



Näkökulmia tuotannon kehittämiseen

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Savonia, Tuotannon hienosuunnittelu, 31.10.2018

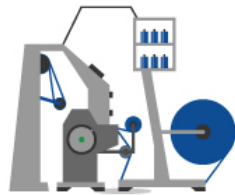
Late 18th century

Beginning of 20th century

1970s–2000s

2010 onward

“Making the lot-size-1 economically feasible”



First industrial revolution: Power generation

- Introduction of the power loom in 1784
- Mechanization of production facilities with water and steam power



Second industrial revolution: Industrialization

- Introduction of the assembly line in slaughterhouses in 1870
- Electrification drives mass production in a variety of industries



Third industrial revolution: Electronic automation

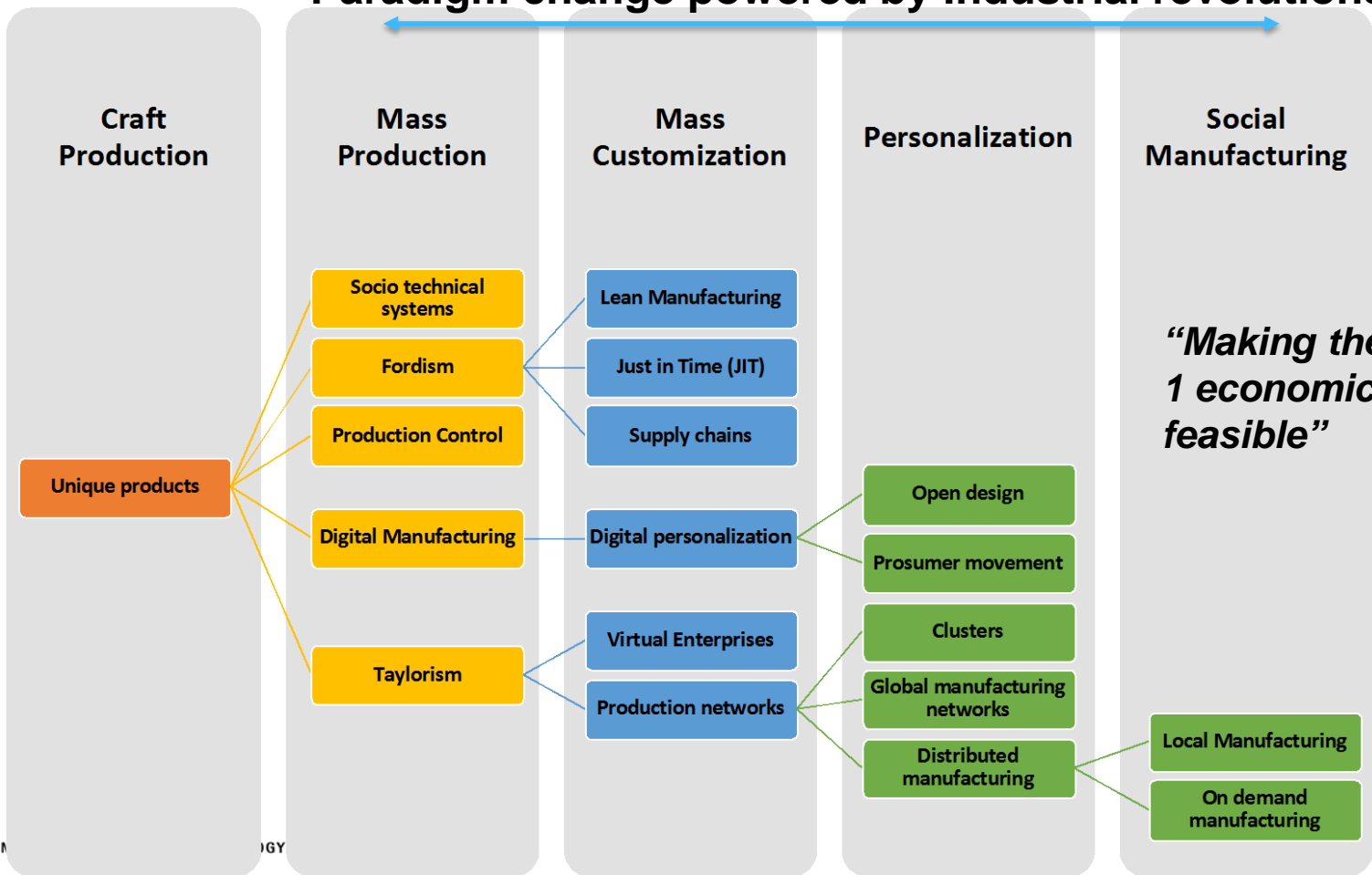
- Development of the first programmable logic controller (PLC) in 1969
- Growing application of electronics and IT to automate production processes



