INDUSTRIE 4.0
SMART MANUFACTURING FOR THE FUTURE
One of 10 "Future Projects" identified by the German government as part of its High-Tech Strategy 2020 Action Plan, the INDUSTRIE 4.0 project represents a major opportunity for Germany to establish itself as an integrated industry lead market and provider.

At Germany Trade & Invest we have been monitoring developments in the intelligent manufacturing and production sector as part of our ongoing "GERMANY. SMART SOLUTIONS. SMARTER BUSINESS." international marketing campaign. We are delighted to present in this brochure the first fruits of our own INDUSTRIE 4.0 labors as part of our commitment to helping establish Germany as a lead market and provider of INDUSTRIE 4.0 solutions and services. We would like to extend a heartfelt thank-you to our science and industry partners without whom this publication would not have been possible.

We now invite you to join us on a journey which will effectively reinvent industrial production as we know it, one in which value chains become value networks, and in which countless new markets and market opportunities are created. We now move into the age of integrated industry.

Dr. Benno Bunse
Chairman / CEO Germany Trade & Invest

INDUSTRIE 4.0 is the German strategic initiative to take up a pioneering role in industrial IT which is currently revolutionizing the manufacturing engineering sector. INDUSTRIE 4.0's strategy will allow Germany to stay a globally competitive high-wage economy. Hence, cyber-physical systems (CPS) improve resource productivity and efficiency and enable more flexible models of work organization. Companies that use CPS will have a clear advantage when it comes to recruiting the best employees, since they can offer a better work-life balance. Germany has the potential to develop its position as a leading supplier and to become the leading market for INDUSTRIE 4.0 solutions - thereby strengthening the German economy, intensifying international cooperation and creating new Internet-based markets.

Professor Henning Kagermann
President acatech - National Academy of Science and Engineering
Spokesperson of the Communication Promoters Group of the Industry-Science Research Alliance and Co-Chair of the INDUSTRIE 4.0 Working Group

The Internet of Things is finding its way into production. Semantic machine-to-machine communication revolutionizes factories by decentralized control. Embedded digital product memories guide the flexible work piece flow through smart factories, so that low-volume, high-mix production is realized in a cost-efficient way. A new generation of industrial assistant systems using augmented reality and multimodal interaction will help factory workers to deal with the complexity of cyber-physical production and enable new forms of collaboration by digital social media. Since on-demand production of highly individualized products like cars or kitchens requires short logistic chains in the markets where they are used, production is guaranteed to remain the backbone of Germany’s economic performance.

Professor Wolfgang Wahlster
CEO and Scientific Director of DFKI (German Research Center for Artificial Intelligence)
Member of the Industry-Science Research Alliance and Chair of the INDUSTRIE 4.0 Working Group on Human Factors

The text continues with detailed descriptions of various industries and technologies related to INDUSTRIE 4.0.
The second period of radical transformation—with the advent of industrial production and the birth of the factory at the start of the 20th century—was no less precipitous, ushering in as it did an age of affordable consumer products for mass consumption. In the late 1960s the use of electronics and IT in industrial processes opened the door to a new age of optimized and automated production.

Today we stand on the cusp of a fourth industrial revolution, one which promises to marry the worlds of production and network connectivity in an “Internet of Things” which makes “INDUSTRIE 4.0” a reality. “Smart production” becomes the norm in a world where intelligent ICT-based machines, systems and networks are capable of independently exchanging and responding to information to manage industrial production processes.

One of 10 “Future Projects” identified by the German government as part of its High-Tech Strategy 2020 Action Plan to pursue innovation objectives over a 10 to 15-year period, INDUSTRIE 4.0 represents a major opportunity for Germany to secure its technological leadership role and establish itself as an INDUSTRIE 4.0 lead market and provider.

Germany has the ideal conditions to become a global leader in innovative, internet-based production technology and service provision. Technological leadership and vision in the fields of manufacturing, automation and software-based embedded systems, as well as historically strong industrial networks, lay the cornerstone for the long-term success of the INDUSTRIE 4.0 project.

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INDUSTRY 4.0: SMART MANUFACTURING FOR THE FUTURE. WWW.GTAI.COM
More than 98 percent of all processors produced worldwide are deployed in regulator, control, and monitor functions in devices for all facets of daily life. For instance, they are there in everything from vehicle ABS and ESP systems, smart phone communication and information services and ordinary domestic household devices to industrial production plant systems. Embedded systems are the intelligent control units at work in most modern technological products and devices. They typically operate as information-processing systems “embedded” within an “enclosing” product for a set range of device-specific applications. These “connect” with the outside world using sensors and actuators; allowing embedded systems to be increasingly interconnected with each other and the online world.

1.2 GERMANY - EMBEDDED SYSTEMS LEADER

Germany is an international leader in embedded systems and also enjoys a leading position in security solutions and business enterprise software. Germany also boasts an enviable engineering reputation in matters system solutions-related and can call upon considerable semantic technologies and embedded systems know-how.

Germany's embedded system market currently generates around EUR 20 billion annually, a figure which is forecast to rise to more than EUR 40 billion by 2020. The applications sector alone generates annual turnover in the region of EUR 4 billion, with an estimated value added factor of approximately EUR 15 billion. As such, Germany’s embedded systems market is the third biggest in the world behind the USA and Japan.

1.3 NATIONAL ROADMAP EMBEDDED SYSTEMS

In 2009 a group of more than 40 decision makers from important companies, research institutes and relevant industry associations came together to create the National Roadmap Embedded Systems for the further development of embedded systems technology. Representatives from a number of industry sectors - including auto construction, automation technology, and machine and plant manufacturing – will spend more than EUR 2.5 billion in six research areas over the ten-year lifetime of the project.

INDUSTRIE 4.0 connects embedded system production technologies and smart production processes to pave the way to a new technological age.
1.4 CYBER-PHYSICAL SYSTEMS

Cyber-physical systems (CPS) are enabling technologies which bring the virtual and physical worlds together to create a truly networked world in which intelligent objects communicate and interact with each other. Cyber-physical systems represent the real evolutionary step from existing embedded systems. Together with the Internet and the data and services available online, embedded systems join to form cyber-physics (CP) systems.

Cyber-physical systems provide the basis for the creation of an Internet of Things, which combines with the Internet of Services to make INDUSTRIE 4.0 possible. They are "enabling technologies" which make multiple innovative applications and processes a reality as the boundaries between the real and virtual worlds disappear. As such, they promise to revolutionize our interaction and communication.

