New Industrial Paradigms: i4.0 & Sustainability

SIM4.0 WORKSHOPS

Castelo Branco, 13 March – Sanjotec, 14 March
Évora, 15 March 2018

EU Efforts to Support Industrial Sustainability & Digitisation

Erastos Filos, PhD

Directorate « Industrial Technologies »
DG Research & Innovation

Research and Innovation

European Commission

Presentation Outline

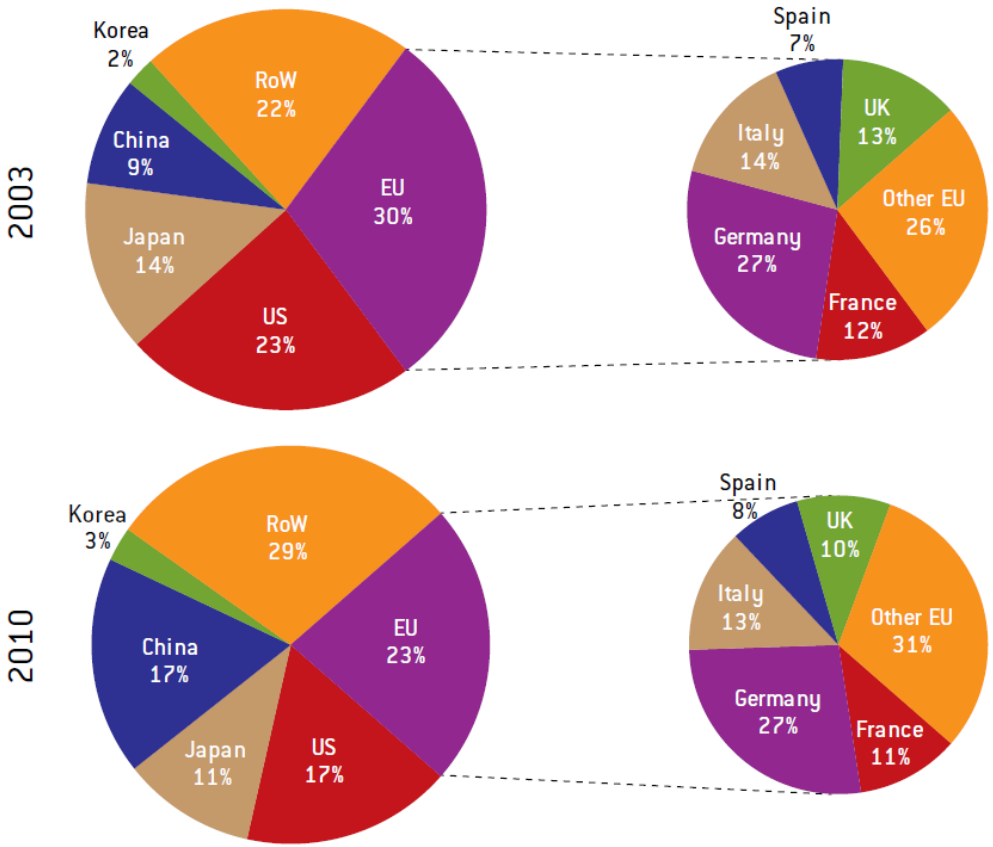
- Adding Value to Manufacturing in Europe
- Technological Innovation & ICT Driving Europe's Re-Industrialisation
- The 'Factories of the Future' PPP & Digitising European Industry Initiative
- Towards a Platform-driven Industry

European Commission

Manufacturing Matters

- 16% of EU GDP
- 20% of direct jobs and twice as many indirect jobs
- 66% of private EU R+D+I investments
- Part of a complex global economic system

Manufacturing: The Heartbeat of EU's Economy



- EU: world leader in many industrial domains
  - *e.g. mechanical engineering: 37% of global market share*
- 28% of final energy consumption
- R&D intensive, drives innovation

Source: R. Veugelers (2013): Manufacturing Europe's Future, Bruegel

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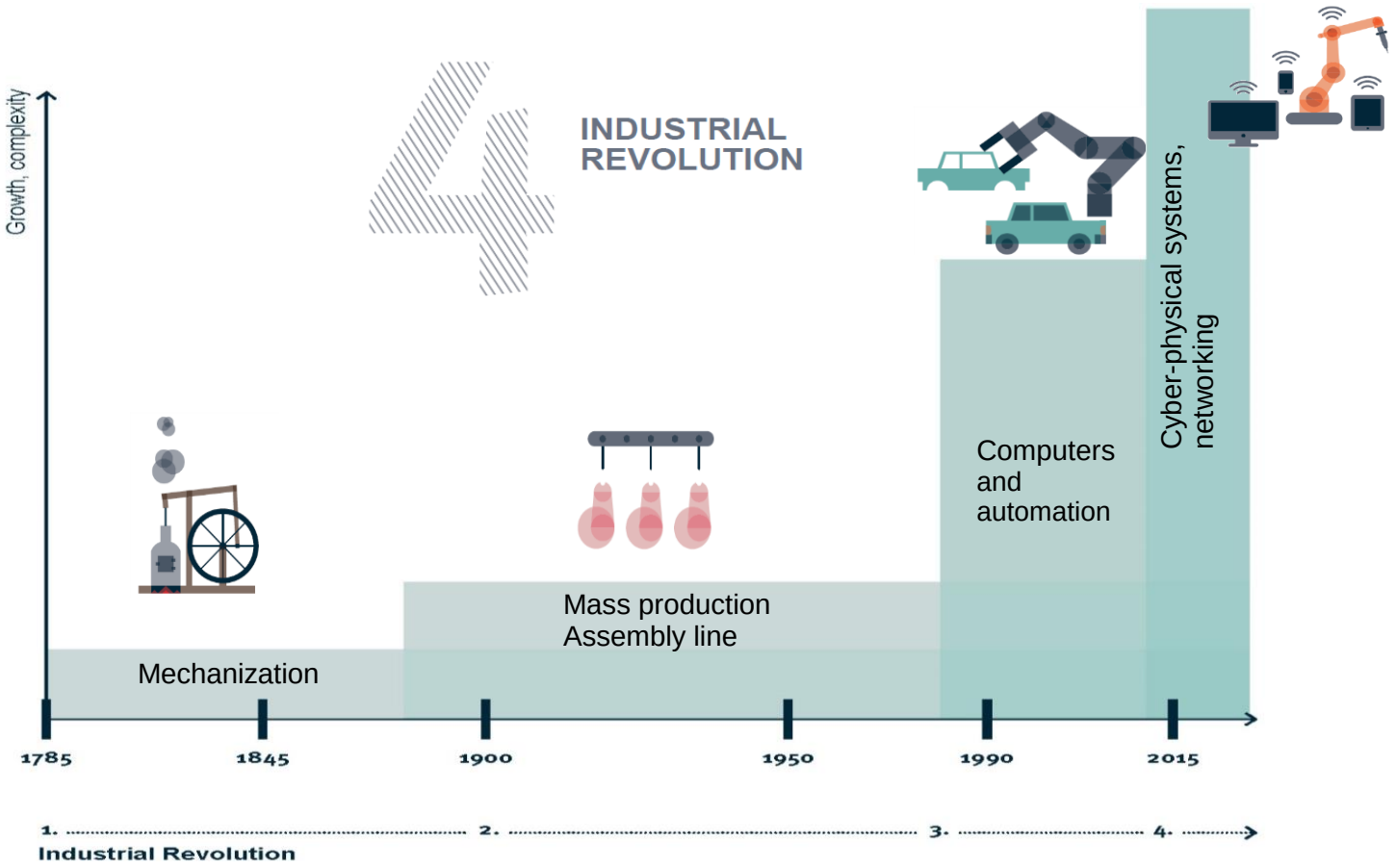
The Revolution Context