Fourth industrial revolution: Smart automation

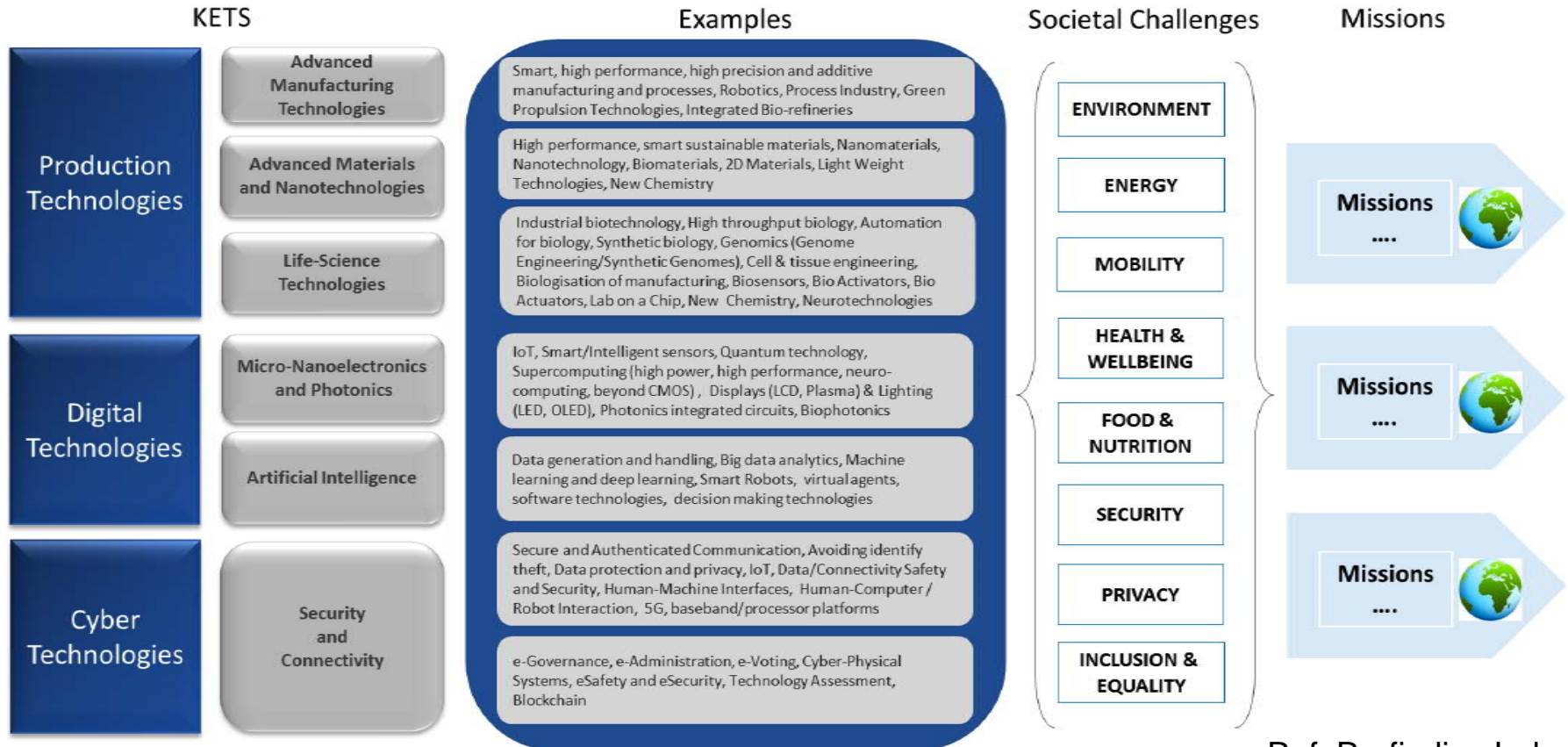
- Increasing use of cyber-physical systems (CPS)
- In January 2011, Industry 4.0 was initiated as a “Future Project” by the German federal government
- With the introduction of IPv6 in 2012, virtually unlimited addressing space becomes available
- Governments, private companies, and industry associations have been focusing on Industry 4.0 and making investments since the 2010s

Paradigm change powered by Industrial revolutions



Drivers: Globalisation – Digitisation – Knowledge Society

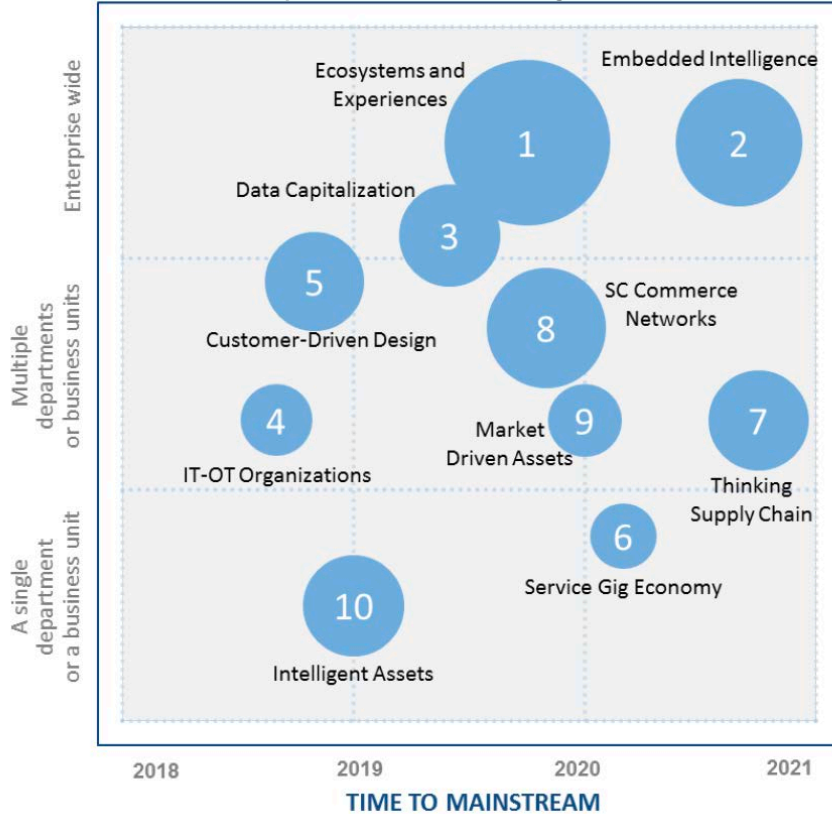
Rational: Global Excellence, Systemic Relevance, European Sovereignty, Sustainability, Multi-purpose