The interplay between high performance software-based embedded systems and dedicated sensor interfaces which are integrated into digital networks creates a completely new world of system functionality. Modern mobile telephones are perhaps the most obvious example of this, offering as they do a complete bundle of innovative applications and processes a reality as the boundaries between the real and virtual worlds disappear. As such, they promise to revolutionize our interaction and communication. Cyber-physical systems represent the next evolutionary step from existing embedded systems. To-date, the device's original telephony function. Cyber-physical systems (CPS) study extended the spectrum to local networked embedded systems which are integrated into digital networks creating a completely new world of system functionality. Modern mobile telephones are perhaps the most obvious example of this, offering as they do a complete bundle of innovative applications and processes a reality as the boundaries between the real and virtual worlds disappear. As such, they promise to revolutionize our interaction and communication.

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Cyber-physical systems represent the next evolutionary step from existing embedded systems. Cyber-physical systems will make contributions to human security, efficiency, comfort and health in a way that has not previously imaginable. In doing so, they will play a central part in addressing the fundamental challenges posed by demographic change, scarcity of natural resources, sustainable mobility, and energy change.

1.5 CYBER-PHYSICAL SYSTEMS AND THE INTERNET OF THINGS, DATA AND SERVICES

The "Evolution of Embedded Systems into the Internet of Things, Data and Services" illustration depicts the vision of a global "Internet of Things, Data and Services" through the evolutionary development of embedded systems as a result of their being networked over the Internet. Embedded systems are already conceivable as a result of the intelligent networking of various sensor interfaces. Requirements for the next step to locally networked embedded systems are already made in the National Roadmap Embedded Systems 2011, which in its "CPS study" extended the spectrum to global networking (e.g., using the intelligent networking road junction that makes use of traffic jam information). Cyber-physical systems represent the next stage on the road to the creation of smart cities through the creation of an Internet of Things, Data, and Services.

Industry sectors including the automotive industry, the energy economy and, not least, production technology (INDUSTRIE 4.0) for example, will be transformed by these new value chain models. Global megatrends of globalization, urbanization, demographic change and energy transformation are the driving forces driving the technological imperative to identify solutions for a world in flux. In this way, cyber-physical systems make contributions to human security, efficiency, comfort and health in ways that have not previously imaginable. In doing so, they will play a central part in addressing the fundamental challenges posed by demographic change, scarcity of natural resources, sustainable mobility, and energy change.

WHAT DOES INDUSTRIE 4.0 MEAN FOR THE SOFTWARE SECTOR – ERP OR MES?

INDUSTRIE 4.0 has sparked a debate within the German software industry as to whether enterprise resource planning (ERP) or manufacturing execution systems (MES) will establish themselves as the dominant software system force in production environments. The use of CPS in the future will lead to the virtualization of the production control systems (PCS) at the production level, thereby eliminating the need for ERP software. Conversely, a significant contingent considers MES software to be excellently situated for the implementation of INDUSTRIE 4.0.

In reality, the answer is not as clear cut as in INDUSTRIE 4.0 will also cause significant transformation processes. While the "industrial software," e.g., airbags, remain indispensable to production management, it remains unlikely that one software system will replace the other. A practical consequence of the convergence of the two systems, there is the merging of software suites into integrated solutions. This scenario motivates the advancement of interoperability and the strategic alignment of the product lifecycle from INDUSTRIE 4.0 up to advanced production, service, and sharing. Software systems utilized in INDUSTRIE 4.0 will also have to address new challenges including, for example, data correlations, as a result of a greater number of communication interfaces and learning applications and the need to manage more Later and more complex systems of data.

THE EVOLUTION OF EMBEDDED SYSTEMS INTO THE INTERNET OF THINGS, DATA AND SERVICES

Vision: Internet of Things, Data and Services

Cyber-Physical Systems e.g. intelligent networked road junction

Networked Embedded Systems e.g. oiling

Embedded Systems e.g. airbag

THE INTERNET OF SERVICES

Cross-sectional themes applicable to all application scenarios:

- Semantic technologies, Cloud computing, Operator platforms for services

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This represents a production revolution in terms of both innovation and cost and time savings and the creation of a ‘bottom-up’ production value creation model whose networking capacity creates new and more market opportunities. Smart factory production brings with it numerous advantages over conventional manufacture and production.

These include:

- CPS-optimized production processes: smart factory units are able to determine and identify their field(s) of activity, configuration options and production conditions as well as communicate independently and wirelessly with other units;
- Optimized individual customer product manufacturing via intelligent compilation of ideal production system which factors account product properties, costs, logistics, security, reliability, time, and sustainability considerations;
- Resource efficient production;
- Tailored adjustments to the human workforce so that the machine adapts to the human work cycle.

1.6 THE SMART FACTORY – THE FUTURE OF AUTOMATED MANUFACTURING

The merging of the virtual and the physical worlds through cyber-physical systems and the resulting fusion of technical processes and business processes are leading the way to a new industrial age best defined by the INDUSTRIE 4.0 project’s ‘smart factory’ concept.

The deployment of cyber-physical systems in production systems gives birth to the ‘smart factory’. Smart factory products, resources and processes are characterized by cyber-physical systems; providing significant real-time quality, time, resource, and cost advantages in comparison with classic production systems. The smart factory is designed according to sustainable and service-oriented business practices. These instil upon adaptability, flexibility, self-adaptability and learning characteristics, fault tolerance, and risk management. High levels of automation come as standard in the smart factory; this being made possible by a flexible network of cyber-physical system-based production systems which, to a large extent, automatically oversee production processes. Flexible production systems which are able to respond in almost real-time conditions allow in-house production processes to be radically optimized. Production advantages are not limited solely to one-off production conditions, but can also be optimized according to a global network of adaptive and self-organizing production units belonging to more than one operator.
A comprehensive package of complementary policy and funding programs and activities has been put in place in order to establish Germany as a lead market and provider of cyber-physical systems by 2020.

The objective of the Agenda CPS project led by the German National Academy of Science and Engineering (acatech) on behalf of the Federal Ministry of Education and Research (BMBF) is to establish an integrated CPS research agenda that allows Germany to shape this technological revolution as a lead market and provider of cyber-physical systems, the Internet of Things and Services. The Agenda CPS project prioritizes research in the following four key categories:

- **Climate/Energy**
- **Health/Nutrition**
- **Security**
- **Communication**

These categories are further subdivided into specific research areas. The research focus varying between each project.

