The Sensing Enterprise - Enterprise Information Systems in the Internet of Things

Keynote Lecture

28th April 2016

ICEIS 2016, International Conference of Enterprise Information Systems, Roma

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Engineering Ingegneria Informatica SPA

ENGINEERING

RESEARCH

250 researchers

70 live projects

33 mln Euros investments

6 laboratories

Innovation areas

Augmented Reality
Big Data
Border Security
Cloud Computing
Content & Media
Cyber Security
Digital Economy
eHealth
Energy & Green IT
Future Internet
Internet of Things
Open Data
Open Public Service Innovation
Payment Systems
Smart & Social Enterprises
Tourism & Culture
Transportation, Logistics & Infrastructures

ICT for Manufacturing – Why something else?

Rosa García
Presidenta de Siemens en España

"Software, itself, does nothing, it does not build anything, it does not save lives. The objective should be to **adapt it to industrial technologies**. Unify the software with the tools already available".

The fundamental challenge is to start a business process digitalisation in sectors so far not digitised, which opens a world of opportunities for enterprises".

July 2014

Digitising Industry vs. Digital Innovation

1. Different **Innovation** pace, speed, jargon, model between IT and Industry (Manufacturing in particular). IT/OT gap. E.g. Hackathons
2. An **Industrial** (Manufacturing) **Innovation** is not limited to software. Important roles are played by further intangibles (data, knowledge, models, human skills) and non-IT tangibles (production systems, engineering infrastructures). E.g. Engagement / Awareness
3. Evolution of basic FI Technologies (CPS, IoT, BigData, Cloud) and integration of domain independent with domain dependent **Software Enablers**. E.g. Industrie 4.0 and RAMI 4.0 compatibility
4. **Cloud Strategy**, Journey, Adoption methods and tools are needed for EU industry in order to fully trust the Open Cloud Value Proposition and its SLAs (availability, scalability, performance, security). E.g. Industry-oriented SLAs and commercial value propositions

Digital **Innovation** in Manufacturing: disruptive-incremental - push-pull?

Speech of Commissioner Oettinger at Hannover Fair 14 April 2015

*Objective: Making sure that any industry in Europe, wherever it is located, can make the best use of **digital technologies** while adapting our workforce to the change*

1. **Wide-spread adoption: access to technology and knowledge**
2. **Leadership in digital platforms for industry**
3. **Closing the digital skills gap**
4. **Smart regulation for smart industry**

COMMISSION PRIORITY

Digital Single Market

Bringing down barriers to unlock online opportunities

Digital Single Market: making the EU's single market freedoms "go digital"

An EU wide strategy for digitisation can ensure "scale", mobilise actors with value chains spreading across Europe and support interoperability and standardisation.

http://europa.eu/rapid/press-release_SPEECH-15-4772_en.htm

Digitising European Industry April 19th

Brussels, 19.4.2016
COM(2016) 180 final

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

Digitising European Industry
Reaping the full benefits of a Digital Single Market

{SWD(2016) 110}

The purpose of this Communication is **to reinforce the EU's competitiveness in digital technologies and to ensure that every industry in Europe, in whichever sector, wherever situated, and no matter of what size can fully benefit from digital innovations.**

Facilitated by a dynamic framework for coordination and experience sharing between public and private initiatives at EU, national and regional level, the proposed actions are expected to mobilise close to **50 B€** of public and private investment in the next 5 years, explore and adapt when needed the legislative framework and reinforce coordination of efforts on skills and quality jobs in the digital age.

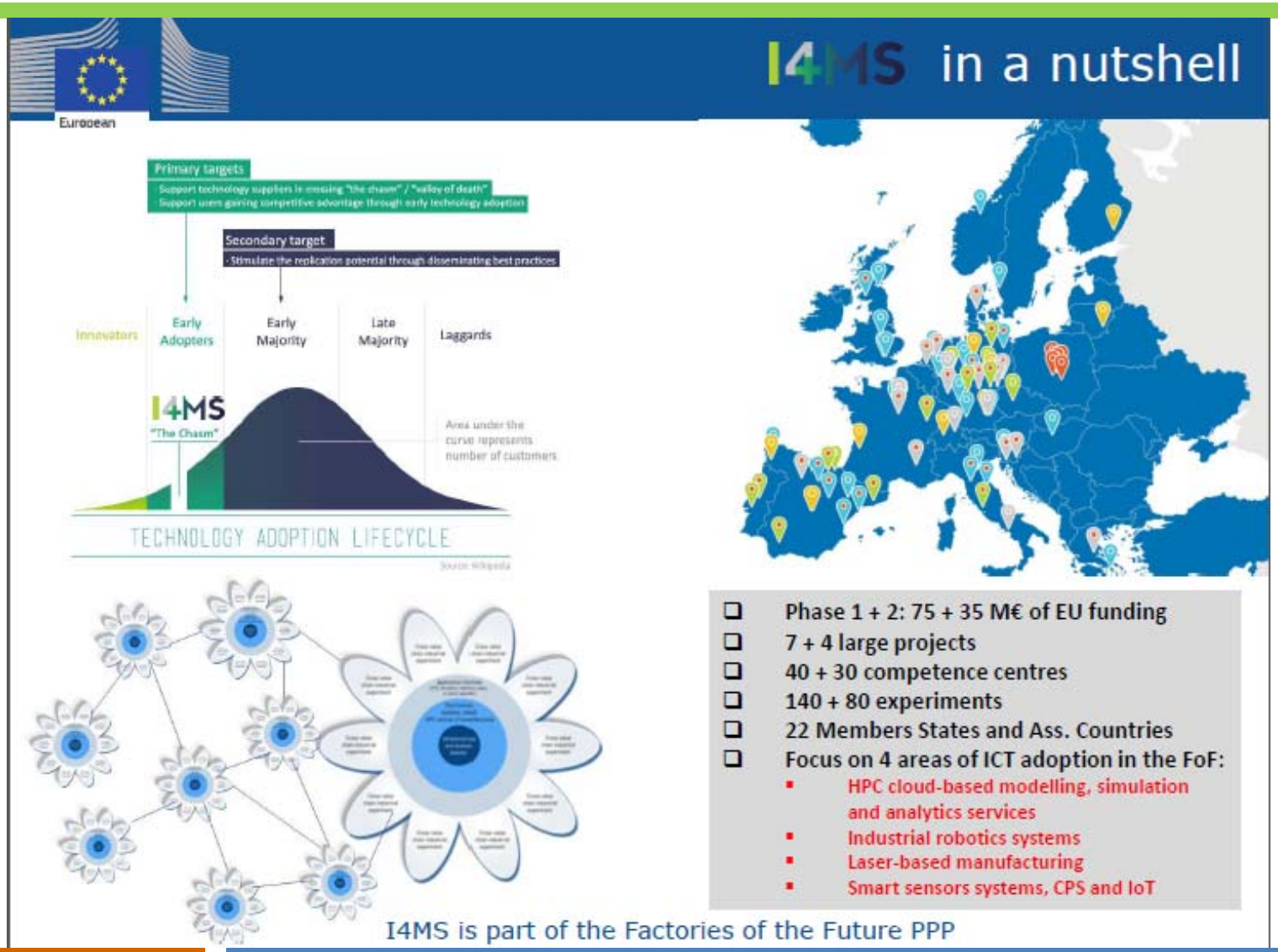
Digitising European Industry: 3 steps

The **DSM strategy**, especially the pillar on "**maximising the growth potential of the digital economy**", contains all the major levers for improving industry digitisation with actions in areas such as the **data economy, IoT, cloud computing, standards, skills and e-government**.

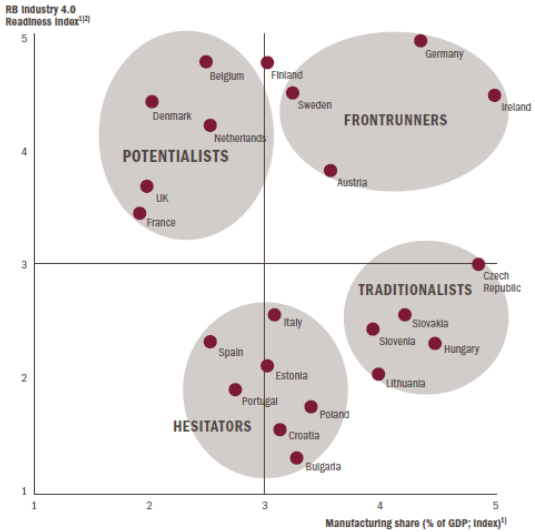
With about **4% of GDP**, the ICT sector in Europe represents an important share of the economy employing more than **6 million people**. The value added of this sector in the EU (production of digital goods), spanning from components to software products is above 580 B€ and represents close to 10 % of the added value of industrial activity overall. Recent studies estimate that digitisation of products and services will add more than **110 B€** of revenue for industry per year in Europe in the next 5 years. Just **in Germany**, further digitisation of industry is expected to bring up to 8 % of productivity growth over ten years and a revenue growth of about 30 B€ per year. It will also lead to a **6 % increase in employment**.

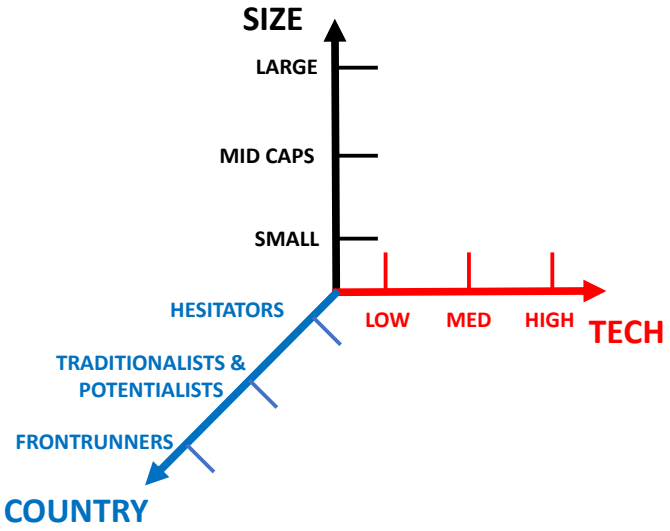
- **Digital Products**: Driven by the development of the Internet of Things. this includes developments of markets like the connected car, wearables or smart home appliances.
- **Digital Processes**: the further spread of automation in production and the full integration of simulation and data analytics over the full cycle from product design to end of life (circular)
- **Digital Business Models** by re-shuffling the value chains and blurring boundaries between products and services. to increase profitability by up to 5.3% and employment by up to 30%.

