 4.0 with reference architectures from the U.S., France, Italy and China confirms that there is a very similar understanding of the basic principles. Cooperation with the Labs Network Industrie 4.0 and the Standardisation Council Industrie 4.0 ensures a coordinated approach to feeding the platform's ideas into international standardisation processes (cf. also chapter "Driving (international) standardisation").

The dialogue on various approaches towards a regulatory framework is also very valuable for the stakeholders on the platform. Data ownership, data usage and competition law are important areas in which a balance of interests needs to be achieved between suppliers and users of Industrie 4.0 technologies. Transparent approaches create a level playing field between the various economic areas.

### Trilateral cooperation between Germany, France and Italy



At European level, Germany's Plattform Industrie 4.0, France's Alliance Industrie du Future and Italy's Piano Impresa 4.0 (formerly: Piano Industria 4.0) building up a trilateral alliance (TRICOOP). They have established a joint plan of action. Three working groups focus on standardisation, supporting SMEs, and the legal framework.



**Trilateral Cooperation on Digitizing the Manufacturing Industry Common Position on „Data Ownership“**

<http://bit.ly/2F3P5Of>



**The Structure of the Administration Shell**

<http://bit.ly/2qLJVik>





The initial results demonstrate the influence exerted by the three European industrial nations. A joint commitment to interoperable, open, scalable standards, characterised by plug&play and security concepts, provides a framework for advocating a joint position in international standardisation bodies. All of the parties support the elaboration of the Administration Shell, and this will speed up the rapid specification of the sub-models.

At the same time, TRICOOP has launched a European debate via its coordinated position on data ownership. Its message that, at present, there is no need to regulate the exchange of data in the industrial sector, and that contractual arrangements are entirely adequate, is a clear signal from the three initiatives. At the same time, they are showing where the weakness in the exchanging of data are to be expected, and are raising awareness on the part of stakeholders in the EU of potential misuse or monopolisation of data.

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### European Union: Digitising European Industry initiative

The European Commission's Digitising European Industry initiative organises the networking of the 30-plus national initiatives to digitise industry in Europe.

The series of events, which was launched in Essen in 2017 by the Economic Affairs Ministry and the European Commission, entered its second round in Paris on 27 and 28 March 2018. The Plattform Industrie 4.0 took up the invitation from the European Commission and the French Ministry for the Economy and Finance, and intensified the dialogue with the European partners. France's Alliance Industrie du Future initiative, which hosted the event, succeeded in its aim of bringing the European initiatives together and establishing continuity in the dialogue. The focus was not only on the national initiatives, but also on a presentation of the European funding for digital innovation hubs, which are to be built up as a core element of the strategy to digitise European industry. At the same time, a working group on standardisation was set up at EU level to advise the European Commission on this issue; it intends to network closely with the trilateral work being done by Germany, France and Italy.




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### Japan: Robot Revolution & Industrial IoT Initiative

Germany and Japan are key partners when it comes to the digitalisation of industry. This is a good foundation for a joint consideration of the opportunities and challenges. The Plattform Industrie 4.0 and Japan's Robot Revolution Initiative (RRI) have been working in close partnership since February 2016 on international solutions, and are benefiting from the pooling of expertise. The two partners raised their dialogue to a new level in 2017: the "Hannover Declaration" between Germany's Economic Affairs Ministry and Japan's Ministry of Economy, Trade and Industry (METI) and Japan's Ministry of Internal Affairs and Communications (MIC) set out an agreement on close cooperation in the field of Industrie 4.0. In a joint paper, the platform and the RRI stress the importance of international standards which also address IT security aspects. Flagship events like the German-Japanese forum at this year's Hannover Messe trade fair mark a further milestone.



### USA: Industrial Internet Consortium



Cooperation between Germany and the U.S. continued unabated in the last 12 months. The joint IIoT World Tour saw the platform and its U.S.-based partner, the Industrial Internet Consortium (IIC), presenting their results around the world and strengthening cross-border cooperation – with support from Germany’s bilateral chambers of commerce. Events in Turin, Singapore and San Francisco hosted debates on the latest developments in digitised industry between more than 400 experts from companies and government.

The interplay between the architecture models RAMI (Reference Architecture Model for Industrie 4.0) and IIRA (Industrial Internet Reference Architecture) continues to be a key issue for the partnership. The Joint Task Groups published their findings in two publications – one on reference architecture models and one on product life cycle. A further publication followed this year about the first joint demonstrator in the field of industrial cyber security at the 2017 Hannover Messe trade fair.

