The SAP Perspective on Industry 4.0
Leading the Way in the Fourth Industrial Revolution
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The fourth industrial revolution is changing the traditional way of conducting business, disrupting the operational model across the entire business network. Increasing connectivity and data availability for global production and supply chains are needed on a secure and reliable technological foundation. SAP is in a unique position to guide our customers with their transition to Industry 4.0 by using new technological solutions that provide business innovations and connect things, processes, and people.
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WHAT IS INDUSTRY 4.0?
Industry 4.0 is an initiative from key German companies in collaboration with the German government, academia, and labor representatives to drive the fourth industrial revolution in manufacturing (also known as the “Platform Industry 4.0”).

The core of the fourth industrial revolution is the horizontal and vertical integration arising from machines connecting to the outside world. The previous revolutions were the introduction of mechanical production using water and steam power in the 18th century, the introduction of the assembly line in the 19th century, and the automation of production through electronics and IT in the 20th century (see Figure 1).

While the digitalization under “Industry 3.0” focused on the automation of single machines and processes, Industry 4.0 focuses on the end-to-end digitalization of all physical assets driven by the Internet of Things (IoT), cyberphysical systems, and cloud computing. This includes horizontal integration with value chain partners and customers as well as vertical integration of the technology stack. Seamless generation, analysis, and communication of data within a complete digital ecosystem are the key drivers of the gains promised by Industry 4.0.

Figure 1: Overview of the Four Stages of Industrial Revolution

SOURCE: Abschlussbericht Industrie 4.0, Deutsches Forschungszentrum für Künstliche Intelligenz GmbH (DFKI), Kaiserslautern, Germany, April 2015.

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PLATFORM INDUSTRY 4.0 AND SAP’S INVOLVEMENT
In addition to activities centered in Germany, the German platform, Platform Industry 4.0, also interacts with other international collaborations and standardization bodies, such as Industrie du Futur (France) and the Industrial Internet Consortium (IIC), to drive adoption internationally.

Platform Industry 4.0 is actively driving five topics to facilitate the adoption of Industry 4.0:
- Standardization of protocols and architectures
- Research and development
- Network security
- Legal frameworks
- Labor and education

As one of the founding members of the platform and the largest European software company, SAP has been involved in shaping the platform from the beginning. Bernd Leukert, member of the executive board for products and innovation at SAP, is currently chairing the steering committee of the platform. SAP is contributing to all working groups with a special focus on standardization and network security. SAP is also assuming leadership roles in other international platforms, for example, with Tanja Rückert cochairing the IIC.

THE VALUE BEHIND INDUSTRY 4.0: CHANGING BUSINESS MODELS
As with previous industrial revolutions, companies are reevaluating their business models under Industry 4.0 and looking at three fundamental choices to decide future direction:

- **Boost existing business – doing things better**
  To improve its existing business under Industry 4.0, a company would, for example, completely automate entire plant facilities and include simulation capabilities and predictive data analytics to offer decision support for the remaining human workers. This would create further operational efficiencies that were previously not possible.

- **Transform operating model – doing things differently**
  Companies that want to do their existing business differently could, for example, create more-personalized versions of their products.

- **Start something new – doing different things**
  To change or expand its existing business, a company should focus on its core competencies. Industry 4.0 offers a vast array of solutions to support this by connecting businesses with other businesses, enabling a company to expand its reach. This allows for new business models, for example, offering risk-sharing models for the operation of assets.
Use Cases for **Industry 4.0**

Rather than approaching the transformation into Industry 4.0 holistically, companies drive innovation through concrete business use cases with fast payoff for maximum value generation.

There are nine types of use cases being implemented in the context of Industry 4.0. They are centered on connected assets, connected products, and connected supply chains:

**Connected assets**
- Adaptable factory focuses on a production resource. It describes how this can be designed with respect to adaptability and how this impacts the supplier of the production resource, the system integrator, and the plant operator.
- Value-based services describe the design of service value networks, if product or process information is provided on an IT platform.
- Human-technology interaction in production describes future support of an operator in the production based on new technologies.

**Connected products**
- Transparency and adaptability of delivered products focuses on a product and describes the design of transparency and adaptability of delivered products based on an IT platform.

**Connected supply chains**
- Self-organizing and adaptive logistics are closely linked to order-controlled production but address the entire value chains for interlogistics and intralogistics.
- Innovative product development describes new methods and processes in product development with a focus on the early phases of a product.
- Seamless and dynamic plant engineering describes an integrating plant model that is created during the initial engineering process for the construction of a plant. This model is maintained over the entire life of the realized plant in permanent, interweaved processes between engineering, operation, and service of the plant.

