

**“Artisans for Industry 4.0”**



## Agenda

- 1 Introduction to Industry 4.0**
- 2 High level of complexity in Industry 4.0**
- 3 Industry 4.0 – the Human Factor**
- 4 Qualification 4.0**
- 5 Q & A**

# From Industry 1.0 to 4.0 | Emphases of the particular industrial revolutions



## 1. Industrial Revolution



**Mechanization:**  
Mechanical production  
(End of the 18th century)

**Technical inventions**

## 2. Industrial Revolution



**Industrialization:**  
Mass production  
(Beginning of the 20th century)

**Organization al inventions**

## 3. Industrial Revolution



**Automation:**  
Electric automation  
(Early 1970s)

**Technical inventions**

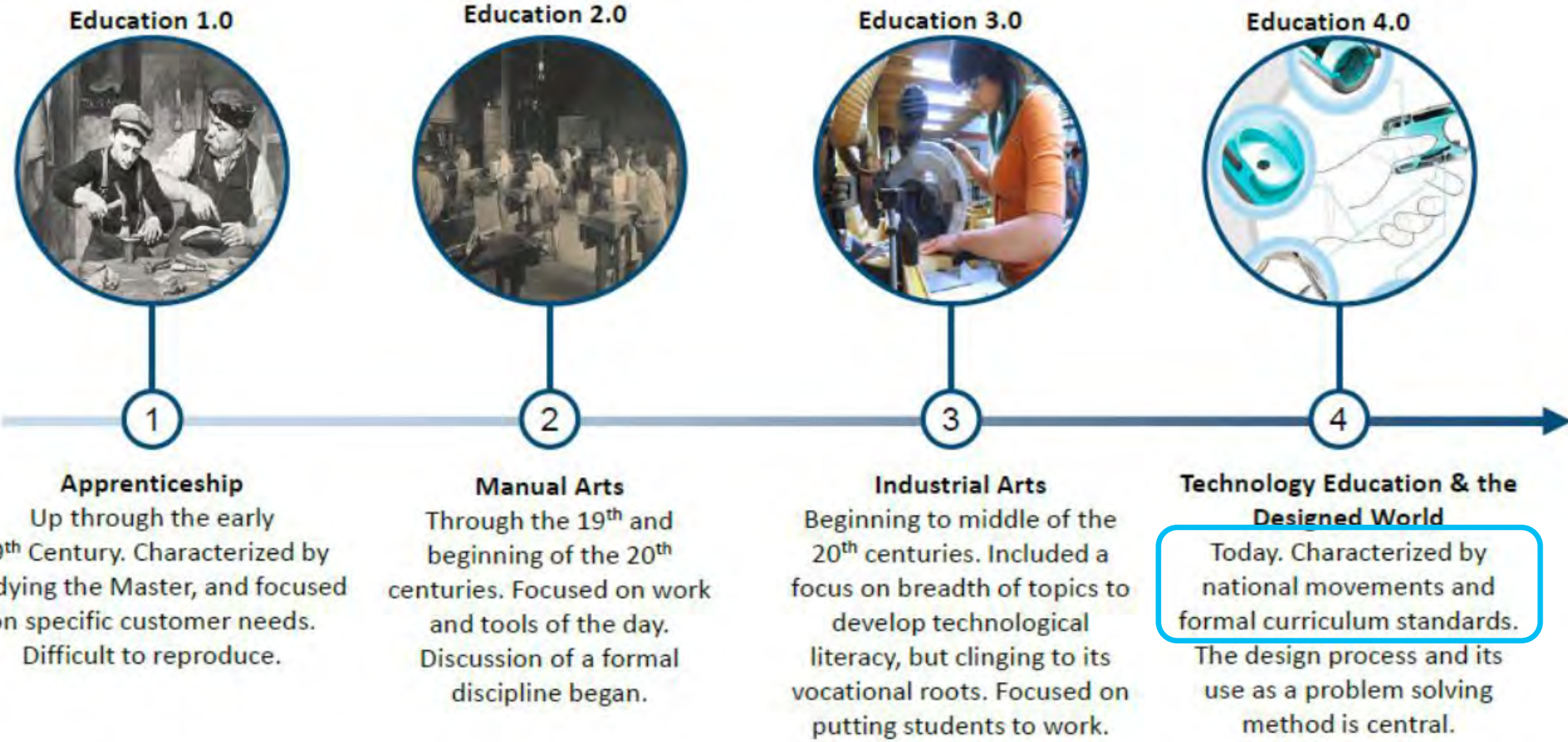
## 4. Industrial Revolution



**Cyber-physical systems:**  
Integrated automation  
(Today)

**Organization al inventions**

# From Industry 1.0 to 4.0 | Industry 4.0 Demands “Qualification 4.0”



Source: Nathan Hartman, Purdue University



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**3 Industry 4.0 – the Human Factor**

