PLATTFORM
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PROGRESS REPORT
APRIL 2016

Digitization of Industrie –
Plattform Industrie 4.0

Preface

Whether we consider it revolution or evolution, disruption or transformation – we are witnessing fundamental changes to society and the economy thanks to digitization. To equip ourselves for the race for tomorrow's products and markets, the foundations for the digital transformation of our industries must be laid today. This is one of the central tasks in the coming years, a task that we want to tackle together in Plattform Industrie 4.0. At the heart of this transformation is the one factor that is key to the success of Germany's national economy: its vigorous, highly innovative, and future-oriented industrial sector.

Numerous studies have come to the conclusion that the instituting of Industrie 4.0 will contribute in a major way to the growth of Germany's economy and its business enterprises in the coming years.

Industrial production and the services surrounding it are at the core of Germany's national economy. They represent more than half of its economic performance. The fact that Germany is an innovation leader in many areas puts it in an ideal position to meaningfully contribute to shaping the way Industrie 4.0 is introduced. And it is vital that it be introduced nationwide. Successful competition with the USA and other industrial nations, such as the Southeast Asian countries, depends on this, as does the ability to fortify Germany's status as the world's most modern industrial nation.

We are now looking back at a year of successful achievements in relation to Plattform Industrie 4.0. We have succeeded in bringing together a network of diverse expertise and perspectives, in identifying challenges, in making recommendations on courses of action, and in providing businesses with information. We have also begun developing cooperations on the international level.

In this brochure, Plattform Industrie 4.0 is presenting the results of its work and the discussions that have been going on up to now. Its goal is to provide the impetus for the successful digital transformation of the German economy.

Digital Transformation of Production "Made in Germany"

The Platform as a Network for Shaping Digital Transformation

Plattform Industrie 4.0 is the central network for the national and international activities surrounding digital transformation in Germany. With this platform, Germany is presenting a promising way of bringing together digitization and production in a systematic manner. The platform unites all those stakeholders who are interested in contributing to the shaping of Industrie 4.0: The solidarity that the platform creates between the economic sector, professional associations, the scientific community, trade unions, and the government fosters coordinated processes in the economic sector and in society through the harmonization of the various perspectives and approaches. The platform sees itself as a network that brings the stakeholders together, discusses the various issues with them, moderates processes, raises awareness for the issues, and mobilizes businesses – all of which to ensure that Industrie 4.0 "Made in Germany" will be a success. The work of the platform is therefore concentrated in four areas:

Making content recommendations

The underlying idea is that Germany maintain its status as one of the most modern industrial nations and that it continues to develop in a dynamic way. Based on the knowledge obtained through research and practical experience, the platform's working groups identify where action is needed and make recommendations for implementing suitable framework conditions. This makes it easier for businesses to integrate the new Industrie 4.0 approaches and technological developments into their business practices.

Mobilizing businesses, particularly small and medium-sized business enterprises

Around a third of businesses in Germany are currently involved with the topic of Industrie 4.0. The Online Map on the platform's website pinpoints example cases where it is already being practiced and provides information on specialist events. The idea is to encourage even more businesses to get involved with Industrie 4.0. On the basis of these use cases, businesses can inform themselves about the different topics and grapple with them in a concrete way. It also encourages them to try them out and implement such scenarios themselves.

Providing single-source support

There are numerous programmes and projects in Germany in the area of Industrie 4.0. Plattform Industrie 4.0 provides interested individuals with quick access to information about these, for example information about funding programmes. The platform is therefore the central point of contact for interested individuals within and outside of Germany. Synergies are thereby being created and the duplication of work avoided.

Promoting international networking

Plattform Industrie 4.0 receives numerous requests both from within as well as from outside Germany. It maintains close ties with initiatives in Japan, the USA, France, and China and is systematically expanding these relationships. The platform also participates in national and international events and in national and international networks.

Shaping transformation together:

Industrie 4.0 Scenarios in 2020: A Systematic Look at the Future of Industry

With the creation of concrete future Industrie 4.0 scenarios, the platform helps not only businesses but also the government, the scientific community, and employee-representation bodies to coordinate the process of the digital transformation of industry in Germany.

The use scenarios, which are developed by the platform's partners, show industrial production in the future. A clear graphic presentation of the "production of tomorrow" concretely demonstrates the impact of digitization on the various value-creation systems.

In connection with those use cases where Industrie 4.0 has already been realized, the scenarios provide a holistic picture of the developments to be expected. They thereby enable the platform stakeholders to get a sound grasp of the status quo and to see which options they have to digitally transform their industrial production.

A comprehensive overview of the seven current future scenarios is available in the brochure **"Aspects of the Research Roadmap in Application Scenarios"** published by Working Group 2 – Research and Innovation – of Plattform Industrie 4.0.

Seven Future Scenarios

❶ **Order-based production** Cross-business production concepts based on an automated production marketplace facilitate the efficient production of customer-tailored orders.

❷ **Value-based services** Virtual platforms bundle machine and production data and create the basis for providing need-specific maintenance and individual services.

❸ **User support in production** Digital assistance systems assist people in the production and modify not only the work itself but also the organization of work.

❹ **Transparency and Adaptability of delivered Products** Networked production facilities can be updated by the manufacturer and can then adapt their process spectrum to current requirements to meet specific needs.

❺ **Adaptable Factories** Production competencies and capacities are fully automated in a highly modularized production facility and adapted and optimized on an order-by-order basis.

❻ **Self-organising Adaptive Logistics** Flexibility and reaction speed of industrial systems along the entire industrial delivery chain is increased on the basis of comprehensive and automated logistic solutions.

❼ **Smart Product development for Smart Production** Production and product data are being used selectively and holistically in the development of customer-tailored solutions.