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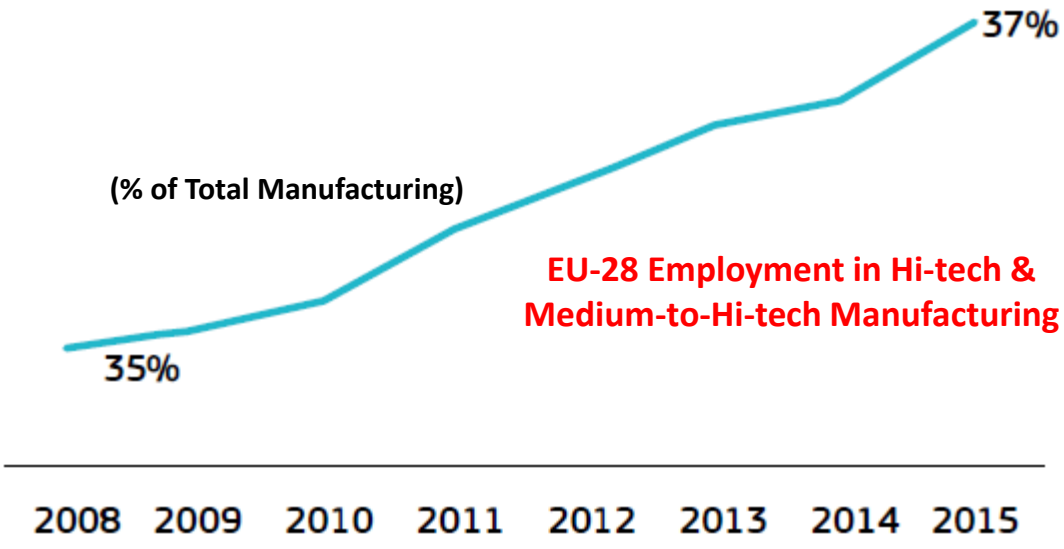
EU-28 Manufacturing Moving Up …



Source: Eurostat

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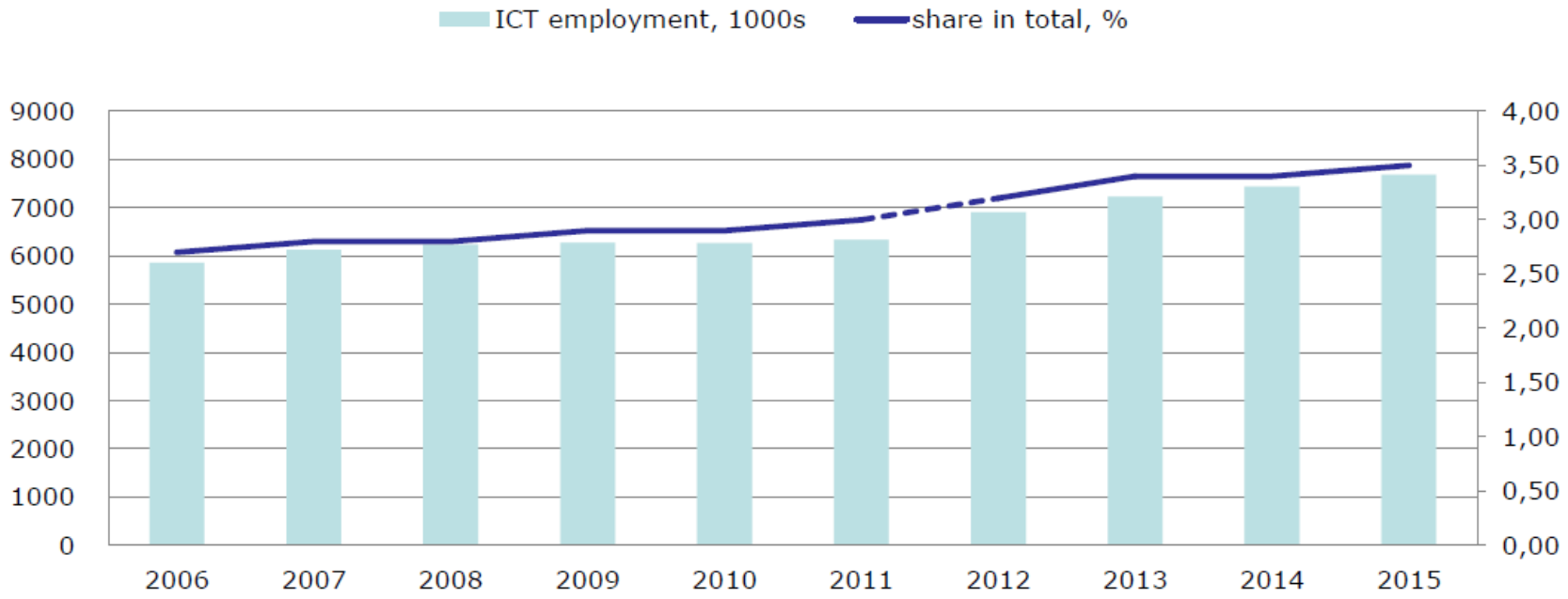
… due to R&D and Innovation

Employment of ICT specialists in the EU in absolute terms and as a share of total employment, 2006-2015



