Digitising Europe's economy
The essential role of software-intensive systems

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Khalil Rouhana
DG CONNECT, European Commission
Outline

• Digital innovations: What is at stake?

• Where does Europe stand?
  • Digital industry and digitisation of industry

• What are we doing about it?

• Our financial investments in embedded software and systems in H2020

• Concluding remarks
"Digital inside": Innovations in all types of products
- Smart connected objects (or IoT) powered by e.g.
  - Sensors, wearables, embedded software, Connectivity, Big data, Cloud ...
  - Large opportunities in all sectors (Non-tech, high-tech, SMEs, etc)

Digital transformations of processes
- From logistics and product design to shop floor automations and CRM
  - Increasing resource efficiency, productivity, ..
  - Built on IoT, digital design, robotics, laser technologies, big data,..

Radical/disruptive changes in business models
- Blurring the boundaries (products-services), reshuffling value chains
  - XaaS, 3D Printing & customisation, CRMs, maintenance, A Value services
  - Built on real time information, data analytics, etc..
The 'digital inside' value chain

New digital value chains

- 33% of added value
- >25% of AV
- ~40% of AV
- >40% of AV
Importance of Embedded Software

Source: Roland Berger, ITEA ARTEMIS-IA High-level Vision 2030
## R&D investments in ICT by non ICT sectors

<table>
<thead>
<tr>
<th>Sector</th>
<th>R&amp;D spending (€)</th>
<th>% on ICT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerospace and defence</td>
<td>150</td>
<td>37</td>
</tr>
<tr>
<td>Automotive</td>
<td>700</td>
<td>38</td>
</tr>
<tr>
<td>Electrical equipment</td>
<td>160</td>
<td>75</td>
</tr>
<tr>
<td>Healthcare equipment/services</td>
<td>65</td>
<td>55</td>
</tr>
<tr>
<td>Industrial manufacturing</td>
<td>240</td>
<td>55</td>
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</tbody>
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Digital process innovation: e.g. manufacturing

Modelling, Simulation, Analytics and big data

Cyber-physical systems for process (chain) optimisation

Data, CPS, autonomy, connectivity

Robotics and automation

Laser-based manufacturing
Transforming the business model
Blurring boundaries: products-services

Blurring of boundaries

Trends in business models
- "Reintegration" across the value chain
- Expansion to services
- Expansion to "systems of systems"
- "Sharing" economy
- Des-intermediation

Technology
- Sensors, μcontrollers, low power μprocessors, μactuators, MEMS,..
- Embedded Operating systems, embedded applications software, control software
- Networking (local, Internet,..)
- Applications on the Cloud (Data analytics, CRM on Clouds, Maintenance software,..)
Technology tracks and Opportunities ahead

- **Five main converging innovation tracks**
  - Big Data
  - Cloud
  - CPS, Smart connected objects and IOT
  - Robotics, Autonomous systems and automation
  - Hyper connectivity, BB and wireless

- **Areas of business opportunities**
  - High growth "Smart X" and IoT markets
    - Mobility, society (smart homes, smart cities, wearables,..), manufacturing, health, energy, etc..
  - High growth of vertical markets!!
    - Automotive, energy, security, etc.
  - Next digital champions may come from "non-digital" industries
    - And vice versa!!
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Digital industry: Where does Europe stand?

• **Strengths**
  - Professional and vertical markets (products and services)
    • Components, software, systems (robotics, engineering), networking,
  - World class R&D hubs
  - Good infrastructure
  - Size of EU market (~27% of world ICT market)

• **Weaknesses**
  - Consumer markets, Internet and web products and services
    • From components to applications, Data platforms' ownership
  - **Structural weaknesses**
    • No DSM yet (substantial impact on attractiveness to investment including VCs, BAs, etc..)
    • Lagging in investment in R&D
      – Already paying the price
EU strengths: embedded software & systems

- 11% of world production
- >20% of world production
- 30% of world production
Digitised industry: What is the situation?