Software systems and knowledge processing research funding is divided into three specific categories:

- **Embedded systems** focusing on software-intensive embedded systems, the Internet of Things and Services.
- **Information and communication technology**
- **Software systems and knowledge processing**

The three category research areas are complemented by the cross-sectional technologies of software engineering, reliability and security due to their specific focus on the strategic priorities of software-intensive embedded systems, grid applications and infrastructure as well as virtual/augmented reality. Applicant projects should be business-oriented and include cooperation with either university or non-university research institutions. Calls for applications are published on a case-by-case basis, with the research focus varying between each project.
2.7 AUTONOMICS FOR INDUSTRIE 4.0

The AUTONOMIK für INDUSTRIE 4.0 - Produktion, Produkte, Dienste im multidimensionalen Internet der Zukunft (“AUTONOMICS for INDUSTRIE 4.0 - Production, Products, Services in the Multidimensional Internet of the Future”) technology program contributes to the implementation of the goals set out in the High-Tech Strategy 2020. Priority areas include developing the next evolutionary steps for machines, service robots and other systems able to deal with complex tasks autonomously as the transition from ICT-based control mechanisms to autonomously acting components and systems usher in a new age in which efficiency, cost effectiveness, and quality increase in new and flexible production infrastructures.

The technological development of the Internet of Things has already been covered in the Federal Ministry of Economics and Technology (BMWi) next generation media (new technologies and ubiquitous computing) and AUTONOMIK (autonomous, simulation-based systems for small and medium-sized enterprises) precursor projects which provided significant impulse to new products, services and business models in different application scenarios. Important developments in the field of semantic technologies applicable in the Internet of Applications and Services were also established in the BMWi THESEUS R&D funding project. The successor AUTONOMICS for INDUSTRIE 4.0 project has made EUR 40 million in funding available to companies and research institutions in order to advance intelligent interacting between ICT and industrial production in the areas of future-oriented production systems and production logic; future-oriented, premium products (including service robots); and future-oriented, knowledge-intensive electronic services.

2.8 CYPROS (CYBER-PHYSICAL PRODUCTION SYSTEMS)

The CyPros (Cyber-Physical Production Systems) research project consisting of a consortium of actors from science and industry led by Wittenstein AG was initiated in 2012 in order to research and develop a representative spectrum of cyber-physical system modules for production and logistics systems for industrial use. Together with the underlying reference architecture, also to be developed during the course of the three-year project, these system modules will allow the manufacturing industry to realize a significant increase in productivity and flexibility which will also equip Germany to become the lead user and provider of such systems.

This will allow the complexity of increasing competition to be controlled, but also lead to a sustainable and significant increase in productivity and flexibility of manufacturing companies through the development and introduction of cyber-physical production systems (CPPS). The resulting CPPS technologies will also allow Germany to increase its competitiveness as an international production location as a result of improved productivity and flexibility, while simultaneously allowing CPPS to be introduced in the market as marketable products, thereby establishing the country as a lead CPPS provider.

CyPros follows three separate goal stages:

- Development of a reference architecture and a representative spectrum of cyber-physical system modules for production and logistics systems.
- Provision of universal practices, support tools and platforms for the introduction of cyber-physical production systems.
- Technical and methodological basis for the commercial operation of cyber-physical production systems and their implementation in the real production environment of a showcase factory.

2.9 RES-COM

Launched in June 2011 and funded by the Federal Ministry of Education and Research, the RES-COM project addresses automatized conservation of resources through highly interconnected and integrated sensor-actuator systems in an INDUSTRIE 4.0 context. Prototype scenarios for context-activated resource efficiencies are being imple-mented. RES-COM adopts a completely new type of core technology based on active digital product memory and software service agents with embedded sensors and actuators. The project is overseen by the German Research Center for Artificial Inte-lligence (DFKI) in partnership with partners including SAP, Siemens, IS Predict, and 7x4 Pharma.
3.1 INDUSTRY-SCIENCE RESEARCH ALLIANCE

Initiated by the Federal Ministry of Education and Research (BMBF) in 2006, the Industry-Science Research Alliance is an umbrella group which brings together 19 leading representatives from science and industry to accompany the High-Tech Strategy of interministerial innovation policy initiatives.

In January 2011, INDUSTRIE 4.0 was initiated as a “Future Project” of the German Federal Government through the Communication Promoters Group of the Industry-Science Research Alliance. The Industry-Science Research Alliance, in partnership with acatech – National Academy of Science and Engineering, established the INDUSTRIE 4.0 Working Group co-chaired by Dr. Siegfried-Douglas Schantz, President of the German Research Center for Artificial Intelligence – Kaiserslautern (DFKI); and Dr. Johannes Helbig, Deutsche Post AG.

Kagermann, acatech; Prof. Dr. Wolfgang Wahlster, Fraunhofer IPA; Fried Dais (Robert Bosch GmbH) and Professor Henning Schmid, President of the German Research Center for Artificial Intelligence – Kaiserslautern (DFKI; and Dr. Johannes Helbig, Deutsche Post AG). The Communication Promoters Group of the Industry-Science Research Alliance (Prof. Dr. Henning Schmid, President of the German Research Center for Artificial Intelligence – Kaiserslautern (DFKI); and Dr. Johannes Helbig, Deutsche Post AG) and the Federal Government.

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3.2 ACATECH – NATIONAL ACADEMY OF SCIENCE AND ENGINEERING

acatech – the National Academy of Science and Engineering – represents the interests of the German scientific and technological communities, at home and abroad. It is autonomous, independent and non-profit organization. As a working academy, acatech supports policy-makers and society by providing qualified technical evaluations and forward-looking recommendations.

In 2010, acatech initiated a research project on cyber-physical systems – the technical core of INDUSTRIE 4.0. Initial implementation recommendations were formulated by the INDUSTRIE 4.0 Working Group from January to October 2012 under the coordination of acatech.

How does the INDUSTRIE 4.0 project contribute to the attractiveness of Germany as a location?

INDUSTRIE 4.0 marks a fundamental paradigm shift towards decentralized and individualized production cycles which will enable new, interdependent business and services models. INDUSTRIE 4.0 offers Germany the chance to further strengthen its position as a manufacturing location, manufacturing equipment supplier and IT solutions supplier. All the stakeholders in Germany are now closely cooperating through the Plattform INDUSTRIE 4.0 in order to push implementation. Germany will also profit from becoming a global pacesetter in the area of INDUSTRIE 4.0.

What advantages does INDUSTRIE 4.0 have for small and medium-sized enterprises?