Source: Eurostat 2016

Workplace Trends

The 2020 Workplace

- Complex, networked
- Open, flexible
- Innovative, virtual

Crucial Requirements

- Adaptability
- Multi-disciplinarity
- Creativity

Skills in 2020

- ICT competency
- Critical thinking
- Problem solving
- Social skills

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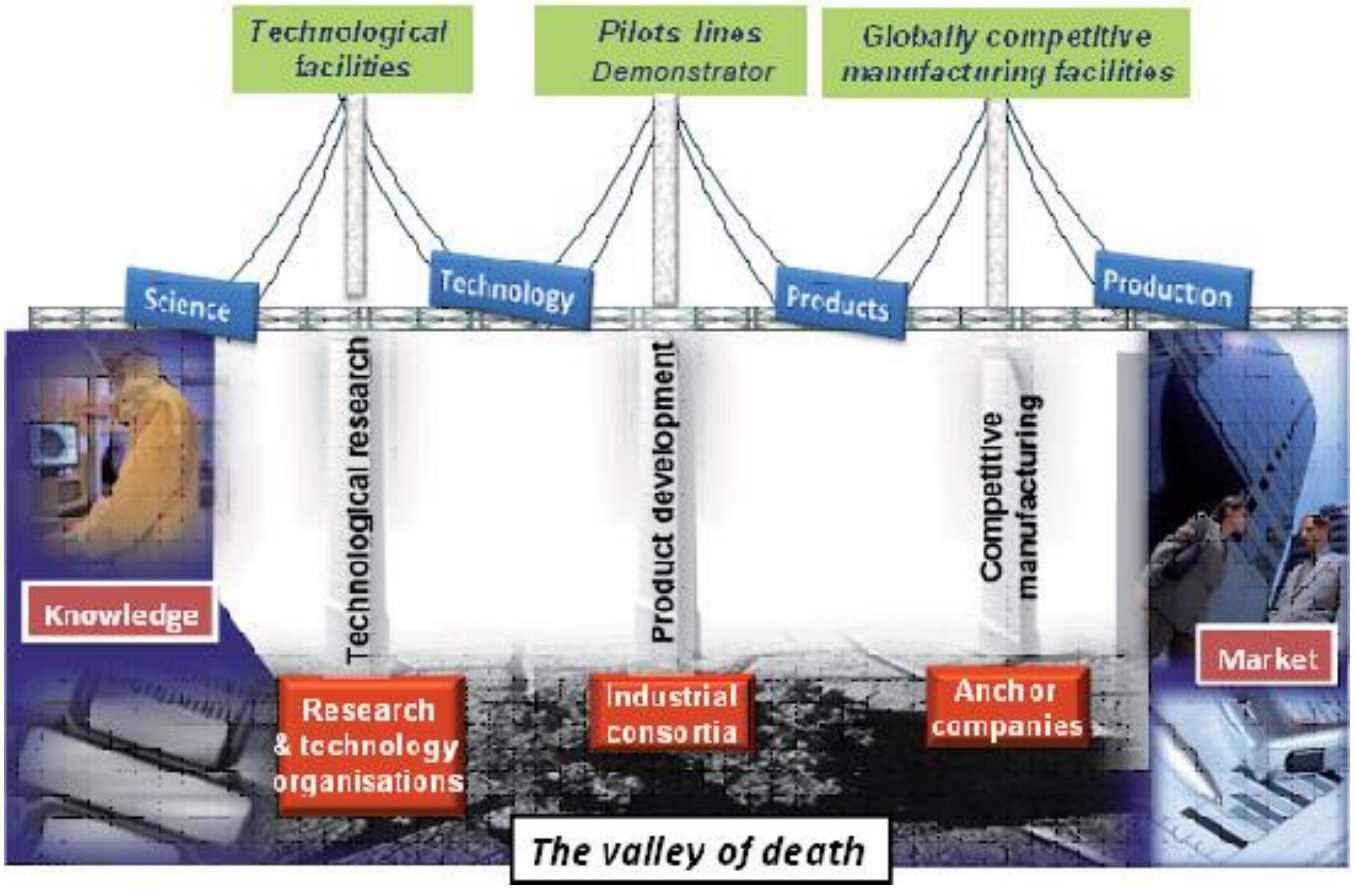
How to Advance Industry?

1# Innovation



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How to Advance Industry?

2# Deployment of Advanced Technologies

Global CEO survey: Ranking of future importance of advanced manufacturing technologies by executives

Advanced Manufacturing Technologies	US	China	Europe
Predictive analytics	1	1	4
Smart, connected products (IoT)	2	7	2
Advanced materials	3	4	5
Smart factories (IoT)	4	2	1
Digital design, simulation, and integration	5	5	3
High performance computing	6	3	7
Advanced robotics	7	8	6
Additive manufacturing (3D printing)	8	11	9
Open-source design/Direct customer input	9	10	10
Augmented reality (to improve quality, training, expert knowledge)	10	6	8
Augmented reality (to increase customer service & experience)	11	9	11

Source: Deloitte Touche Tohmatsu Limited and US Council on Competitiveness, 2016 Global Manufacturing Competitiveness Index

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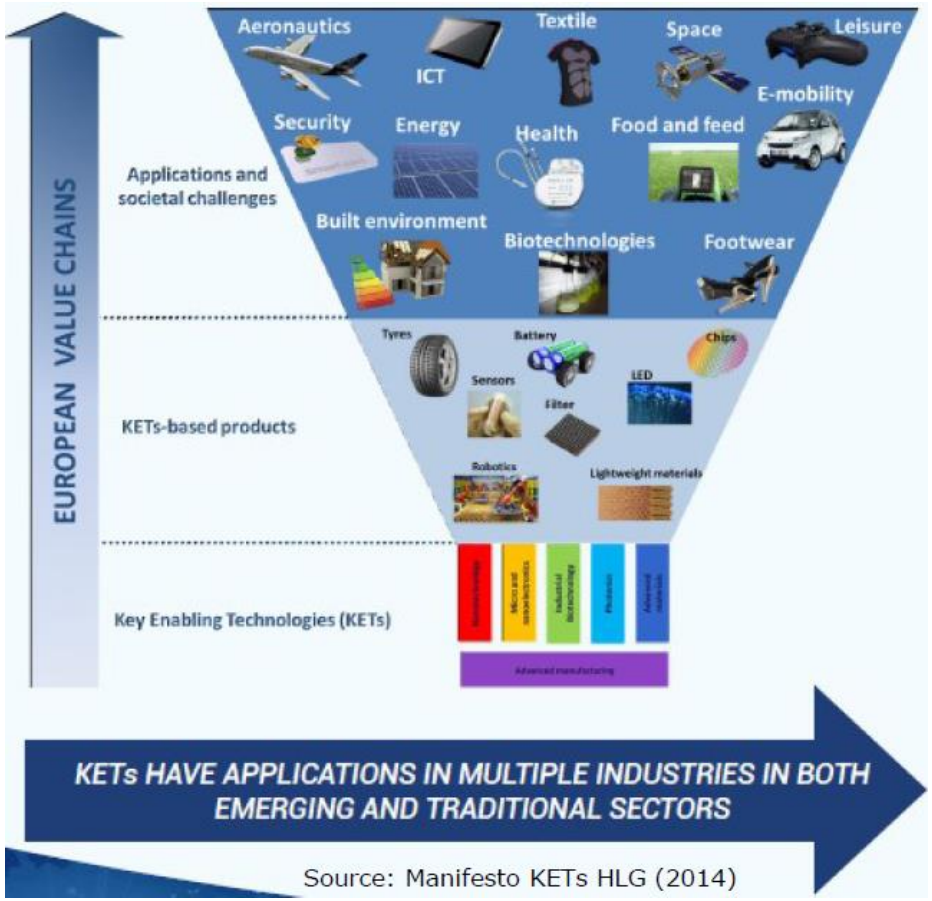
Industrial Deployment of Key Enabling Technologies



