

## Emerging Enabling Technologies: the Italian landscape

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Italian version: <https://www.airi.it/2019/09/tecnologie-abilitanti-emergenti-il-panorama-italiano/>

The HORIZON 2020 Program was undoubtedly the driving force that allowed an adequate development of the KET area in European countries and in Italy too.

The Italian research and innovation system has always been characterized by fragmentation: a marked individualism and a limited propensity for cooperation, leading to a difficult process of Tech-transfer from the Research system to the Innovation system.

Referring to the field of KET, the push of HORIZON 2020 helped to partially overcome this criticality, by generating public/private collaborations of particular relevance. This also thanks to some national initiatives including KET and launched in alignment with the goals of HORIZON (slide 1):

### INITIATIVES IN ITALY

- a) Italian National Research Program (2015-2020);**
- b) Funding Program «Sustainable Growth» (2016);**
- c) Funding Program “Industry 4.0” (2017);**
- d) Smart Specialization Strategies that have enhanced local innovation systems (2016).**

*Fig.1 Italian initiatives including Enabling Technologies*

Looking at the Smart Specialization Strategies, the next Table shows the relation between KET and some relevant goals in the Emilia Romagna region in the AgriFood area (Table 1)

KETS	Industrial Biotechnologies	Nanotechnologies	Micro and nanoelectronics	Photonics	Advanced Materials	Advanced manufacturing	ICT
Industrial Biotechnologies	Highly Related	Not related	Not related	Not related	Not related	Highly Related	Not related
Plant and Instruments	Not related	Not related	Highly Related	Related	Highly Related	Highly Related	Highly Related
Precision Agriculture	Highly Related	Not related	Related	Not related	Not related	Related	Related
Quality	Highly Related	Not related	Related	Not related	Not related	Related	Not related
Sustainable Processes	Not related	Related	Related	Not related	Not related	Highly Related	Related



Table 1

These actions supported the Italian R&I system in three fundamental directions:

- Improving education of new graduates and continuous professional training of workers;
- Increasing the competitiveness of the industrial system. Considering for example the Transportation Area, important goals can be reached only by an appropriate combination of some KET (Fig.2)

	Nanotechnology	Advanced Materials	Bio-technology	Advanced Manufacturing	ICT
Security				•	•
Environmental Sustainability	•	•	•		
Energy Efficiency		•	•	•	•
Connettivity				•	•
Comfort		•		•	•
Product life-cycle		•		•	
Infrastructures and logistic				•	•

*Fig.2 KET and Transportation Area*

- Ensuring social impact of R&I results. According to the Italian National Statistics Institute, on a sample of about 400,000 companies, 52.3 percent of the sample can be defined as unsustainable, 15.0 percent slightly sustainable, 15.1 percent average sustainable and 17.6 percent highly sustainable (Table 2)

<b>MANUFACTURING</b>	<b>N° Companies</b>	<b>Productivity</b>
<b>- COMPANIES NOT SUSTAINABLE</b>	<b>202.854</b>	<b>Benchmark</b>
<b>- COMPANIES SLIGHTLY SUSTAINABLE</b>	<b>58.180</b>	<b>+ 4,5%</b>
<b>- COMPANIES AVERAGE SUSTAINABLE</b>	<b>58.568</b>	<b>+ 7,9%</b>
<b>- COMPANIES HIGHLY SUSTAINABLE</b>	<b>68.264</b>	<b>+ 10,2%</b>

*Table 2*

Very interesting the consideration about the productivity: compared to companies with zero sustainability, taken as benchmarks, we observe an increase of productivity increasing the sustainability. These results are also due to the the significant participation of Italian research organizations, both public and private, in H2020 programs, including NMBP and others, such for example in Science with and for Society.

Therefore, NMBP funding program has supported a change in the culture of the players of the Italian innovation system. There is an increased awareness and improved competences and skills to address and integrate together the economic, environmental and social aspects of innovation.

Can this set of skills be exploited within the next Horizon Europe and specifically in Pillar 2 in the Digital, Industry and Space cluster? Considering the Key R&I orientations (Fig.3) of the new program, the answer can only be affirmative.

## **Cluster: Digital, Industry and Space**

### **Key R&I Orientations**

<b>Enabling Technologies</b>	<b>Economic and Societal Transitions</b>
<b>Enabling Technologies</b>	<b>Circular Industries</b>
<b>Digital Technologies</b>	<b>Low Carbon and Clean Industries</b>
<b>Advanced Materials</b>	
<b>Emerging Enabling Technologies</b>	
<b>Artificial Intelligence and Robotics</b>	
<b>Next Generation Internet</b>	
<b>Advanced Computing and Big Data</b>	
<b>Competitive Space Sector</b>	

*Fig.3 R&I orientations in the cluster “Digital, Industry and Space”*

More specifically, two topics are of particular relevance for Italy:

a) The first one concerns digital technologies and in particular the development of artificial intelligence, which in the Italian view is still addressed with an anthropocentric approach. The main industrial interests converge on the following sectors:

- Pharma Industry (Drug Discovery, Drug development and Clinical Applications);
- Automotive Industry (Autonomous Driving, Predictive Maintenance, Cyber Car, Connected Supply Chain);
- Microelectronics (Smart Driving, Smart Industry, Smart Home and Smart Things);
- Energy (Cognitive Discovery platform, addressed to significantly reduce the exploration risk related to geological complexity).

b) The second one is related to the good Italian position in the field of Advanced Materials. Starting from the consideration that developments in renewable and sustainable energy technologies are critically dependent on the ability to design and realize materials with optimal properties; materials discovery and design efforts

ideally involve close coupling between materials prediction, synthesis and characterization. The increased use of computational tools, the generation of material databases have substantially accelerated these activities: it is therefore an appropriate time to consider future prospects for materials by design approaches.

Looking at the emerging Economic and Societal Transitions, I think the Italian Innovation System is aware and ready to take advantage of the value of sustainability. For the Italian Companies efforts toward sustainability are moving along two directions:

a) Be aware of the impact of activities;

b) Make a responsible use of the following six forms of Capital

- *NATURAL CAPITAL provides resources to productive activity of the Company and guarantees the disposal of waste generated by this activity;*
- *HUMAN CAPITAL knowledge, skills and abilities possessed by employees that allow them to carry out business activities efficiently and effectively;*
- *INTELLECTUAL CAPITAL patents, technologies, know-how, information on customers and suppliers that contribute to the creation of value in the Company;*
- *MANUFACTURED CAPITAL tangible assets which, together with intangible assets, contribute to the creation of value in the Company;*
- *SOCIAL CAPITAL the relationship system of the Company with the stakeholders including its own employees;*
- *FINANCIAL CAPITAL provides the Company with the financial resources necessary for the needs of the business*

In conclusion the Italian R&I system is ready to take advantage of future opportunities in the next Horizon Europe Program, and there are a number of aspects to address to strengthen it:

- A more flexible and dynamic eco-innovation system

- Improved public-private cooperation (reducing fragmentation)
- Technology transfer (improving exploitation of research results)
- Participation of SMEs to HE and national programmes
- Improved access to (R&I) finance
- Availability of venture capital
- Research infrastructures for easy access to competences and equipments,