Framework Conditions for Industrie 4.0

Need for Action and Recommendations: The Results of Plattform Industrie 4.0 at a Glance

What central challenges are revealed by the scenarios for politics, the business sector, the scientific community, and for trade unions? What possible solutions have come to light that would allow the visions of Industrie 4.0 to become reality and therefore allow the successful and active digital transformation of German industry? To answer these questions, Plattform Industrie 4.0 has prioritized five fields of activity to be worked on in the working groups:

Working Group 1
Reference Architectures,
Standards, and Norms

Working Group 2
Research and Innovation

Working Group 3
Security of Networked Systems

Working Group 4
Legal Framework

Working Group 5
Work, Education and Training

Working Group 1
Reference Architectures, Standards, and Norms

Essential to a speedy implementation of Industrie 4.0 concepts in industrial practices is a standardization process that is based on consensus and tied in with the ongoing research. Working Group 1 coordinates the national standardization activities in the area of Industrie 4.0 and compiles the work of the various stakeholders.

One of the main results of this is the development and definition of the uniform "Reference Architecture Model of Industrie 4.0" **RAMI 4.0**.→ 1 RAMI 4.0 is the first compilation of the essential technological elements of Industrie 4.0 in a uniform model. It therefore provides businesses from different branches with a uniform orientation framework. Depending on the particular use scenario and solution approach, RAMI enables the identification of relevant standards. If a suitable standard is not available, then RAMI helps to identify these gaps. On the initiative of the working group, the Reference Architecture Model RAMI 4.0 has been certified and published as a DIN specification, namely DIN SPEC 91345.→ 2

1 VDI Status Report: Reference Architecture Model Industrie 4.0, 2015
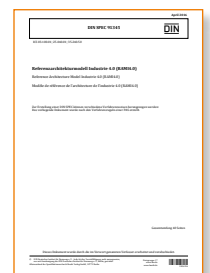
2 Reference Architecture Model Industrie 4.0 (RAMI 4.0), Beuth Verlag GmbH

3 Reference Architecture Model Industrie 4.0 (RAMI 4.0) – An Introduction

4 Information on Standardization Initiative Industrie 4.0

5 Structure of the Administration Shell: Continuation of the Development of the Reference Model for the Industrie 4.0 Component

6 Interaction Model for Industrie 4.0 Components

After the conversion of RAMI 4.0 to a standard, the next step is the continued distribution and application of RAMI 4.0 in industrial practices. What this especially entails is the initiating of cooperations with international projects.

In addition to numerous cooperation discussions with international initiatives, the working group has produced a clear presentation of the model. The targets and the benefits of the model are concisely explained in it. → 3

The working group also provides assistance to current political and economic structuralization programmes involving the harmonization of the national standardization landscape. The goal here is to simplify access for German businesses to international standardization boards and consortiums. This task has been assumed by the "Standardization Council I4.0", which was founded and is being funded by the industrial associations bitkom, VDMA, and ZVEI together with DIN and DKE. → 4

For the continued development of the contents of the RAMI architecture, the communication interface between the components plays a central role. For this, a so-called "administration shell" is defined, which as a "digital twin" contains all of the data of the real component. → 5

Defining a common vocabulary as a lingua franca of machine communication is the basic requirement for being able to ensure the interoperability between the solution concepts of the various providers in the networked world of Industrie 4.0. → 6

The basis for Industrie 4.0 is the availability of all relevant information through an application-conducive networking of all components of the value-creation system.

The working group's goal is to make recommendations for the global standardization for communication networks in industrial applications. It formulates the essential requirements of such network communication and identifies standards that already exist or standards that are being worked on. → 7

Working Group 2
Research and Innovation

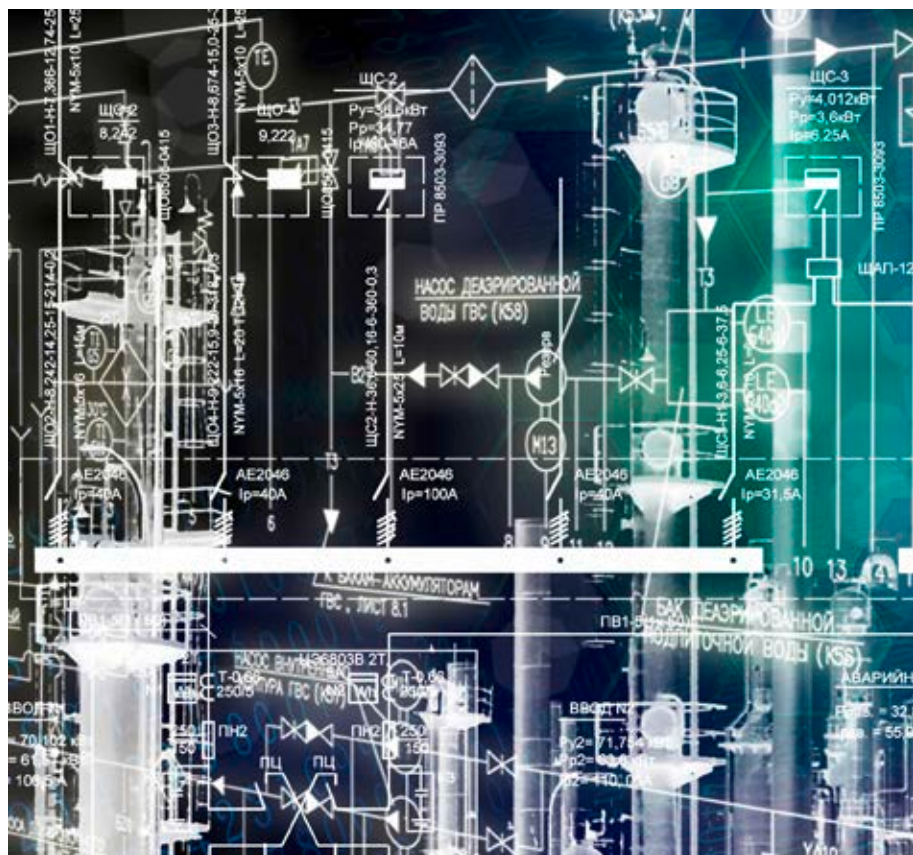The task of Working Group 2 is to analyse which research and innovation is needed for the shaping of Industrie 4.0. This should result in recommendations regarding which key technologies have to be developed and established in Germany for Industrie 4.0. Recommendations should also be made regarding the measures that are needed to foster the transfer of technology throughout the entire business sector.