Predictions2018

IDC FutureScape: Worldwide Manufacturing 2018 Predictions

ORGANIZATIONAL IMPACT



- Ecosystems and Experiences:** By 2020, 60% of G2000 manufacturers will rely on digital platforms that enhance their investments in ecosystems and experiences and support as much as 30% of overall revenue.
- Embedded Intelligence:** By 2021, 20% of G2000 manufacturers will depend on a secure backbone of embedded intelligence, using IoT, blockchain, and cognitive to automate large-scale processes and speed execution times by up to 25%.
- Data Capitalization:** By 2020, 75% of all manufacturers will participate in industry clouds, although only one-third of those manufacturers will be monetizing their data contributions.
- IT-OT Organizations:** By 2019, the need to integrate operational technology and information technology as a result of IoT will have led to more than 30% of all IT and OT technical staff having direct project experience in both fields.
- Customer-Driven Design:** By 2019, 50% of manufacturers will be collaborating with customers and consumers on product designs through crowdsourcing, VR, and product virtualization, with up to 25% improvement in product success rates.
- The Service Gig Economy:** In 2020, AR and mobile devices will drive the transition to the gig economy in the service industry, with "experts for hire" replacing 20% of dedicated customer-and field-service workers.
- The Thinking Supply Chain:** By the end of 2020, one-third of all manufacturing supply chains will be using analytics-driven cognitive capabilities thus increasing cost efficiency by 10% and service performance by 5%
- Supply Chain Commerce Networks:** By 2020, 80% of supply chain interactions will happen across cloud-based commerce networks, improving participants' resiliency and reducing the impact of supply disruptions by up to one-third.
- Market-Driven Assets:** By 2020, 25% of manufacturers in select subsectors will have balanced production with demand cadence and achieved greater customization through intelligent and flexible assets.
- Intelligent Assets:** By 2019, 15% of manufacturers that manage data-intensive production and supply chain processes will be leveraging cloud-based execution models with edge analytics for real-time visibility and operational flexibility.

Elements for surprises



Disruptive technologies



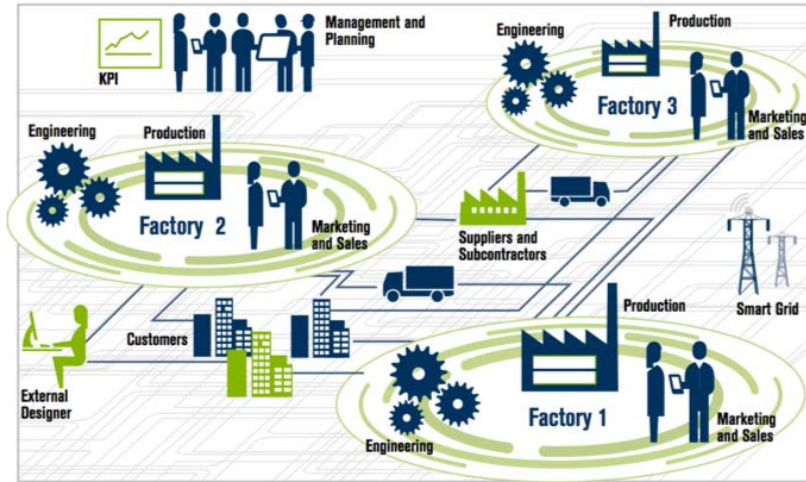
Industrial ecosystems



Skills development



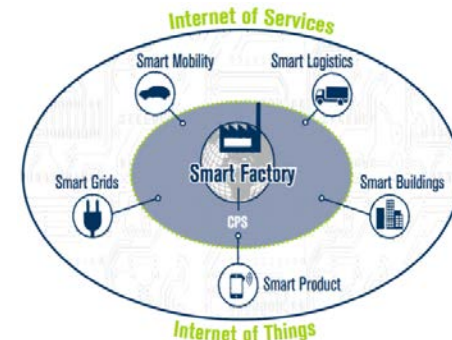
Vision: Industry 4.0



” In the manufacturing environment, these Cyber-Physical Systems comprise smart machines, storage systems and production facilities capable of autonomously exchanging information, triggering actions and controlling each other independently.

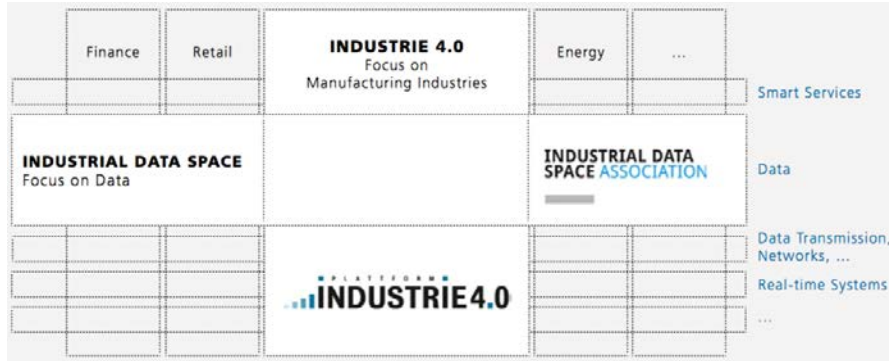
This facilitates fundamental improvements to the industrial processes involved in manufacturing, engineering, material usage and supply chain and life cycle management.”

- **Interoperability:** cyber-physical systems (work-piece carriers, assembly stations and products) allow humans and smart factories to connect and communicate with each other.
- **Virtualisation:** a virtual copy of the Smart Factory is created by linking sensor data with virtual plant models and simulation models.
- **Decentralisation:** ability of cyber-physical systems to make decisions of their own and to produce locally thanks to technologies such as 3d printing.
- **Real-Time Capability:** the capability to collect and analyse data and provide the derived insights immediately Service Orientation.
- **Modularity:** flexible adaptation of smart factories to changing requirements by replacing or expanding individual modules



Industrial Data Space

Relations with Plattform Industrie 4.0

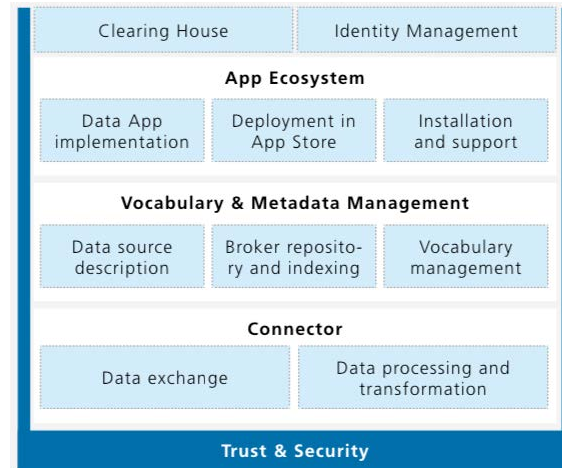


The Industrial Data Space initiative has established, and aims to establish, liaisons with other initiatives, among them

- Big Data Value Association (<http://www.bdva.eu>)
- FIWARE Foundation (<https://www.ware.org/foundation>)
- Industrial Internet Consortium (<http://www.iiconsortium.org>)
- OPC Foundation, (<https://opcfoundation.org>), and
- Plattform Industrie 4.0. (<http://www.plattform-i40.de>)

Furthermore, the Industrial Data Space initiative seeks collaboration and exchange of ideas with existing research and standardization initiatives.