Germany’s global market leaders include numerous “hidden champions” who provide specialized solutions. IN
dustry 4.0 will also result in new ways of creating value and novel business models. In the future, it will provide startups and small businesses with the opportunity to develop and provide downstream services.

What impact will INDUSTRIE 4.0 have beyond Germany?

The fourth industrial revolution is a global trend. Many of Germany’s competitors have also recognized this trend of advancing the “Fourth Industrial Revolution” and are promoting it through a range of international and financial measures.

How can international companies profit from INDUSTRIE 4.0?

First, INDUSTRIE 4.0 will involve increased networking and cooperation between several different partners in international networks of value creation. To realize INDUSTRIE 4.0, a close international network between science, industry and academia is needed. INDUSTRIE 4.0 will address and solve some of the challenges the world is facing today such as renewable source and energy efficiency, urban production and demographic change.

A number of important research and trade actors and institutions are working closely together to realize Germany’s INDUSTRIE 4.0 vision.

What role does your organization play in Germany’s INDUSTRIE 4.0 project?

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THE DFKI PERSPECTIVE

3.3 GERMAN RESEARCH CENTER FOR ARTIFICIAL INTELLIGENCE - DFKI

The German Research Center for Artificial Intelligence (DFKI) was founded in 1988 and today has research facilities in Kaiserslautern, Saarbrücken, Bremen and a project office in Berlin. In the field of innovative commercial software technology using artificial intelligence, DFKI is the leading research center in Germany.

DFKI is actively involved in numerous organizations representing and continuously advancing Germany as an excellent location for cutting-edge research and technology. For beyond the country’s borders DFKI enjoys an excellent reputation for its academic training of young scientists. It presently hosts 135 highly qualified researchers and 272 graduate students from more than 42 countries and is contributing to more than 250 DFKI research projects. Over the years, more than 60 staff members have been appointed professors at universities in Germany and abroad.

Based on application-oriented basic research DFKI develops product functions, prototypes and patentable solutions in the field of information and communication technology. Research and development projects are conducted in twelve research departments and research groups, ten competence centers and five living labs. Funding is received from government agencies like the European Union, the Federal Ministry of Economics and Technology (BMWi), the German Federal Ministry of Education and Research (BMBF), the Federal Ministry of Economics and Technology (BMWi), the German Federal Ministry of Economics and Technology (BMWi), the Federal Ministry of Economics and Technology (BMWi), the Federal Ministry of Economics and Technology (BMWi), the Federal Ministry of Economics and Technology (BMWi), the Federal Ministry of Economics and Technology (BMWi), the Federal Ministry of Economics and Technology (BMWi), the Federal Ministry of Economics and Technology (BMWi), the Federal Ministry of Economics and Technology (BMWi), the Federal Ministry of Economics and Technology (BMWi), the Federal Ministry of Economics and Technology (BMWi), the Federal Ministry of Economics and Technology (BMWi), the Federal Ministry of Economics and Technology (BMWi), the Federal Ministry of Economics and Technology (BMWi), the Federal Ministry of Economics and Technology (BMWi), the Federal Ministry of Economics and Technology (BMWi), the Federal Ministry of Economics and Technology (BMwi) and the German Research Foundation (DFG). DFKI is on the forefront of INDUSTRIE 4.0 research. The SmartFactory Living Lab operates performance and testing of the latest technologies in process engineering and prototype goods under industrial conditions. The project ‘FRES-COM’ examines the vision of an automated and integrated sensor-actuator systems.

SmartFactory Living Lab which serves as a reference architecture for INDUSTRIE 4.0, has already worked on the initial concepts for INDUSTRIE 4.0 as part of the Industry 4.0 Research Alliance advisory board. The partners work with policy makers on an equal footing in order to design and practically implement joint production expertise in order to contribute towards decentralized self-organization. Both projects are funded by the BMWF establishing Germany as one of the leading pioneers in the field of the Internet of Things.

What advantages does INDUSTRIE 4.0 have for small and medium-sized companies?

INDUSTRIE 4.0 will be of particular importance to small and medium-sized enterprises (SMEs). Flexible value chains will transcend departmental, business and company boundaries. As a result, SMEs can become competitive, innovative networks with precisely calculated value added contributions. Continuous networking of systems presents a challenge for security technology, but INDUSTRIE 4.0 allows clients to personalize production and commercial processes. INDUSTRIE 4.0 will enable more efficient use of resources. Far beyond the country’s borders DFKI envisages the world’s first so-called “smart factory” as a living lab which serves as an exemplary reference architecture for INDUSTRIE 4.0.

How can international companies profit from INDUSTRIE 4.0?

Industry 4.0 is an industrial and political revolution. That is to say, there will be no single defining event that takes place, but rather a period of dynamic development. New resource and energy optimization programs make environmental protection and sustainable production more attractive than ever. INDUSTRIE 4.0 will therefore make a significant contribution to the biggest problems facing society; be it climate change, energy efficiency optimization processes make environmentally friendly policies an attractive proposition, but INDUSTRIE 4.0 will be of particular importance to small and medium-sized enterprises (SMEs). Flexible value chains will transcend departmental, business and company boundaries. As a result, SMEs can become competitive, innovative networks with precisely calculated value added contributions. Continuous networking of systems presents a challenge for security technology, but INDUSTRIE 4.0 allows clients to personalize production and commercial processes. INDUSTRIE 4.0 will enable more efficient use of resources. Far beyond the country’s borders DFKI envisages the world’s first so-called “smart factory” as a living lab which serves as an exemplary reference architecture for INDUSTRIE 4.0.
With its clearly defined mission of application-oriented research and its focus on key technologies of relevance to the future, the Fraunhofer-Gesellschaft plays a prominent role in the German and European innovation process. Applied research has a knock-on effect that extends beyond the direct benefits perceived by the customer. Through their research and development work, the Fraunhofer Institutes help to reinforce the competitive strength of the economy in their local region, and throughout Germany and Europe. They do so by promoting innovation, strengthening the technological base, improving the acceptance of new technologies, and by helping to train the urgently needed future generation of scientists and engineers.

As an employer, the Fraunhofer-Gesellschaft offers its staff the opportunity to develop their personal and professional skills. They can take up positions of responsibility within their institute, universities, in industry and in society. Students also wish to work on projects at the Fraunhofer Institutes have excellent prospects of securing employment with the institute or another Fraunhofer Institute after graduation. The main reason for this is the Fraunhofer-Gesellschaft's reputation for being the place to work on the cutting edge of technology.