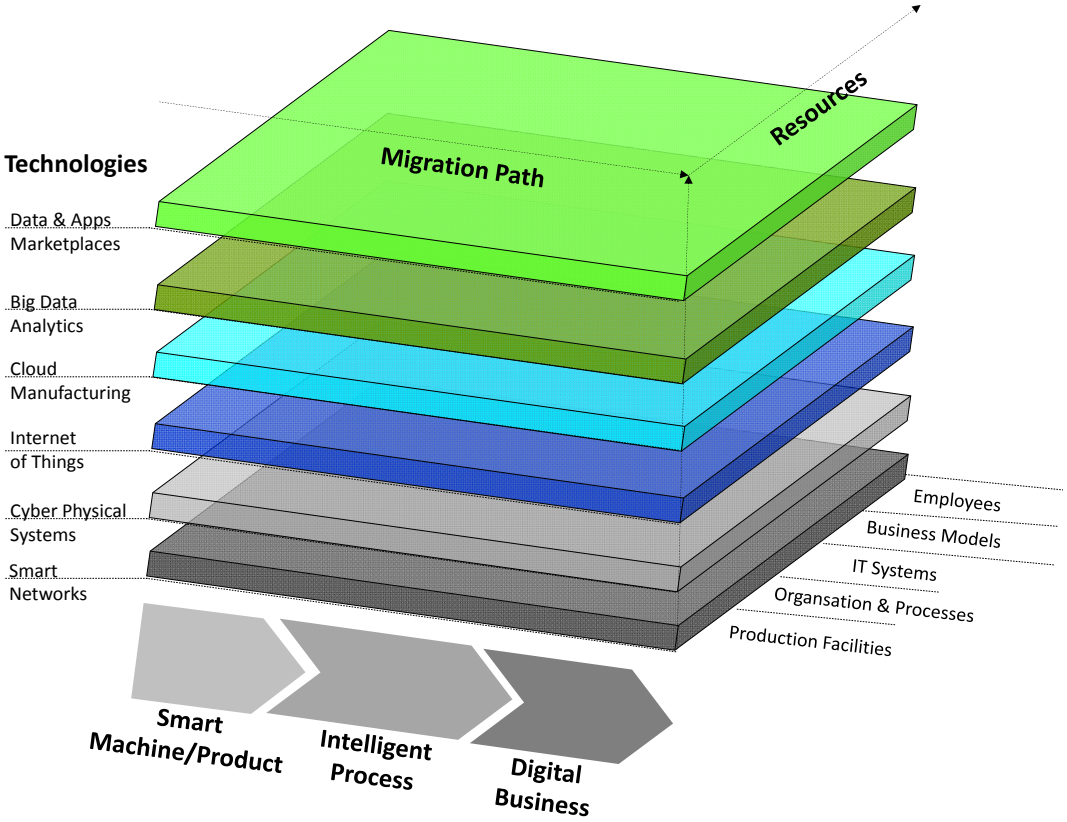
I4MS Programme: Innovation for SMEs



Migrating Industry to ICT: a Methodology







Industrie 4.0 and Digital Skills gap

Several national and regional initiatives such as **Industrie 4.0** (DE), Smart Industry (NL), Catapults (UK) and Industrie du Futur (FR) were launched recently to tap into the opportunities offered by digital innovations in industry. They show the commitment across Europe to seize the digital opportunities ahead. However, addressing the challenges of digital transformation at national level alone bears the risk of leading **to further fragmentation** of the single market and to efforts below the critical mass needed to attract private investments.

About 40% of EU workers have an insufficient level of digital skills. The **need for new multidisciplinary and digital skills** is exploding, such as combined data analytics and business or engineering skills. The gap between the demand for, and availability of digitally skilled workers in Europe is growing. Digital innovations have also a great potential for additional jobs creation in industry with the growth of new businesses and by helping preserve and re-shore industrial jobs. Looking only at ICT professionals, more than a million additional jobs have been created over the last three years. Despite this, it is expected that rapidly growing demand will lead to more than 800 000 unfilled vacancies by 2020. At the same time, advances in automation, robotics and smart systems are increasingly transforming the nature of work, not only for repetitive tasks but also for sophisticated tasks in administrative, legal or supervisory functions. Work in a digitised economy will involve also new skills and capacities including more creativity, communication and adaptability. It will require a massive upskilling of the workforce at all levels. The above hurdles require a collective public and private effort.

Industrie 4.0: the EU CPPS value proposition

Figure 1:
The four stages of
the Industrial Revolution

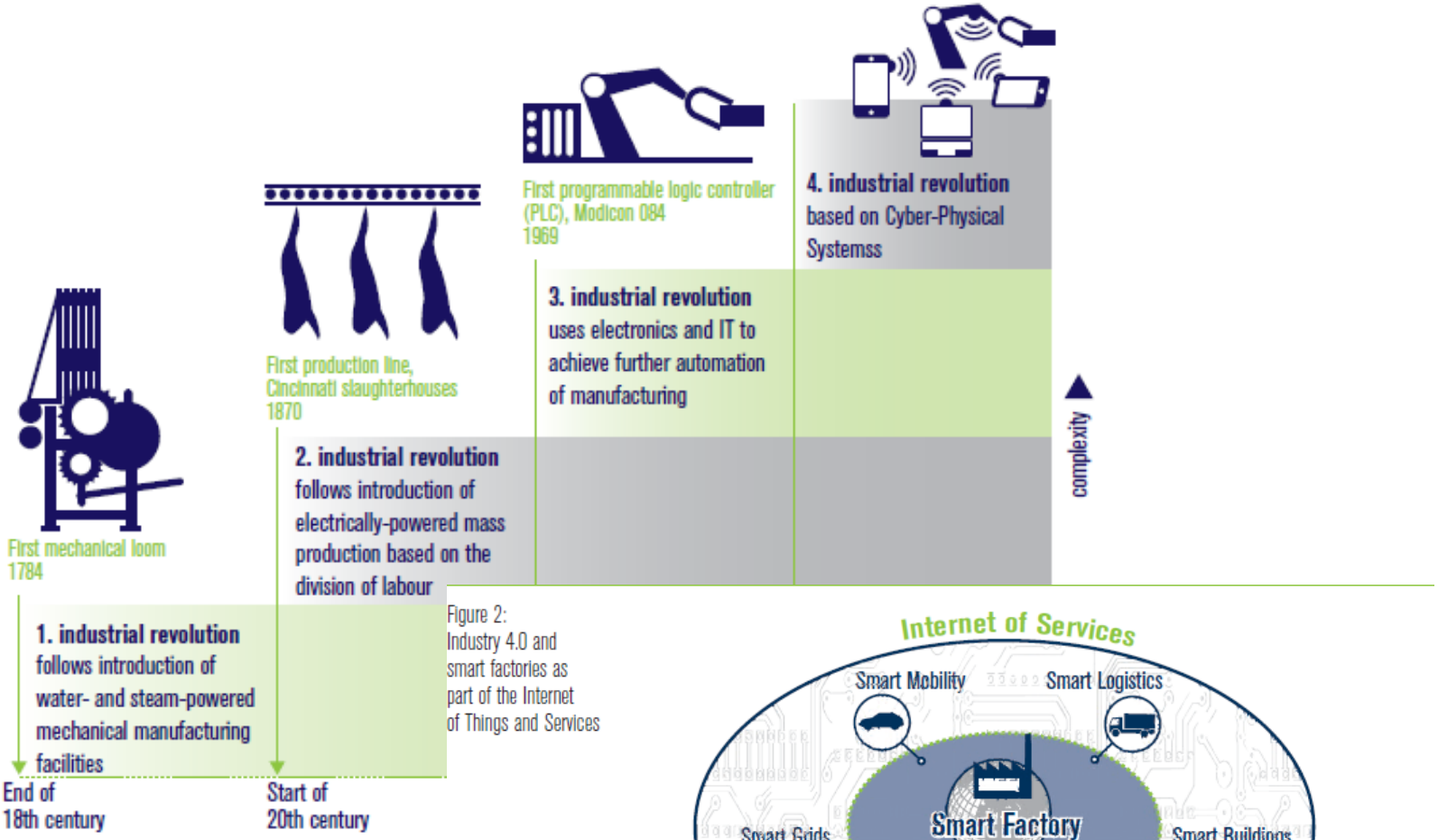
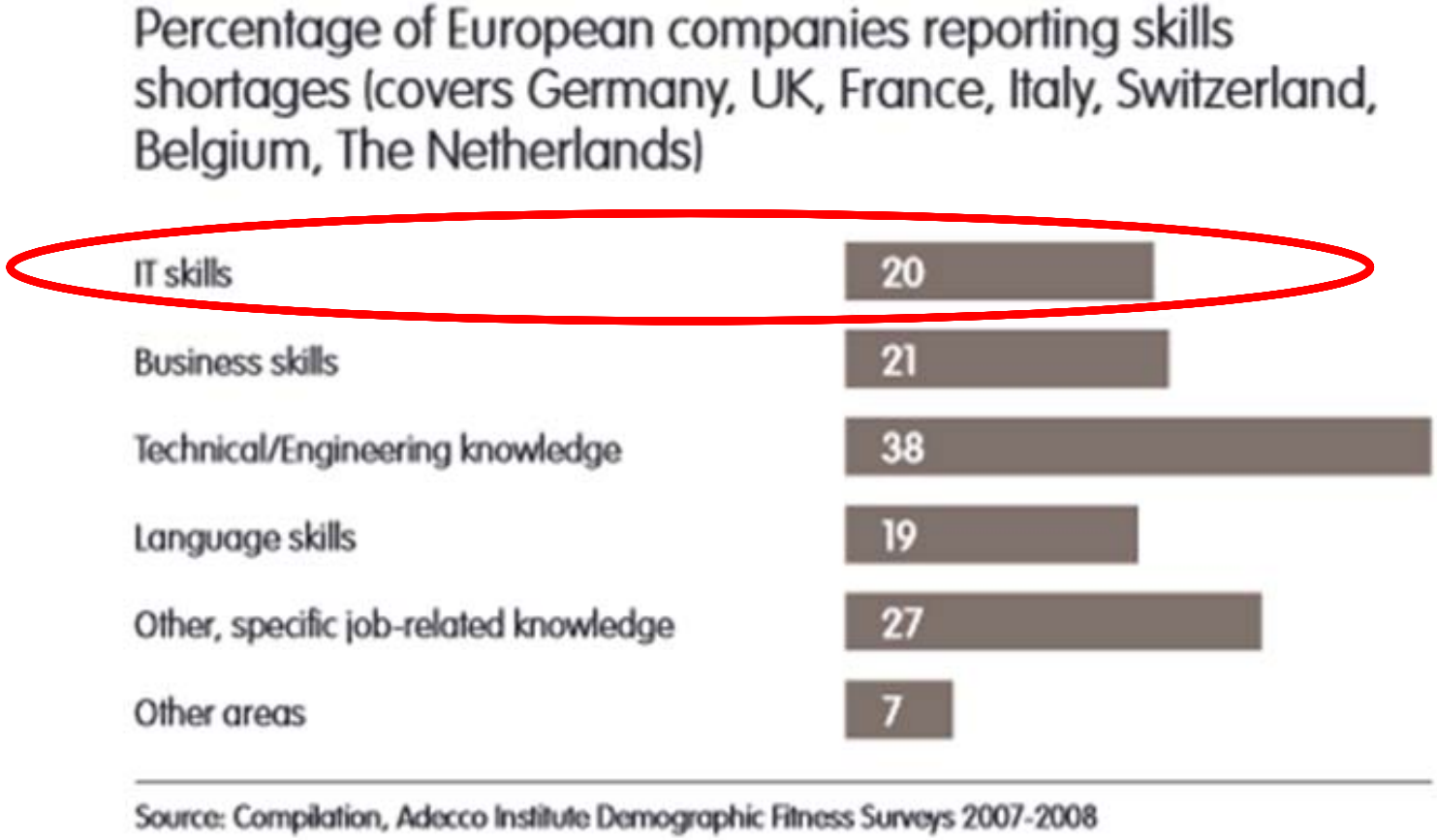


Figure 2:
Industry 4.0 and
smart factories as
part of the Internet
of Things and Services

Which Skills Shortage in manufacturing?



