IND4.0 - Expectations and opportunities of the manufacturing industry

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Introduction

• The most comprehensive definition of IND4.0 is introduction of ICT technologies on **massive scale** into production processes in order to achieve 30 % productivity improvement.

• IND4.0 main purpose is to improve the existing level of production automation with the digitalization of production and integration of all production sites in the total value chain.
Introduction

• Production sector will significantly benefit from the implementation of such solution, which will enable:
  - efficient flexible production,
  - short production cycle,
  - lower consumption of energy and materials.
Introduction

• The aim of future 'smart factories’ is to establish mutual communication between machines, devices and future end products (barcode, RFID, etc.).

• Incoming raw materials, equipment and machinery are connected to industrial IoT (modular way) in early stage.

• Ensure highly flexible and individualized mass production.
Barriers in implementation

• **Courage** to carry out serious changes?
• Coordination within the company?
• **Lack** of proper staff competencies
• Questionable **security and data protection**
• The reasonableness of the eligibility of investments for the modernization of the entire IT architecture
Barriers in implementation

The biggest manufacturing challenges:
• What data (or information) to collect?
• Who or what will get the information derived from the data?
• How will we use the information?
• Were the correct decisions taken?
The future of manufacturing - Siemens view

• Manufacturing changes are needed faster than ever before and Industry 4.0 will help to overcome the challenges it faces.
The future of manufacturing - Siemens view

• For each product, alongside its physical depiction, a virtual depiction is available at every stage of the value adding process which continues to undergo further development.
The future of manufacturing - Siemens view

Change of paradigms for the next productivity stage:
Integrating product and production lifecycles can reduce time-to-market by 50%
The future of manufacturing - Siemens view

**Today: Industrie 3.x**
- Local controls
- Realtime communication
- Digital "copies" of products and production
- Manufacturing Execution Systems
- Industrial security concepts
- Execution and decision making mainly by humans

**Future: Industrie 4.0**
- Dynamic network of local controls
- Extended complex communication
- Digital models of the overall process and participants
- Process optimization in dynamic networks
- Self-configuring security concepts also for temporary requirements
- Humans to define rules and frameworks for decision making
The future of manufacturing - Siemens view

• Manufacturing beyond 2025

Industry 4.0 ...

- Organisation and control across entire value chain & product life cycle
- Individualised to customer wishes
- Encompassing all phases:
  - From idea to order
  - Development and production
  - Delivery to the customer
  - Even recycling and related services

Key research areas

- Horizontal integration via value-added networks
- End-to-end engineering across the entire value chain
- Vertical integration and networked production systems

Source: acatech, April 2013 “Recommendations for implementing the strategic initiative Industrie 4.0”
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Macro-Regional Innovation Week, Trieste
Solution: Machine Tool 4.0

- Schaeffler - leading manufacturer of industrial bearings for automotive, aerospace and machine building industry
- Data-oriented production
- Digitalization of total production
- Accurate monitoring of machines (optimum performance)
- Ensuring adequate maintenance
Solution: Machine Tool 4.0

• Machine Tool 4.0 created on the basis of joint R&D project with DMG MORI
• 2 prototype machines (DMC 80FD duo block machining center) used for the implementation of Industry 4.0 solution
Solution: Machine Tool 4.0

- Actual manufacturing machine
Solution: Machine Tool 4.0

- Bearings are key components in drive systems
- Present in all the moving parts of the machine
- The installation of digital sensors in the bearing elements
- Collecting, analyzing and sharing information leads to better decisions in the production process
- Machine parts connected to industrial IoT help to increase the utilization rate and product quality
Solution: Machine Tool 4.0

- Control system in both prototype machines have built-in programs for the manipulation of measured sensor data and analysis of the machinery state.
Solution: Machine Tool 4.0

- In both machines more than 60 sensors are built-in to measure vibration stress forces, temperatures and pressures in specific points of individual bearings.
- The machine is connected to a Profibus network to which the user can connect additional sensors and actuators, and external control units.
- OPC UA protocol used to exchange data between the control system and Celos GUI.
Solution: Machine Tool 4.0

- Machine Tool 4.0 presented on the Hannover fair
Solution: Machine Tool 4.0
Solution: Machine Tool 4.0

- Architecture
Solution: Machine Tool 4.0

- Data can be transferred to cloud
- Improving methods for preventive detection of faults in the bearings
- With the digitization of production they achieved better flexibility
- Individual (isolated) solutions, which require manual interventions, are blocked
- Vertical integration enables connection to ERP system - automatic processing of orders
Solution: Machine Tool 4.0

• Easy monitoring of entire production
Conclusion

• Future of manufacturing will increasingly be based on improved: accuracy, productivity and efficiency!

• Improved automation level will allow greater production flexibility and easier integration with emerging innovative production technologies

• Built-in intelligence will allow better production cycle optimization
Thank you for your attention.

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