The Fraunhofer-Gesellschaft is a recognized non-profit organization that takes its name from Joseph von Fraunhofer (1787–1826), the illustrious Munich researcher, inventor and entrepreneur. Fraunhofer (1787–1826), the illustrious Munich researcher, inventor and entrepreneur.

3.4 FRAUNHOFER-GESELLSCHAFT

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What role does your organization play in Germany's INDUSTRIE 4.0 project?

The Fraunhofer IAO has been helping shape the INDUSTRIE 4.0 project since its very beginning as part of the project ‘R&D for Industry 4.0’ by the German Industry Research Alliance. Since 2012 we have been working with industry partners in the field of Industrial 4.0. This work formed the basis of the publicly funded ‘KapaflexCy’ project (http://www.kapaflexcy.de) in INDUSTRIE 4.0 within the framework of the Innovation Network ‘Production 4.0’. INDUSTRIE 4.0 is the networked production of the future. The research project essentially embraces the idea of linking the fields of industry, research, universities and education. The project ‘KapaflexCy’ focuses on the area of highly flexible, self-organized capacity management as part of the project ‘Innovative Network Production 4.0’ (production of the future – INDUSTRIE 4.0). In the 2012–2015 period, the project ‘KapaflexCy’ has developed a new application and business model for INDUSTRIE 4.0 with industry and trade association partners.

How does the INDUSTRIE 4.0 project contribute to the attractiveness of Germany as a location?

With its innovative and leading mechanical engineering, automotive and electronic industries, Germany is a country with deep industrial roots that is already becoming a global technology supplier for INDUSTRIE 4.0 factories. This provides the German manufacturing sector with the opportunity of continuing to be a world leader in embedded systems (the technological basis for INDUSTRIE 4.0). In order to keep the German automotive and mechanical engineering industries competitive, complex software systems are needed for unequalled capacity utilization. INDUSTRIE 4.0 therefore acts as an industrial forum for the industry and trade association partners. Since 2012 we have been working with industry partners in the field of Industrial 4.0. This work formed the basis of the publicly funded ‘KapaflexCy’ (http://www.kapaflexcy.de) project (http://www.kapaflexcy.de) in INDUSTRIE 4.0 within the framework of the Innovation Network ‘Production 4.0’. INDUSTRIE 4.0 is the networked production of the future. The research project essentially embraces the idea of linking the fields of industry, research, universities and education. The project ‘KapaflexCy’ focuses on the area of highly flexible, self-organized capacity management as part of the project ‘Innovative Network Production 4.0’ (production of the future – INDUSTRIE 4.0). In the 2012–2015 period, the project ‘KapaflexCy’ has developed a new application and business model for INDUSTRIE 4.0 with industry and trade association partners.

What advantages does INDUSTRIE 4.0 have for small and medium-sized companies?

The German manufacturing environment is characterized by a large number of small and medium-sized enterprises (SMEs). These SMEs rely on highly innovative production for the rest of the world. New market segment will open up for these companies dynamically and internationally with INDUSTRIE 4.0. However, SMEs in particular stand to benefit from the standardized networking of their own production resources as well as from work with proprietary systems. This will allow SMEs to drastically reduce production management effort and expand in a significantly faster manner in market requirements.

What impact will INDUSTRIE 4.0 have beyond Germany? INDUSTRIE 4.0 is not an issue that is limited just to Germany. There are similar approaches being carried out across the world which are being promoted by organizations such as the Industrial Internet Consortium (IIC). IIC alone is a research and development forum for the future. IIC alone is a research and development forum for the future. However, these forums have been set up in an ad-hoc manner. The IIC’s forum currently focuses only on the area of application of INDUSTRIE 4.0 within the framework of the Innovation Network ‘Production 4.0’. INDUSTRIE 4.0 is the networked production of the future. The research project essentially embraces the idea of linking the fields of industry, research, universities and education. The project ‘KapaflexCy’ focuses on the area of highly flexible, self-organized capacity management as part of the project ‘Innovative Network Production 4.0’ (production of the future – INDUSTRIE 4.0). In the 2012–2015 period, the project ‘KapaflexCy’ has developed a new application and business model for INDUSTRIE 4.0 with industry and trade association partners.

How can international companies profit from INDUSTRIE 4.0?

Global networking and distributed processes are always associated with considerable coordination and management time and effort. INDUSTRIE 4.0 allows information to cover long distances in close to real time. International companies will therefore be able to quickly react to client requirements within globally distributed production systems as well as provide their customers with cost-effective and high-quality products. INDUSTRIE 4.0 allows information to cover long distances in close to real time. International companies will therefore be able to quickly react to client requirements within globally distributed production systems as well as provide their customers with cost-effective and high-quality products.

What impact will INDUSTRIE 4.0 have on the future employment market? What will impact have on the education and training of the future?

The operations of a factory according to the INDUSTRIE 4.0 principle require skills that are different from the relevant production and IT know-how. For the future it is important to create corresponding training courses in order to tackle interdisciplinary issues in a new and highly innovative level. By means of just-in-time learning and just-in-time training, workers will be equipped for dealing with short-term, unplanned work activities with changing content on the job, thereby becoming qualified to solve various problems as they are dealing with them.

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The Fraunhofer IAO is a member of the Fraunhofer-Gesellschaft. Fraunhofer IAO includes research on digital development in the fields of engineering, IT, economics and social sciences.
The development, deployment, maintenance and lifecycle management of products, machines and systems will be improved by it’s OWL technologies and solutions. Their reliability, resource efficiency, and user friendliness will also be optimized, with individualized and adaptable production processes becoming reality.

Within the it’s OWL technology network, 170 companies – including world leaders such as Bosch, Claas, DNM MORE: SIHI: AKTIENSEIFFENHOF, Harting, Lenze, Miele, Phoenix Contact, WAGO, Weidmüller, and Wincor Nofeld – and research institutions are carrying out pioneering work in this area. Intelligent products and production systems are being developed in 65 projects, from automation and drive solutions to manufacturing facilities and connected systems. This includes self-correcting manufacturing processes, digitization of work planning, energy efficient intralogistics for warehouses, resource-efficient industrial laundry as well as energy management in smartgrids.

The project clearly strengthens machine engineering as well as the electronics industry; industries which are thankfully still very strongly represented in Germany. In recent times these industry sectors have been dismissed as “old economy,” with countries like Great Britain daily focusing on the service sector – something we now know to be a mistake. I believe that with INDUSTRIE 4.0 we have a unique opportunity to combine and play off our strengths to become not only the lead provider for production in the future but also to remain an important production location.

