mKETs-PL working document

Country report Italy

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- Netherlands organisation for Applied Scientific Research TNO
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- Commissariat à l'énergie atomique et aux énergies alternatives (CEA)
- Cambridge University-Cambridge enterprise
- VTT
- Tecnalia
- Technology Partners Foundation
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Content

1. Policy perspective

The first section include an overview of the main institutions promoting innovation in Italy as well as the structure of the research system in Italy. Furthermore the description of the Italian characteristic of the research and innovation system are provided (performances, investments, etc...).
Policy on multi-KETs and on pilot lines at national level are explained within the two next sections.

1.1. Country specific innovation system with emphasis on KET

At political level, the Parliament and the Council of Ministries are the most important bodies for R&D policies.
The coordination of Science and Technology policy within the government is under the responsibility of Interministerial Committee for Economic Planning CIPE especially for medium long term actions. The CIPE role became more effective after a special section "Sessione Ricerca" dedicated to research and education was created during the last decade. The CIPE also reviews the so-called Economic and Financial Document (DEF), including the National Reform Programme (PNR) and release the three-year PNR under proposal of MIUR.
At the operational level, in Italy the Ministry for Education, University and Research (MIUR) coordinates national and international scientific activities, distributes funding to universities and research agencies, and establishes the means for supporting public and private research and technological development (RTD) funding.
The Ministry for Economic Development (previously called Ministry for Production Activities) supports and manages industrial innovation. Other Ministries (Health, Agriculture, etc) manage research funding in their specific fields.