Regional Digital Innovation Hubs

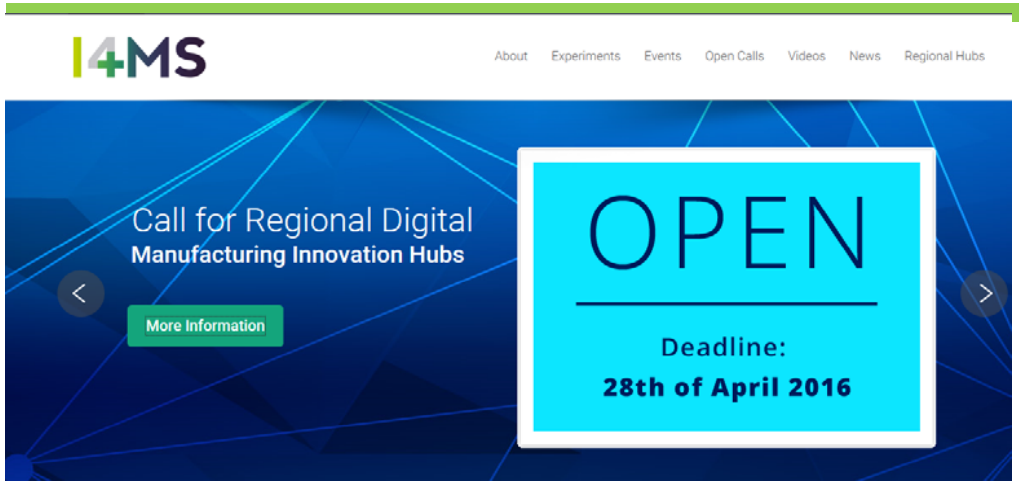
The Commission plans to focus 500M€ investment from H2020 on **digital innovation hubs** on:

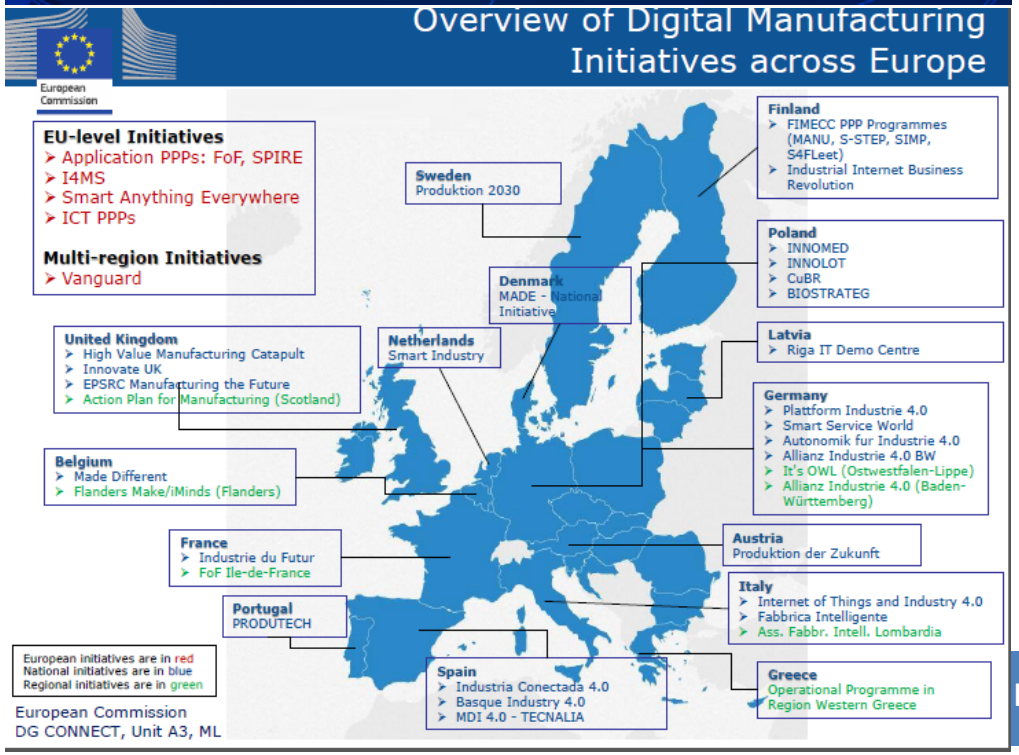
- **Networking and collaboration of digital competence centres** and cluster partnerships.
- Supporting **cross-border collaboration** of **innovative experimentation** activities.
- Sharing of best practices and developing, by end of 2016, a **catalogue of competences**.
- **Mobilising regions** with no Digital Innovation Hub to join and invest22.
- Wider use of **public procurement** of innovations to improve efficiency and quality of public sector

The Commission will also set up in June 2016 a thematic **smart specialisation platform for industrial modernisation**.

The Commission encourages **Member States** and Regions to invest in DIH and incentivise industry to embrace digital innovations and foster synergies with other key enabling technologies..

I4MS Open Call for Regional DIH





I4MS as a whole aims to do business from **EXPERIMENTS**. This is the concept of DIH: 'one-stop-shops' for any business to access support in understanding digital technologies and support on how to finance/nurture the necessary investments

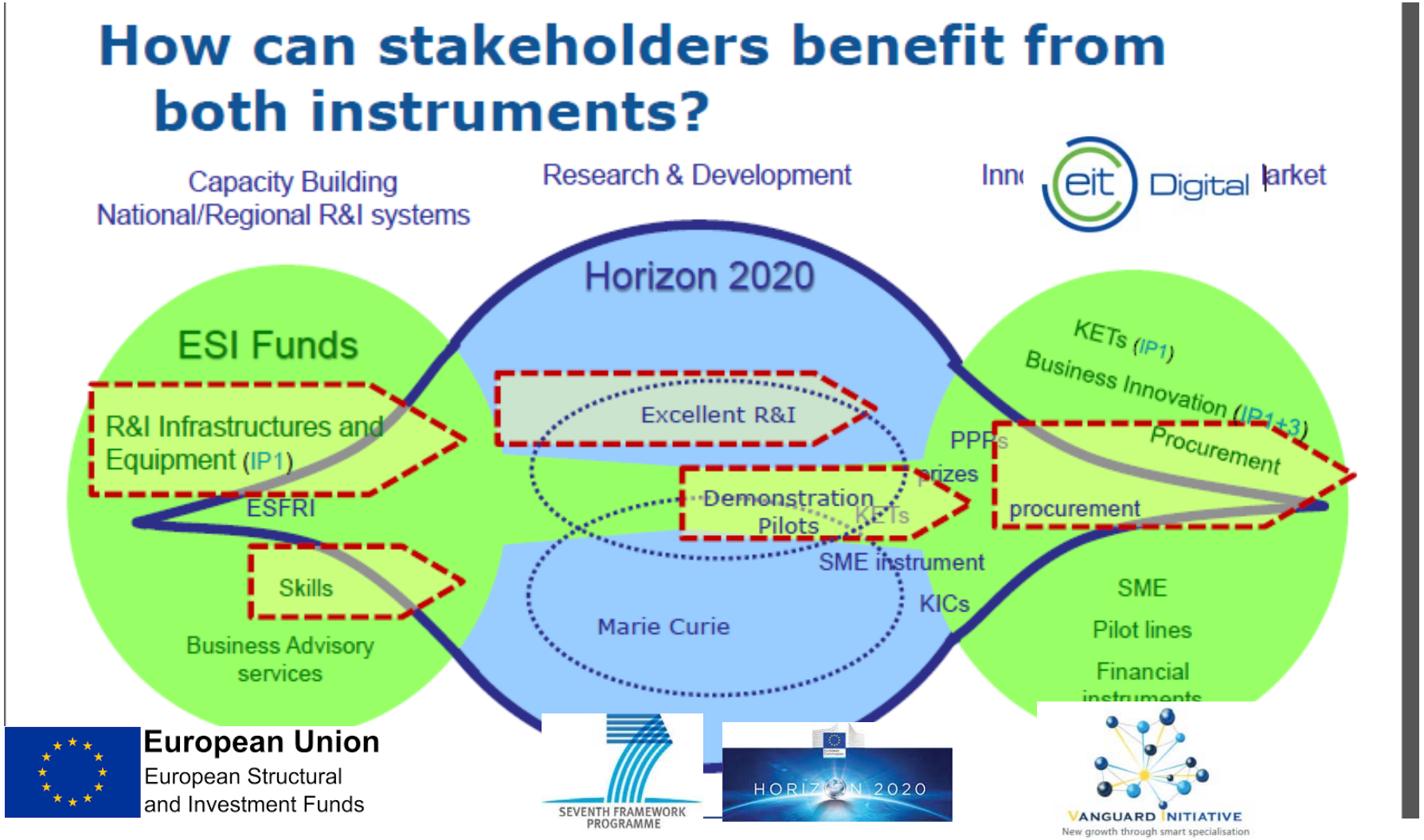
i. Hub expands the Competence Center with non-technological services and activities to support SMEs/MidCaps with business dev

ii. Services include networking, showcasing, matchmaking, brokerage, startup support, advice on IPR, and dissemination activities, etc

iii. Development of the innovation network with regard to the (regional) ecosystem is supported

iv. Organisations involved are triple helix and horizontal/vertical supply chain actors

Confluence ESIF, H2020 and gotomarket



Digitising European Industry April 19th

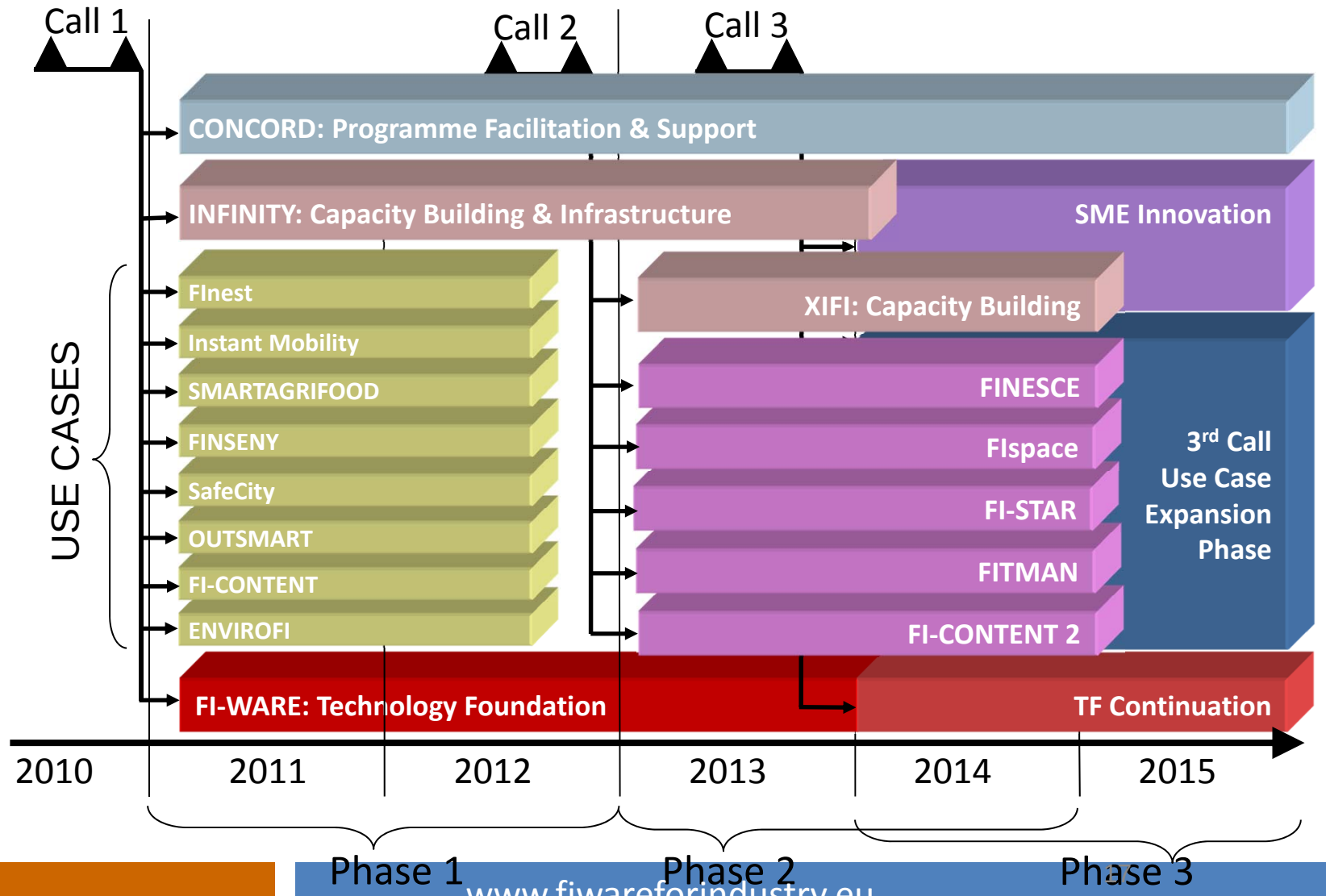
Overall, more than 20 B€ are already planned to be invested in the coming 5 years in the digital-sector PPPs by industry and the EU in support of strategic R&I agendas.

