Manufacturing & embedded systems

WHY SHOULD REGIONS INVEST STRUCTURAL FUNDS IN MANUFACTURING AND EMBEDDED SYSTEMS?

Manufacturing and embedded systems: an overall context

Embedded Systems are everywhere. In our daily lives, from the moment we wake up, our alarm clock contains an embedded/complex system. These complex systems are included also in microwave, washing machines, cars and most appliances used by a normal citizen. Regional development in Europe should aim at boosting innovation and create the optimum environment for our industry to grow.

Industrial production accounts for 17% of Europe's GDP[i] and remains a key driver for innovation, economic growth and job creation. More than 32 million people in the EU are employed in industry and each job in manufacturing generates at least an additional job in services. 80% of innovations today are made in industry and 75% of EU exports are manufactured products. However, Europe's position as an industrial power house is eroding and its leadership in many important sectors is constantly challenged. Since the beginning of the crisis, employment in manufacturing has fallen by 11% triggering the fear of collapse of major parts of the industrial fabric. SMEs are the backbone of the manufacturing industry in Europe. Micro, small and medium enterprises provide around 45% of the added-value due to manufacturing whilst providing around 59% of the EU's employment in manufacturing.

Synergies need to be explored to reverse the trend towards de-industrialization in Europe. These include.

- Bringing together Europe's strengths in many domains of manufacturing with advances in ICT, both of them being available but scattered broadly across Europe, leading to a radical modernization of our manufacturing processes;
- Achieving fast progress and economies of scale by exchanging best practices between the early adopters of advanced ICT in different sectors and by supporting take-up measures which allow the vast majority of industries go the same profitable route.
- These synergies can be stimulated by significant public intervention at European scale, which has therefore to rely on regional funding in order to achieve critical mass investment

BARRIERS AND CHALLENGES

Barriers

In the framework of Manufacturing and embedded systems in particular, the main barrier is the gap between basic knowledge generation and the subsequent commercialisation of this knowledge in marketable products (the socalled "Valley of Death"). Its effects can include not only relocation of manufacturing and R&D, but also the disruption of entire value chains with their ultimate consequences on the sustainability of various strategic sectors in Europe.

A second barrier is the ongoing underinvestment in R&D in Europe. Compared with major trading partners such as the US, the Commission observes that "R&D in ICT in Europe is not only a much smaller proportion of total R&D spent – 17% compared with 29% – but in absolute terms represents around 40% of US expenditure". Furthermore, as "ICT represents a significant share of total value-added in European industrial strengths such as automobile (25%), consumer appliances (41%) or

health and medical (33%); the lack of investment in ICT R&D is a threat to the entire European manufacturing and service sectors."

A third barrier is the fragmented and scattered European strengths, leading to a suboptimal access to market for sourcers of ICT solutions and to entry barriers for integrators.

Challenges

The challenges are:

- Make manufacturing more efficient by introducing ICT-based solutions across the manufacturing process chain for the complete product life cycle leading to more personalized, diversified and mass-produced products and allowing for agility and flexible reaction to market changes;
- Reduce time-to-market, improve quality of products, and increase productivity through using advances in simulation, visualisation and analytics in digital design, rapid prototyping and manufacturing engineering;
- Enable better integration of the human element on the shop floor;
- Make production more sustainable in terms of resources, materials and energy through the use of modern ICT-based manufacturing technologies;
- Stimulate common platforms within and across manufacturing domains and reinforce ecosystems around these platforms;
- Create 'virtual' value chains independently from the geographical location of its actors thereby allowing for better exploitation of the potential of skilled labor forces across Europe.

This requires an economic assessment of where advanced manufacturing and embedded systems can be used to create regional growth and jobs.

The Factories of the Future initiative has been launched as part of the European Economic Recovery Plan, adopted in November 2008, to tackle the consequences of the global economic downturn. Although its initial focus was to restore growth and to boost competitiveness in a strategic sector, the Factories of the Future initiative faces tremendous structural and societal challenges in order for European producers to compete in global markets while maintaining their manufacturing activities in Europe.

This strategic roadmap is a very useful reference documents for regions having plans to invest in Manufacturing. It identifies technologies fields and innovation opportunities for Europe to develop in the next 7 years which can be a very valuable input for regions to develop their own RIS3 plans.

HOW TO ACT?

Regions wishing to invest structural funds in terms of smart specialization and the creation of clusters/living labs should consider the following 5 steps:

1. ANALYSIS: (a) Assess the kinds of competitive advantage in terms of smart specialization in their region and in which ways all the research and industrial actors could work together in a cluster or living lab; (b) Estimate the cost of clustering and investigate the potential sources of public and private financing, including through Public-Private Partnerships (PPPs); (c) Determine the available skills and necessary technological resources. A number of EU-funded projects explore how ICT can facilitate networking on a European level:

HYCON2 **– *Highly-complex and networked control systems –*** *It is a Network of Excellence that connects 25 level 1 research institutes/academic partners across Europe and Switzerland, 29 level 2 research institutes/academic partners across Europe, Russia, USA, Turkey and India, and 22 industrial partners (1 associated company and 21 connected companies) across Europe and the USA. It promotes research in the framework of control systems all over Europe.*

2. GOVERNANCE/STAKEHOLDER INVOLVEMENT: Public regional and local authorities should engage with relevant stakeholders .These actors will vary depending on which potential there is in a region, but may include:

- Public sector, such as national/regional ministries in charge of ICT, culture, or regional and local governments.
- Research centres and institutions - as drivers for value added and key elements in the cluster creation
- European industry (users and suppliers) from different sectors – in particular making use of the competitive advantages of each region in the framework of smart specialization

Besides Structural Funds to co-fund regional development activities as part of projects having an impact on the regional economy, MS and regions should consider PPPs to create new ways of funding. Stakeholders may therefore also include companies willing to invest in the creation of these clusters for smart specialization.