The use scenarios of Industrie 4.0 function as a base for identifying research needs. These were produced in close collaboration with the other working groups of the platform. Based on the research roadmap[8] established by the platform, the scenarios were systematically analysed in relation to available and still-to-be developed technological fields. Five areas were thereby identified, which have priority for the future implementation of the scenarios:[9]

- negotiating and concluding contracts in automated value-creation networks

- systems engineering for modifiable systems

- social network industry – work organization, assistance systems, and the human digital footprint

- Logistics 4.0 – self-organizing and adaptable

- vocabulary for Industrie 4.0

The second area of the working group's activities involves the identification of obstacles to innovation and at the same time the designing of measures that foster the implementation of Industrie 4.0, especially in the SMEs. What was identified as an essential element for accelerating the transfer dynamic in the SMEs was the provision of low-threshold measures for the (initial) implementation of digital process models.

As a result of discussions held with the political stakeholders and with the businesses of the platform, the association "Labs Network Industrie 4.0" was founded as a central contact point for users on the implementation side of the platform (http://lni40.de).

Additional support for SMEs is provided by a programme of the Federal Ministry of Education and Research. SMEs are provided with support in the testing and evaluating of innovative components for Industrie 4.0 in testbeds at universities and research institutions (i40-testumgebungen-fuer-kmu.de).

Working Group 3
Security of Networked Systems

Indispensable for the successful implementation of Industrie 4.0 is the secure and trustworthy handling of data and the reliance on the protection of cross-business communication. In order that businesses, especially SMEs, are able to actively participate in future in the development of Industrie 4.0, an appreciation of the central security aspects must first be generated. This is followed by the actual implementation of basic security measures. An introductory guide has been compiled by the working group to help determine the status quo of the individual's own company and as orientation for identifying which basic steps should already be taken today.[10]

7 Network-based communication for Industrie 4.0

8 Industrie 4.0: White Paper R&D Topics (only in German)

9 Aspects of the Research Roadmap in Application Scenarios

10 IT security in Industrie 4.0: First steps towards secure production

11 Technical Overview: Secure Identities

12 Technical Overview: Secure cross-company communication

13 Can 'analogue' regulation work for a digitised industry? An overview of the various fields of action

Fundamental to secure cross-business cooperation is the issue of whether the senders and recipients of the data are actually who they purport to be and whether they are authorized to send or receive the particular data. In the cooperation networks of Industrie 4.0, the identity of the communication partners – whether it is a person, a machine, or a product – must be unequivocally ascertained. Also required is a secure exchange of data within the network: Only if appropriate security measures are in place can the availability, integrity, and confidentiality of the transmitted data be ensured.

In the publications **Secure Identities and Secure Communication**, the working group has compiled an overview of the elements essential to a trustworthy development of value-creation networks. On the basis of this, it has made recommendations to the government and the business sector on the establishment of such networks. → *11, 12*

The various strands are then woven together in a guide with the title **Introducing IT Security to Industrie 4.0 for SMEs**. The guide will be presented at the IT-Gipfel 2016. It explains the risks involved with cross-business communication and helps small and medium-sized enterprises to safely implement Industrie 4.0.

Working Group 4
Legal Framework

This working group examines the most important – currently identifiable – aspects of the digitized economy from a legal perspective. It focuses on the issue of whether the current law, which is geared primarily to the notion of humanly controlled conduct, needs to be further developed in light of machine-controlled communication and learning capability. And if it does, then how should it be further developed? The underlying idea is to support commercial practices in the development and implementation of new standards and business models and to draw attention to those areas where legislative solutions are needed or are arising.

The working group examines five main points under the topic "Legal Framework" in the context of Industrie 4.0: civil law and civil procedure law, the law of IT security and data protection law, product liability law and product safety law, the law of intellectual property, and employment law. The examination views the issues from both a German law as well as a European law perspective. → *13*

One issue that is highly relevant across a large number of areas is the issue of data sovereignty. Data is becoming more and more important for today's and tomorrow's business models in conjunction with Industrie 4.0. Regardless of the size of the business enterprise, data now represents a considerable economic value for many businesses. With respect to the rights to machine data, for example, there are no specific statutory provisions that cover these. It is therefore unclear at the present time just which legal principles should govern the issue of data sovereignty. The issue therefore involves the legal safeguarding of such data, which the working group illuminates in a separate publication. → *14*

Working Group 5
Work, Education and Training

Working Group 5 focuses on the issues affecting human beings – how they work and how they learn in Industrie 4.0. The idea is to take a more rational look at the current debate on the future of employment, work, and professional education, to look at which opportunities and which risks the digital transformation triggered by Industrie 4.0 presents for our working lives, and to expedite its future form in communication with the social partners (i.e. employer/trade union partnerships). Recommendations are being made on which actions are needed at the political, business, and social levels.

Concretely, the working group aims to identify the current challenges and the actions that are needed in the areas of apprenticeships and continuing education in order to preserve and strengthen the productivity and competitiveness of business enterprises in the future and to improve the working conditions, professional development opportunities, and the employment perspectives in conjunction with this.

Pivotal to the work of this working group is the consultation with the employee-representation councils – not only as experts on the transformation of work and qualifications but also as important voices when it comes to formulating qualification needs – and in the case of IG Metall, as co-determiners of apprenticeship regulations. Along with the developments in relation to Industrie 4.0, demographic trends in particular are also being taken into account. The following steps are to be implemented in this respect:

- identification of business examples, instruments, methods, and best practices → 15

- identification of the impacts of Industrie 4.0 on work and qualifications

- making of recommendations for action in the areas "roles, functions, job profiles", "structuring and organization of work", and "qualifications, apprenticeships and continuing education"

14 In the spotlight: Industrie 4.0 – Issues surrounding data
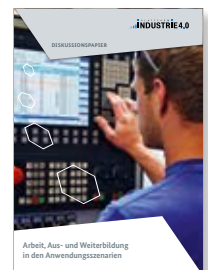
**15** Work, education and training in the application scenarios (only in German)

Getting started in the industrial practice: Online Map Industrie 4.0 in Germany

Industrie 4.0 is already a reality in many locations. Machines are communicating with machines. Digitally networked factories are adapting in an intelligent way to ever-changing requirements. One of the main success factors in the implementation of Industrie 4.0 is the openness of the German business sector to innovation. Proof of this can be seen on the Online Map of Plattform Industrie 4.0 – with an overview of remarkable use cases, practice-oriented testing centres, and expert consulting services.