**4 Qualification 4.0**

**5 Practical Demonstration CP (Cyber Physical) Factory**

# Industry 4.0 application | Smart factory, mobility, buildings, grid, etc.....



# Industry 4.0 application | Aviation, Agriculture, Oil, Mining, Electrical, Logistics, etc.....

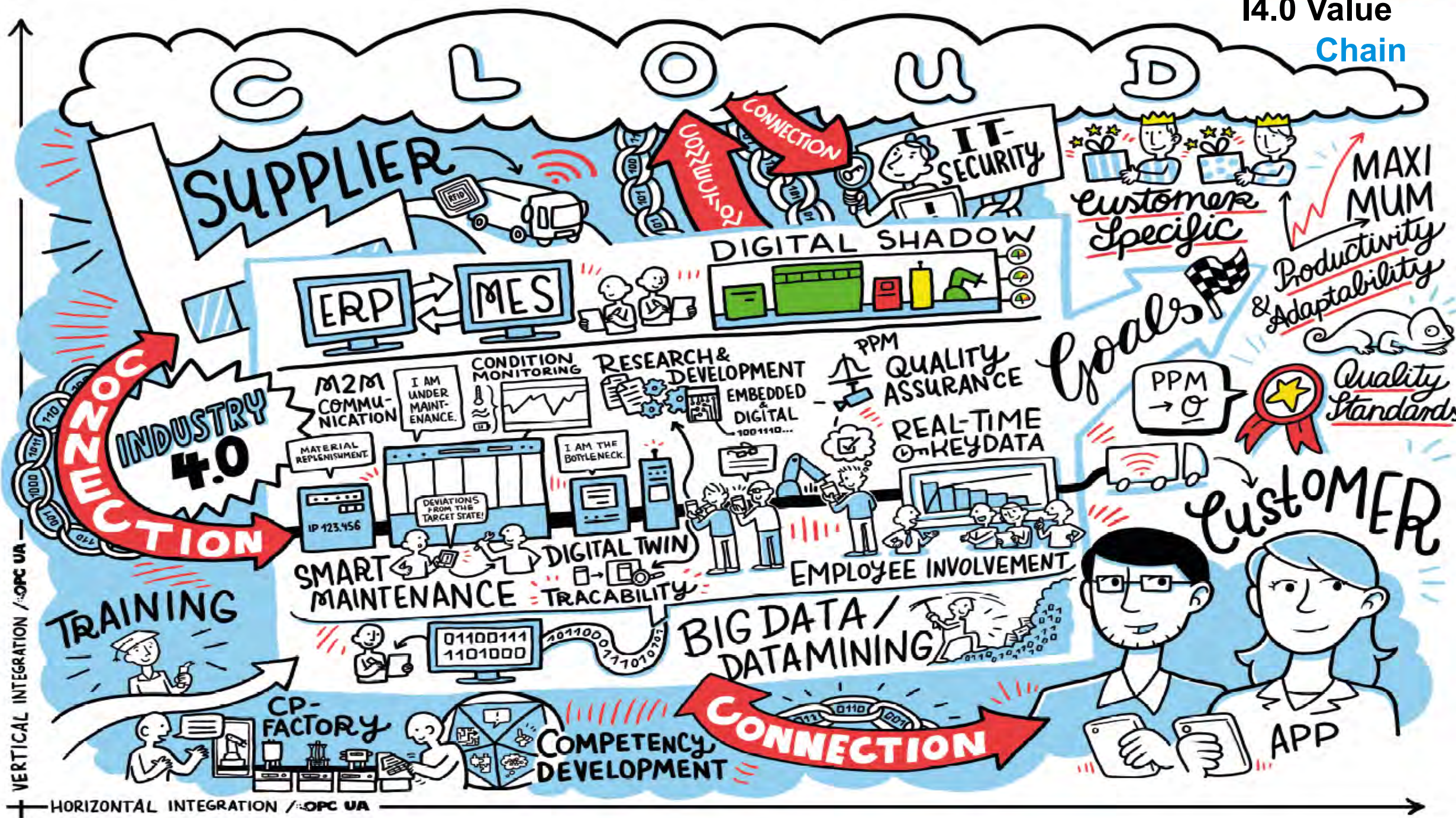


plus.....  
.....





