Industry 4.0: Challenges, opportunities and main axis of research

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I4.0

Sorry, we’re late!

TECHNOLOGY / INDUSTRY 4.0

What will Industry 5.0 mean for manufacturing?

Phil Cartwright, executive chairman of the Centre for Modelling & Simulation, looks forward to the fifth industrial revolution and predicts the role humans will play in automated manufacturing.

By Ben Rossi – March 7, 2018
About Industry 4.0

1st industrial revolution
Through introduction of mechanical production facilities with the help of water and steam power

First mechanical weaving loom
1784

2nd industrial revolution
Through introduction of mass production with the help of electrical energy

First assembly line
1870

3rd industrial revolution
Through application of electronics and IT to further automate production

First programmable logic control system 1969

4th industrial revolution
On the basis of cyber-physical production systems (CPPS), merging of real and virtual worlds

Industry 4.0

Industry 3.0

Industry 2.0

Industry 1.0

End of 18th century
Beginning of 20th century
Beginning of 1970s of 20th century
Today

Ref: Deloitte
About Industry 4.0

Digitalisation

Cyber Physical Systems

Digital Twin

Ref: https://www.semiwiki.com/forum/content/6341-industry-4-0-manufacturing-processes.html
About Industry 4.0

Gartner **Hype Cycle** for Emerging Technologies, 2017

- **Connected Home**
- **Deep Learning**
- **Machine Learning**
- **Autonomous Vehicles**
- **Nanotube Electronics**
- **Cognitive Computing**
- **Blockchain**
- **Commercial UAVs (Drones)**
- **Virtual Reality**
- **Augmented Reality**
- **Enterprise Taxonomy and Ontology Management**
- **Software-Defined Security**
- **Human Augmentation**
- **Digital Twin**
- **Volumetric Displays**
- **Serverless PaaS**
- **5G**
- **Neuromorphic Hardware**
- **Deep Reinforcement Learning**
- **Artificial General Intelligence**
- **4D Printing**
- **Brain-Computer Interface**
- **Quantum Computing**
- **Augmented Data Discovery**
- **Smart Workspace**
- **Edge Computing**
- **Smart Robots**
- **IoT Platform**
- **Virtual Assistants**

Plateau will be reached in:
- **less than 2 years**
- **2 to 5 years**
- **5 to 10 years**
- **more than 10 years**

As of July 2017
Challenges

✓ Making European industry competitive again
  Reduce Costs
  Improve Quality

✓ How do we get there?
  Flexibility
  Efficiency

✓ Consequence => Cost reduction and quality increase
We already produce enough, now it is a question of adapting quickly to the market:

- Reduction in production times
- Ability to produce customized products
- Produce on demand
- Digital prototypes

In all the resources we use, materials, energy, human resources, etc. But also in the processes (supply chain):

- Elimination of paper work
- Integration of management and production
- Quality control
- Product traceability
- Reduction of downtime

Make the production sustainable with the environment, including the workers of the factory.
Opportunities in research

In order to have a **Smart Factory** there are three fundamental elements:

- **Production chain**: Flexible value chains with real-time information from all company areas.

- **Virtual and Real World Merge**: Integration of product design and production engineering to reduce time-to-market.

- **Based on cyber-physical systems**: Devices with integrated computing and communication capabilities, and their own intelligence. The internet of things.
Opportunities in research

✓ The priority for future research is shifting towards the R&D of fully **describable**, **manageable**, **context-sensitive** and **controllable** or **self-regulating** manufacturing systems.

Cyber-Physical Systems technology

End-to-end engineering across the entire value chain

Vertical integration and networked manufacturing systems

New social infrastructures in the workplace

Example: Bottling plant
Example: Smart carts
Example: Sharing workspace
Example: end-user programming
Thank you for your attention!

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