Hamburg

Hanover

Düssel-dorf

Frankfurt

Stuttgart

❶ Discovering use cases

The most frequently asked questions by business enterprises in relation to Industrie 4.0 are: How exactly does an investment in Industrie 4.0 benefit one's own business and how exactly can this be implemented? Over 200 examples show how this is already successfully being done in Germany.

Berlin

Leipzig

Munich
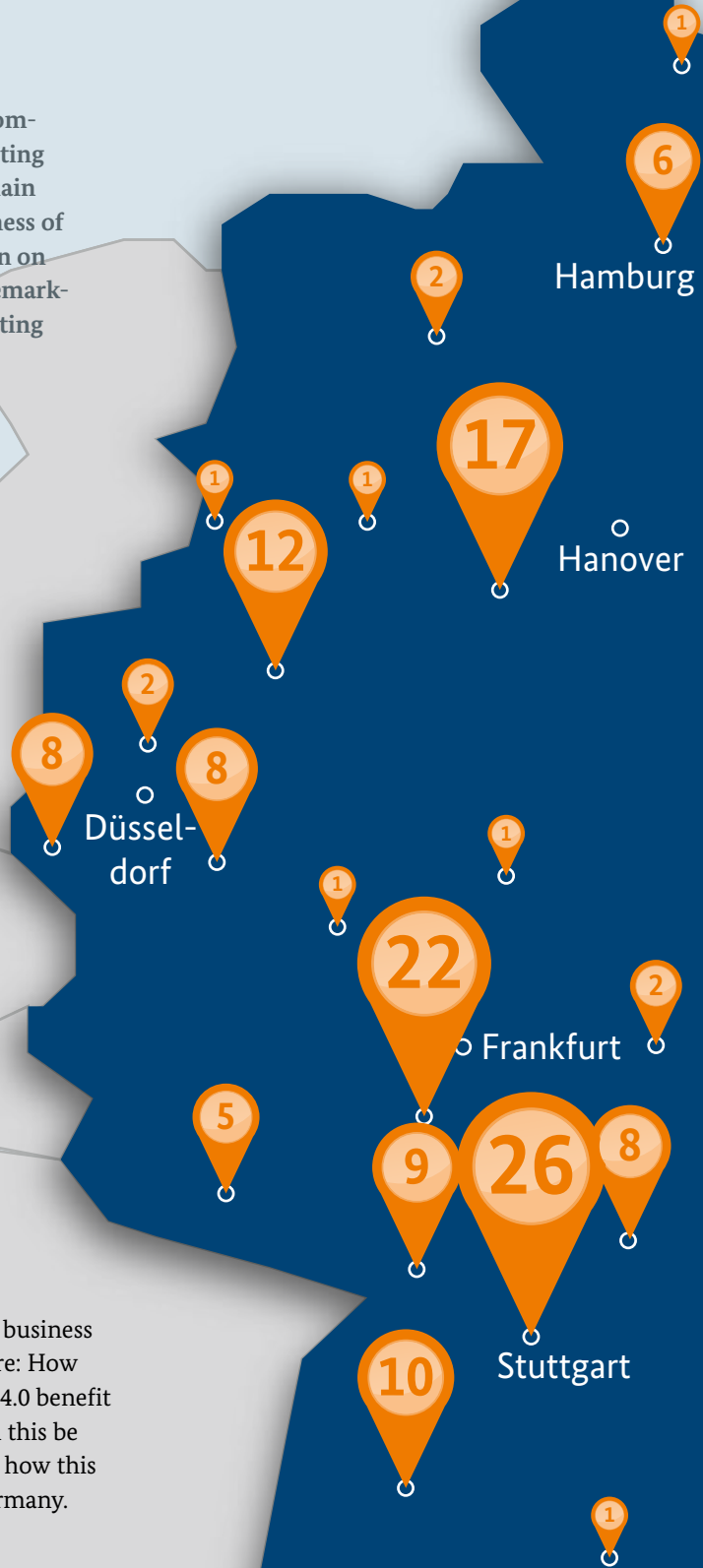
❷ Finding the right testbed

Before the actual implementation of Industrie 4.0 in industrial production, a number of developmental steps must first be taken. Many small and medium-sized enterprises are already developing new components for Industrie 4.0. They are looking for networked testbeds that are as close as possible to reality where they can test their new developments as practice-oriented as possible and where they can make their ideas ready-for-use before investing. Germany now has a large number of testing labs and testing infrastructures in universities and research institutions: The Online Map shows the locations of such testbeds, the locations of the 4.0 Centres of Excellence where SMEs can obtain advice, and provides information about their services.

❸ Finding information and advice in the region

Digitization means grappling with new business contexts and learning about topics that were formerly unknown. Getting advice about implementation is therefore a very valuable source of support, especially for small and medium-sized enterprises. The map also answers the question of where you as a business enterprise can obtain information. Business enterprises can research where to find the suitable non-commercial information and advisory services in their region, and can find the person to contact to obtain such advice. This is the first step in implementing Industrie 4.0 in their own business contexts.

Three Questions for Manfred Nicklas

Head of Production, Bender GmbH & Co. KG

Mr Nicklas, you have introduced an integrated production system in your final-assembly plant. What added value does this system offer you?

With the new production system, we produce many different serial and customer-specific products in a consciously chaotic sequence in very short throughput times. Lot sizes of one unit per year are as possible without preproduction expenditures as is the production of tens of thousands of parts of the same kind.

How does the system actually work?

In our production, we have linked the Manufacturing Execution System (MES) to the Enterprise Resource Planning (ERP) and therefore operate a transfer system with manual and automatic workplaces. An information system automatically provides the workers during the ongoing production with important information about the product and the work flow. The system has a traceability system, which makes the entire production process transparent.

What was the biggest challenge to implementation? And: What advice would you give to other companies wishing to implement digitized production?