# I4.0 Value Chain



SUPPLIER

INDUSTRY 4.0

DIGITAL SHADOW

ERP

MES

M2M COMMUNICATION

I AM UNDER MAINTENANCE

CONDITION MONITORING

RESEARCH & DEVELOPMENT EMBEDDED & DIGITAL

QUALITY ASSURANCE

REAL-TIME KEY DATA

SMART MAINTENANCE

DIGITAL TWIN

EMPLOYEE INVOLVEMENT

BIG DATA / DATAMINING

COMPETENCY DEVELOPMENT

customer Specific

MAXIMUM Productivity & Adaptability

Quality Standards

CUSTOMER







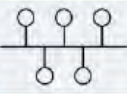























APP

VERTICAL INTEGRATION / OPC UA


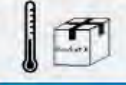
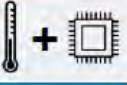
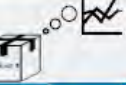
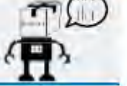

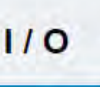
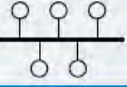








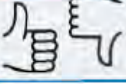





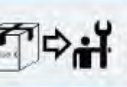





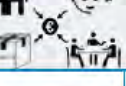
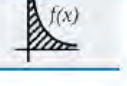
HORIZONTAL INTEGRATION / OPC UA

# Industry 4.0 | Production and Product Toolbox

## Toolbox Industrie 4.0

Industrie 4.0					
Production					
<b>Data processing in the production</b>	 No processing of data	 Storage of data for documentation	 Analyzing data for process monitoring	 Evaluation for process planning / control	 Automatic process planning / control
<b>Machine-to-machine Communication (M2M)</b>	 No communication	 Field bus interfaces	 Industrial Ethernet interfaces	 Machines have access to Internet	 Web Services (M2M software)
<b>Company-wide networking with the production</b>	 No networking of production with other business units	 Information exchange via mail / telecommunication	 Uniform data formats and rules for data exchange	 Uniform Data formats and Inter-divisionally linked data servers	 Inter-divisional, fully networked IT solutions
<b>ICT infrastructure in production</b>	 Information exchange via mail / telecommunication	 Central data servers in production	 Internet-based portals with data sharing	 Automated information exchange (e.g. order picking)	 Suppliers / customers are fully integrated into the process design
<b>Man-machine interfaces</b>	 No information exchange between user and machine	 Use of local user interfaces	 Centralized / decentralized production monitoring / control	 Use of mobile user interfaces	 Augmented and assisted reality
<b>Efficiency with small batches</b>	 Rigid production systems and a small proportion of identical parts	 Use of flexible production systems and identical parts	 Flexible production systems and modular designs for the products	 Component-driven, flexible production of modular products within the company	 Component-driven, flexible production in value-adding networks

## Toolbox Industrie 4.0

Industrie 4.0					
Products					
<b>Integration of sensors / actuators</b>	 No use of sensors / actuators	 Sensors / actuators are integrated	 Sensor readings are processed by the product	 Data is evaluated for analyses by the product	 The product independently responds based on the gained data
<b>Communication / Connectivity</b>	 The product has no interfaces	 The product sends or receives I/O signals	 The product has field bus interfaces	 The product has Industrial Ethernet interfaces	 The product has access to the internet
<b>Functionalities for data storage and information exchange</b>	 No functionalities	 Possibility of individual identification	 Product has a passive data store	 Product with data storage for autonomous information exchange	 Data and information exchange as integral part
<b>Monitoring</b>	 No monitoring by the product	 Detection of failures	 Recording of operating condition for diagnostic purposes	 Prognosis of its own functional condition	 Independently adopted control measures
<b>Product-related IT services</b>	 No services	 Services via online portals	 Service execution directly via the product	 Independently performed services	 Complete integration into an infrastructure of IT services
<b>Business models around the product</b>	 Gaining profits from selling standardized products	 Sales and consulting regarding the product	 Sales, consulting and adaptation of the product to meet customer specifications	 Additional sale of product-related services	 Sale of product functions