- Strong digitisation in high tech industries and in some MSs.
- But:
  - Slowness and disparities in adopting digital solutions across industries and regions
    - Mainly SMEs and non tech sectors lagging behind
  - New competition from non-EU digital platform owners
    - E.g. OS, Web and Data platform owners
  - Lack of standards and interoperable solutions
  - Skills and re-skilling of work force
  - Legislative and regulatory gaps
  - Fragmentation of effort in Europe
Digitisation readiness: disparities in Europe

The diagram illustrates the digitisation readiness of European countries, categorized into four groups:

- **POTENTIALISTS**: Belgium, Denmark, Netherlands, UK, France, Ireland, Austria, Germany.
- **FRONTRUNNERS**: Sweden, Finland.
- **HESITATORS**: Spain, Estonia, Portugal, Poland, Croatia, Bulgaria, Greece, Latvia, Lithuania, Croatia.
- **TRADITIONALISTS**: Czech Republic, Slovakia, Slovenia, Hungary, Italy.
Overview of Digital Manufacturing Initiatives across Europe

Germany
- Industrie 4.0
- Smart Service World
- Autonomik fur Industrie 4.0 (It’s OWL (Ostwestfalen-Lippe))
- Allianz Industrie 4.0 (Baden-Württemberg)

Netherlands
- Smart Industry

France
- Usine du Futur
- FoF Ile-de-France
- Vanguard

United Kingdom
- High Value Manufacturing
- Innovate UK
- Action Plan for Manufacturing (Scotland)

Belgium
- Made Different
- Flanders Make/iMinds (Flanders)

Portugal
- Produtech

Spain
- Estrategia Fabricacion Avanzada (Basque region)

Sweden
- Produktion 2030

Italy
- Fabbrica Intelligente
- Ass. Fabbr. Intell. Lombardia

Finland
- FIMECC PPP Programmes (MANU, S-STEP, SIMP, S4FLeet)
- Industrial Internet Business Revolution
- IoT pilot Factory (IoT PFF)

Greece
- Operational Programme in Region Western Greece

Poland
- INNOMOTO
- INNOLOT
- Digital manufacturing for the SME (Mazovia)

EU-level Initiatives
- Application PPPs: FoF, SPIRE
- I4MS
- Smart Anything Everywhere
- ICT PPPs

Multi-region Initiatives
- Vanguard

EUROPEAN COMMISSION
DG CONNECT, Unit A3, ML
The reskilling issue

Employment shares by occupational group (EU15+NO, 2005Q1=100 for each occupation group)

Source: Eurostat
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What are we doing about it? (1)

• Combine policies to achieve clear goals
  • Financial support, regulatory issues, Skills
  • E.g. maintain 30% of world production of CPS

• Build on strengths and seize opportunities
  • Maintain leadership in stronghold as they move mainstream
  • A strong digital industry and strong digitised industry

• Work in partnerships
  • Leverage investment, focus and strategy

• Address the whole value chain and innovation chain
  • Supply-demand interaction, multiple stakeholders, SMEs

• Connect to national and regional actions
  • Combine resources to reach critical mass, align strategies
  • Links to hubs of excellence and regional clusters
What are we doing about it? (2)

- Wide-spread adoption and best use of digital technologies
  - In all industrial sectors
  - Focus on key digital technologies ("The musts")

- Leadership **in digital platforms** for industry
  - Platforms on which value is created
    - E.g. embedded OSs, Autonomous systems building blocks, Cloud platforms, data, security
    - Openness, Interoperability, security

- Filling the skills gap and preparing the workforce for change
  - Essential!