3. PRIORITY SETTING: (a) Position your level of ambition and its indicative targets per Member State by 2015; (b) Establish your RIS3/OP priorities taking into account the expected socio-economic impacts; (c) Establish roadmap to reach the defined goals.

4. POLICY MIX: In this process, regions should also seek synergies with other national and regional initiatives and EU activities. Of particular interest in this area is the networking opportunity offered by the Research and Innovation Programme (Horizon 2020).

5. EVALUATION AND MONITORING: The Commission calls upon Member States and regions to further develop their planning and monitoring and provides a number of targets useful for benchmarking and monitoring.

Below, a number of possible lines of action are proposed. They permit to bring together the main stakeholders and develop opportunities for innovating along and across the value chain(s):

a) Structuring the regional stakeholders around an Innovation Cluster

Looking at European innovation panorama, three innovation centres are to be mentioned: IMEC[ii] (Leuven, Flemish Brabant, Belgium), CEA-LETI[iii] (Grenoble, Rhône-Alpes, France) and Fraunhofer[iv] (Dresden, Saxony, Germany). They not only perform research but also cooperation with industry.

The European backbone research clusters include the mentioned research centres and a satellite of players around them, from industrial suppliers to users that boost the European competitiveness of these regions. Structural funds investment across Europe would allow the raise of more research centres inside and outside the European backbone, therefore covering other European regions, The creation of value chain across borders interconnects the European research centres and industries already linked to these centres with other industrial players and other centres, being suppliers from a centre in another Member State for example.

b) Linking value chain activities through cross-cluster and cross-region cooperation (Smart specialization and networking of regional centres)

The starting point in the European smart specialization is to take into consideration the competitive advantages of each European region and map which are currently the main industrial sectors that drive its competitiveness. We observe that the main user industries which successfully build electronics in their products are Automotive and Aerospace, and Manufacturing in general.

There are however other medium-sized sectors which are nevertheless important in some European regions and which need of complex systems and electronics in their final products or production processes which are the following ones: Electrical engineering and the installation of components for the above mentioned sectors[v], Agriculture, Food, Consumer, Construction, Chemicals, Pharmaceuticals, Optical-glass, Construction, Furniture and Wood-working etc.

A preliminary mapping[vi] indicates that the main research themes in embedded systems projects could be brought together in the specializations of these regions, leading therefore to Partnership Agreements (PA) and Operational Programmes (OP).

The main research sectors in the European industry where ICT and, in particular, embedded systems[vii] adds value are mainly the following ones:

- Manufacturing
- Automation – Process automation
- Aerospace - Security and critical infrastructures
- Healthcare and wellbeing - Chemicals, Pharmaceuticals, Optical
- Communication and interoperability - Smart environments
- Urban infrastructure – Sustainability - Construction
- Human centred design – Consumer items including Tourism
- Computing platforms
- Other sectors- Agriculture, Food, Textile

In the framework of the RIS3 research and innovation strategies for smart specialization, regions need to map the impact of the main industrial sectors in their areas in terms of competitive advantage, expertise, impact on employment, spill-over effect in other sectors etc. A SWOT analysis per region would be beneficial and a European map to find out synergies across areas should be done at EC level for policy making.

After having identified a higher number of innovation centres and identified the main research sectors across the European regions, the objective is to establish European networks of regional innovation/design centres. These centres would be higher in number than the three above mentioned innovation centres (IMEC, CEA-LETI and Fraunhofer) and would relate to the smart specialization of our regions in Europe.

In Europe, there are already networks of competence centres. Projects like ***Fortissimo***, in the framework of I4MS show us the kind of regional networking that can be developed in the future (7 networks were funded so far: http://europa.eu/rapid/press-release_IP-13-533_en.htm).

FURTHER READING & FORTHCOMING EVENTS

http://s3platform.jrc.ec.europa.eu/home

[i] Report from the Workshop on 'ICT Innovation for the Factories of the Future' held on 10th July 2012 in Brussels, Belgium

[ii] IMEC stands for Interuniversity Microelectronics Centre

[iii] CEA-Leti stands for Commissariat à l'Energie Atomique et aux Energies Alternatives - Laboratoire d'électronique des technologies de l'information

[iv] Fraunhofer research institute complete name is Fraunhofer Gesellschaft zur Förderung angewandter Forschung e. V.

[v] Electrical engineering and installation of components companies for Automotive and to less extent to Aeronautics are sometimes placed in regions outside the European backbone whereas the main Automotive and Aeronautics companies being at the end of the value chain are mainly in the European backbone area.

[vi] http://s3platform.jrc.ec.europa.eu/home

[vii] The main research sectors are inspired in the 2013 call of the ARTEMIS Joint Undertaking for embedded systems innovation pilot programmes and sub-programmes:

ARTEMIS Innovation Pilot Programmes

AIPP1: Critical Systems Engineering Factories
AIPP2: Innovative Integrated Care Cycles
AIPP3: Seamless communication and interoperability - Smart environments: the Neural System for society
AIPP4: Production and Energy Systems Automation
AIPP5: Computing platforms for embedded systems
AIPP6: "Intelligent-Built" environment and urban infrastructure for sustainable and "friendly" cities

ARTEMIS Sub-programmes

ASP1: Methods and processes for safety-relevant embedded systems
ASP2: Embedded Systems for Healthcare and Wellbeing
ASP3: Embedded systems in Smart environments
ASP4: Embedded Systems for manufacturing and process automation
ASP5: Computing platforms for embedded systems

ASP6: Embedded Systems for Security and Critical Infrastructures Protection
ASP7: Embedded Systems supporting sustainable urban life
ASP8: Human-centred design of embedded systems