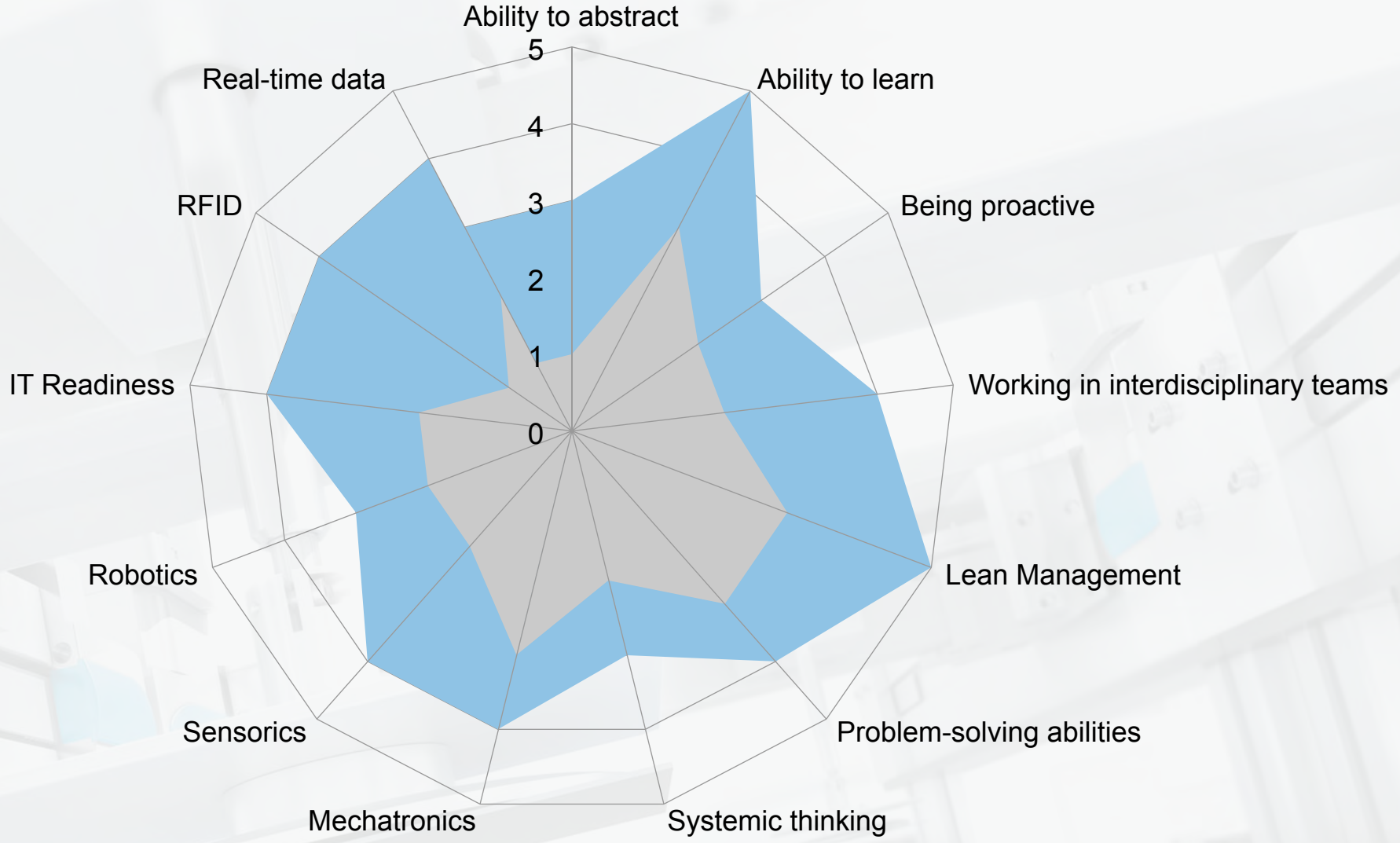
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# The Human Factor | Qualification 4.0