What advantages does INDUSTRIE 4.0 have for small and medium-sized companies?

The current state of affairs is that the subject seems a little far off for SMEs. I say “seems” very deliberately, as there are also companies who are already very successfully active in the INDUSTRIE 4.0 area. For example, MSF Vathauer Antriebstechnik – an it’s OWL cluster member – won the Industry 2013 prize for its decentralized drive solutions for INDUSTRIE 4.0. It certainly plays a key role in Germany. That’s why we have set up our technology transfer project specifically for these companies in order to pass the benefits of INDUSTRIE 4.0 on. For instance, there is the “Value Added in Production” in 2016. I don’t think this would have been the case without Germany’s INDUSTRIE 4.0 initiative.

What impact will INDUSTRIE 4.0 have beyond Germany?

It has certainly not gone unnoticed by other countries that Germany has fared comparatively well despite the financial and economic crisis of recent times. The reason for this is that we are still a strong production location. For instance, even the European Institute for Innovation and Technology (EIT) will invite tenderers for a Knowledge and Innovation Community (KIC) in the area of “Value Added in Products” in 2016. I don’t think we would have been in this position without Germany’s INDUSTRIE 4.0 initiative.

How can international companies profit from INDUSTRIE 4.0?

Quite simply: by buying our solutions. Because here they can access all of the components for future-proof production. International companies can of course also profit from these innovations. We should not forget that Germany has invested enormously in research and development for this success. That is the only reason why we now stand on the threshold of a fourth industrial revolution.
What role does your organization play in Germany's INDUSTRIE 4.0 project?

Together, three leading industry associations are pushing the INDUSTRIE 4.0 theme forward. BITKOM, VDMA and ZVEI founded the Plattform INDUSTRIE 4.0 partnership which started operations in April of this year. The Plattform is based in Frankfurt am Main with a joint information portal and “virtual office” set up online. Plattform INDUSTRIE 4.0 will continue the work of the Federal Government’s “Future Project INDUSTRIE 4.0” within the framework of the High-Tech Strategy. The main objective is the development and expansion of knowledge and networking as well as the distribution of research results and their practical application in INDUSTRIE 4.0. The Plattform is intended as the central point of contact for all matters INDUSTRIE 4.0 related and, as such, will actively involve and/or participate with all relevant actors.

How does the INDUSTRIE 4.0 project contribute to the attractiveness of Germany as a location?

The INDUSTRIE 4.0 project builds bridges between manufacturing companies, providers, science, and politics. Cross-industry exchange of ideas and information help accelerate knowledge transfer for innovation in Germany. From the point of view of the three industry associations, INDUSTRIE 4.0 is of tremendous importance to the competitiveness of German industry. The term stands for networked - often with the internet over and beyond company borders – and connected industrial production. As a location we are strong in the development and application of production, automation, and embedded software-intensive IT and have longstanding and established industrial networks.

What impact will INDUSTRIE 4.0 have beyond Germany?

It is important to define and expand the traditional core of German industry and its excellent international position with the advent of internet technologies. As an export nation, machines and plants are not only made, but also produce in branch factories and by licensees. The concepts at play in INDUSTRIE 4.0 do not observe national borders. The paradigm shift in industrial production and intelligent products creates the opportunity to increase productivity, flexibility and quality in many different economic regions.

What can international companies profit from INDUSTRIE 4.0?

Further improvements in the implementation of industrial processes in manufacturing, engineering, supply chain and lifecycle management intensify on new ideas, algorithms, technologies, reference architecture, standards, and business models. Germany has the ideal conditions to fulfill these tasks in order to play an internationally leading role in INDUSTRIE 4.0. Numerous standards, like the internet protocol, will be used internationally by foreign companies, thus allowing a soft entry for the Internet of Things and the Internet of Services into industrial production in Germany too.

www.plattform-i40.de
Within these plants, the key aspects of INDUSTRIE 4.0 are demonstrated in an intuitive and accessible way. The central research and demonstration platform of the SmartFactoryKL is its hybrid demonstration plant which can produce a customized product (soap bottles) in the batch size one to customer specification. Terms of requirements, structure and complexity of the laboratory system with industrial production in practice is absolutely comparable. Functional electrical components (i.e. controllers, sensors, actuators) from different vendors are flexibly networked. Communication systems operate wirelessly, both within the system as well as for overall control levels. The mobile production line showcases the flexible production of an exemplary product whose components (i.e. case cover, case base, printed circuit board) are handled, mechanically machined, and assembled. The product is able to control its own production process as it has all of the necessary information available in its digital product memory stored on an RFID tag. The process is not controlled by a standard programmable logic controller (PLC), but by a service-oriented, decentralized control system consisting of distributed microcontrollers communicating using internet standards. Human workers are supported with innovative mobile device and augmented reality-based assistance systems.

3.7 SMARTFACTORY KL

The SmartFactoryKL technology initiative, located at the German Research Center for Artificial Intelligence (DFKI) in Kaiserslautern, is the first European vendor independent demonstration factory for the industrial application of state-of-the-art information and communication technologies. The venture has the purpose of supporting the development, application and propagation of innovative automation technologies in different sectors as well as providing a basis for their extensive usage in science and industry.

Founded in 2005, the SmartFactoryKL initiative is a successful example of public-private-partnership: being a cooperative venture between vendors and users (manufactured) of modern automation technologies as well as representative of public interests. The common projects range from fundamental work on basic technologies to the development of marketable products. Members, sponsors and promoters create a long-term partnership in order to realize the vision of a future industrial landscape with modern and innovative means.

SmartFactoryKL works as a pioneer for the technology transfer of key aspects of INDUSTRIE 4.0 into practice. By operating several modular pilot plants, both state-of-the-art technologies and cutting-edge research results can be implemented and evaluated.
4.0 INDUSTRY VOICES: A SELECTION

4.1 ROBERT BOSCH GMBH

The Bosch Group is a leading global supplier of technology and services. In 2012, its roughly 306,000 associates generated sales of EUR 52.5 billion. Since the beginning of 2013, its operations have been divided into four business sectors: Automotive Technology, Industrial Technology, Consumer Goods, and Energy and Building Technology. The Bosch Group comprises Robert Bosch GmbH and its roughly 360 subsidiaries and regional companies in some 50 countries. If its sales and service partners are included, then Bosch is represented in roughly 150 countries. This worldwide development, manufacturing, and sales network is the foundation for further growth. Bosch spent some EUR 4.8 billion for research and development in 2012, and applied for nearly 4,800 patents worldwide. The Bosch Group’s products and services are designed to fascinate, and to improve the quality of life by providing solutions which are both innovative and beneficial. In this way, the company offers technology worldwide that is “Invented for life.”

