Shaping the Digital Transformation
Plattform Industrie 4.0

Thomas Hahn, Siemens AG | February 8th, 2017
Digitalization changes everything
The world is becoming more digital ... also in industrial environments – taking into consideration of the installed base, lifetime and processes.

- Manual machine configuration
- Virtual commissioning
- Large power plants
- Virtual power plants
- X-ray photography
- Digital imagine and analysis
- Fixed maintenance intervals
- Predictive maintenance
Massive pervasion of technologies driven by exponential growth of computational power are enablers for digitalization

The availability of data and the possibility to get value out of the data is increasing rapidly

> 40 Zettabyte of data in 2020 expected …
≈ 20 Zettabyte machine generated data included

Source: Oracle 2012, IDC CEO Summit 2015, misc. internet
What is a possible way to address the challenges?
Future projects in the Demand Area Communication of the “Forschungsunion”

Development of ten future projects in the demand areas climate/energy, security/safety, mobility, health/nourishment and communication to assure that Germany has a pole-position in solving the global challenges.

Future project “Industrie 4.0”

Smart Factory: Manufacturing sites in Germany are guided into a new era by merging of technical processes with business processes via ICT.

Source: Umsetzungsforum Industrie 4.0, Berlin, October, 2012, Plattform Industrie 4.0, April 2015

Future project “Smart Service Welt”

Using secure cloud infrastructures and provisioning of new service platforms are the basis for internet economy in Germany.

Source: CeBIT, Hannover, April, 2015
First recommendations for “Platform Industrie 4.0” were delivered

Five major research themes specified in the final report Industrie 4.0

- Horizontal integration through value networks
- End-to-end engineering across the entire value chain
- Vertical integration and networked manufacturing systems
- New social infrastructures in the workplace
- Cyber-Physical Systems technology
Industrie 4.0: Increasing complexity leads to new value systems ... ... and productivity, speed and flexibility remain the biggest challenges

Based on: The Global Manufacturing Revolution; sources: Ford, beetleworld.net, bmw.de, dw.de.
Digitalization impacts business models, value creation processes and products

Source: ZVEI following PwC
Many initiatives making progress to innovate manufacturing
Many initiatives around the world focusing on digitalization

Examples

Smart Manufacturing Leadership Coalition

Industrie du Futur

Robot Revolution Initiative

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Made in China 2025

Prognosis of future market size (examples)
- IDC (May 2014): revenue forecast IoT $1.9 trillion in 2013 to $7.1 trillion in 2020
- IDC (CEO Summit 2015): machine generated data 1.5 ZB in 2013 to 18 ZB in 2020

Sources: misc. Internet, Gartner, IDC
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The digital transformation needs a broad-based foundation

… is a project of and for society as a whole …

… which requires close cooperation among the private sector, academia, politics, trade unions and associations …

… and needs to be translated into practice and be implemented right now.

The Platform Industrie 4.0 provides support for the coordinated and organized transition to the digital economy in Germany.

Source: Plattform Industrie 4.0
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Chair
Ministers Zypries, Wanka

Steering Committee (business)
- Led by businesses, with the participation of BMWi, BMBF
- Chairs of working groups and other guests/ambassadors

Development of industrial strategy, technical coordination, decision-making and implementation

Working Groups
- Reference Architectures, Norms and Standardisation
- Research and Innovation
- Security of Interconnected Systems
- Legal Framework
- Employment, Apprenticeships and Life-Long Learning

Working bodies with technical and practical competences: departments involved: BMWi, BMBF, BMI, BMBF, BMIN, BMAH

Strategic Committee (Politics, industry associations, trade union, academia)
- Chair: Secretary of State Machnig, Secretary of State Schütte
- Representatives of the Federal Chancellery, BMI
- Representatives of the Federal States Working Group
- Representatives of the industry associations (VDMA, ZVEI, BITCOM, BDI, VDA, BDEW)
- Representatives of the trade union (IG Metall)
- Representatives of the academia (FhG)

Agenda-setting, political steering, multipliers

Project office as service provider
Coordination of the network, organisation, project management, internal and external communication

Academic Advisory Board

Reference architectures, standards and norms

- Industry consortia and initiatives
  - Market implementation: Testing, Use Cases

Research and innovation

- International standardisation
  - Standardisation bodies (DKE and others), consortia

Security of networked systems

- Legal Framework

Work, education and training

Source: Plattform Industrie 4.0
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Plattform Industrie 4.0
Overall guiding principles

Customer benefits first

- Industrie 4.0 will be successful only if there is a market for Industrie 4.0 solutions.
- We need to create solutions that generate customer benefits.

Build on own core competencies and strengths

- We have profound knowledge of the physical world, e.g. machines, automation, mechatronics.
- We have a deep understanding of the core value creation processes in manufacturing industries.
- Digitalization offers the opportunity to bolster these strengths.

Use-case based approach

- Heterogeneity of manufacturing industries does not allow a one-size-fits-all approach.
- Elaboration of sets of problems and solution approaches.
- Not every elaborated problem may be of interest to a specific customer.
- A specific solution approach can address several problems.
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Setup of a strong triangle for Recommendations, Testing and Standardization

Recommended actions
SME mobilization
International cooperation

Digital Transformation

Initiation of cross-sector standards
Coordination of national / international standards
Strengthen the international collaborations

Network of test centers
Practical testing
Validated input for standardization
Further development of the RAMI 4.0-Model (Reference Architecture Model Industrie 4.0)

- Development and Publication of the structure of the administration shell
- Design of an “Industrie 4.0-grammar”

Standardisation and international cooperation

- Initiating and support of DIN SPEC 91345 Part 1
- Development and coordination of the requirements for network communication
- Initiating a test-bed “RAMI 4.0-Fabrik” as an EU-funded project (Consortium outside the Platform)
- Foundation of a “Semantic Alliance” with w3c, IIC and other actors

Source: Plattform Industrie 4.0
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Industrie 4.0 scenarios

- Development and documentation of various scenarios regarding the future development of Industrie 4.0
- Criteria for the qualification of test-labs, recommendations for development of test-beds and CoE's
- Development of migration guidelines for the support of SME's

R&D-Roadmap and innovation strategies

- Identify research and innovation requirements from the industry perspective and set priorities

Scenarios mapped on value-add networks that integrate Life Cycle / Supply Chain Mgt.