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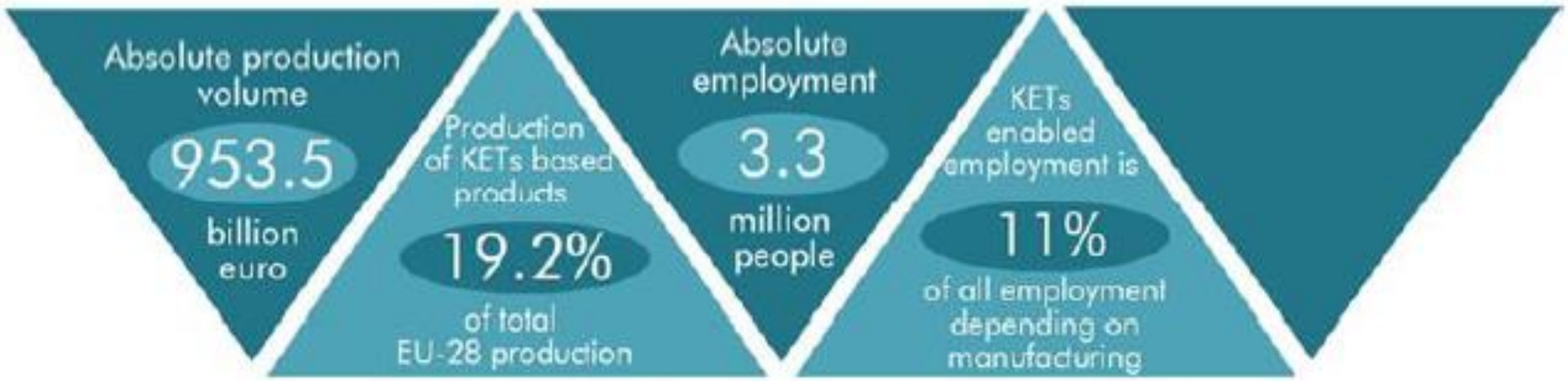
Value Created by the Deployment of KETs



Source: KETs Observatory, 2013 Eurostat data

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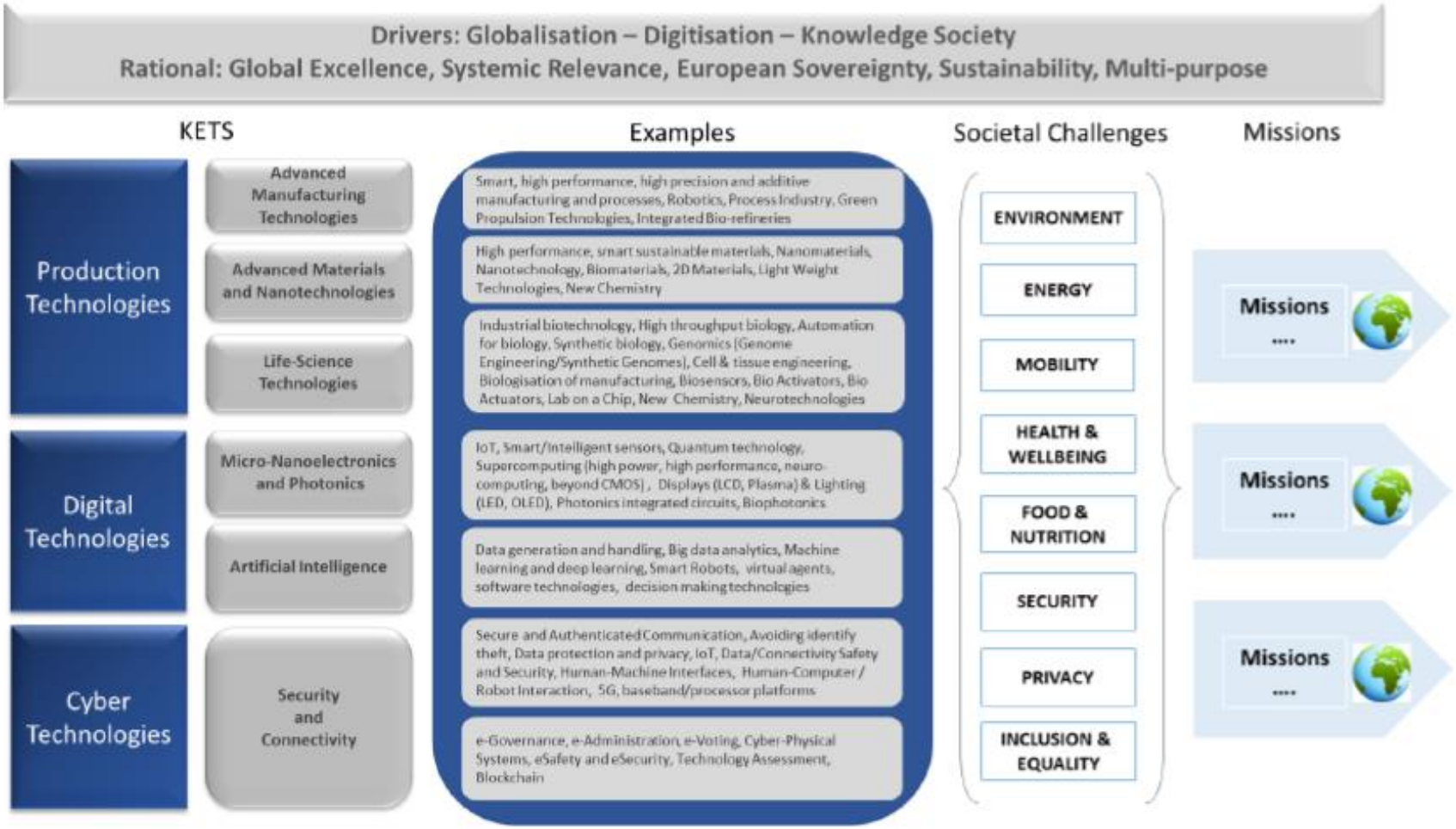
A Renewed KETs Concept



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EU-Driven Policies Impacting Industry

Digitising Europe's

#DigitalSingleMarket

Circular Economy

30+ Years of Industrial R&D in Europe

- 1984: Framework Programme I – Esprit/BRITE
  - *Bringing together suppliers + users of manufacturing technologies*
- 1993: Advanced Information Technology (AIT)
  - *Automotive & aerospace industries*
- 2003: Manufuture Technology Platform
- 2008: Factories of the Future (FoF)
- 2014: FoF, SPIRE, SPARC, Photonics, etc.

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Horizon 2020: Integrating R&D + Innovation

- A single programme:
  - *Bringing together 3 programmes/initiatives that were separated before: FP7 – CIP – EIT*
  - *Budget: ~ € 80 bn (2014-2020)*
- A coupling of research to innovation:
  - *From the lab to the market*
- Focus on challenges facing society in Europe:
  - *e.g. health, clean energy, efficient transport*
- Simplified access …
  - *… for companies, universities, institutes in all EU countries*

Public Private Partnerships

Example: The European Factories of the Future Research Association

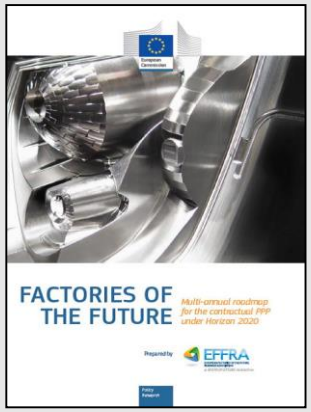
www.effra.eu

- Represents the private side of PPP 'Factories of the Future'
- Scope:
  - ✓ Multi-sector activities
  - ✓ Covering whole supply chain
  - ✓ Pre-competitive R&I projects to strengthen advanced manufacturing in Europe
- EFFRA works closely with European Commission