One of the biggest challenges was the design of the production system so that the former and future product range could be produced. Another challenge was bringing the employees from the old to the new production methods. It is therefore important to include the employees at an early stage in the designing of the processes. One should also try and understand the concept of Industrie 4.0 as a whole and to base his or her own goals on this.

i

Use Cases on the Online Map Industrie 4.0

Three Questions for Prof. Dr.-Ing. Reiner Anderl

**TU Darmstadt, Efficient Factory 4.0,
Centre of Excellence Industrie 4.0**

Professor Anderl, with the Efficient Factory at the TU Darmstadt, you have established a test centre for Industrie 4.0. You also head one of the SME 4.0-Centres of Excellence funded by the Federal Ministry for Economic Affairs and Energy. What aspects (scenarios) can companies test on your demonstrator?

Five use scenarios with corporate industrial partners have been realized in the Efficient Factory 4.0. These include component parts and industrial materials as information carriers, a paper-less quality assurance, a digital value stream mapping for production controlling in real time, status and energy consumption monitoring, and flexible, intelligent machine-operator assistance systems. An "SME 4.0-Centre of Excellence" was also established at TU Darmstadt, which transfers knowledge of Industrie 4.0 to industrial practices. The main areas of focus here are "Efficient value-creation processes", "Energy management", "New business models", "Work 4.0", and "IT security" as a related topic.

What can be tested in your facilities and how do business enterprises benefit from this?

The Efficient Factory 4.0 is not really meant as a testing centre in the sense of a "testbed". It is rather meant to provide the corporate partners with a use environment to test methods and instruments in order to implement the knowledge gained in their own organizations. A second motivating factor is to be able to demonstrate use scenarios that are publically accessible for other interested businesses.

In your testing experience, what is the biggest challenge to implementation? And: What advice would you give to companies wishing to implement digitized production?

In my opinion there are three main challenges:

Firstly, businesses need to develop a new mindset. They have to be made aware of the fact that the changes that digitization brings with it, especially in the production, also leads to new business models.

Secondly, business enterprises have to assess the current state they have achieved with respect to Industrie 4.0 technology. On this basis, a strategy can then be developed that indicates which performance profile the company would like to achieve in the future. Out of this, plans can be prepared with respect to time, capacity, and investments and with respect to how employee know-how is to be created.

Thirdly, I advise every business enterprise to think about the advantages it would like to achieve by using Industrie 4.0 and which new business models and development opportunities will arise for the business. The new business models in particular are extremely important in my opinion!
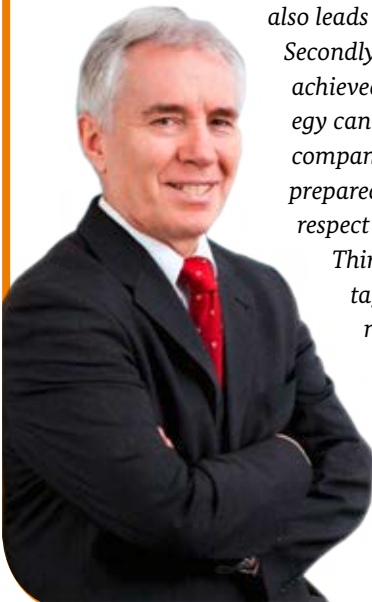
The "Efficient Factory 4.0" is a learning factory. It shows business enterprises how the development and implementation of Industrie 4.0 technologies can be implemented in a resource-efficient manner. The project is co-financed out of funding of the Land Hessen and the EU.

The "Centre of Excellence SME 4.0" is a joint project with the partners IHK Darmstadt, Handwerkskammer Frankfurt Rhein-Main, and Fraunhofer SIT and Fraunhofer LBF under the direction of the TU Darmstadt. It is funded by the Federal Ministry for Economic Affairs and Energy.

Finding Information and Advice in the Region

Three Questions for
Dagmar Lange

Project Manager Digitization, Industrie 4.0,
Programme of the Federal Ministry for Economic Affairs and Energy, "SME 4.0-Agency Processes"

Mrs Lange, what kind of questions can business enterprises ask the SME 4.0-Agency?
One typical question is: "How can an anticipatory maintenance of machines through the use of sensors be realized effectively in terms of time and costs? Companies can turn to us with questions in connection with the introduction and use of digital processes, primarily in the areas of production and logistics. The main focus is on the areas "Production and Service Provision" and "Technical Support and Maintenance" and the IT and information security issues in connection with these areas.

Which exact business enterprises are your services directed at?
We want to help SMEs and skilled-tradesmen firms strengthen their competitiveness, open up new business fields through the digitization and networking of processes, and provide them with support during the digital transformation process. This is accomplished generally through commercial chambers, trade associations, and other institutions that support commercial activities. Through special educational and training programmes, we help them with the preparation and implementation of events aimed at knowledge transfers in the companies.

What in your advising experience is the biggest challenge for business enterprises? And: What advice would you give to companies wishing to implement digitized production?
Digitization causes radical changes to production and work processes. These changes are the challenges that have to be met by SMEs if they want to remain competitive in the future. Multipliers on the other hand are faced with the challenge of conveying to the companies the knowledge needed for such changes.
Our advice to companies that want to digitize their production and ...ses is to adequately inform themselves about it to ...e optimal success of the operational processes in their ...form. This is exactly what the funding programme SME ...vides.

The SME 4.0-Agency Processes is a part of the funding programme "SME 4.0 – Digital Production and Work Processes". It is funded by the Federal Ministry for Economic Affairs and Energy in connection with the main programme "Digital SME – Strategies for the Digital Transformation of Business Processes".

Signpost for Digital Transformation: Support and Services for Business Enterprises

Most companies have recognized that their own production and business processes are already influenced by digitization. What now needs to be done is to transpose this knowledge to their business practices by introducing new technologies and developing new business models. This has to be done in order to secure and strengthen the competitive edge that the robust German industry has in international competition.

Much of the technology for Industrie 4.0 solutions already exists, advice centres are readily available, and know-how has been developed. But the information is scattered across the different sectors, is presented in very technical terms, and is often not reaching companies across the board. The platform provides this information through both well-established and new services, thereby positioning itself as a contact point and an information network with respect to Industrie 4.0.