Source: Plattform Industrie 4.0  Graphic based on: GMA 7.12. (vdi Fachausschuss “Industrie 4.0”)
AGP – Order-Controlled Production: describes dynamic composition of necessary production resources for an order
WFF – Adaptable Factory: focuses on a production resource with respect to an adaptable design and addresses the consequences for supplier and system integrator
SAL – Self Organizing and Adaptive Logistics: considers entire inter- and intra-logistics
VBS – Value Based Services: describes the design of service value networks if product- and/or process information is provided based on an IT-platform
TWP – Transparency and Adaptability of Delivered Products: focuses on a product and describes design of transparency and adaptability of delivered products based on an IT-platform
AUP – Operator Support in the Production: describes future support of operator in the production based on new technologies
SP2 – Smart Product Development for Smart Production: describes collaborative product engineering, starting with product requirements and designing seamless engineering workflows to deliver necessary information to production and service
IPE – Innovative Product Development: describes new methods and processes in product development with focus on early phases
DDA – Seamless and Dynamic Engineering of Plants: addresses increasing dynamic in plant engineering and importance of validation of engineering decisions
KRW – Circular Economy: considers (delivered) products up to recirculation of its physical parts in an overall material cycle

Source: Plattform Industrie 4.0
IT-Security for SMEs

- introduction of “Industrie 4.0 security” aspects to SMEs
- help facilitating the necessary confidence between value chain partners

IT-Security within education and training

- define the new knowledge and experience required of employees in relation to Industrie 4.0 security issues

Source: Plattform Industrie 4.0
Highlighting the fields where legislative action is needed

- Analysis of how the present regulation, which essentially addresses human-controlled behaviour, needs to be adapted to cover machine-controlled communication

Focus on the following fields of law

- Civil Law and Civil Procedure Law
- IT- and Data Protection Law
- Product Liability Law
- IP-Law
- Labour Law

Source: Plattform Industrie 4.0
Work, education and training for Industrie 4.0

- In networked information and production spaces, human-machine interfaces and cooperation must be designed to serve the interests of the people involved and the innovative capacity of enterprises.
- The organisational frameworks for coalescing value networks must be designed to facilitate working and learning within the processes.
- Training and qualification programmes in hybrid fields must be designed to accommodate operational skills development, process-oriented learning and new forms of learning.

Source: Plattform Industrie 4.0
The Online-Library offers a systematic access to Industrie 4.0.

Results of the Plattform Industrie 4.0 and partners are available as specifications, compendiums and documents and can be downloaded.

Expert knowledge available.
Several international cooperations initiated

- **Industrial Internet Consortium (IIC)**
- **Alliance Industrie du Futur Frankreich**
- **Cooperation with China**
- **Robot Revolution Initiative Japan**

Referenzarchitekturen angleichen für mehr Interoperabilität
Examples
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Where Industrie 4.0 is already being practiced today in Germany

>260 examples of Industrie 4.0 applications and products …

… from large and small enterprises in a wide range of different industry sectors.

Number of employees of the enterprises

- More than 15,000 employees: 28%
- 5,000 – 15,000 employees: 29%
- 1 – 250 employees: 28%
- 250 – 5,000 employees: 15%

Source: Plattform Industrie 4.0
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The laser sintering process can be used to produce small batches at a lower cost and much more quickly than using the costly casting process.

This process is used to make prototypes in order to integrate the testing of certain gas turbine components into the product development process. Now even aggressive component designs can be quickly evaluated and sent back to the design cycle. The result is greater efficiency increases.

"The innovative selective laser sintering process shortens production times compared to conventional production processes, so much so that function-critical components can already be tested during the product development stage."

Sebastian Piegert, Siemens AG.

Source: Platform Industrie 4.0, Siemens AG, Berlin Gas Turbine Factory.
Data analytic supports optimization machines e.g. improved efficiency of wind parks (Project ALICE*)

More than 200 GB of sensor data sensors from ≈ 7,800 wind parks
Early detection of divergent behavior
Autonomous learning with Neural Networks
Common research project: Siemens, IdaLab GmbH, TU Berlin

1-3% increase of annual energy

* ALICE = Autonomous Learning in Complex Environments
Data analytic supports availability of systems e.g. health check for CERN's Large Hadron Collider

99.9999991% the speed of light
The biggest detectors ever …
… 600 million collisions per sec
Huge supervisory system and hundreds SIMATIC systems controlling the production

With rule and pattern mining methods increase operating hours

Source: CERN
Mindsphere: Siemens offers plant cloud services for the industry sector

Optimization of plants and machines as well as energy and resources

- **Open standard (OPC)** for connectivity of Siemens und third-party products
- **Plug and play connection** of Siemens products (engineering in the TIA Portal)
- Optional **cloud infrastructure** – public cloud, private cloud or on premise solution
- **Cloud for industry** with open application interface for individual customer applications
- Transparent **pay-per-use pricing model**
- Opportunities for completely new **business models** (e.g. selling machine hours)
On the way to Industrie 4.0 – Driving the Digital Enterprise – Digital Enterprise Software Suite

- Italian passion – Virtually developed – Efficiently built
- Maserati increasing its competitiveness through digitalization of production
Thank you!
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