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Transformation Journey to Industry 4.0

Industry 4.0 is at the core of what SAP stands for – driving real business value for customers by digitalizing their operations. This is not limited to isolated business functions, but goes across lines of business as well as across companies to take collaboration to the next level.

OVERCOMING THE HURDLES TO IMPLEMENTATION OF INDUSTRY 4.0

Common standards and security are the key hurdles standing in the way of common adoption of Industry 4.0. To overcome this, the “Industry 4.0 Administration Shell” is being developed in collaboration with the respective industry associations as well as the IIC, Industrie du Future, the European Union, and other international standardization bodies. The goal is to semantically describe all IoT-enabled objects and their capabilities.

SAP is going to implement this semantic interface in all IoT applications to ensure immediate connectivity of things to the SAP® ERP-equivalent “digital twin.” This will significantly reduce implementation costs of IoT solutions and their integration to the SAP ERP application or SAP S/4HANA®, once the standards are being adopted.

SAP has taken the lead in various organizations to drive the adoption of IoT security and common standards. Many customers are approaching SAP to play a neutral and leading role to ensure that investments in business process standardization, which has been achieved through SAP R/3® software and the underlying data and master data models, are being leveraged for the development of next-generation standards.

Customers should focus on making their business better rather than worrying about specific technologies.
A SUCCESSFUL PATH TO INDUSTRY 4.0

Customers should focus on making their business better rather than worrying about specific technologies. This means that they should identify specific business problems that they want to solve rather than aiming for a full-fledged digital transformation to Industry 4.0 right from the start. By focusing first on the most relevant use cases and fast implementation, they will be able to build capabilities, motivate change, and take steps to a data-driven digital business model, as shown in Figure 2.

When identifying use cases, customers should not only focus on how to improve existing business, but they should also consider how to do their existing business differently, or even how to expand what they do based on their core competencies. This will prepare enterprises to employ new technologies as opportunities, rather than reacting after they have become threats.

Figure 2: Stages to a Data-Centric Business Model – Industry 4.0 Maturity Model
SAP’s core competence is helping our customers solve business problems. This means helping them connect to the world.
Our core competence is helping our customers solve business problems. In the past, we have done this by connecting departments within a company and connecting companies to each other through business networks. Now we want to help companies connect to the world.

With the SAP Leonardo IoT platform, we have built a comprehensive set of offerings that connects things to people and processes and provides solutions for all major use cases. In addition, SAP has built a strong technological foundation to deliver on connectivity and security as well as supporting customers in rapid implementation.

**SAP LEONARDO INTERNET OF THINGS CAPABILITIES**

The capabilities offer a range of packaged, end-to-end enterprise solutions for connected things from products to people across line-of-business and industry use cases. These applications solve business problems by using information from “things” (such as fixed and moving assets and products), business processes, algorithms (such as machine learning), constituents of a business network (such as people and business partners), and contextual information (such as news reports, weather, and traffic).

Examples of our solutions for Industry 4.0 include the following:

- Industry 4.0 packages for manufacturing connect production systems to business processes and provide end-to-end visibility and analytics capabilities.
- SAP Asset Intelligence Network brings together operators, OEMs, and service providers and also provides a network for a collaboration of business partners, rather than just suppliers.
- The SAP Predictive Maintenance and Service solution optimizes asset operations and maintenance by analyzing live data, correlating it with business information, and predicting and preventing future malfunctions and system failures.

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SAP Leonardo IoT accelerator packages are fixed-price promotional offerings to get customers up and running within three months. Customers can select from several cloud solution bundles, which include licensing and services.

The SAP Leonardo IoT Bridge is a digital operations center that combines real-time information from connected things with business processes to turn extended supply chains into collaborative and actionable live supply chain environments.

SAP Leonardo IoT Foundation includes both best-of-breed business services that enable users to rapidly build IoT applications by building digital twins, reusing application services, and applying predictive algorithms; and core technical services to process data at a high velocity, with the ability to stream analytics and run predictive scenarios. These are delivered on SAP Cloud Platform coming from millions of devices.

SAP Leonardo IoT Edge ingests data irrespective of connectivity, latency, and device-protocol concerns while at the same time delivering intelligent edge applications. It combines the advantages of cloud computing – low infrastructure cost and highly scalable storage and computing capacity – with the advantages of traditional on-premise computing – low latency, fast response time, and strong security standards.

LEARN MORE
Industry 4.0 is changing the methods, processes, and even business models of how products are designed, manufactured, and delivered to the market. Assets report on their health, products stay connected, supply chains stretch from raw materials to the user, and customers are intimately engaged throughout the entire process.

To learn more about how you can transform your business in the new industrial age, visit us at www.sap.com/manufacturing and www.sap.com/iot.