# Skills, Knowledge and Attitude Industry 4.0 | Qualification 4.0



Source VDMA:  
Competence fields

Gray = current competency  
Blue = required competency for Industrie 4.0



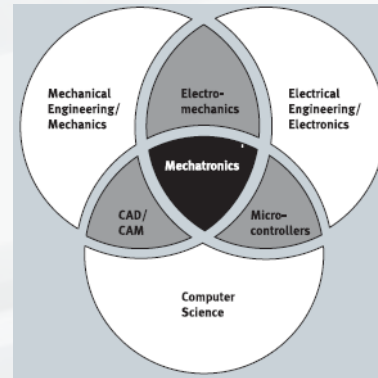
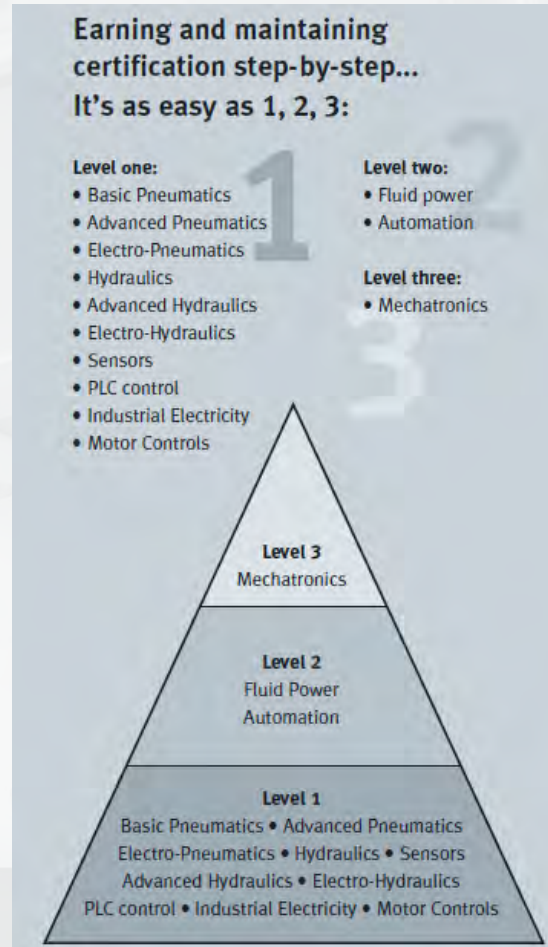
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# Short, Medium, Long Term Approach | Qualification 4.0

## Short Term | Qualification 4.0

- Identify Existing Talent
- Re-skilling / up- skilling – on and off the job training
- Part Qualification by means of Skills Programs

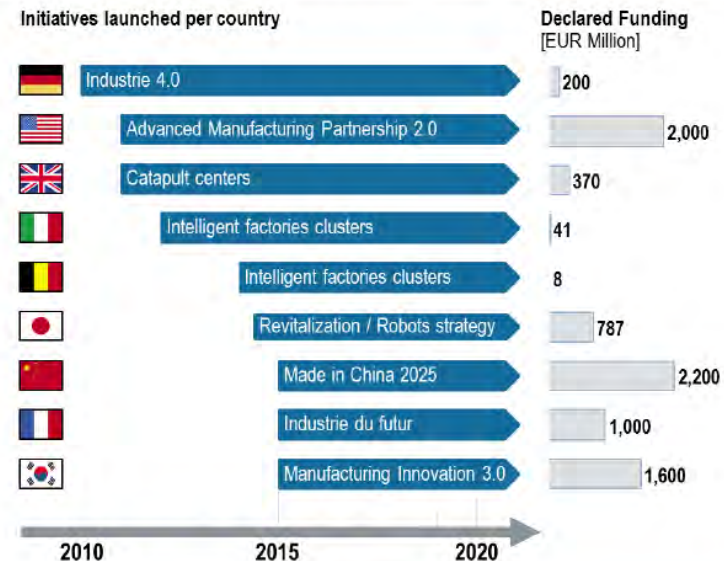


# Short, Medium, Long Term Approach | Qualification 4.0

## Medium Term | Qualification 4.0

- Create formal I4.0 Artisan qualification – use Mechatronics qualification experience
- Create a National I4.0 Framework with all stakeholders:
  - DTI, DST, DHET, DBE, Seta's, Tertiary Institutions, Industry
- Policy formulation and implementation