The Plattform Industrie 4.0 will be represented with its own events at the U.S. equivalent of the Hannover Messe in Chicago in 2018. The international arena serves to host a dialogue on projects already underway, e.g. on industrial cyber security.

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### China



Cooperation with China involves three areas of policy cooperation: 1) A Memorandum of Understanding between the Economic Affairs Ministry and China’s Ministry of Industry and Information Technology (MIIT) on cooperation between Germany and China in the area of Industrie 4.0. 2) Under the umbrella of the Sino-German Commission for co-operation on standardisation, a sub-working group on Industrie 4.0 / smart manufacturing was set up between the Economic Affairs Ministry, the Standardisation Council Industrie 4.0, the Standardization Administration of China, and MIIT. 3) In January 2016, the German Research Ministry and the Chinese Ministry of Science and Technology signed an MoU on scientific and technological cooperation in the field of smart manufacturing (Industrie 4.0) and smart services.

The bilateral political cooperation in these three areas provides for a joint meeting at vice minister level each year. The next meeting is scheduled for autumn 2018. The focus of the discussions is on issues like standardisation, data security, intellectual property, demonstration projects and, currently, the Chinese Cyber Security Law. Ongoing projects between companies and research institutes are also to be made visible as key steps in a systematic dialogue.



### Other cooperation

Germany's G20 Presidency, which ended in late 2017, gave a big boost to the global dialogue on digital policy. The Digital Ministers of the 20 leading industrial countries elaborated the Roadmap "Policies for a Digital Future", which outlines 11 priority fields of action for the coming years. In the run-up to this, the Federal Ministry for Economic Affairs and Energy and the Plattform Industrie 4.0 held a high-level conference with more than 500 international experts. The conference facilitated a dialogue between Industrie 4.0 initiatives from the G20 countries, highlighted best practices and addressed key issues in three panels and 13 workshops. The aim was also to boost international cooperation on Industrie 4.0, e.g. on standardisation, access to test centres and support for SMEs. It was accompanied by an exhibition by various national initiatives. The results of the conference were summarised in a comprehensive report and can be downloaded.

At the 2017 Hannover Messe trade fair, Germany's Plattform Industrie 4.0 and the Australian Prime Minister's Industry 4.0 Task Force agreed on closer cooperation in order to leverage the potential for both economies in this area. The Plattform Industrie 4.0 was subsequently delighted to accept the invitation to Perth for a dialogue during the Asia-Pacific Conference in October.

In the Asia-Pacific region, the platform also intensified its collaboration with South Korea. For a first meeting, the platform's Global Representative, Prof. Henning Kagermann, travelled to Seoul and witnessed a country which understands that the fourth industrial revolution is resulting in far-reaching changes in society.

These three activities are just some examples of other international efforts. The Plattform Industrie 4.0 believes that international and intercontinental alliances can help speed up the digitalisation of industry.



#### Digitising Manufacturing in the G20 – Initiatives, Best Practice and Policy Approaches

November 2017 |  
Conference Report



<http://bit.ly/2K47TAU>

## The stakeholders on the Plattform Industrie 4.0

**The Plattform Industrie 4.0 is driven by policy-makers, business representatives, academics, associations and trade unions. More than 300 stakeholders from more than 150 organisations (as of April 2018) are actively involved in the work of the platform:**

### A

ABB AG  
 ABB STOTZ-KONTAKT GmbH  
 acatech – National Academy of Science and Engineering  
 Accenture Dienstleistungen GmbH  
 admeritia GmbH  
 aicas GmbH  
 Airbus Group SE  
 Airbus Operations GmbH  
 Alexander von Humboldt Institute for Internet and Society (HIIG)  
 Association of Energy and Water Industries (BDEW)  
 Association of German Chambers of Commerce and Industry (DIHK)  
 Assystem Germany GmbH  
 Atos Deutschland  
 AUDI AG  
 Automotive Industry Association (VDA)

### B

BASF SE  
 Bavarian Ministry of Economic Affairs and Media, Energy and Technology  
 Benteler Deutschland GmbH  
 Benteler International GmbH  
 Berner & Mattner Systemtechnik GmbH  
 Bird & Bird LLP  
 BMW Group  
 Bosch Rexroth AG  
 Bosch Software Innovation GmbH  
 Bundesdruckerei GmbH  
 Bundesnetzagentur