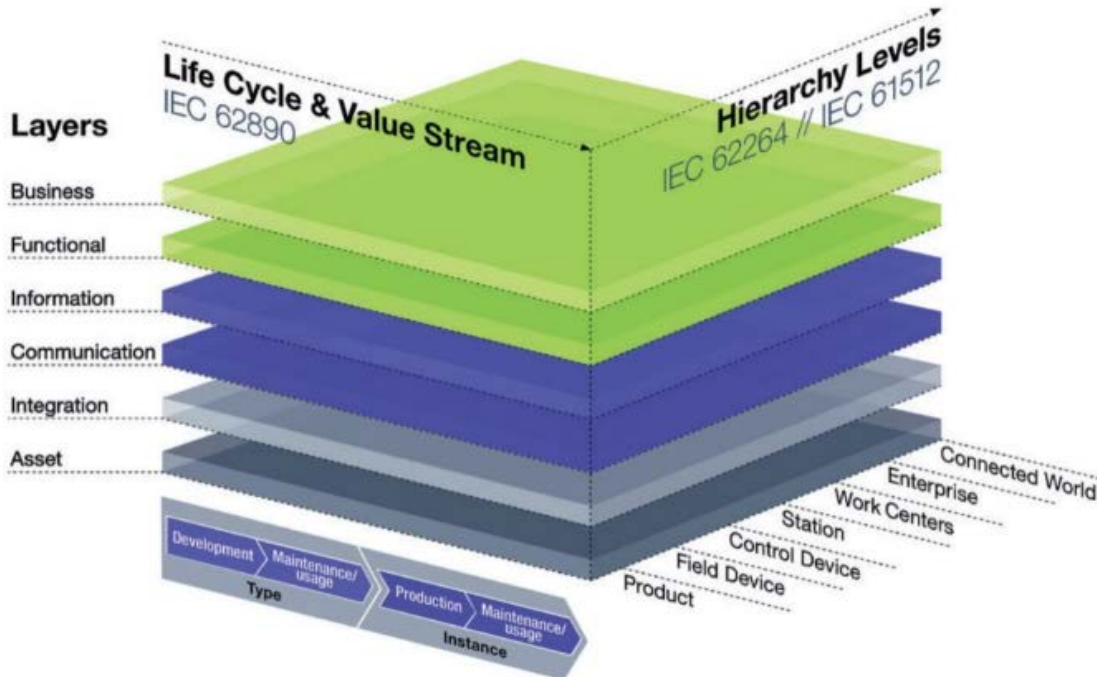
Functional Architecture of the Industrial Data Space



https://www.fraunhofer.de/content/dam/zv/de/Forschungsfelder/industrial-data-space/Industrial-Data-Space_Reference-Architecture_Model-2017.pdf

RAMI 4.0

Reference Architectural Model Industrie 4.0 (RAMI 4.0)



The German Industrie 4.0 platform, consisting of ZVEI, VDMA, and BITKOM, has jointly reached important milestones in the standardization of Industrie 4.0. The first version of a reference architecture model for Industrie 4.0 (RAMI 4.0) which precisely describes Industrie 4.0-compliant production equipment, has been developed.

<https://www.zvei.org/en/subjects/industry-4-0/the-reference-architectural-model-rami-4-0-and-the-industrie-40-component/>

Need for stronger collaboration

Positive impacts

Access to new technology

Ability to strengthen innovation capabilities

Access to new markets and customers

Access to larger contracts

Risks Reduction

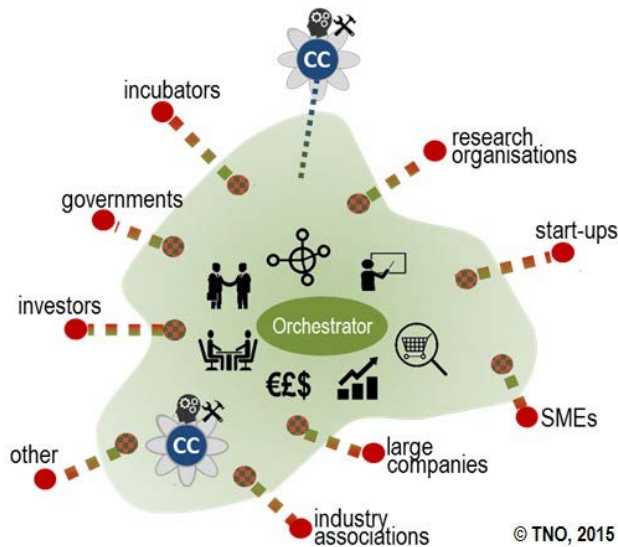
Ref: <https://www.linkedin.com/pulse/collaboration-key-driver-organisational-success-peter-westbrook/>

Negative challenges

C1	Company with synergetic business interests left the project in early stage. This was possibly due to financial challenges.
	Other companies were distant.
C2	Other companies had different focusses in their R&D.
	Company, that was considered as a potential partner, focused on different technology.
C3	Big customer, that encouraged C3 to participate, did not participate the "group project". The customer was not able to reach an agreement with other participating companies.
	Other companies were already in their own networks, and P3 was not able to fit into them.
C4	Other companies were interested in C4 part, but did not want to allocate resources to collaboration. From business perspective the times were difficult and this affected the resourcing.
	One potential company to do collaboration with left out just before project started
C5	Project topic in C5 was different. Other companies focused on product development when C5's aim was to develop their risk management processes.
	Insufficient resources in C5.
C6	R&D subjects were close, but not close enough to do collaborative development
C7	Lack of resourcing in C7. Collaboration would have required human resources from wide range of functions in C7)
	Scope of R&D was such that it did not lead to collaboration.
C8	Desired results were delivered with very little collaboration. Knowledge exchange between companies happened through research organization.