Given the national level of public support to R&I in ICT, the **total investment can reach up to 35 B€** in the next 5 years if Member States would dedicate at least 3 B€ per year to these strategies including financing opportunities from **EFSI and ESIF**. Such levels of focused investments will bring a radical step change to Europe's innovation capacity and endow industry with unique differentiating factors to compete at a global scale.

Leadership in IoT*:* The Commission will invest in demand-driven large-scale pilots and lighthouse initiatives in areas such as smart cities, smart living environments, driverless cars, wearables, mobile health and agro-food.

The investment will address notably **open platforms** cutting across sectors and accelerate innovation by companies and communities of developers, building on existing open service platforms, such as **FIWARE**. The accompanying **staff working document on IoT** outlines a.o. standardisation and regulation challenges and opportunities for IoT and the role of **the Alliance for IoT Innovations (AIOTI)**.

The FI PPP Programme in FP7

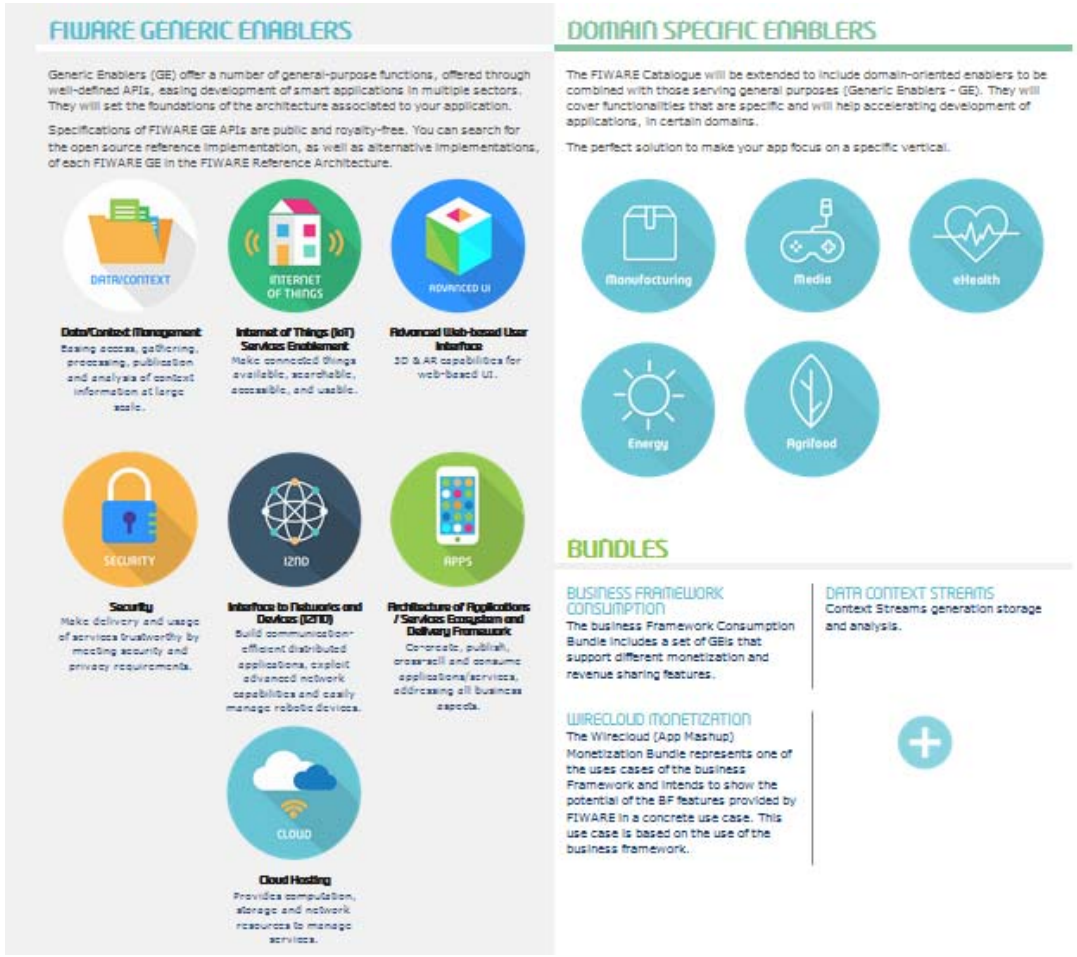


The FIWARE Open Platform

FIWARE
OPEN APIs FOR OPEN MINDS

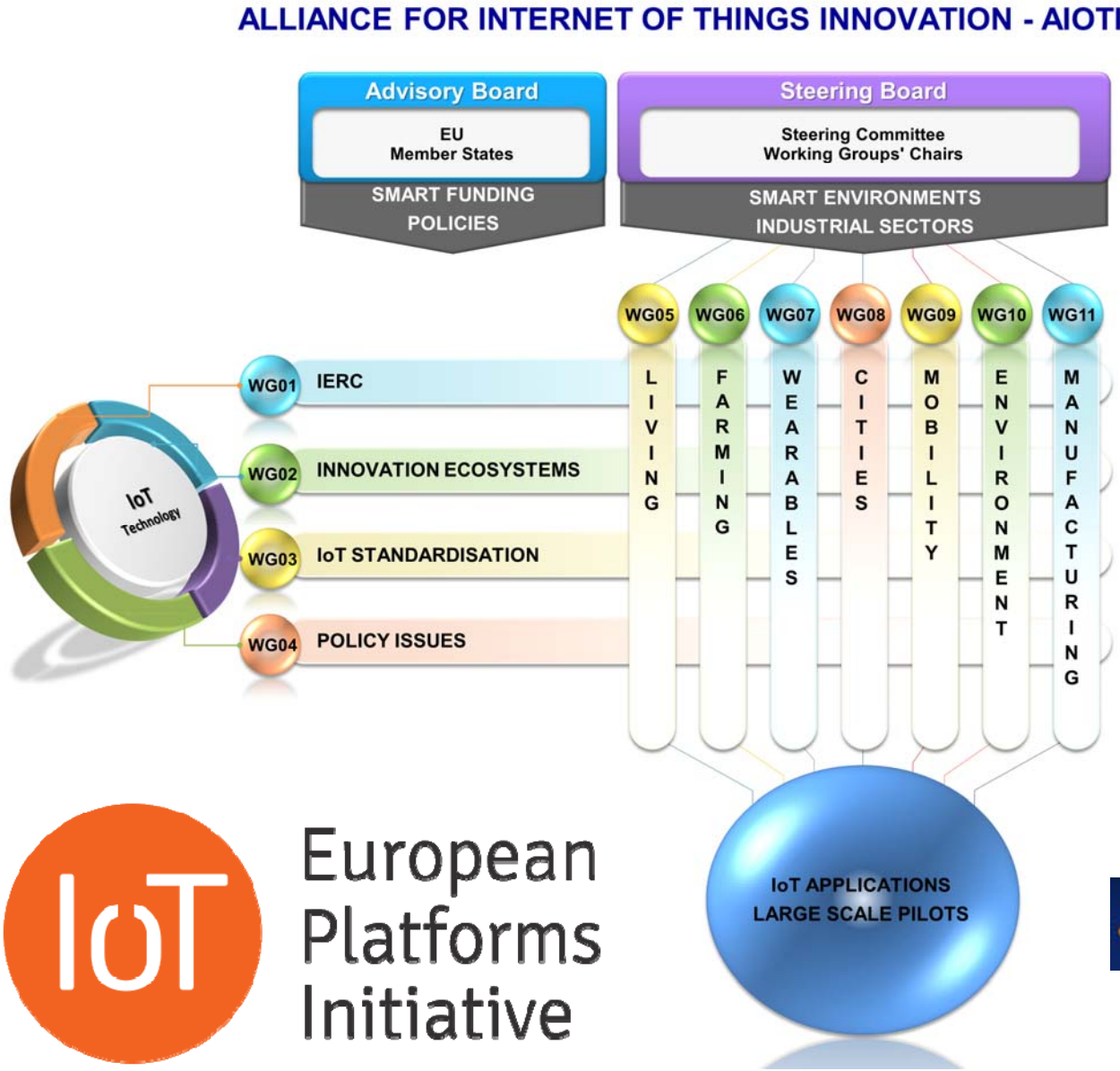
FIWARE Lab
Spark your imagination

FIWARE Ops
Easing your operations



- http://fiware.org
- http://lab.fiware.org
- http://catalogue.fiware.org/

Open Platform: the AIOTI Alliance



www.aioti.eu

Four horizontal working groups and seven (for the time being) verticals covering different application domains.

Call ICT 2016 and IoT.1 Large Scale Pilots in five different domains

IoT European Platforms Initiative

IoT OPEN PLATFORMS

Open Platform: the AIOTI WG11

WG11 Smart Manufacturing

Contact For More Information:
Zeljko Pazin (Zeljko.pazin@effra.eu)