EFFRA
EUROPEAN FACTORIES OF THE FUTURE RESEARCH ASSOCIATION
a MANUFUTURE initiative

Why A Factories of the Future PPP

- Manufacturing is a key contributor to the EU's economic prosperity:
  - *Employment & wealth creation*
  - *Exports*
  - *Technological competence & market leadership*
- Complex R&D-intensive activity, requiring long term horizon:
  - *R&D costs & risks with high & long RoI (market failure)*
  - *R&I needs public support, as e.g. USA, China, Korea, Japan*
- Tech capabilities & supply chains dispersed across EU:
  - *Need critical mass of stakeholders & leadership at EU level*
  - *Contractual PPP effort for timely deployment of new technologies, across sectors & also in SMEs*



https://bookshop.europa.eu/en/factories-of-the-future-pbKI0213266/

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Factories of the Future: Going Forward

Factories 4.0 & Beyond

Key priorities for FoF 18-19-20

Agile value networks: Lot-size one - distributed manufacturing

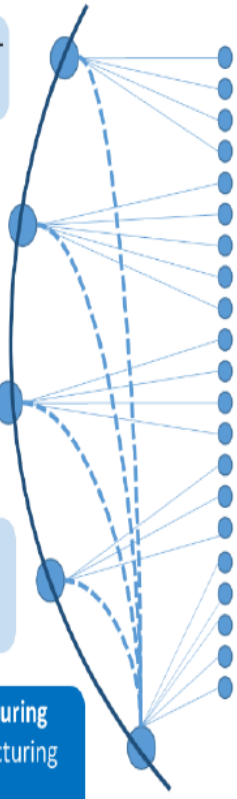
Excellence in manufacturing: Advanced manufacturing processes and services for zero-defect processes and products

The human factor: Human competences in synergy with technological assets

Sustainable value networks: Manufacturing in a circular economy

Interoperable digital manufacturing platforms: connecting manufacturing services

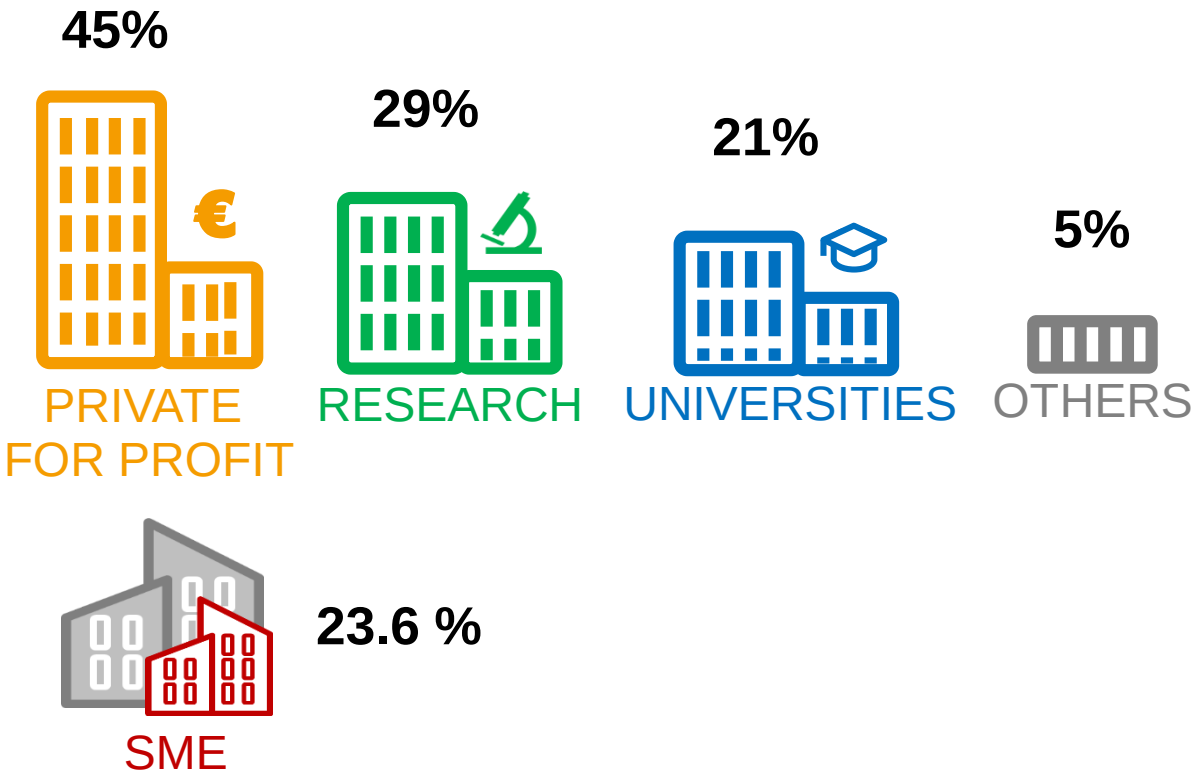
Research headlines for FoF 18-19-20



- HL02 - Quality Controlled and Integrated Additive Manufacturing
- HL12 - Reconfigurable cells, self-reconfigurable cells through smart sensors/devices
- HL19 - Digitisation of the Supply Chain – Manage complex customer-driven value networks
- HL22 - Manufacturing as a Service (MaaS) – Servitisation of autonomous and reconfigurable production
- HL01 - Manufacturing for complex and/or multi-material components
- HL03 - High precision manufacturing
- HL07 - Zero-defect manufacturing – quality assurance – self-learning systems
- HL08 - Upgrading of factories
- HL30 - New methodologies for introducing innovative production technologies
- HL10 - Supporting the human in the workplace – Manufacturing training/re-skilling
- HL11 - Human machine/robot cooperation for flexible and evolving factories
- HL24 - User Centric Product and Production Equipment Engineering
- HL23 - Collaborative Engineering
- HL04 - Material and resource efficiency in manufacturing
- HL06 - Energy efficiency on factory level
- HL28 - European Circular Economy Open Platform
- HL16 - Digital Factory Modelling and Simulation
- HL17 - Multiple Source (Big) Data Mining and Real Time Analysis
- HL18 - CPS: Integration with physical legacy machines in factories
- HL26 - Security, Privacy and Liability – Cybersecurity and Industrial Safety
- HL25 - Digital Platform Interoperability