### Countries Aggressively Implementing Policies to Achieve Digital Manufacturing Leadership



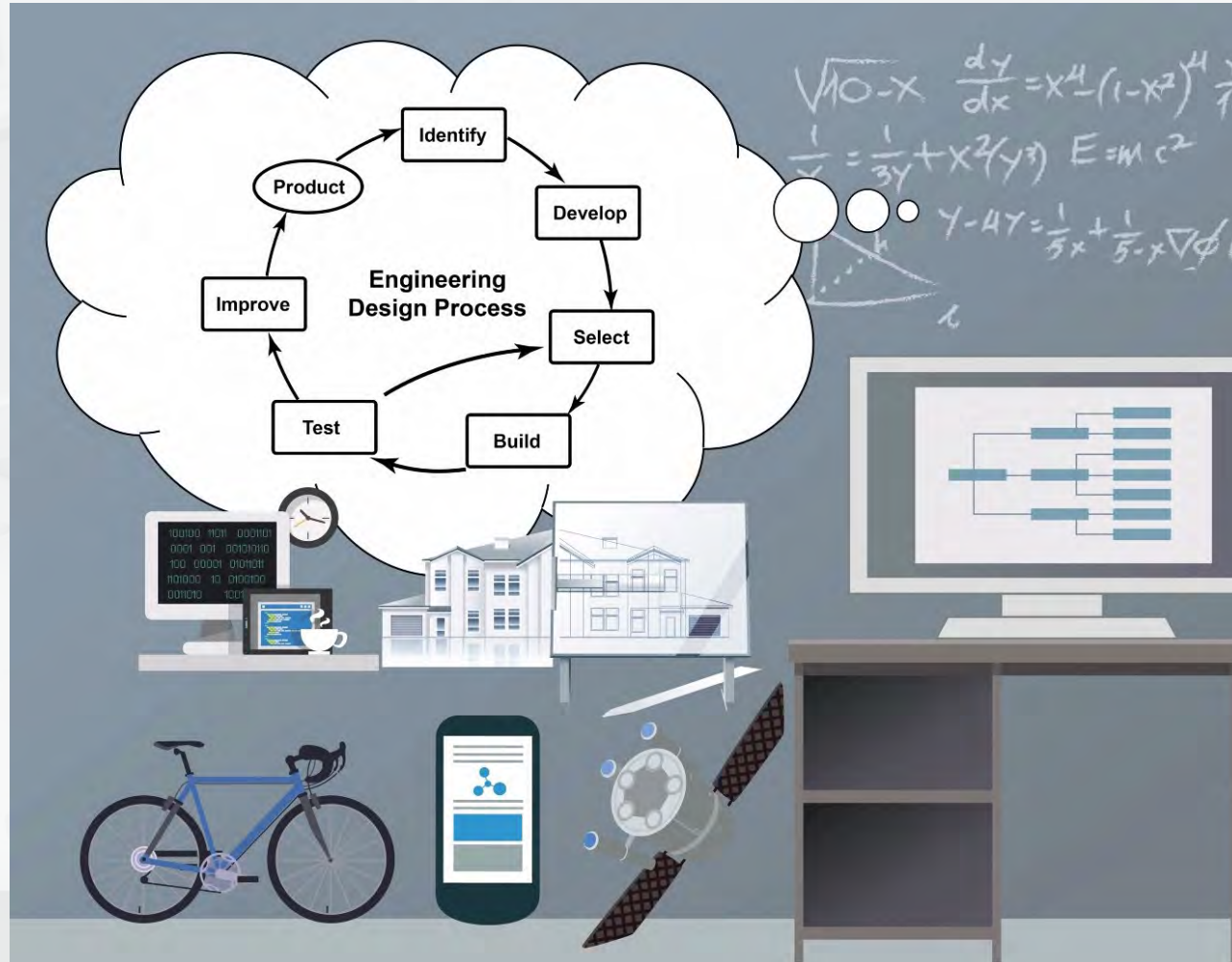
Source: Roland Berger



# Short, Medium, Long Term Approach | Qualification 4.0

## Long Term | Qualification 4.0

- Develop a feeder group at Basic Education level
- Expand the DBE Maths, Science, Technology (STEM) project



Science



Technology



Engineering



Math

# STEM Education | Africa must prepare for the future

“Failure to educate Africa’s youth in STEM has widespread implications, economically, politically, and socially.”

<https://www.africa.com/africa-stem-education/>

“Africa is crying out for skilled young people in every single country. The mismatch between their current skills and what the companies need is getting wider.”

[https://www.huffingtonpost.com/mariame-jamme/africas-workforces-need-r\\_b\\_6340556.html](https://www.huffingtonpost.com/mariame-jamme/africas-workforces-need-r_b_6340556.html)

“...to prepare for the future of work, the region must expand its high-skilled talent pool by developing future-ready curricula, with a particular emphasis on STEM education.”

*Saadia Zahidi, Head of Education, Gender and Work and Member of the Executive Committee at the World Economic Forum*

*The Future of Jobs in Africa: Preparing the Region for the Fourth Industrial Revolution*



Science



Technology



Engineering



Math



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