Online Map Industrie 4.0

Use cases, Testbeds, Advisory and Information Services

The map shows examples of cases in Germany where Industrie 4.0 is already being practiced – a "pin" for each example. It also includes information on testbeds and about where advice and information can be obtained throughout Germany.

www.plattform-i40.
de/I40/Landkarte

Online Library Industrie 4.0

Recommendations, Guides, and Discussions

The Online Library provides a systematic introduction to the topic of Industrie 4.0. The results and the guides that the platform publishes are available as downloads, as are the publications and studies of the partners of the platform. Expert information is available to businesses in a simple and structured form. Specialists can find direct access to recommendations and discussions.

www.plattform-i40.
de/I40/Online-
Bibliothek

Networking Events

SME Days, Regional Forums, and Visiting Businesses

Through regional events, Plattform Industrie 4.0 provides small and medium-sized businesses in particular with information about the digital transformation in Germany and raises their awareness for the topic of Industrie 4.0. This includes cooperations with professional associations, commercial chambers, and other regional initiatives and institutions. An example of this includes the joint information and qualification events, which reach business enterprises in all regions of Germany. The platform actively brings its experiences and work results to the various regions, for example as a partner of the event series "Industrie 4.0 @ Mittelstand" of the Chamber of Industry and Commerce.

http://www.plat-
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Plattform/Veran-
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staltungen.html

Industrie 4.0 – Testbeds

Information, advice, coordination

A focal point of Plattform Industrie 4.0 is the practice transfer. It fosters the creation of new ways to facilitate access to testbeds and presents which measures have been developed at the political and commercial levels so far.

- The Federal Ministry of Education and Research provides funding for the testing of innovative Industrie 4.0-Components by small and medium-sized enterprises in designated testbeds. To be able to advise interested SMEs on which testbed is most suited to their particular issues, a central contact and coordination office has been established at the University of Stuttgart under the direction of Prof. Dr. Bauernhansl. The results achieved here will be made publicly available, including to specialists.

- Alongside the government programmes, the initiative "Labs Network Industrie 4.0" was created by companies and professional associations of Plattform Industrie 4.0. "Labs Network Industrie 4.0 e.V. – Ini40.de" was founded as a central coordination point for the various approaches. It was founded to help companies initiate Industrie 4.0 projects and to compile the results from the testbeds and to process these in relevant competitive structures, for example in the areas of standardization and international cooperation.

i40-testumgebun-
gen-fuer-kmu.de

Industrie 4.0 – Fostering Practice Transfers

Regional and national networking

The more digitized and networked businesses become, the more interfaces are created. Plattform Industrie 4.0 therefore fosters the exchange of information and the participation of the relevant stakeholders. This close-knit network makes it easier to recommend the right contact person for the business enterprise, to provide it with expertise, and to bundle forces across the board in the activating phase.

- The platform therefore works together with the SME 4.0-Centres of Excellence and the multipliers in the programme SME-Digital. The initiative "SME 4.0 – Digital Production and Work Processes" provides support to small and medium-sized companies and skilled-tradesmen firms in the areas of digitization, networking, and getting started with Industrie 4.0 applications. The "SME 4.0 Agencies" work on general digitization topics such as cloud computing, communication, commerce, and processes. These will be disseminated widely through the use of multipliers. The "SME 4.0-Centres of Excellence" will provide business enterprises with information, raise their awareness for the issues, qualify them, and provide them with practical observation and testing opportunities.

- The platform also has close ties to the initiative Industrial Data Space, which aims to create a secure data environment. The basis of this is a reference architecture model, which is being developed in conjunction with a project of the same name that is funded by the Federal Ministry of Education and Research. Twelve Fraunhofer institutions under the direction of Professor Otto (Fraunhofer IML) are involved in the project.

Plattform Industrie 4.0 – An international network interface for the digital transformation of production

Plattform Industrie 4.0 draws a great deal of interest at both the national and international levels. The fact that it receives numerous cooperation requests from around the world is proof of this. The platform has established itself here as *the* contact partner at the international level. The platform currently has international cooperations with the countries set out below. The number of these is growing continually, however.

- **Industrial Internet Consortium (IIC):** The two internationally leading initiatives regarding Industrie 4.0 or the Internet of Things (IoT) – namely Plattform Industrie 4.0 and the IIC – entered an agreement at the beginning of March 2016 to cooperate more closely. This cooperation focuses on the work to create common standards, the harmonization of the respective reference architectures of IIC and Plattform Industrie 4.0, and the realization of joint testbeds. The two initiatives also complement each other in a productive manner: While IIC focuses on the IoT world and the communication among various IoT dimensions, such as health, logistics, etc., Plattform Industrie 4.0's focus is on the digitization of industrial production.

- **China:** Both the Federal Ministry for Economic Affairs and Energy (together with the Ministry of Industry and Technology) and the Federal Ministry of Education and Research (together with the Ministry of Science and Technology) have signed a Memorandum of Understanding with China to intensify cooperation in the area of Industrie 4.0. Based on the agreed work processes, the results of the cooperation are being presented at the annual German-Chinese conferences.

- **France:** At the first German-French digitization conference in October 2015, a common work process between the two countries in the area of digitization was started. Federal Chancellor Merkel and President Hollande as well as the Economic Ministers Gabriel and Macon were present at the conference. In the meantime, working groups and common projects have been agreed in the areas of technology, standardization, testing infrastructures, use cases, and education. A map of use cases in France similar to the German Online Map has already been created. The German-French cooperation is also helpful in the shaping of the initiatives of the European Commission in the area of digital transformation.

- **European Commission:** Germany supports the European Commission in its efforts to provide a tight networking of the national Industrie 4.0 initiatives at the European level, and in doing so supports concrete activities with funding programmes. At the instigation and with the support of Germany, the European Commission is planning annual networking conferences on Industrie 4.0.

- **Japan:** The gross domestic products of both Japan and Germany have a very high industrial component. Digitization therefore creates similar challenges to both of these countries. The planned cooperation between the two countries particularly makes it easier for German companies to access the Japanese market. The cooperation is intended to take place on a number of levels and includes a cooperation between Plattform Industrie 4.0 and the Japanese Robot Revolution Initiative. The aim of the cooperation is to improve harmonization, especially in the areas of testbeds, standards, security, legal framework, and research.