EFFRA
EUROPEAN FACTORIES OF THE FUTURE RESEARCH ASSOCIATION
a MANUFUTURE initiative

Profile of Beneficiaries in PPP R&D



Factories of the Future: Progress in Figures

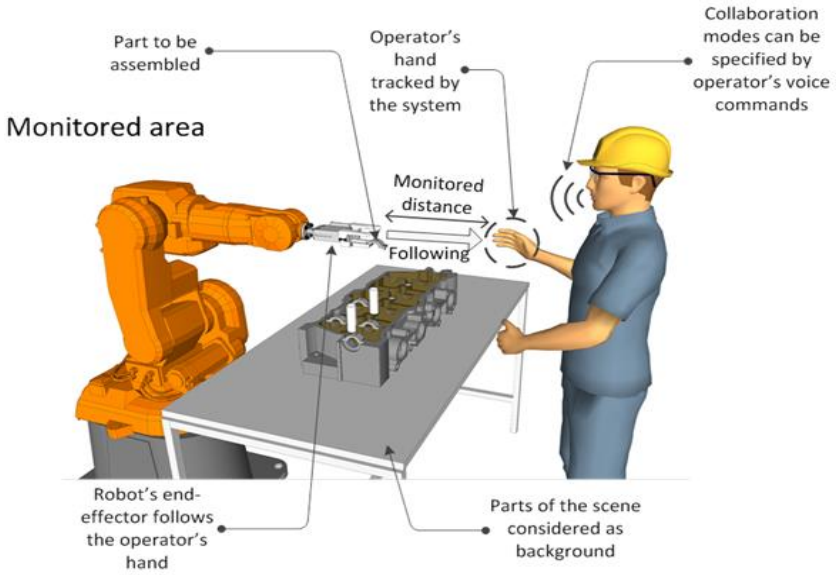
- 200+ projects (2009-2018)
- 1,300+ organisations participating
- 60% industrial participation

Indicator	Initial Figures
Number of patent applications	30
Standardisation inputs	50
Number of developed systems & technologies	364
Estimation of private investments related to the projects and the FoF PPP Roadmap	2.5 – fold leverage of investments
Contribution of the PPP projects to the reduction of energy use and CO_2	20% on average
Contribution of the PPP projects to the reduction of waste and material use	15% on average

Source: EFFRA

Project Examples (1/2)

Symbiotic Human-Robot Collaborative Assembly: Technologies, Innovations & Competitiveness



€6.5 million in EC funding
Start: April 2015
End: March 2019

Expected Impacts:

- No-fence safe Human-Robot collaboration
- Increased use of affordable robots by SMEs
- Improvement of productivity by task redistribution
- Re-shoring of industrial activities to Europe

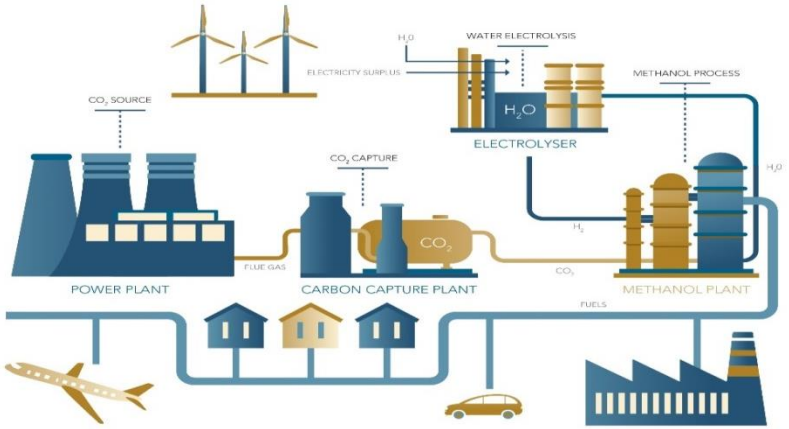
http://www.symbio-tic.eu/

Factories of the Future
Public Private Partnership

Project Examples (2/2)

Synthesis of methanol from CO_2

€8.6 million in EC funding
Start: Dec 2014
End: Nov 2018



Expected impacts:

- CO2 emissions reduction in C-leakage sensitive industries, e.g. steel, cement
- Support target of 10% use of renewable energy in transportation
- Reduce Europe's dependency on methanol imports

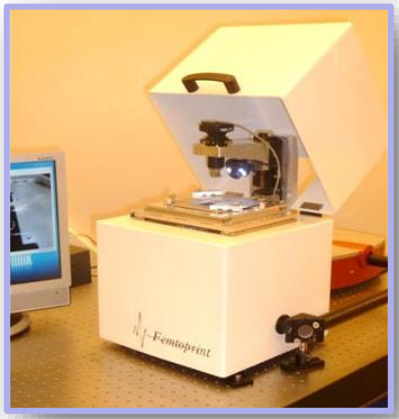
http://www.mefco2.eu/

Delivering Progress: Start-Ups

Uptake of project results has led to spin-offs and business start-ups

FEMTOprint SA

Spin-off from Femtoprint project: Commercialised project result = Femtoprinter (3D printing for glass micro-devices)



Sentio

Spin-off from VISTRA project: Commericialised project result = Training system for complex assembly

Cognibotics

Spin-off from COMET project: Unique system to monitor & compensate robot wear

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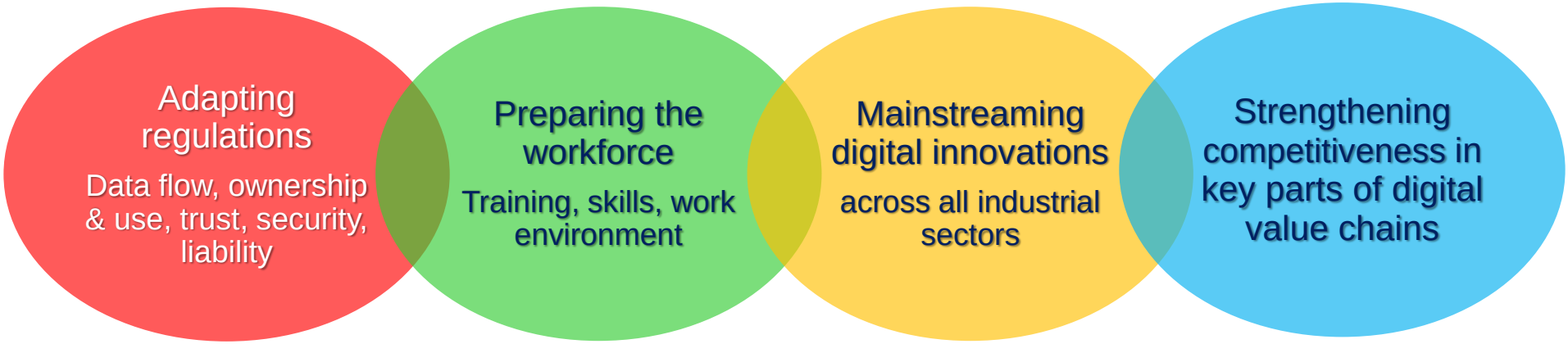
Digitising European Industry



A coordination framework for EU and national initiatives

#DigitiseEU

https://ec.europa.eu/digital-single-market/en/policies/digitising-european-industry

Research and Innovation

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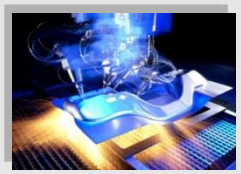
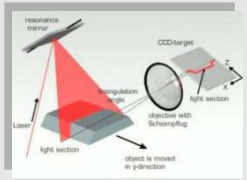
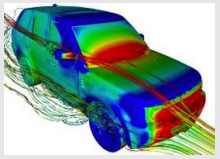
From Digitising Factories to Digitising Industry