### C

Chemnitz University of Technology  
 College of Fine Arts Berlin  
 Coriant GmbH & Co. KG

### D

Daimler AG  
 Deutsche Telekom AG  
 Deutsches Institut für Normung e. V. (DIN)  
 Dürr Aktiengesellschaft

### E

EABB Consulting  
 EnBW Energie Baden-Württemberg AG  
 Ericsson GmbH  
 ESR Pollmeier GmbH Servo-Antriebstechnik  
 Evosoft GmbH

### F

Federal Chancellery  
 Federal Ministry for Economic Affairs and Energy  
 Federal Ministry of Education and Research  
 Federal Ministry of Justice and Consumer Protection (BMJV)  
 Federal Ministry of Labour and Social Affairs  
 Federal Ministry of the Interior  
 Federal Office for Information Security (BSI)  
 Federation of German Industries (BDI)  
 Festo AG & Co. KG  
 Festo Didactic SE  
 Fraunhofer Institute for Applied and Integrated Security (AISEC)  
 Fraunhofer Institute for Experimental Software Engineering (IESE)  
 Fraunhofer Institute for Machine Tools and Forming Technology (IWU)  
 Fraunhofer Institute for Manufacturing Engineering and Automation (IPA)  
 Fraunhofer Institute for Material Flow and Logistics (IML)  
 Fraunhofer Institute for Production Systems and Design Technology (IPK)  
 Fraunhofer Institute of Optronics, System Technologies and Image Exploitation (IOSB)  
 Fraunhofer Research Institution for Microsystems and Solid State Technologies (EMFT)

Fraunhofer Society  
Free University Berlin  
Fritz Communication  
Fujitsu Technology Solutions GmbH

## G

GE Digital  
genua GmbH  
German Association for Information Technology,  
Telecommunications and New Media (BITKOM)  
German Commission for Electrical, Electronic &  
Information Technologies of DIN and VDE (DKE)  
German Engineering Federation (VDMA)  
German Research Centre for Artificial Intelligence (DFKI)  
Gesellschaft für Informatik (GI)  
Giesecke + Devrient Mobile Security GmbH  
GREIF-VELOX Maschinenfabrik GmbH

## H

HARTING AG & Co.KG  
HDI Global SE  
Helmut Schmidt University, Institute for Automation  
Technology  
Hewlett Packard Enterprise  
Hirschmann Automation and Control GmbH  
HiSolutions AG  
Hitachi High-Technologies Europe GmbH  
HUAWEI TECHNOLOGIES Deutschland GmbH  
HUAWEI TECHNOLOGIES Düsseldorf GmbH  
Hugo Sinzheimer Institut für Arbeitsrecht

## I

IABG mbH  
IBM Deutschland GmbH  
ifak, Institut für Automation & Kommunikation e.V.  
Magdeburg  
IG Metall  
IG Metall Baden-Württemberg  
IMA Klessmann GmbH  
Infineon Technologies GmbH  
Institute for Practical Interdisciplinarity (Institut PI, Berlin)  
Institute of Electronic Business e.V. (IEB)  
INTEC International GmbH  
Intel Deutschland GmbH  
ISRA VISION AG  
IUNO coordination body

## J

J. Müller Agri + Breakbulk Terminals GmbH & Co. KG  
Jones Day

## K

Kaiserslautern University of Applied Sciences  
Karlsruher Institut für Technologie (KIT), wbk Institut für  
Produktionstechnik  
KLOECKNER DESMA Schuhmaschinenfabrik GmbH  
Knick Elektronische Messgeräte GmbH & Co. KG  
KORAMIS GmbH  
KUKA AG  
KUKA Roboter GmbH

## L

Labs Network Industrie 4.0  
Lenze Engineering GmbH & Co. KG  
Lenze SE  
Luther Rechtsanwaltsgesellschaft mbH

## M

M&M Software GmbH  
Maschinenfabrik Reinhausen GmbH  
Merck KGaA  
Microsoft Corporation  
Microsoft Deutschland GmbH  
Ministry of Economic Affairs, Employment and Transport  
of Lower Saxony  
Ministry of Finance and Economic Affairs of  
Baden-Württemberg  
Mitsubishi Electric Europe B.V.