Expectations for emergence of ecosystems

Digital Innovation Hubs



© TNO, 2015

Search

Countries

None selected ▾

Evolutionary Stages

1 selected ▾

Technical Competences

None selected ▾

Services Provided

None selected ▾

Focus on TRL

None selected ▾

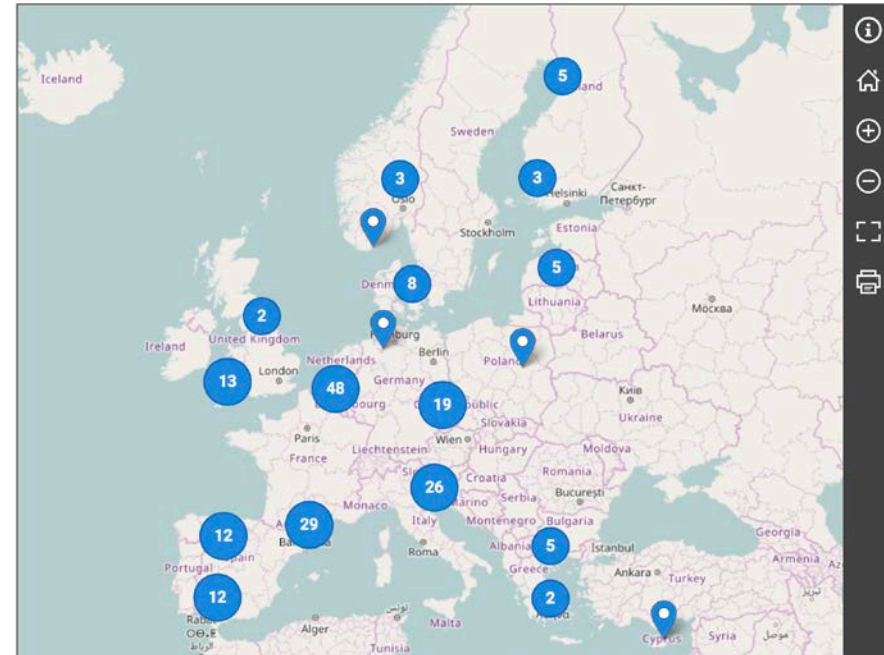
Market sectors

None selected ▾

SEARCH

Contact us in the following email: JRC-B3-DI-H@ec.europa.eu

<http://s3platform.jrc.ec.europa.eu/digital-innovation-hubs-tool>

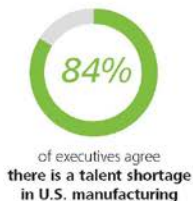


<https://www.slideshare.net/StartupEurope/digital-innovation-hubs-in-europe>

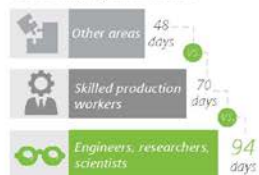
Over the next decade nearly **3 1/2 Million** manufacturing jobs likely need to be filled The skills gap is expected to result in **2 Million** of those jobs being unfilled

CEOs and manufacturing executives around the world identify talent-driven innovation as the number one determinant of competitiveness.¹ Yet, manufacturing executives report a significant gap in their ability to find talent with required skills. More troubling...the skills gap is expected to grow substantially over the next decade. What impact could the gap have on company performance and how large is the gap likely to grow? The Manufacturing Institute and Deloitte conducted a study² to understand the impact and extent of the skills gap, and the study results are as follows:

Filling jobs is no easy task



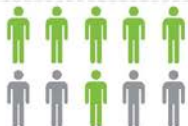
It takes **90+ days** to recruit highly skilled workers



80% of manufacturing companies are willing to pay more than the market rates in workforce areas reeling under talent crisis

SIX out of TEN

open skilled production positions are unfilled due to talent shortage



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Source: Deloitte, Bureau of Labor Statistics (BLS) and Deloitte analysis.

1. Deloitte LLP and U.S. Council on Competitiveness, 2013 Global Manufacturing Competitiveness Index: Creating a Competitive Advantage of 400 executives from across six emerging and established economies responded to the 2013 Gap Survey. 2. Deloitte and Economic Planning Institute. 3. U.S. Department of Commerce, Bureau of Economic Analysis.

The skills gap is widening

Over the next decade nearly **3 1/2 million** manufacturing jobs will likely be needed and



The implications are significant

Every job in manufacturing creates another 2.5 new jobs in local goods and services³

For every \$1 invested in manufacturing, another \$1.37 in additional value is created in other sectors⁴

2.7 Million baby boomer retirements

700K manufacturing jobs expected from economic expansion

Only **1.4 Million** jobs are likely to be filled

leading to an expected **2 Million** manufacturing jobs unfilled due to the skills gap

3.4 Million manufacturing jobs are likely to be needed over the next decade



By 2025 the skills gap is expected to grow to **2 million**
In 2011, **600K** jobs were unfilled due to the skills gap

The **retirement** of baby boomers, strength of the economy and **attractiveness of the industry** are ranked among leading factors impacting the talent shortage.