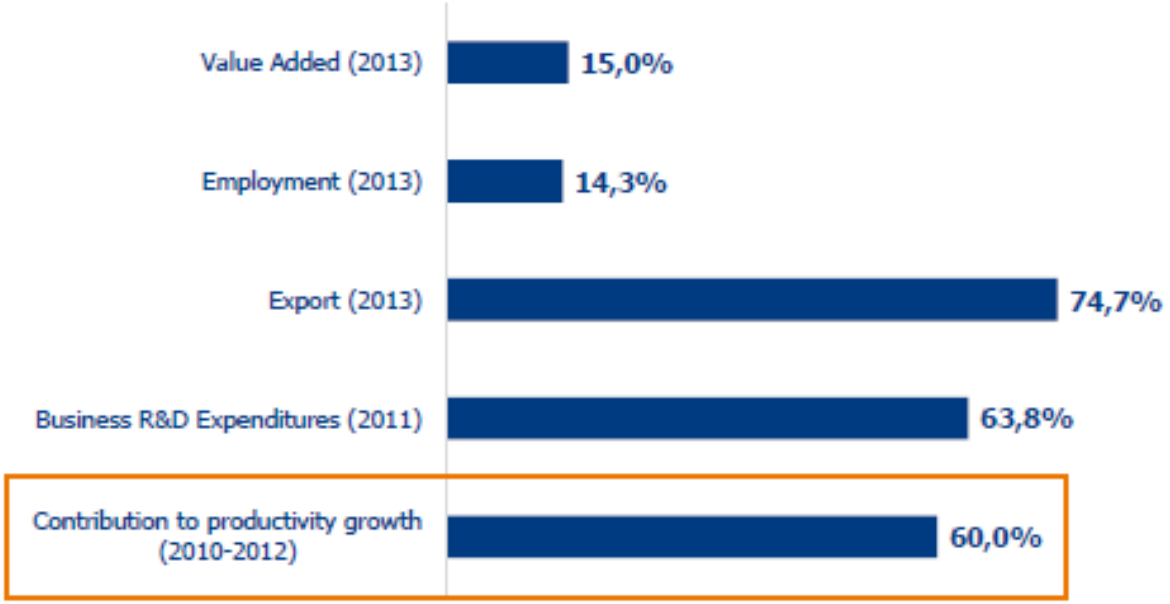
Manufacturing Renaissance in EU

World Manufacturing Forum

The European House Ambrosetti

... this is why Manufacturing is such a pivotal sector for Europe

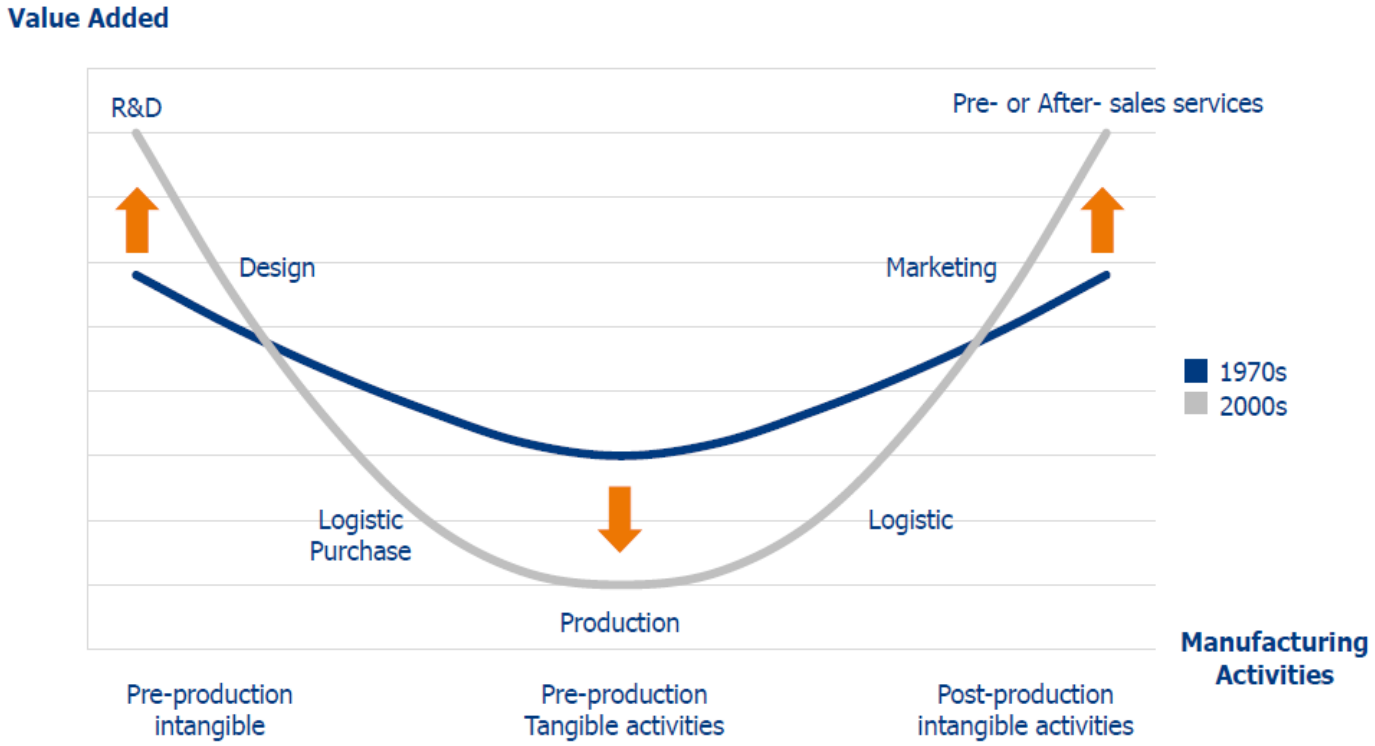
Importance of Manufacturing sector in the EU (% on the total economy)



Source: The European House - Ambrosetti re-elaboration on Eurostat, AMECO and OECD data, 2014

Manufacturing evolution 1970s-2000s

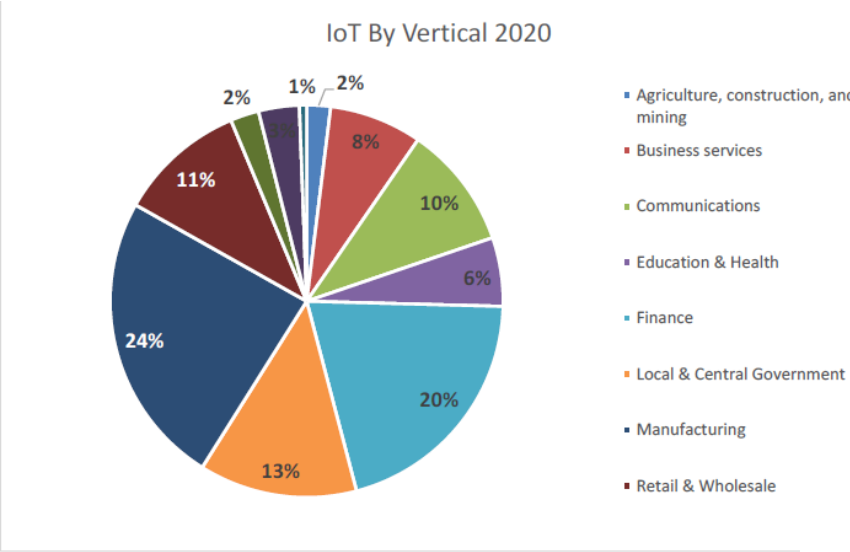
The "SMILE" challenge: European businesses must focus on high value added activities



- Value creation in Manufacturing is progressively shifting **towards pre-production** (R&D and Design) and **post production** (marketing and Pre-or-After sales service) activities

Source: The European House - Ambrosetti re-elaboration on Bruegel data, 2014

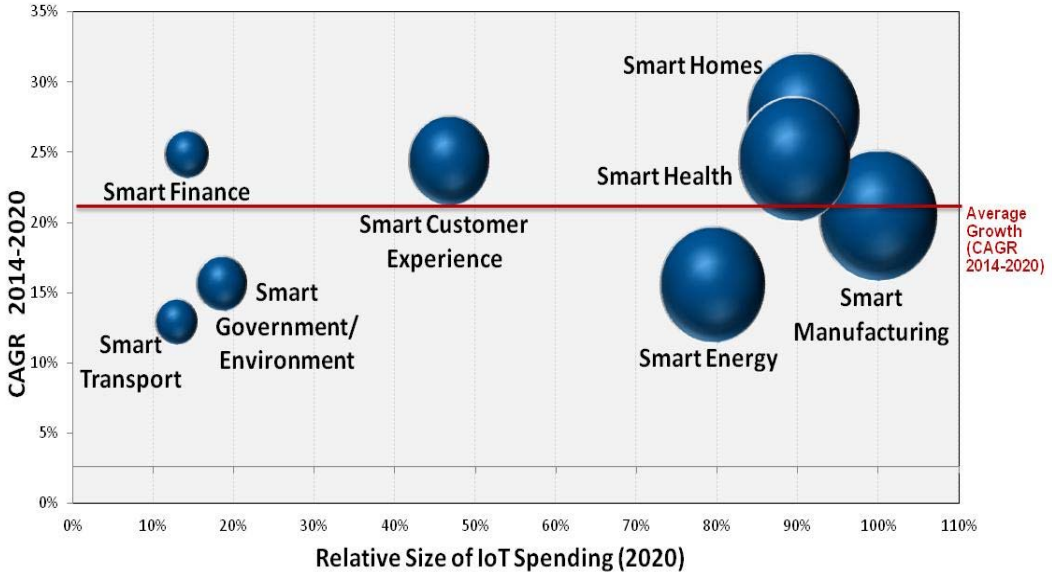
FI-driven Innovation in Manufacturing



Source: IDC 2014

Smart Manufacturing excels not just in the potential size of the market, but is also well positioned regarding the estimated growth of such a market

Smart Manufacturing is one of the most promising domains for IOT-driven innovation (24% of the estimated IOT EU market size)

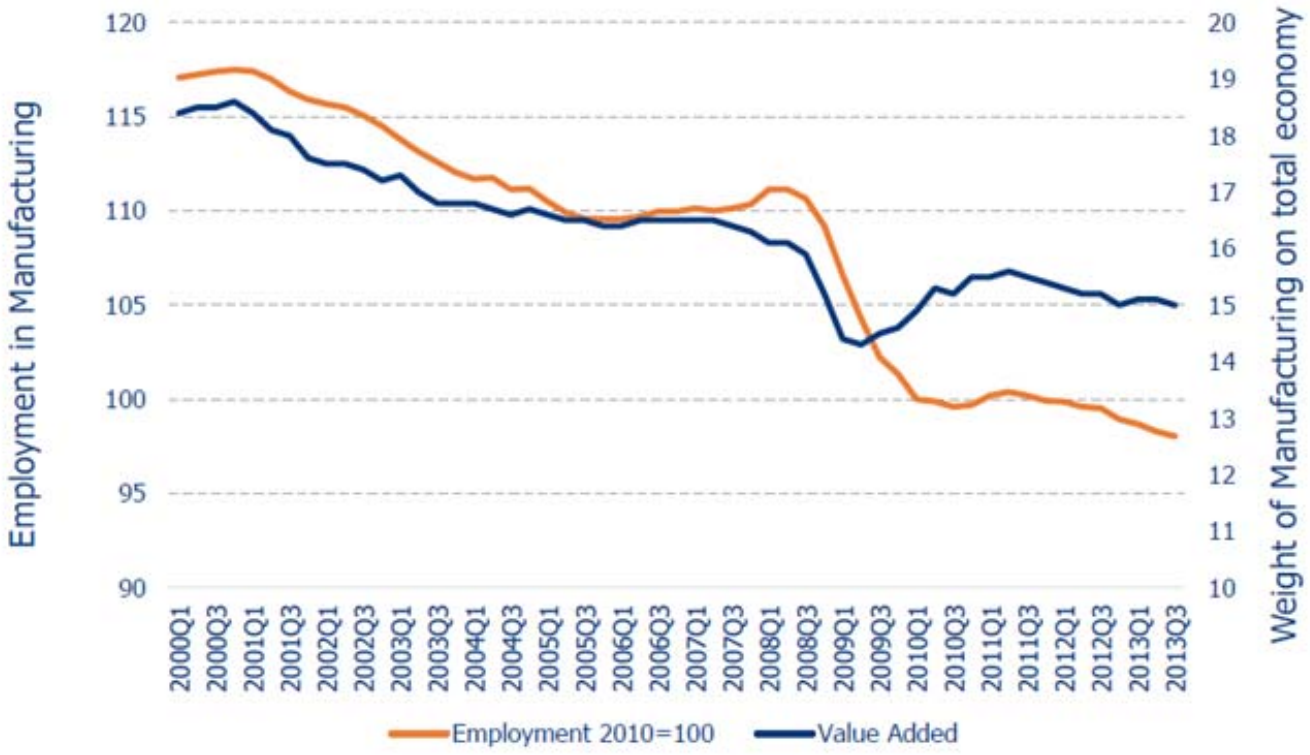


http://ec.europa.eu/digital-agenda/en/news/definition-research-and-innovation-policy-leveraging-cloud-computing-and-iot-combination

Growth and Jobs in Manufacturing

But European Manufacturing is also affected by a long-term structural decline ...