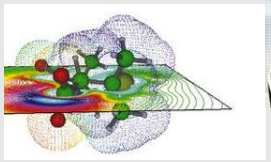
Laser-based manufacturing





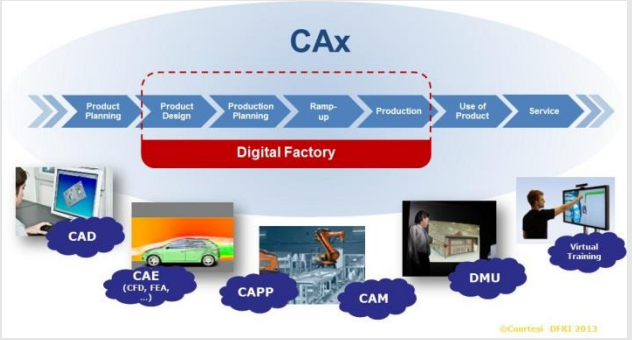
Cyber-physical systems for process (chain) optimisation





Robotics

Modelling, Simulation, Analytics



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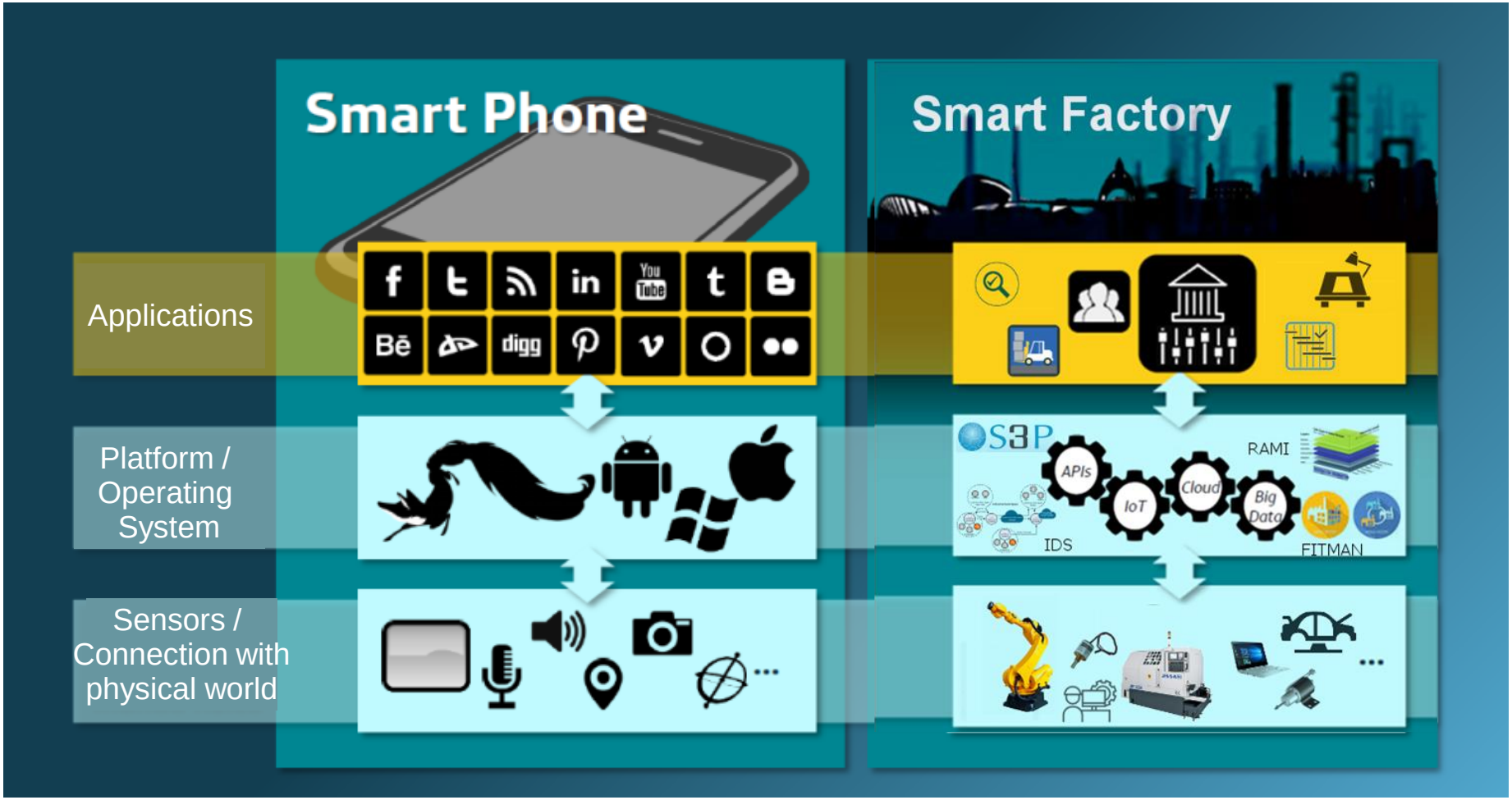
Platforms-Based Factory Environments?



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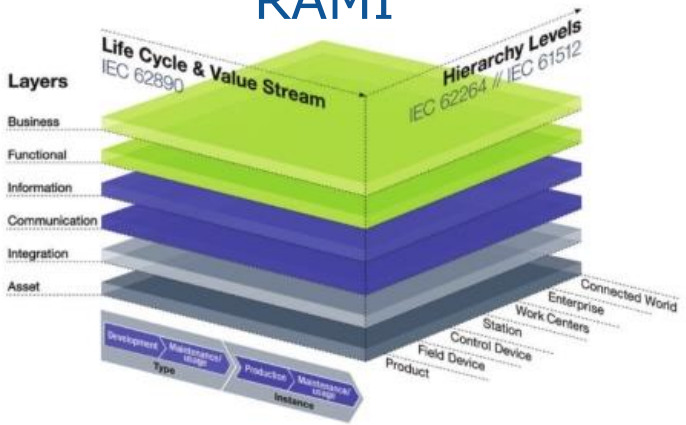
Examples of Open Platforms

Community-led, sector-specific (vertical)

RAMI



FI-WARE

FITMAN

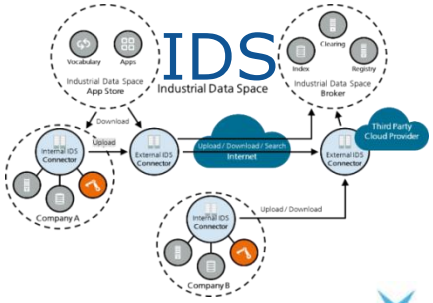
Community-led, cross-sector (horizontal)