Developing talent is essential

Adding to the complexity is finding workers with the skills required to meet today's advanced manufacturing requirements

The most effective skilled production workforce development strategies cited by executives



Percentage of executives that indicate current employees are not sufficient in key skills



70% technology/computer skills



67% basic technical training



69% problem solving skills



60% math skills

Talent shortage impact to the business

82%

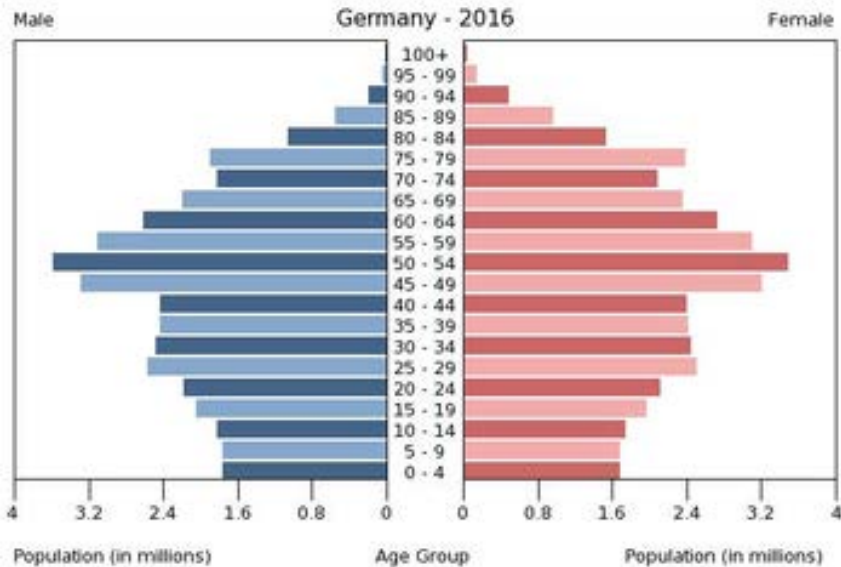
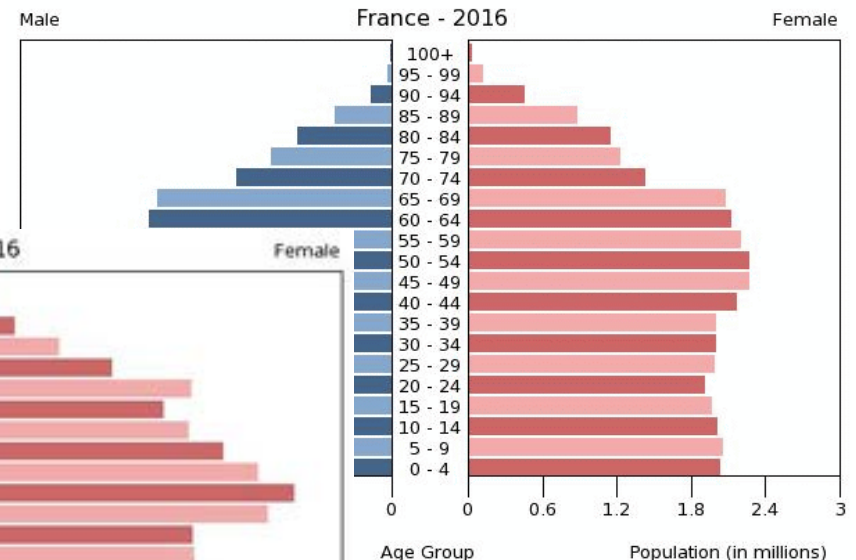
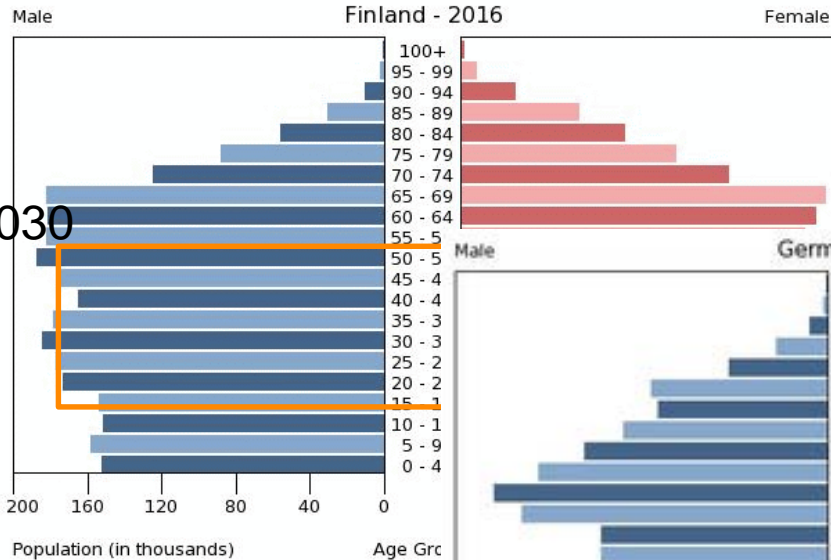
of executives believe the skills gap will impact their ability to meet customer demand

executives also feel it will impact their ability to...

- 78%** implement new technologies and increase productivity
- 69%** provide effective customer service
- 62%** innovate and develop new products
- 48%** expand internationally