- Providing the best framework conditions
  - Regulation: DSM, Data protection, Liability, safety
  - Access to finance: EIB, EIF, etc..
Addressing all industries: Example

Existing and emerging EU networks of competence centres complemented by Satellite Nodes/ Digital Innovation Hubs

Regional Satellite Nodes/Projects

- Feasibility studies
- Best practice experiments
- Local dissemination
- Skills development
- Infrastructure provisioning

- H2020 Funding augmented through
  - regional/structural funds, e.g. ESIF
  - Juncker package (EFIP)
- Focus on regional strengths/smart specialisation
- Flexibility/little synchronisation needs

+ access to finance for SMEs and Mid-Caps
Platforms on which value is created – on and across levels:
- Well-being, home, cars (user perspective)
- Analytics, design & simulation
- Cloud and web applications (free from vendor-lock-in)
- Middleware: embedded OSs, IoT, autonomous systems building blocks, Systems of Systems, security frameworks, ...

Scale-up our efforts by collaboration
- ICT PPPs: ICT Platforms + large scale demonstrators (IoT, ECSEL, ...)
- Platforms for the manufacturing sector – from cradle to grave

Platform interoperability and standards within Digital Single Market
- Platforms supported and adopted across MSs and regions
Example of digital platform: AUTOSAR

**Standardized architecture for automotive software**

- Eases cooperation of automobile manufacturers, suppliers and tool developers
- Facilitates innovation through open standards
- "Cooperate on standards, compete on implementation"
Opportunities for new digital platforms

- Vertical Platform: e.g. AUTOSAR
  - e.g. mixed criticality computing

- Horizontal platform (e.g. connectivity)

Value Chain

Sectors
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Our financial instruments

• R&D&I instrument toolbox (Horizon 2020)
  • Research projects, innovation actions, pilot lines, large-scale demonstrators, SME scheme, ...
  • ICT a main priority in H2020: ~14 B€ of investment

• European Structural and Investment Funds (ESIF)
  • 320 B€ of investment in 2014-20
  • Innovation and digital technologies: Two key priorities out of 4
    • E.g. foster the emergence of industrial clusters through regional smart specialisation strategies

• New investment (Junker) package (315 B€)?
  • Support to innovation, infrastructure & also industrial projects
  • SMEs and mid caps (75 B€ in equity and loans)
In 2007-13: Around 1B€ of public investment

ICT work programme (incl. advanced computing):
- about 75 M€ per year
- Total FP7: 510 M€

ARTEMIS JTI:
- 190 M€ EU investment for period 2008-2013
- 335 M€ member states

+ ~1 B€ of private investment
H2020 – LEIT – ICT, Embedded and cyberphysical systems

Societal Challenges

- Componen ts & Systems: Smart CPS ...
- Advanced Computing
- ECSEL JTI
- Robotics PPP
- ICT KETs
- Nanoelectronics Photonics
- ICT for Manuf. Factories of the Future PPP
- Excellent Science/ FET ("Graphene Flagship")

Estimate for embedded syst 2014-20, ~1.3B€ all encompassing (without Ms)
In 2014-15: ~280 M€,

- Open Disruptive Innovation, IoT, Cyber-
- Security, Horizontal Support to Innovation
Combining efforts: Essential role of ECSEL

- Strategic roadmap for R&I supported jointly
  - Critical mass, Clear industrial commitment
  - Align strategies

- Cutting across the digital value chain
  - Essential to serve all three stakeholders

- Necessary resources to finance high TRL actions
  - Large scale federating projects and demonstrators

- Can only succeed if it links properly to ITEA, MSs programmes, H2020 normal calls

- Towards one strategic roadmap for Software!
  - Different and complementary schemes: ECSEL, ITEA, normal H2020, national, regional
Concluding Remarks

- Large digital opportunities are ahead of us in areas where Europe is strong!
  - IoT, Big data, CPS, autonomous systems,..

- Europe cannot miss these opportunities
  - What is at stake is its whole economy!

- Our strategy has to cover the whole value chain
  - A strong digital industry and a strong digitised industry

- Software and embedded software has a central role

- Our big challenge is to develop a common strategy for software with complementary implementation mechanisms
  - Let's just do it!
THANK YOU

DG CONNECT (Communications Networks, Content and Technology):
http://ec.europa.eu/dgs/connect/index_en.htm

Cyber-Physical Systems

Horizon 2020 on the web:
http://ec.europa.eu/research/horizon2020/index_en.cfm