## N

NewTec GmbH  
Noerr LLP  
NXP Semiconductors Germany GmbH

## O

OFFIS – Institute for Information Technology,  
Oldenburg University  
Ostwestfalen-Lippe University of Applied Sciences,  
Institute Industrial IT (inIT)

## P

Pepperl + Fuchs GmbH  
PHOENIX CONTACT Cyber Security AG  
PHOENIX CONTACT Electronics GmbH



PHOENIX CONTACT GmbH & Co. KG  
PHOENIX CONTACT Software GmbH  
PSI Automotive & Industry GmbH

## Q

Qualcomm CDMA Technologies GmbH

## R

RWTH Aachen University, Fraunhofer Institute for  
Manufacturing Engineering and Automation (IPA)  
Robert Bosch GmbH  
Rockwell Automation

## S

SAMSON AG  
SAP SE  
Scaltel AG  
Schaeffler AG  
Schaeffler Technologies AG & Co. KG  
Schneider Electric Automation GmbH  
Schuler AG  
secunet Security Networks AG  
Sick AG  
Siemens AG  
Sirrix AG  
SKW Schwarz Rechtsanwälte mbB  
Software AG

## T

T/S/C Fachanwälte für Arbeitsrecht Schipp & Partner  
Rechtsanwälte mbB  
Technische Universität Berlin, Institute for Machine Tools  
and Factory Management  
Technical University of Munich, Institute for Machine Tools  
and Industrial Management, Department of Informatics  
thyssenkrupp AG  
tresmo GmbH  
TRUMPF GmbH + Co. KG  
T-Systems International GmbH  
T-Systems Multimedia Solutions GmbH  
TU Darmstadt  
TU Dortmund University  
TU Kaiserslautern  
TÜV Rheinland Industrie Service GmbH

## U

University of Göttingen  
University of Hohenheim  
University of Jena  
University of Kassel  
University of Paderborn, Heinz Nixdorf Institute  
University of Passau  
University of Stuttgart, Institute of Industrial  
Manufacturing and Management

## V

Vattenfall GmbH  
VDI The Association of Engineers  
VDI/VDE Innovation + Technik GmbH  
viastore SYSTEMS GmbH  
Vodafone GmbH  
Voith GmbH  
Volkswagen AG

## W

Weidmüller Holding AG & Co.KG  
Weidmüller Interface GmbH  
Werkzeugmaschinenlabor WZL RWTH  
WIBU Systems  
WITTENSTEIN SE

## Z

ZF Friedrichshafen  
ZVEI German Electrical and Electronic Manufacturers'  
Association

## Ways to get involved

The broadbased inclusion and networking of all relevant stakeholders enables the Plattform Industrie 4.0 to achieve the necessary dialogue to find innovative responses to the challenges of industrial digitalisation.

The **Working Groups** are basically open to all interested representatives of companies and works councils. Further experts are invited as guests to be key impulse-givers, dialogue partners and shapers of the substantive debates in the Working Groups.

### Participation in the Working Groups

Please send us a brief profile of your expertise if you would like to participate in the Working Groups.

Geschäftsstelle Plattform Industrie 4.0

Bertolt-Brecht-Platz 3

10117 Berlin

Tel.: +49 30 2759506650

[geschäftsstelle@plattform-i40.de](mailto:geschäftsstelle@plattform-i40.de)

Companies can submit Industrie 4.0 solutions as **examples of applications** for inclusion on the Industrie 4.0 online map.

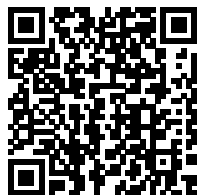


<http://bit.ly/2sTDgY4>

### Submission of examples of Industrie 4.0 applications

Are you using an Industrie 4.0 solution in your company, and would you like to include your example on the map? Send us a brief description of your project and your contact information via our contact form.

Research institutes can suggest test environments for Industrie 4.0 applications for inclusion on the online map.

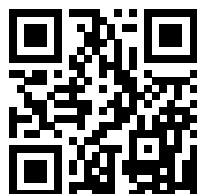


<http://bit.ly/2sTDgY4>

### Presentation of Industrie 4.0 test environments

Would you like to suggest a test environment for the online map in which Industrie 4.0 applications can be tested by companies? Do send us your suggestion via our contact form.

Participation in the platform's events enables you to discuss Industrie 4.0 issues and to network with other stakeholders.



<http://bit.ly/2ukZQaf>

### Events organised by the Plattform Industrie 4.0

Find out about the latest events organised by the Plattform Industrie 4.0 and its stakeholders under "Termine" on the website.