S3P

SMART, SAFE & SECURE PLATFORM

IDS

Industrial Data Space



AIOTI

CRYSTAL

industrial internet CONSORTIUM

ARROWHEAD

Proprietary, with open interfaces

SIEMENS

DASSAULT SYSTEMES

Social and Collaborative apps
Related brands: ENOVIA, 3DSWYM

Information Intelligence apps
Related brands: EXALEAD, NETVIBES

Content and Simulation apps
Related brands: 3DVIA, DELMIA, SIMULIA

3D Modeling apps
Related brand: CATIA, GEOVIA, SOLIDWORKS

Real time 3DEXPERIENCE Platform

SAP HANA®

for Supply Chain and Manufacturing

GE

Predix

Your cloud platform for the industrial Internet

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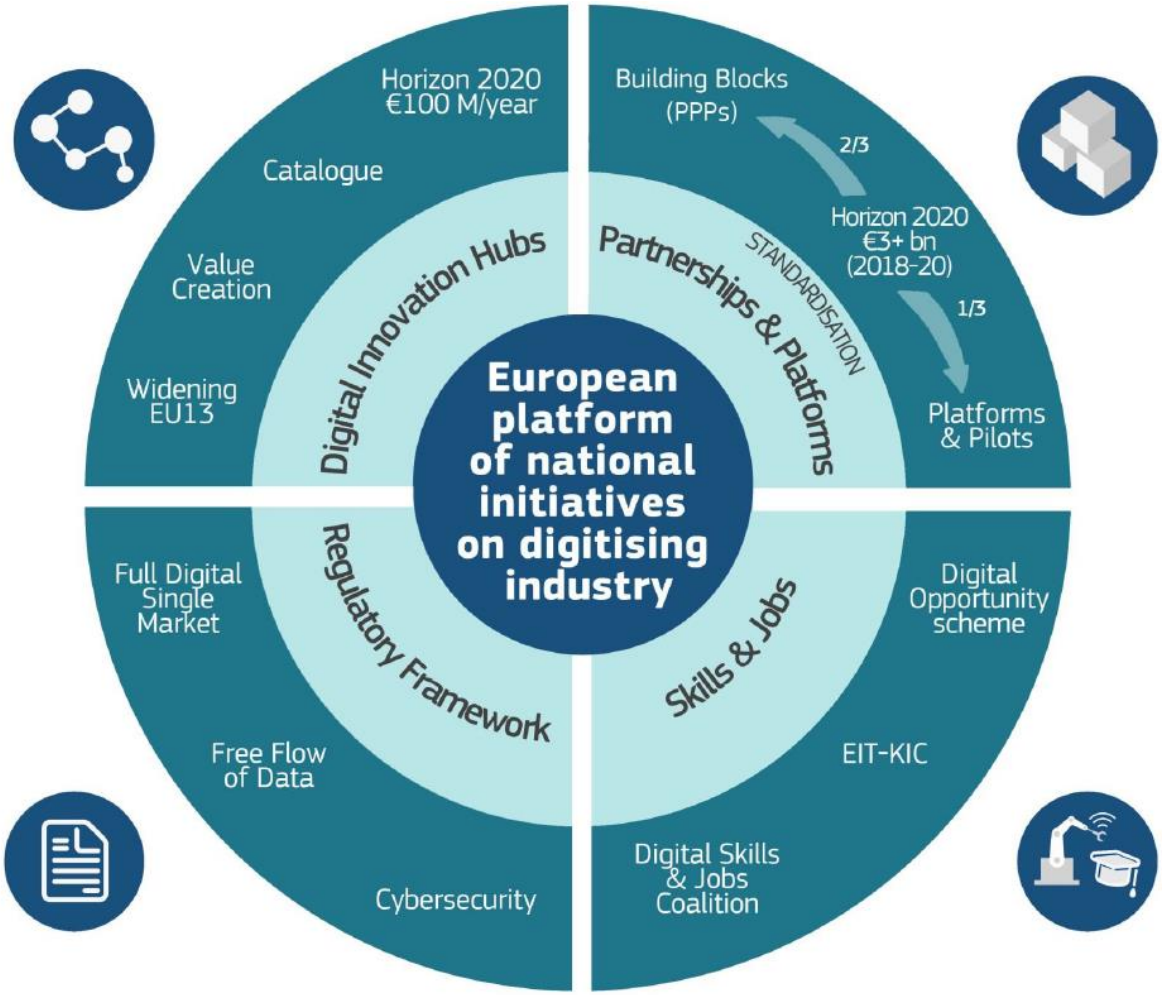
Framework of DEI Activities



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Digital Innovation Hubs (DIH) Calls

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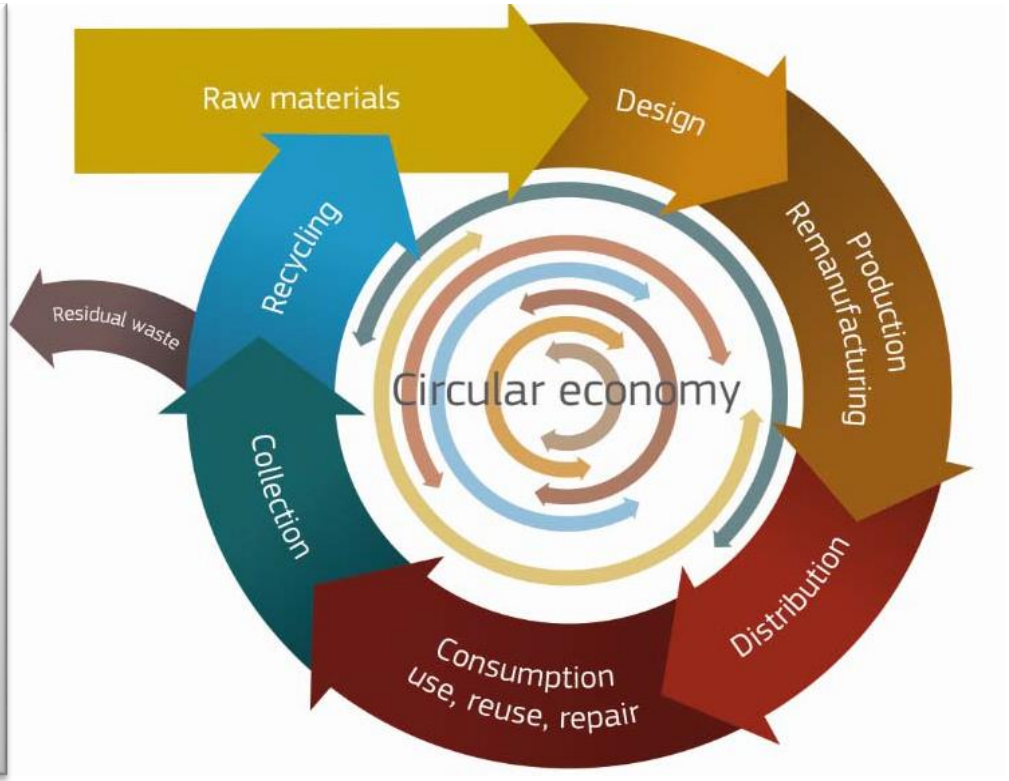
Supporting a Circular Economy

- No longer linear
- Extended life times
- Cross-sector
- Multi-stakeholder
- Innovation in all forms
- Design strategies
- New business models
- Demand-side measures



Further Information

- Contact:
  erastos.filos@ec.europa.eu
- Horizon 2020 Research Themes & Calls:
  ec.europa.eu/research/participants/portal
- Information on PPPs:
  ec.europa.eu/research/industrial_technologies/
- Digitising European Industry Page:
  https://ec.europa.eu/digital-single-market/en/policies/digitising-european-industry

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