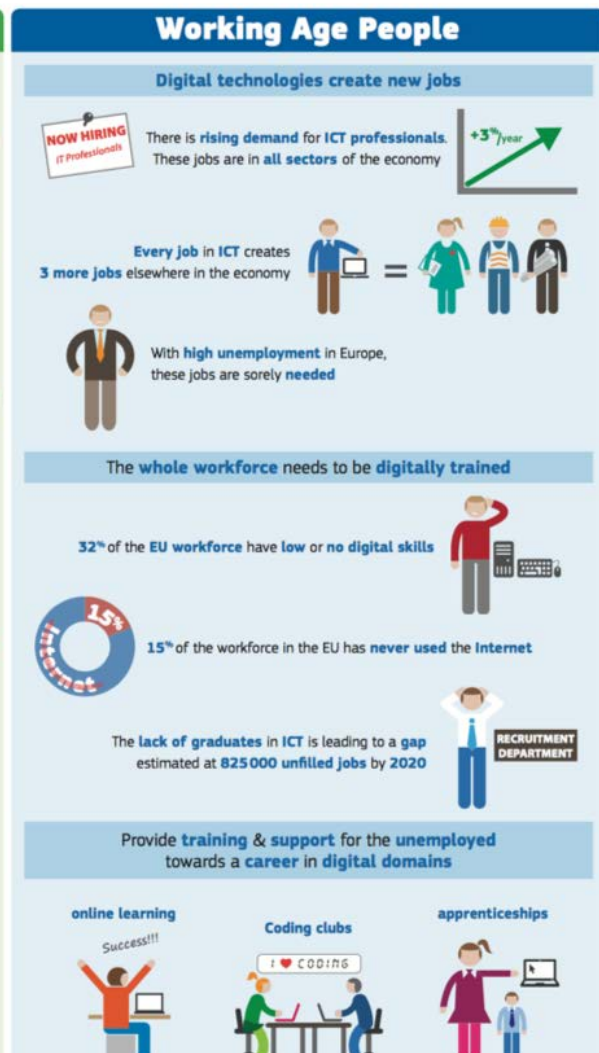
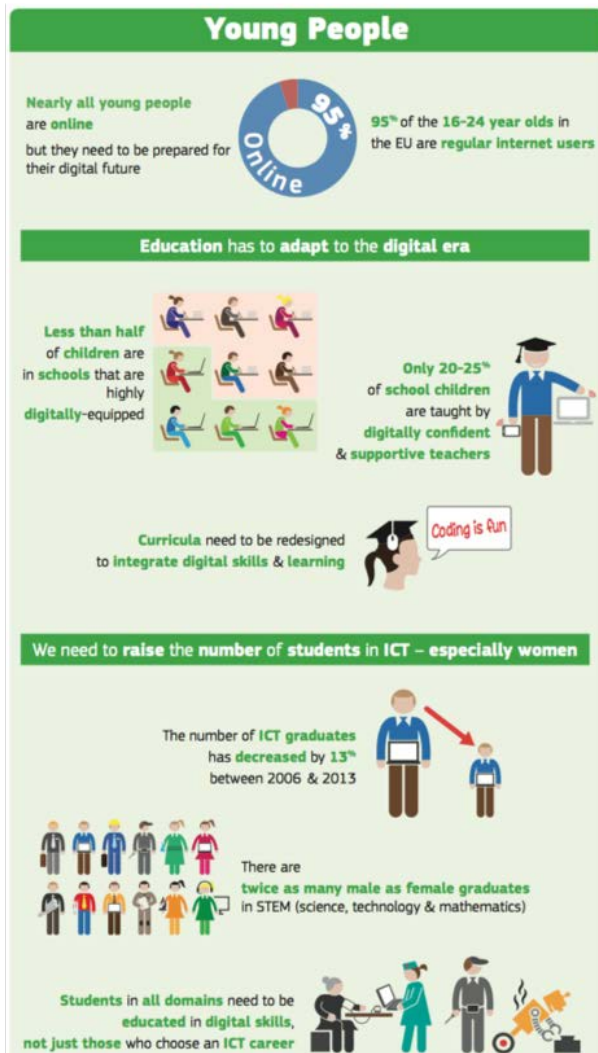
Future European workforce in 2030

2030



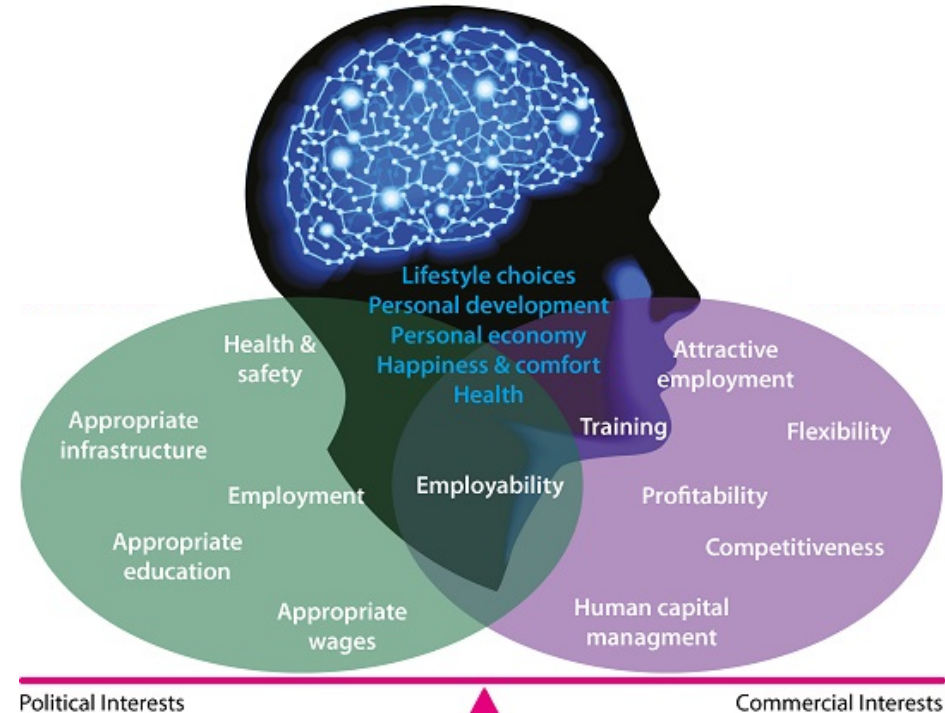
Lifelong learning

- Technology what we teach is outdated when new employees start
- STEM loses its brand already in the low grades.
- The gap between highly skilled people and low skilled people is widening, and we need the middle class in most cases.



Finding the optimal balance between work and life

- The European industry's prime mission is to attract and retain highly skilled employees and foster a working context that enables professional and personal growth in order to maximize the capabilities for current value creation as well as the competences for future (SO SMART, D4.2, 2014; International Labour Office, 2018).
- New public-private collaborative forms should be adopted to build, challenge and develop knowledge, skills and attitudes needed in the manufacturing of the future.
- FP7 SO SMART balance drivers:
 - Enabling work and education
 - Promoting a social product culture
 - Boosting the sharing economy
 - Spreading trust in value networks
 - Collaborating with the local community
 - Harmonizing governance and opening policies