[www.plattform-i40.de](http://www.plattform-i40.de)

## Publications of the Plattform Industrie 4.0 at a glance



All publications are available for download from the Plattform Industrie 4.0's online library:  
[www.plattform-i40.de/I40/Online-Bibliothek](http://www.plattform-i40.de/I40/Online-Bibliothek)

### Plattform Industrie 4.0



Applying Industrie 4.0. Forward Thinking. Practical. Connected.

Progress report  
April 2018



10-point plan for Industrie 4.0 – recommendations by the Plattform Industrie 4.0 (only available in German)

10-point plan

### Cross-Working Groups



Application Scenario in Practice: Order-controlled Production of a Customised Bicycle Handlebar

Working paper

### Research Council



Industrie 4.0 und das Recht: drei zentrale Herausforderungen (only available in German)

Study



Categorisation of the examples of the Industrie 4.0 map in the application scenarios (only available in German)

Study



Engineering smart products and services Plattform Industrie 4.0 (only available in German)

Study



Versatile, human-centred structures in factories and Industrie 4.0 networks (only available in German)

Study

### Reference architecture, standardisation and norms



Language for I4.0 components – communication structure and submodel "Tender" (only available in German)

Discussion paper



Relationships between I4.0 Components – Composite Components and Smart Production Update to the Reference Model for the Industrie 4.0-Component

Working paper



What criteria must Industrie 4.0 products meet? (only available in German)

Guidelines



How to write an OPC UA Companion Specification (only available in German)

Discussion paper



Communication protocols of Industrie 4.0

Discussion paper



Flyer on "Specifics of the Administration Shell" and "Details of the administration shell"

Discussion paper



Structure of the Administration Shell: Progressive development of the reference model for the Industrie 4.0 Component (only available in German)

Working paper



Interaction Model for Industrie 4.0 Components

Discussion paper



Network-based communication for Industrie 4.0

Discussion paper



Industrie 4.0 Plug-and-Produce for Adaptable Factories: Example Use Case Definition, Models, and Implementation

Discussion paper



Relationships between I4.0 Components – Composite Components and Smart Production

Working paper



Reference Architecture Model Industrie 4.0 (RAMI 4.0) – An introduction (only available in German)

Guidelines



Network-based Communication for Industrie 4.0 – Proposal for an Administration Shell

Discussion paper



Interaction Model for Industrie 4.0 Components (only available in German)

Discussion paper



Secure communication for Industrie 4.0 (WG1 and WG3)

Discussion paper



The structure of the Administration Shell: TRILATERAL PERSPECTIVES from France, Italy and Germany

International Paper

## Technology and application scenarios



Usage Viewpoint of Application Scenario Value-Based Service

Discussion paper



Benefits of Application Scenario Value-Based Service

Working paper



Exemplification of the Industrie 4.0 Application Scenario Value-Based Service following IIRA Structure

Working paper



Aspects of the Research Roadmap in Application Scenarios

Working paper



Research agenda Industrie 4.0 – update of the need for research (only available in German)

Working paper



Proposal for a joint “scenario” of Plattform Industrie 4.0 and IIC

Discussion paper

## Security of networked systems



Secure use of OPC UA in Industrie 4.0 (only available in German)

Discussion paper



Integrity of Data, Systems and Processes as the Core Element of Networking and Digitalization

Discussion paper



IT Security – action fields for operators Guidelines

Guidelines



Security in RAMI 4.0

Guidelines



Security of the administration shell (only available in German)

Discussion paper



Technical Overview: Secure cross-company communication

Working paper



Technical Overview: Secure Identities

Working paper



Industrie 4.0 security in vocational and advanced training

Working paper

## Legal framework



IT Security in Industrie 4.0: First steps towards secure production

Guidelines



Cartel law in the light of Industrie 4.0 (only available in German)

Working paper



Industrie 4.0 – How well the law is keeping pace

Working paper



Aspects of the Research Roadmap in Application Scenarios

Working paper



Digitalised industry – analogue law? An overview of the fields of action (only available in German)

Working paper

## Work, education and training



Shaping work with an order-controlled production scenario (only available in German)

Working paper



Shaping Industrie 4.0 together – contribution by the social partners to work, initial and advanced training (only available in German)

Working paper



Examples of and recommendations for initial and advanced training (only available in German)

Guidelines



Industrie 4.0 Guide to initial and advanced training for SMEs (only available in German)

Guidelines



Work, initial and advanced training in the application scenarios (only available in German)

Discussion paper