What role does your organization play in Germany’s INDUSTRIE 4.0 project? Bosch finds itself in a dual role on the way to networked and integrated industry (“INDUSTRIE 4.0”). The company itself deploys technologies and software in order to network its own manufacturing base. On top of this, the company also develops solutions in this area. Boschalready provides numerous solutions for the Factory 4.0. Bosch Packaging Technology is already building intelligent equipment for intelligent factories in the pharmaceuticals and foodstuff industries. A software suite developed by Bosch Software Innovations also optimizes the complete equipment maintenance process.

How does the INDUSTRIE 4.0 project contribute to the attractiveness of Germany as a location? The advent of Web 3.0, i.e. the Internet of Things and Services, in industrial production provides Germany with enormous opportunities in two ways. On the one hand, German companies will develop, sell and export technologies and products for networked industry. On the other hand, the use of these technologies will improve the efficiency, and therefore competitiveness, of German industry.

What advantages does INDUSTRIE 4.0 have for small and medium-sized companies? German companies are – notwithstanding the increasing competition from Asia – leaders in plant and mechanical engineering. German companies also have considerable know-how and a competent workforce in the fields of IT, embedded systems, and automation technology. The framework for a consolidated implementation of networked production has been established with the creation of the PTZ (PTZ, 2010), and ZVEI–awarded “Partners for INDUSTRIE 4.0.” German companies must actively shape the way to networked production and not lose sight of what is required.

What impact will INDUSTRIE 4.0 have beyond Germany? The ideas behind INDUSTRIE 4.0 will change existing value chains—even across national borders. Value chains in which companies and business processes are functionally integrated will emerge. This means that business processes—including their engineering—will be consistently designed across the whole value chain. Production systems are centered in networks—from the supplier to the customer. These highly dynamic business networks provide potential for innovation and new business models. The same also applies to better data generation and evaluation.

How can international companies profit from INDUSTRIE 4.0? Digitalization and networking help to optimize the value chain. Customers are no longer obliged to choose from a fixed product spectrum set by the manufacturer, but instead are able to individually combine single functions and components. The range of variety will become profitable for companies. This can consequently increase the size of the market and turnover. At the same time, customer satisfaction increases as the internal operative costs sink as a result of increased networked chain digitalization.

www.bosch.com
Festo is a leading international supplier of automation technology for factory and process automation. A globally oriented and independently run family business based in Esslingen, the company has established itself as a performance leader in the sector thanks to its innovations and problem-solving competence in the field of pneumatics. Today the company provides pneumatics and electric drive technologies for factory and process automation to more than 300,000 customers in 200 industry sectors across the world. Together with partners from science and industry, Festo is conducting research into new solutions for merging modern information and communication technologies with classical industrial production processes. The trend towards increasingly individualized products in smaller quantities and increased variety requires technologies that are able to continuously adapt to changing production conditions. Festo recognizes intelligent components which organize themselves and process requests from higher level control systems as the basis for tomorrow’s production systems. Festo is actively developing precision engineering and microsystem technologies in order to realize fully networked overall systems. Festo also conducts research into solutions which allow the human workforce to directly interact with new machine and robot technologies. To this end, the company is also extensively concerned with the proper provision of education and training for the next generation of workers in the new production world.

What role does your organization play in Germany’s INDUSTRIE 4.0 project?
Festo contributed to the recommendations made by the Industry-Science Research Alliance. Within the context, a “Resilient Factory” application case – with systems that are tolerant to disruptions – was introduced. These activities have subsequently been transferred to the Plattform INDUSTRIE 4.0 in which Festo is also very much actively involved.

How does the INDUSTRIE 4.0 project contribute to the attractiveness of Germany as a location?
From a European perspective it is important to ensure that production in high-wage countries, of which Germany is one, remains competitive in the long term. INDUSTRIE 4.0 activities will contribute to achieving this. The perspective merging of manufacturing technology with IT can be carried out in especially efficient manner in Germany in particular, as public funds are also in operation. This special situation allows the attractiveness of Germany to be significantly increased with INDUSTRIE 4.0.

What advantages does INDUSTRIE 4.0 have for small and medium-sized companies?
The creation of commonly defined standards with widespread effect is an important part of INDUSTRIE 4.0 activities. Continuous and open standard architectures are also clearly more advantageous for small and medium-sized enterprises (SMEs) than closed concepts from major concerns that shape the market themselves. It is therefore worthwhile for SMEs to force non-proprietary solutions within an INDUSTRIE 4.0 context.

What impact will INDUSTRIE 4.0 have beyond Germany?
Activities are being closely followed, for example, in Great Britain and the USA. Horizontal networking in value chain networks is not limited to just one company or country. Successful concepts which are developed will also be accepted internationally.

How can international companies profit from INDUSTRIE 4.0?
As already alluded to in the answer to the previous question, economic concepts are not applied nationally. International companies will be able to benefit just as much other technological and commercial advantages arise from the implementation of INDUSTRIE 4.0 concepts.
SAP helps companies of all sizes and industries run better. From back office to boardroom, warehouse to storefront, design to device - SAP empowers people and organizations to work together more efficiently and use business insight more effectively to stay ahead of the competition.

As manufacturers face increased cost pressure and market volatility, product life cycles and test cycles are getting shorter. Products are becoming more complex and customized. SAP’s “Idea to Performance” initiative helps manufacturers seize new business opportunities using INDUSTRIE 4.0 concepts and technologies, they can provide individualized products and services based on the wealth of data from smart products and machines.

What role does your organization play in Germany’s INDUSTRIE 4.0 project?
SAP has been engaged in several public research projects and initiatives in the context of INDUSTRIE 4.0 and contributed to the recommendation paper issued by acatech - the National Academy of Science and Engineering. SAP provides technologies and solutions that help companies to embrace the upcoming changes in the manufacturing industries. SAP follows a holistic “Idea to Performance” approach, helping customers to embrace the upcoming changes in the manufacturing industries.

How can international companies profit from INDUSTRIE 4.0?
INDUSTRIE 4.0 is a global topic, encompassing fast-growing markets like China or India as well as traditional manufacturing countries such as Germany, US, Korea or Japan. For example, companies can position themselves and start implementing INDUSTRIE 4.0 scenarios to stay ahead of the competition. SAP helps companies of all sizes and industries run better. From back office to boardroom, warehouse to storefront, design to device - SAP empowers people and organizations to work together more efficiently and use business insight more effectively to stay ahead of the competition.