Value Added (% of total) **and employment** (2010=100) **of Manufacturing in the EU-28**, 2000Q1-2013Q3

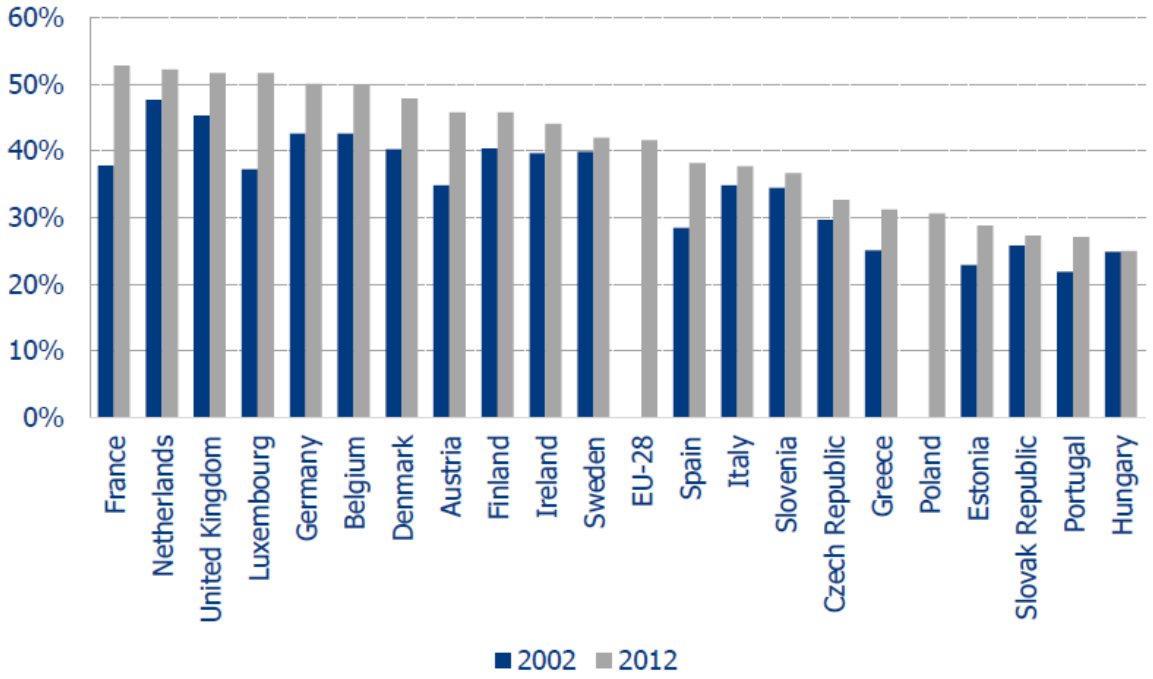


Source: The European House - Ambrosetti re-elaboration on Eurostat and AMECO data, 2014

IOT driving Manufacturing Service Innovation EU

... as the boundaries between Manufacturing and Services are blurring

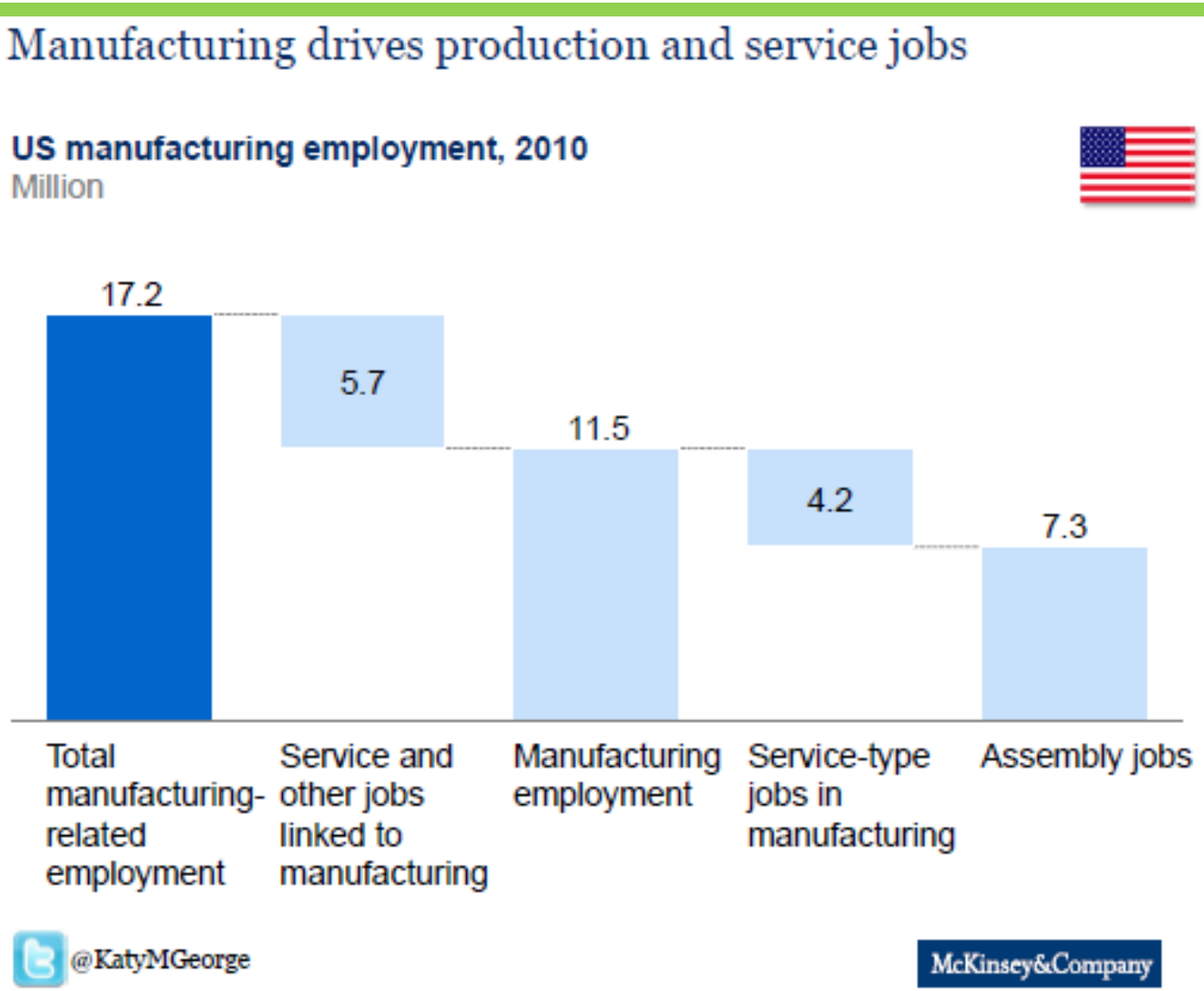
Share of service-related jobs in the manufacturing sector, 2002-2012



- Producing goods is becoming **a smaller part of manufacturing firms'** activities
- Manufacturing now provides a **wide spectrum of services**: from pre- and after- sales services, to design, R&D and marketing services
- Ultimately, the boundaries between Manufacturing and Services are **blurring**

Source: The European House - Ambrosetti re-elaboration on OECD data, 2013

IOT driving Manufacturing Service Innovation US



Factories of the Future Partnership

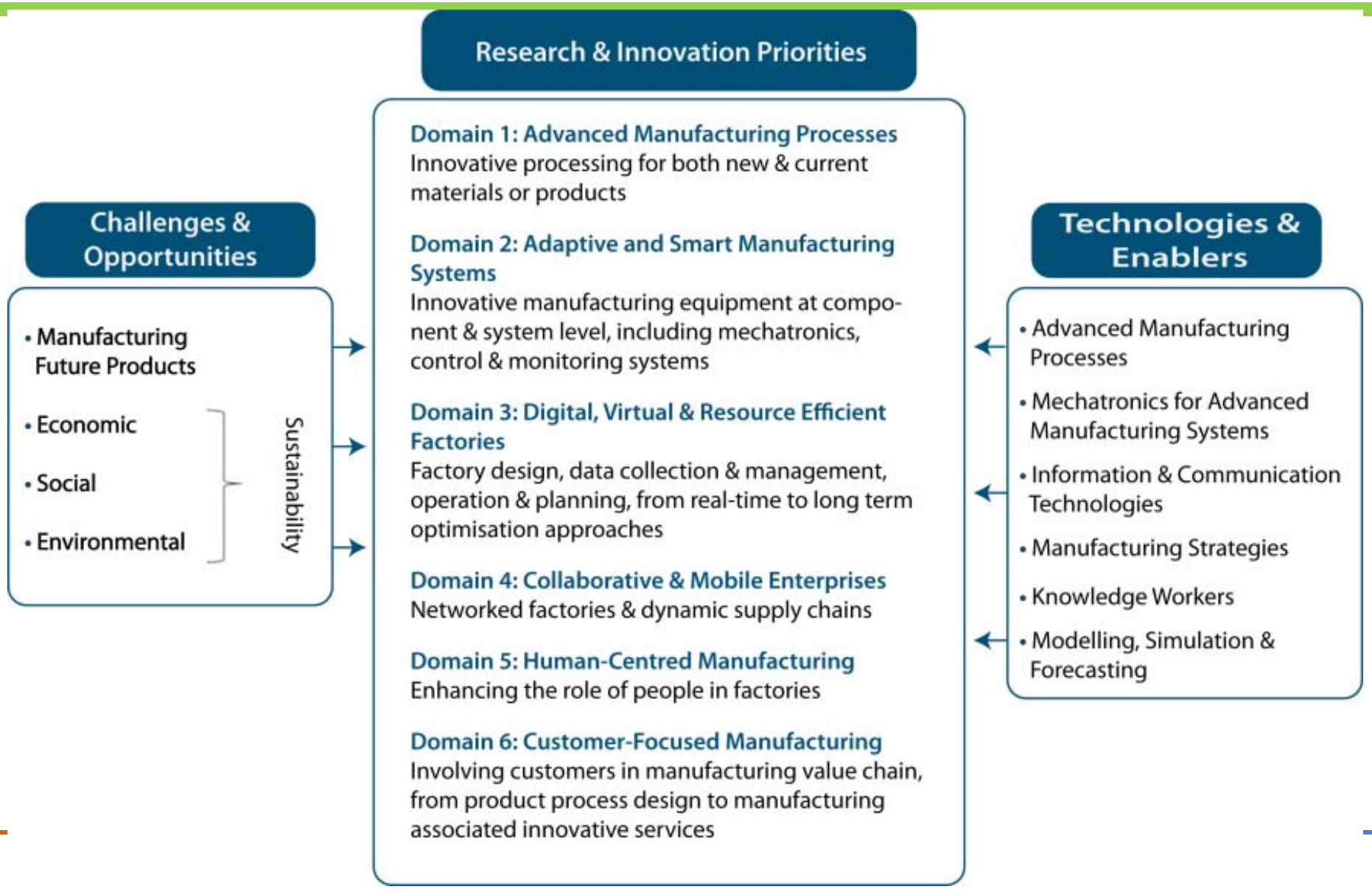
- Factories of the Future is Europe's advanced manufacturing partnership
- A public-private partnership funded by Horizon 2020 (budget of €1.15 billion 2014-2020). 1st Launched under EU's FP7
- Jointly supported through European Commission's DG CONNECT & DG Research and Innovation
- Research & innovation priorities identified by industry/research community
- Over 1,000 organisations participating, High involvement of SMEs: 200+
- 180 Projects to date. 400+ results reported on EFFRA Innovation Portal