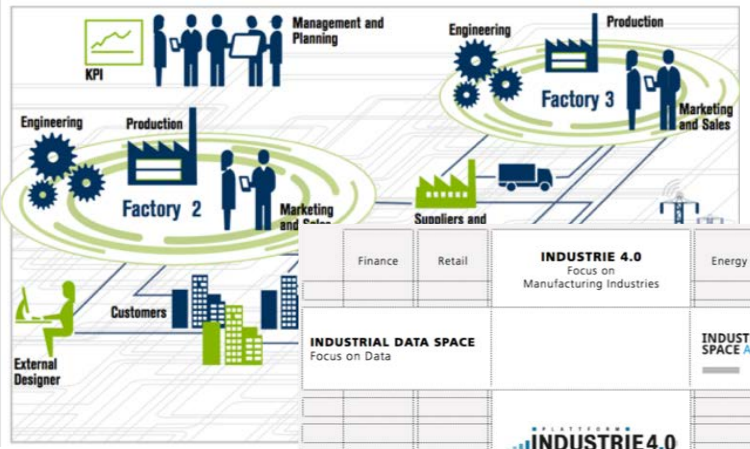
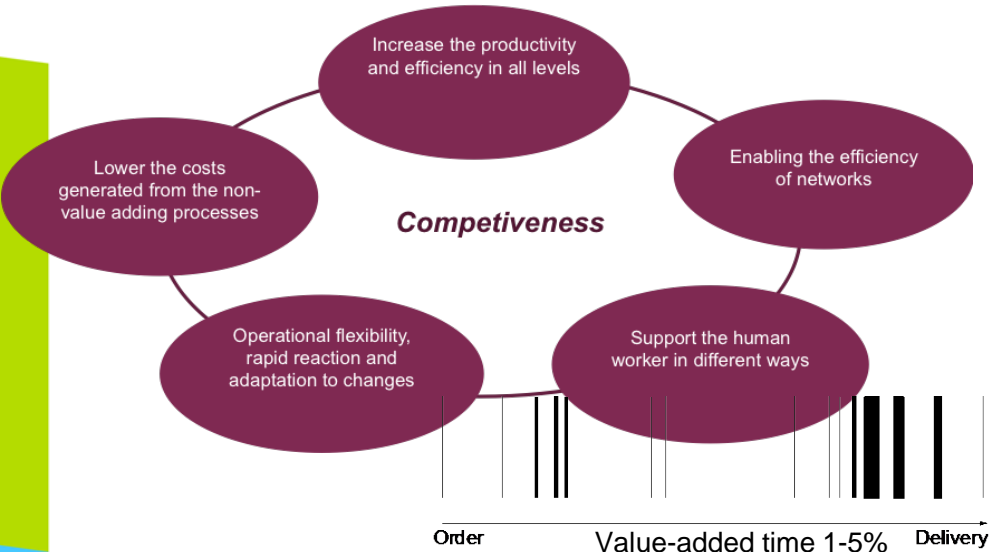


Political Interests

Commercial Interests

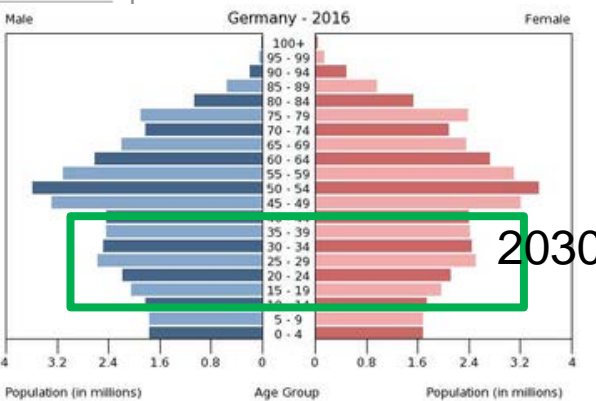
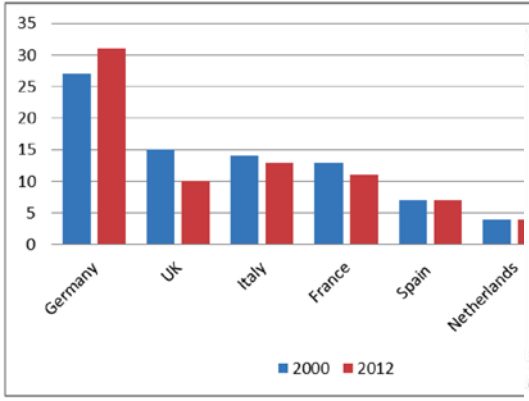
8.11.2018

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Finance	Retail	INDUSTRIE 4.0 Focus on Manufacturing Industries	Energy	...
INDUSTRIAL DATA SPACE Focus on Data		INDUSTRIAL DATA SPACE ASSOCIATION		
INDUSTRIE 4.0				

Distribution of Manufacturing in EU



Distance between 'man and the system'

Low information quality (timing, format, content)

Multiple tools – lack of information flow. Complexity

Digitalization benefits are unclear

Lack of visibility

- Factory
- Network

Lack of trust

- Partner
- IT

Competitiveness

- Increase of competitiveness over the supply network
- Reduce the non-value added time
- Increase the quality and production capacity by robotics and supplier and real-time data visibility by AI

Digitalization

- Find & Use the right analytical methods in right time and for the right purpose
- Improve the input data (collection, filtering, harmonization)
- “Design for data”
- Creation of digital information flow (concrete examples) to increase transparency and traceability

Ecosystems

- Support the forming of temporal ecosystems among SMEs and Large companies
- Find the experts and share competences more efficiently in future
- Increase the trust among companies to form alliances

Skills gap

- Work-life balance to make engineering more attractive
- Provide transfer education for potential candidates
- Skills gap between high skilled and low skilled persons is widening → formal and non-formal life-long training

LeanMES always up-to-data

<http://hightech.dimecc.com/results/leanmes-always-up-to-data>



June 8, 2015 Harri Nieminen

Category Smart production

Result video manufacturing execution system Information flow traceability

Program MANU



MANUFACTURING
PERFORMANCE
DAYS

Harnessing the Ecosystem Economy

Tampere, Finland | June 4th - 6th, 2019

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The first official strategic partners of MPD 2019 have now been published! Read more from NEWS-section.



<https://mes.eventos.fi/event/mpd2019>

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