- **G20:** Under the current Chinese G20 presidency, the topic of digitization/Industrie 4.0 already plays a key role. Under the German G20 presidency in 2017, Germany also plans to put this topic on the agenda and to discuss it in-depth at a planned G20 ministers conference on digitization. With its expertise and as an impetus generator, Plattform Industrie 4.0 can make a significant contribution to the discussion, for example on the topic of standardization.

Plattform Industrie 4.0 – The Largest National Industrie 4.0 Network

With over 250 participants from more than 100 companies and organizations, Plattform Industrie 4.0 is nationally and internationally one of the largest and most diverse Industrie 4.0 networks. Plattform Industrie 4.0 is a knowledge-exchange platform designed as a social partnership. It is operated by and for the political stakeholders, the business sector, the scientific community, professional associations, and trade unions and unites all relevant civic stakeholders for the purpose of advancing the digital transformation of industry.

Organizational Structure and Sections

Directors: Plattform Industrie 4.0 is a joint project of the Federal Ministry for Economic Affairs and Energy and the Federal Ministry of Education and Research. The platform directors are the Federal Minister of Economics, Sigmar Gabriel, and the Federal Research Minister, Professor Johanna Wanka, together with high-ranking members of the business sector, the scientific community, and the trade unions.

Organization	Leitung
Federal Ministry for Economic Affairs	Sigmar Gabriel (Federal Minister)
Federal Ministry of Education and Research	Prof. Dr. Johanna Wanka (Federal Minister)
Deutsche Telekom AG	Reinhard Clemens
Bundesverband der Deutschen Industrie e.V.	Ulrich Grillo
IG Metall	Jörg Hofmann
SAP SE	Bernd Leukert
Fraunhofer-Gesellschaft	Prof. Dr. Reimund Neugebauer
Siemens AG	Prof. Dr. Siegfried Russwurm
Festo AG (to 2016), 4.0-Veit.GbR	Dr. Eberhard Veit

The platform directors constitute the highest decision-making body. They are responsible for defining goal priorities, determining strategical direction, and appointing office holders.

Steering committee: The steering committee is composed of leading SMEs and large corporations. Its function is to coordinate and steer the contents of the work of Plattform Industrie 4.0 and to compile the results of the various thematic working groups into one unified and overriding framework.

Strategy committee: The strategy committee is a forum composed of government bodies, relevant professional associations, and trade unions. It is responsible for identifying issues relevant to the mid-term design of Industrie 4.0 and for political milestone planning. It also functions as a multiplier of the platform results in professional associations and in the scientific community.

Working groups: In five thematic working groups, over 150 experts from the business sector and employee-representation councils work together with representatives of the responsible government departments, professional associations, and scientific organizations to make recommendations and create pre-competitive concepts regarding selected fields of activity of Industrie 4.0.

Scientific council: The scientific council is composed of leading representatives of relevant scientific organizations. The council provides input on research strategies and agendas, and it identifies research institutions to actively co-implement these.

Secretariat: The secretariat is an independent body of Plattform Industrie 4.0 that functions as the central point of contact. It coordinates the various cooperations of the platform, orchestrates both internal and external communication, and coordinates the various committees. It also functions as a gateway to other national and international initiatives.

A common platform for actively shaping Industrie 4.0: Co-determining and participation possibilities

Through its wide-scale inclusion and networking of all material stakeholders, Plattform Industrie 4.0 facilitates the knowledge-exchange necessary for finding innovative answers to the challenges created by digitization for the industry.

- The **working groups** are open to all interested members of the business sector and employee-representation councils. Other experts are invited to the working groups to contribute to the discussions on the various subjects. They play an important role as impetus generators, knowledge-exchange partners, and as co-shapers of the platform.

i **Participating in the working groups**

If you are interested in taking part in the working groups, simply send us a short CV of your qualifications:

Central Office Plattform Industrie 4.0
Bertolt-Brecht-Platz 3, 10117 Berlin
Tel.: +49 30 2759506650
E-mail: geschaeftsstelle@plattform-i40.de

- Businesses can submit implemented Industrie 4.0-Components as practical **use cases** for illustration on the Online Map Industrie 4.0

i **Submitting use cases Industrie 4.0**

You are using an Industrie 4.0-Components in your company and would like to have your case example put on the map? Then simply send us a short description of your project and your contact information via our contact form:
https://www.plattform-i40.de/I40/Navigation/DE/In-der-Praxis/Karte/Projektvorschlag/projektvorschlag.html

- Research institutions can suggest testbeds for Industrie 4.0 solutions/components for presentation on the Online Map.

- Attending platform events enables interested individuals to exchange information on Industrie 4.0 topics and to network with other stakeholders.

i **Presentation of testbeds for Industrie 4.0**

You would like to suggest a testbed for the Online Map in which Industrie 4.0 solutions can be tested by business enterprises? Then simply send us an e-mail with your suggestion to: geschaeftsstelle@plattform-i40.de

i **Plattform Industrie 4.0 events**

Information about current Plattform Industrie 4.0 events and its stakeholders is available on the events calendar on the website:

http://www.plattform-i40.de/I40/Navigation/DE/Plattform/Veranstaltungen/veranstaltungen.html

Stakeholders of Plattform Industrie 4.0

Plattform Industrie 4.0 is a joint project of the German government, the business sector, the scientific community, professional associations, and trade unions. A total of over 250 stakeholders from 159 organizations are actively involved in it:

A

ABB AG
acatech – National Academy of Science and Engineering
admeritia GmbH
Airbus Group SE
Airbus Operations GmbH
Alexander von Humboldt Institute for Internet and Society (HIIG)
Atos Deutschland
AUDI AG

B

BASF SE
Bavarian Ministry of Economic Affairs and Media, Energy and Technology
Benteler International AG
Benteler Deutschland GmbH
Bird & Bird LLP
Bosch Rexroth AG
Bosch Software Innovations GmbH
Federal Office for Information Security
Bundesdruckerei GmbH
Federal Chancellery
Federal Ministry of the Interior
Federal Ministry of Labour and Social Affairs
Federal Ministry of Education and Research
Federal Ministry for Economic Affairs and Energy
Bundesnetzagentur
German Association of Energy and Water Industries (BDEW)
Bundesverband der Deutschen Industrie e.V. (BDI)
Bitkom e.V.