http://www.effra.eu/ --- http://www.effra.eu/portal

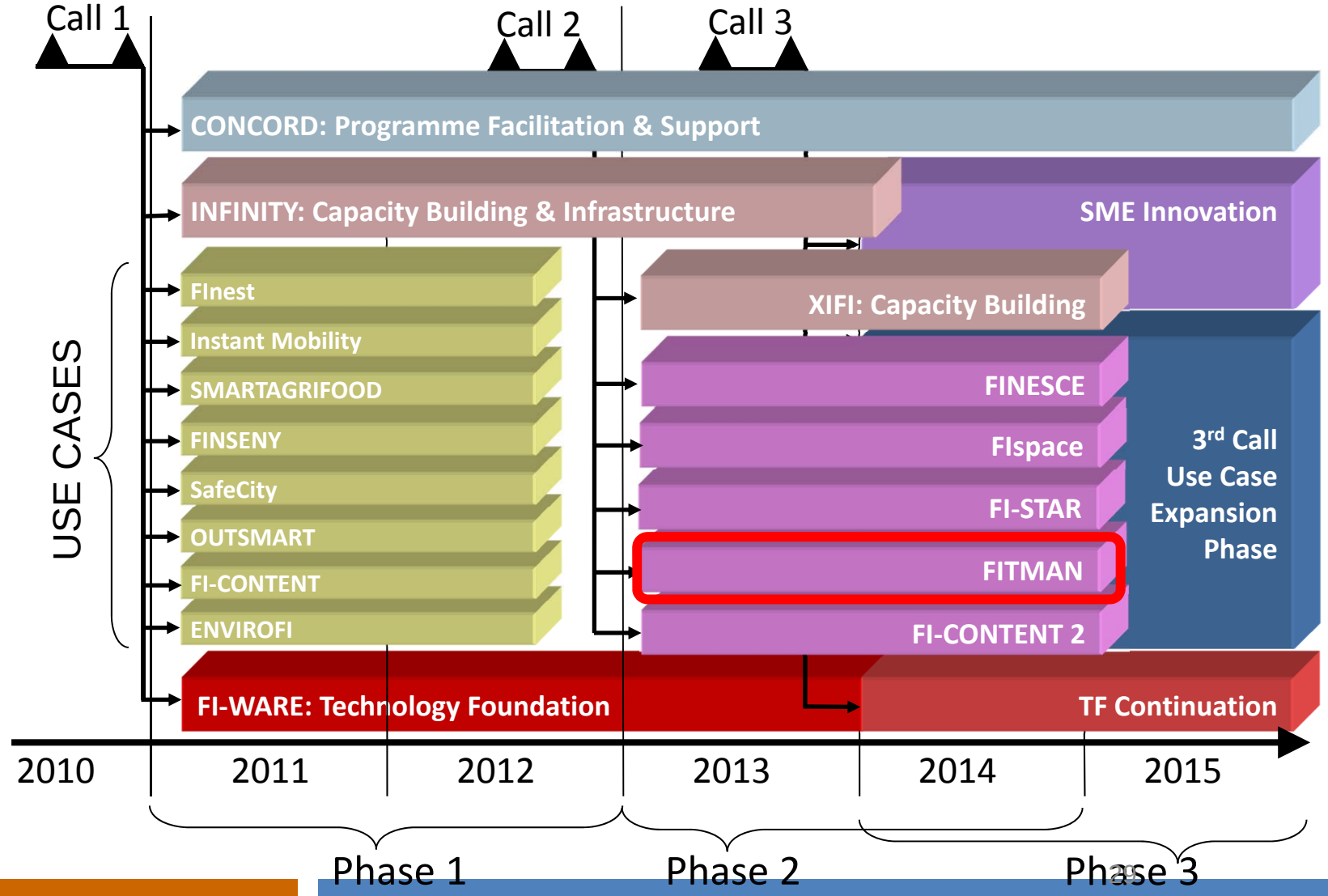
http://www.eurida-research.com/downloads/17.-cross-cutting_2016-2017_pre-publication.pdf page 19+

Factories of the Future 2020

Strategic Roadmap



The EU FI PPP (FIWARE) and FITMAN



FITMAN Factsheet

Project No:	604674
Project Full Name:	**F**uture **I**nternet **T**echnologies for **MAN**ufacturing
Duration:	30 months
Start date:	April 1st 2013
Partnership:	36 partners, 11 countries
Strategic Objective:	FP7-2012-ICT-FI FI.ICT-2011.1.8: Use Case scenarios and early trials
Total Eligible Cost:	18.034.000 EURO
EC Contribution:	12.890.000 EURO
Project Web Site:	www.fitman-fi.eu

FITMAN Beneficiaries

FITMAN Results

One FITMAN Generic Platform for Manufacturing Industries, as a collection of several Generic Enablers

Three FITMAN Specific Platforms as a collection of several Specific Enablers Implementations

- Smart Factory Platform
- Digital Factory Platform
- Virtual Factory Platform

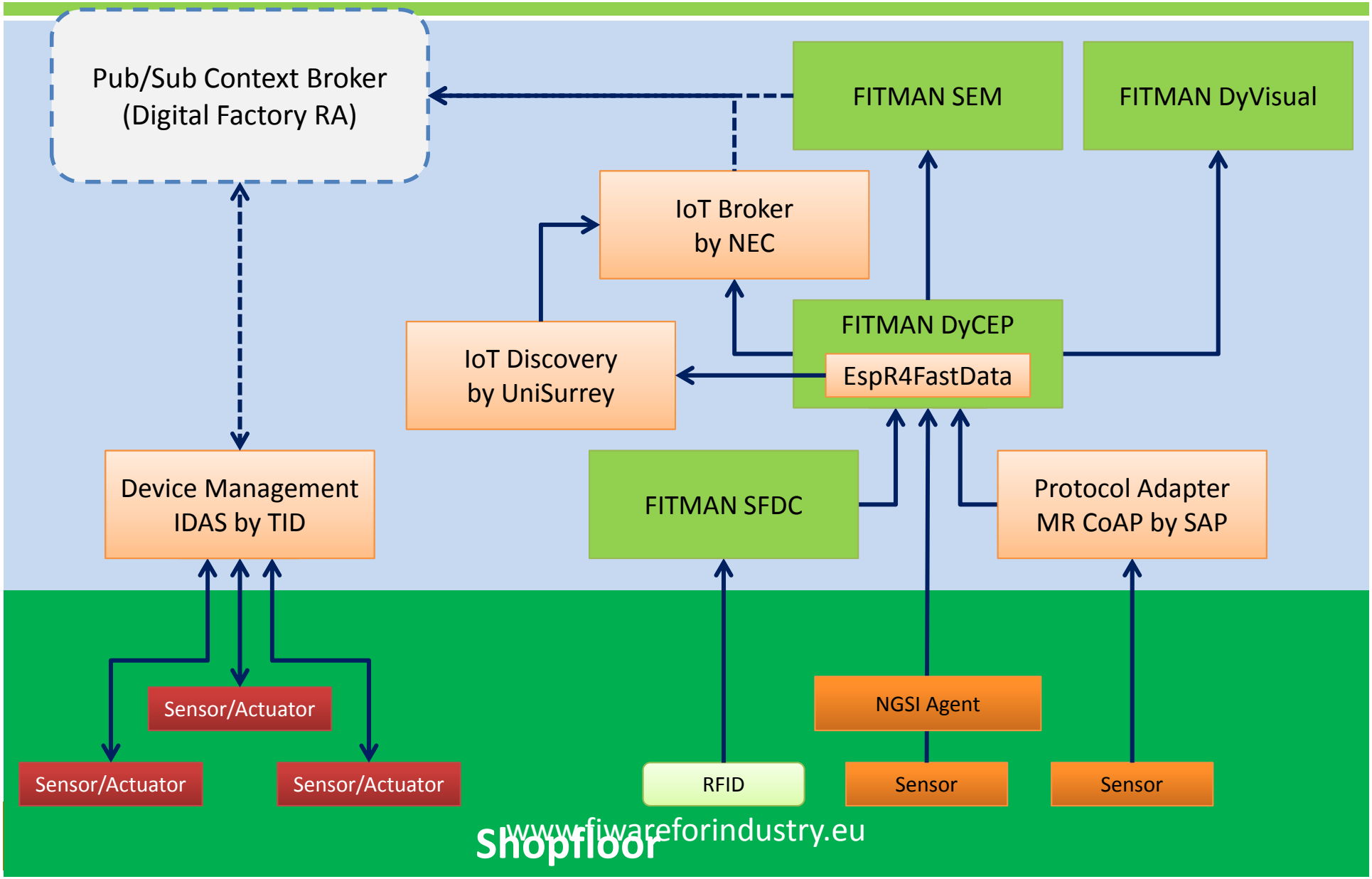
Ten FITMAN Trials Platforms as instantiation of the selected Generic and Specific Enablers for 10 industry-driven multi-sectorial Trials

Whirlpool, TRW, AgustaWestland (A Finmeccanica Company), AIDIMA (Furniture, Wood and Packaging Technology Institute), Consulgal, Piacenza Cashmere 1733, COMplus (COMplus Aktiengesellschaft), APR, TAMET (technology application network)

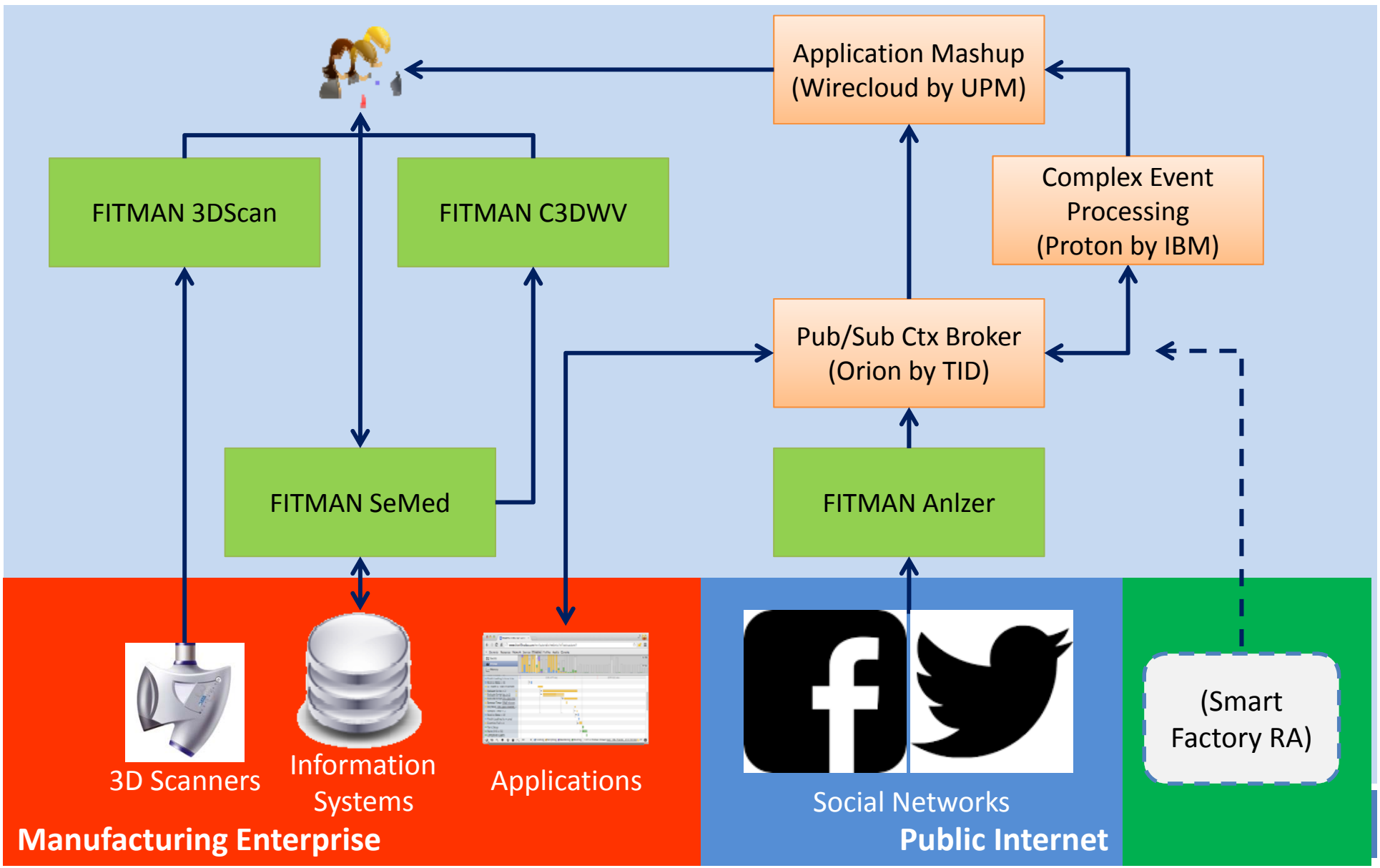
One generic and flexible **Trials Verification and Validation Framework**, encompassing concepts, methods and tools for Manufacturing Trials