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Solutions within the “Idea to Performance” portfolio enable intelligent process execution, resourceful operations, and intuitive user experiences. They help companies become smarter, faster, and simpler.

Make your customers smarter, faster, and simpler.

4.3 SAP AG
As market leader in enterprise application software, SAP helps companies of all sizes and industries run better. From back office to boardroom, warehouse to storefront, design to device - SAP empowers people and organizations to work together more efficiently and use business insight more effectively to stay ahead of the competition.

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Product Life Cycle Management (PLM)
SAP PLM helps companies to develop new business models and a roadmap for implementing INDUSTRIE 4.0 scenarios.

What does INDUSTRIE 4.0 project contribute to the attractiveness of Germany as a location?
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Make your customers smarter, faster, and simpler.
What role does your organization play in Germany’s INDUSTRIE 4.0 project?

TRUMPF has been a member of the federal government-initiated INDUSTRIE 4.0 Working Group since 2011 and has already provided a decisive contribution to the definition of the “smart factory.” As well as this, TRUMPF is also active in the Plattform INDUSTRIE 4.0 management board and steering group set up by the VDMA, BITKOM and ZVEI industry associations. Alongside projects like CyProS – in which 20 partners are conducting research into the implementation of cyber-physical production systems – TRUMPF is also working to create solutions for more productive and efficient production processes.

How does the INDUSTRIE 4.0 project contribute to the attractiveness of Germany as a location?

The INDUSTRIE 4.0 vision is one of networked systems in which no capacity bottlenecks or available resources remain undetected. They are transparent, can react to variations flexibly and allow humans to intervene as intelligent decision makers according to the situation. These systems will allow individual products to be produced in an efficient and swift manner normally associated with mass production. The INDUSTRIE 4.0 project creates the conditions for the implementation of such production networks in Germany.

What advantages does INDUSTRIE 4.0 have for small and medium-sized companies?

Small and medium-sized companies in particular must react quickly to changes – for example short-term customer orders. The networked manufacturing foreseen in INDUSTRIE 4.0 allows all production processes to be transparent and easily influenced. INDUSTRIE 4.0 provides the companies with the flexibility which allows them to remain internationally competitive.

What impact will INDUSTRIE 4.0 have beyond Germany?

The “Global Facility” is one of the five elements of the Smart Factory. Production systems are already internationally networked – with INDUSTRIE 4.0 this networking will continue to increase. Moreover, the new technological opportunities are not only available in Germany. The advantages that the Internet of Things (for example) brings to manufacturing won’t go unnoticed in other countries. The different elements of INDUSTRIE 4.0 will therefore also affect production in other countries.

How can international companies profit from INDUSTRIE 4.0?

Just as is the case for German companies, international companies will be able to more efficiently shape their own production according to the principles of INDUSTRIE 4.0. For this they can call upon the services of German machine builders who have long been occupied with the opportunities made possible by networking. TRUMPF provides its customers, whether domestic or international, with state-of-the-art technology. The company has already been deploying the first elements of INDUSTRIE 4.0 in its machine tools and lasers for years.
With an international workforce of around 1,700 and turnover of EUR 241 million in 2012/13, WITTENSTEIN AG stands for innovation, precision and excellence in the world of mechatronic drive technologies – both nationally and internationally. The group, with headquarters in southern Germany, covers eight innovative business fields with respective subsidiary operations: servos, gearheads, servodrive systems, mechatronics, robotics, medical technology, rotary and linear actuator systems, nanotechnology as well as electronic and software components for drive technology. With around 60 subsidiary and representative operations in approximately 40 countries, the company is represented in all important global technology and sales markets. WITTENSTEIN focuses on innovation – without limiting itself solely to technological innovations and products but also applying itself to new processes. The company intends to merge the terms “innovation” and “factory” in order to bring the new thinking to the fore: innovative products need innovative production. Together with partners from science and industry, WITTENSTEIN has set out on the path of making its own production INDUSTRIE 4.0 capable. INDUSTRIE 4.0 use cases will be carried out at the “Urban Production of the Future” showcase factory established in Fellbach near Stuttgart.

A WITTENSTEIN innovation factory and production facility, which brings together development, sales and production of the different mechatronic company units together at one site, is currently being built at the company headquarters in Igersheim-Harthausen.

What role does your organization play in Germany’s INDUSTRIE 4.0 project?

Dr. Manfred Wittenstein, chairman of the WITTENSTEIN AG board, is certain: INDUSTRIE 4.0 will most likely only become a reality in the next decade. However, companies who want to internationally profit from the new technology wave must lay the proper foundations today. New answers are required in the world of production in order to master the challenges of the future. As one of the INDUSTRIE 4.0 driving forces, WITTENSTEIN, together with its partners, is seeking out the smart answers in order to meet future production requirements. This also has something to do with corporate responsibility in terms of society and the environment.

How does the INDUSTRIE 4.0 project contribute to the attractiveness of Germany as a location?

As a high-performance location, Germany is well equipped to meet global challenges. Should German industry set the pace for the fourth stage of the industrial revolution, then developments made in INDUSTRIE 4.0 will also help contribute to secure Germany’s position. Important and necessary for success here is the integration of science and industry – the major location advantage of German mechanical engineering companies since time immemorial. German companies have a great opportunity to help shape new standards across the entire value chain in a pioneering role.

What advantages does INDUSTRIE 4.0 have for small and medium-sized companies?

Germany’s Mittelstand is used to including and integrating new skills. In fact it is the structure of many small and often family-run businesses in the machinery and equipment sector that provides the ideal conditions for quality and successfully mastering the step in the merging of internet and production technology. The German mechanical engineering industry could be a pioneer with its manufacturing and technology.

What impact will INDUSTRIE 4.0 have beyond Germany?

“INDUSTRIE 4.0 will become the global language of production.”

Hartmut Rauen, VDMA (Verband Deutscher Maschinen- und Anlagenbau - German Engineering Federation)

How can international companies profit from INDUSTRIE 4.0?

INDUSTRIE 4.0 will yield a new generation of automation technology and production systems. The goal for German companies is to become the lead provider in the future market for such systems. For foreign companies, the opportunity exists to profit from the technological achievements of INDUSTRIE 4.0 as well as the reputation and application know-how of German providers of highly productive systems in this market.

www.wittenstein.de/en/
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