C

Coriant GmbH & Co. KG

D

Daimler AG
German Research Center for Artificial Intelligence (DFKI)
Institute for Standardization (DIN)
DKE German Commission for Electrical, Electronic, and Information Technologies of DIN and VDE
Deutsche Telekom AG

E

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

F

Festo AG & Co. KG
Festo Didactic SE
Fraunhofer Institute Application Center Industrial Automation IOSB-INA
Fraunhofer Research Institution for Microsystems and Solid State Technologies EMFT
Fraunhofer-Gesellschaft e.V.
Fraunhofer Institute for Experimental Software Engineering IESE
Fraunhofer Institute for Material Flow and Logistics IML
Fraunhofer Institute for Manufacturing Engineering and Automation IPA
Fraunhofer Institute for Machine Tools and Forming Technology IWU
Fraunhofer Institute for Applied and Integrated Security (AISEC)
Fujitsu Technology Solutions GmbH

G

GE Digital
genua Gmbh
German Informatics Society (GI)
Giesecke & Devrient GmbH

H

HARTING Deutschland GmbH
HARTING IT System Integration GmbH & Co. KG
Harting KGaA
HDI-Gerling Industrie Versicherung AG
Helmut-Schmidt-University – Automation Technology Institute
Hewlett-Packard GmbH
Hirschmann Automation and Control GmbH
HiSolutions AG
Ostwestfalen-Lippe University of Applied Sciences (inIT)
HUAWEI TECHNOLOGIES Düsseldorf GmbH
HUAWEI TECHNOLOGIES Deutschland GmbH

I

IABG mbH
IBM Deutschland GmbH
IG Metall
IMA Klessmann GmbH
Infineon Technologies AG
Institute of Electronic Business e.V. (IEB)

Institute for Practical Interdisciplinarity (Institute PI, Berlin)
INTEC International GmbH
ISRA VISION AG

K

Karlsruhe Institute of Technology (KIT), wbk Institute of Production Science
KLOECKNER DESMA Schuhmaschinen GmbH
Knick Elektronische Messgeräte GmbH & Co. KG
KORAMIS GmbH
KUKA AG
KUKA Roboter GmbH

L

Lenze SE
Lenze Engineering GmbH & Co. KG

M

M&M Software GmbH
Maschinenfabrik Reinhausen GmbH
Ministry of Finance and Economics Baden-Württemberg

N

Noerr LLP
NXP Semiconductors Germany GmbH

O

OFFIS – Institute for Information Technology, University of Oldenburg

P

Pepperl + Fuchs GmbH
PHOENIX CONTACT Cyber Security AG
PHOENIX CONTACT Software GmbH
PHOENIX CONTACT GmbH & Co. KG
PHOENIX CONTACT Electronics GmbH
PSI Automotive & Industry GmbH

R

RWTH Aachen University, Fraunhofer Institute for Production Technology IPT
Robert Bosch GmbH

S

SAP SE
SAMSON AG
Schaeffler Technologies AG & Co. KG
Schneider Electric Automation GmbH
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
TU Berlin, Institute for Machine Tools and Factory Operations
TU Darmstadt
TU Dortmund
TU Kaiserslautern
TU Munich, Institute for Machine Tools and Industrial Management
ThyssenKrupp AG
TRUMPF GmbH & Co. KG
T-Systems International GmbH
T-Systems Multimedia Solutions GmbH

U

University of Kassel
University of Oldenburg, OFFIS – Institute for Information Technology
University of Paderborn, Heinz Nixdorf Institute
University of Passau
University of Stuttgart, Institute for Industrial Production and Factory Operations

V

Vattenfall GmbH
VDI Association of German Engineers
VDI/VDE Innovation + Technik GmbH
German Association of the Automotive Industry (VDA)
Federation of the German Engineering Industries (VDMA)
viastore SYSTEMS GmbH
Voith GmbH
Volkswagen AG

W

Weidmüller Holding AG & Co. KG
Weidmüller Interface GmbH
WZL Laboratory for Machine Tools and Production Engineering of RWTH Aachen University
WITTENSTEIN AG

Z

ZVEI – Association for the Electrical and Electronic Industry
ZF Friedrichshafen AG

Publications of Plattform Industrie 4.0 at a Glance

Plattform Industrie 4.0

Digitization of Industry – Plattform Industrie 4.0, Progress Report (April 2016)

Working Group 1
"Reference Architectures, Standards, and Norms"

Interaction Model for Industrie 4.0 Components, Discussion Paper (April 2016)

Network-based communication for Industrie 4.0, Discussion Paper (April 2016)

Structure of the Administration Shell: Continuation of the Development of the Reference Model for the Industrie 4.0 Component, Working Paper (April 2016)

Reference Architecture Model Industrie 4.0 (RAMI 4.0) – An Introduction, Guideline (April 2016)

Working Group 2
"Research and Innovation"

Aspects of the Research Roadmap in Application Scenarios, Working Paper (April 2016)

Working Group 3
"Security of System Networks"

IT security in Industrie 4.0: First steps towards secure production, Guideline (March 2016)

Technical Overview: Secure Identities, Working Paper (April 2016)

Technical Overview: Secure cross-company communication, Working Paper (April 2016)

Security in RAMI4.0, Guideline (April 2016)

Working Group 4
"Legal Framework"

Can 'analogue' regulation work for a digitised industry? An overview of the various fields of action, Working Paper (March 2016)

In the spotlight: Industrie 4.0 – Issues surrounding data, Working Paper (March 2016)

Working Group 5
"Work, Apprenticeships, and Continuing Education"

Work, education and training in the application scenarios (April 2016) (only in German)

All publications are available as downloads from the Online Library of Plattform Industrie 4.0:

www.plattform-i40.de/I40/Navigation/EN/InPractice/Online-Library/online-library.html