FITMAN Reference Platforms: 14+15 Enablers

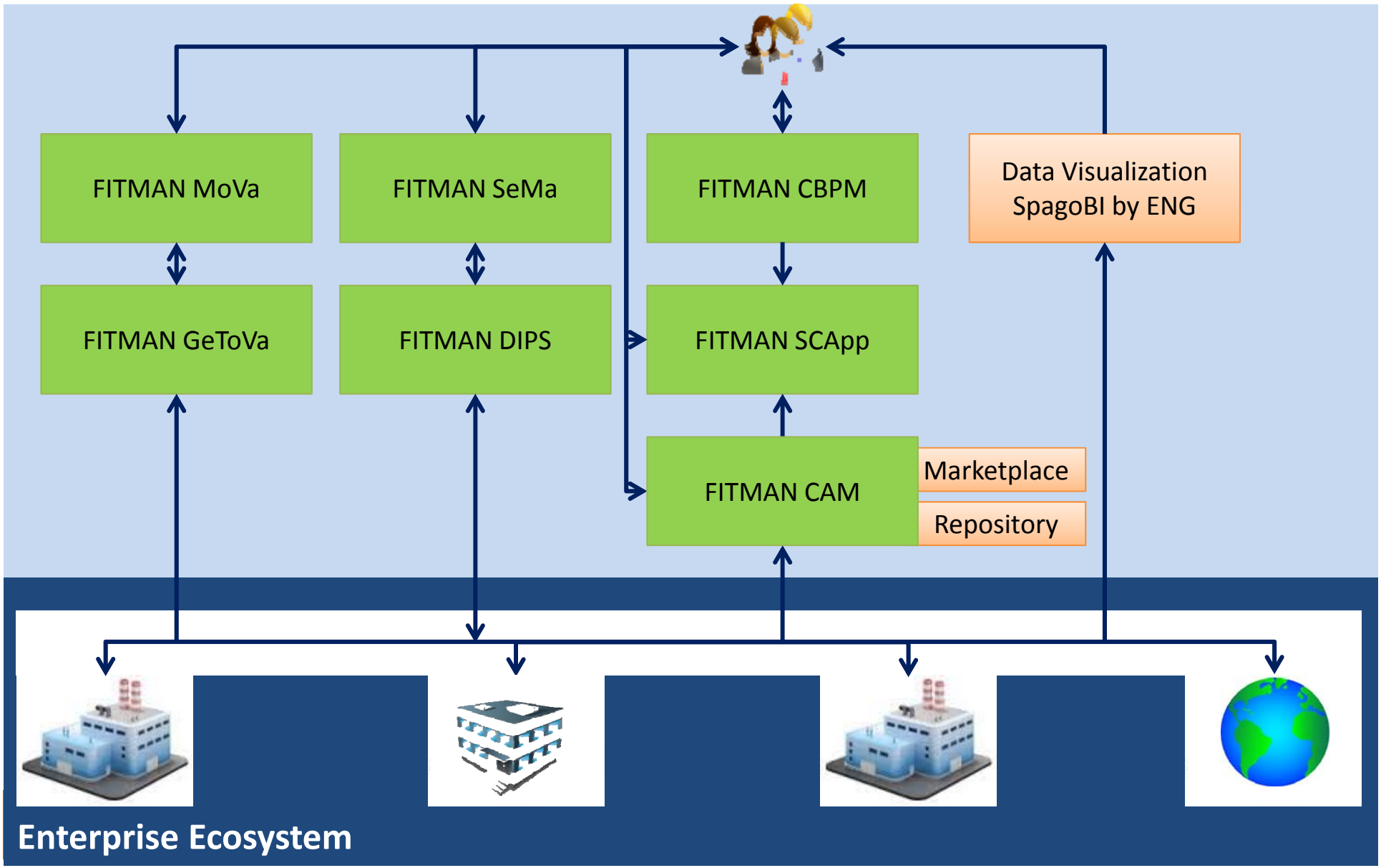
FITMAN Smart Factory RA



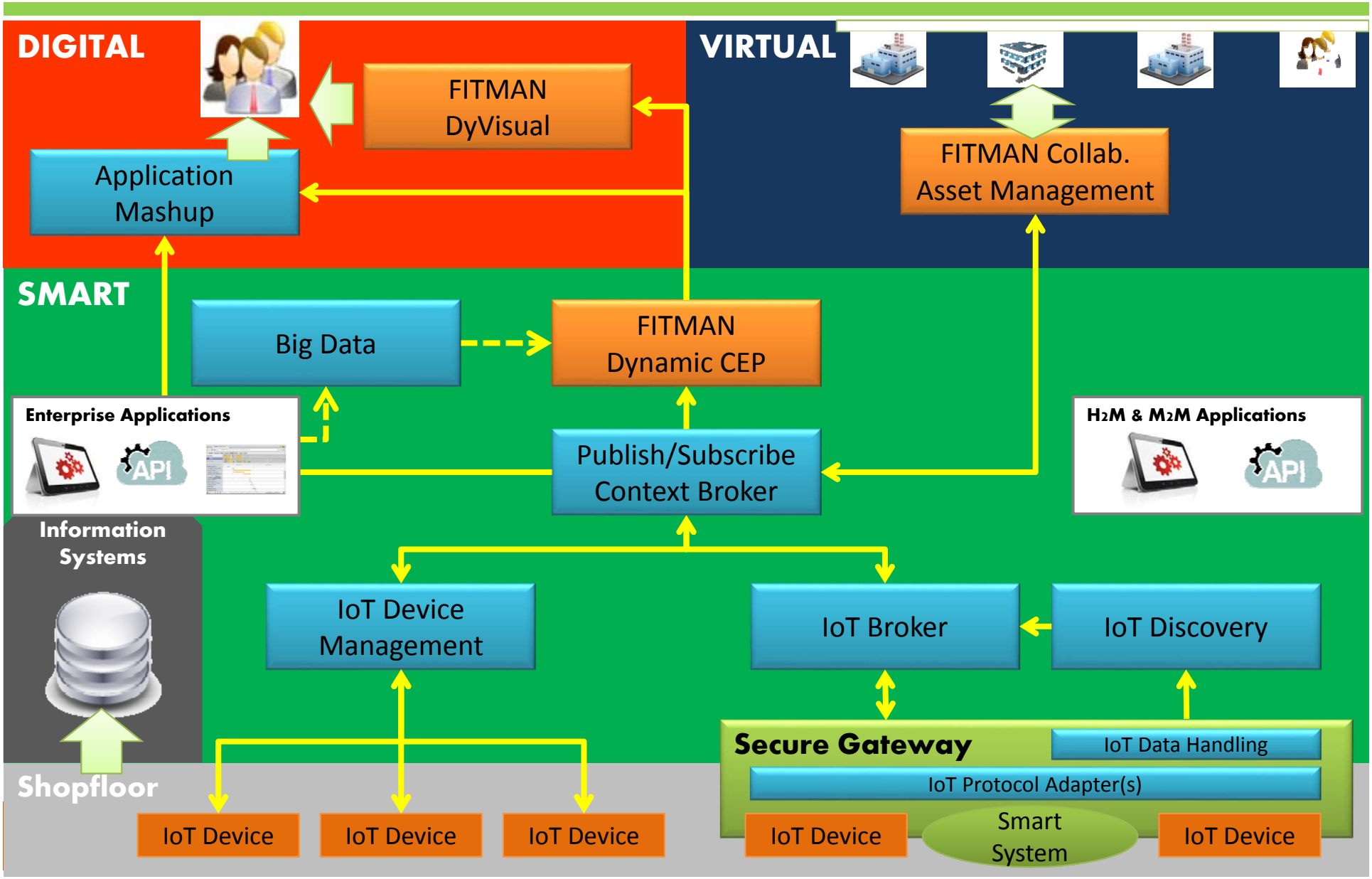
FITMAN Digital Factory RA



FITMAN Virtual Factory RA



FITMAN Industrial IOT Platform



Ten FITMAN Trials in Six Countries

LARGE ENTERPRISES:

- D **#1 VW (Automotive OEM - DE)**
- S **#2 TRW (Automotive Supplier - ES)**
- S D **#3 AGUSTAW (Aeronautics - IT)**
- S **#4 Whirlpool (White Goods - IT)**

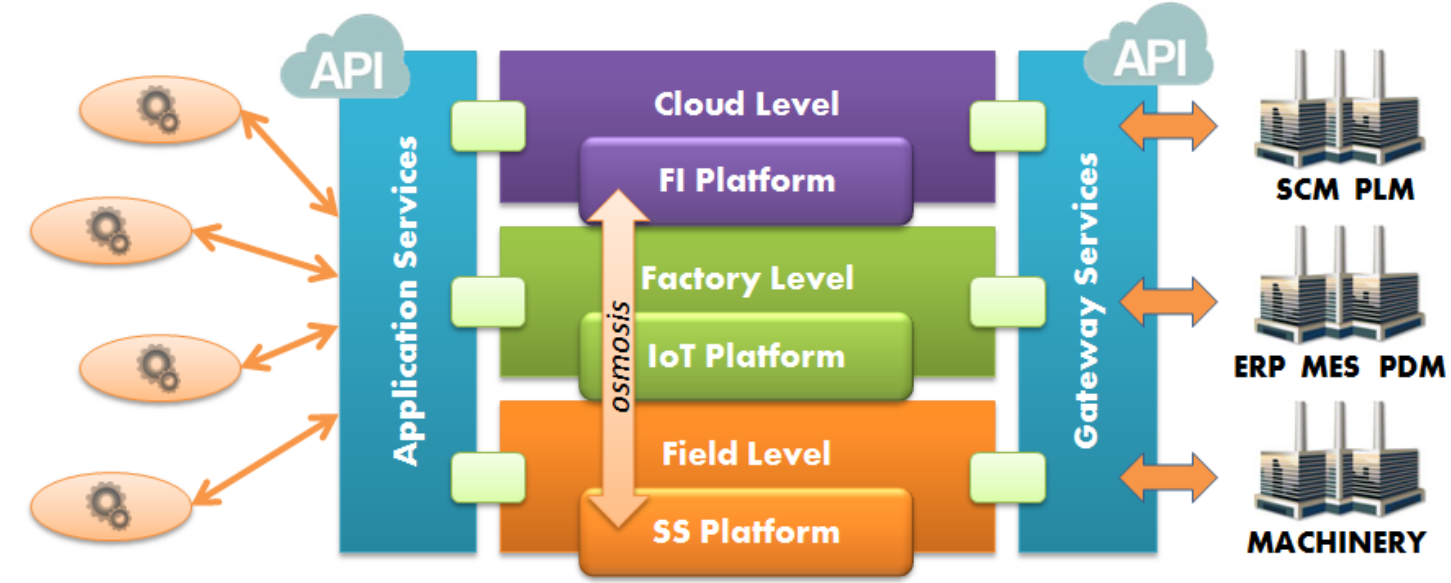
SMEs:

- S V **#5 Piacenza (Textile - IT)**
- V **#6 APR (Plastic - FR)**
- D **#7 Consulgal (Construction - PT)**
- V **#8 TANet (Resource Mgmt. - UK)**
- V **#9 COMPlus (LED Lighting - DE)**
- D **#10 AIDIMA (Furniture - ES)**

The FIWARE-based BEinCPPS

POLITECNICO MILANO 1863

BE in CPPS



BEinCPPS, Business Experiments in Cyber Physical Production Systems

Coord. POLIMI, technical coordinator ENGINEERING

Regional Innovation Ecosystems in Lombardia Euskadi Norte Baden-Wuertemberg Rhone-Alpes

Open Call opportunity to join BEinCPPS

BE in CPPS **Business Experiments in Cyber Physical Production Systems**

Factories of the Future obj. 9: ICT Innovation for Manufacturing SMEs;
Budget: EUR 8,000,000; Open Calls for SMEs: **EUR 2,250,000**;
Start Date: November 1st 2015 – End Date: October 31st 2018

OPEN CALL for APPLICATIONS EXPERIMENTS

i. Big Data RT Decision Support, Planning
ii. Cyber-physical High speed Ramp-up
iii. Energy efficient Manufacturing
iv. Zero Defect Manufacturing
v. Smart Logistics Applications
vi. Visualisation and Training at worklplace
vii. End of Life in a Circular Economy
viii. CPS equipment development integration

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The Sensing Enterprise - Enterprise Information Systems in the Internet of Things

Invited Lecture

28th April 2016

ICEIS 2016, International Conference of Enterprise Information Systems, Roma

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