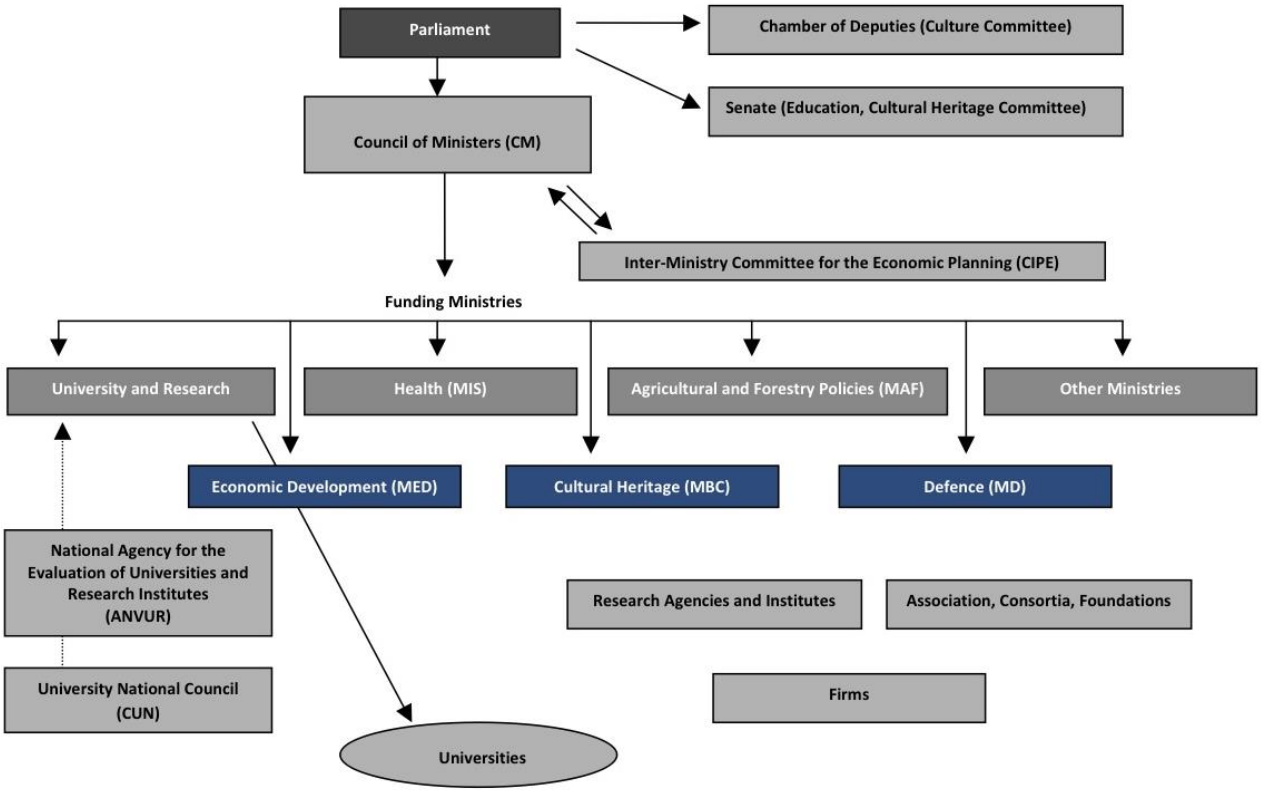


Figure 1.1: Structure of the RTDI system in Italy

Important bodies dealing with advisory tasks are the CUN National Committee for the University, which is in charge of proposal and consultancy on the academic curricula and recruitment; the CNVSU and the CIVR

respectively in charge of the evaluation of the University system and of the research system, now replaced by the ANVUR, the National Agency for the Evaluation of the University and the Research.
At the performer level, universities are the most important public research performers in Italy, in terms of research personnel and budget invested. They are generally public research-oriented organizations, dealing with all the scientific fields.
Public Research Organisations (PROs) play a very significant role in the research sphere. Recently a government decree reforming the PROs under the MIUR supervision passed (D.lgs 213/2009), which foresee the setting of new internal Statutes, a reform of the governance, a multiyear planning of the activities for pursuing scientific excellence and integration with the private sector of research.

Within the European framework, Italy is included in the Moderate Innovator countries group: although many indicators point to a modest level of science, technology and industry activity, attention is being given to increasing it.
Business sector innovation performance varying across firms and regions. In fact, a segment of innovative firms, including flexible SMEs, coexists with many non-innovative firms operating at low levels of productivity. Moreover, much R&D and innovation capacity is concentrated in northern and central regions of the country.
The low share of industry-financed public R&D is indicative of weak industry-science linkages. Venture capital is in short supply and the patenting rate of young firms is low. In general, Italy tends to perform better on indicators of non-R&D-based innovation (for example, it leads in Community designs). Participation in international networks is quite strong, however: 41% of scientific articles and 13% of PCT patent applications were produced with international collaboration.
As explained above, the public research system performs the greater part of R&D. Higher education and PRIs contribute to innovation in a number of ways but their co-operation with business firms needs to be improved. In order to improve public research performance, a reform of funding mechanisms for and management of universities was approved in 2010 by Parliament and is being implemented. The reform of the PRIs under MIUR has also recently been undertaken.
In recent years there has been a shift towards indirect funding of R&D. As stated in the National Reform Programme 2011, for 2011/12, tax incentives have been strengthened for research commissioned by firms to universities and PRIs as well as for research developed in collaboration with them.
The Strategy for the Internationalisation of Italian Research (SIRIT 2010-15) integrates the national research priorities in international strategies and priorities, notably the EU's 2020 Strategy. Italy actively participates in EU R&D programmes, the European Strategy Forum on Research Infrastructures (ESFRI) and other European initiatives such as EUREKA (for international S&T cooperation) and Erasmus (for mobility of students and researchers).
Italy has a dearth of highly skilled human resources, and the most highly qualified sometimes find better opportunities abroad. During 2011/13 academics' salaries and career progression have been frozen in order to contain public spending. A lack of opportunities and unattractive career prospects and working conditions for talented individuals may further weaken the human resource base. A recent parliamentary act aims to support the recruitment of early career researchers. A new action plan for future youth employment (Italia 2020) aims to better align curricula with the changing demand of industry.

1.2. Organisation of mKETs policy

Key Enabling Technologies (KETs) are included but not explicitly mentioned in thematic and structural programmes. They are included in the general target of improving the innovation system through funding and supporting of cooperation between research and industry.

A specific activity on KETs aiming to define a vision on KETs at the national level and to assess their impact within the Italian industrial framework, is the Working Group on "Key Enabling Technologies" established in 2012 by AIRI – Italian Association for Industrial Research – with the support of the National Research Council (CNR).
A comprehensive understanding of the national situation on KETs is essential to identify challenges and opportunities that the EU approach to KETs will offer to the national industrial and R&D players.

The European approach toward KETs deployment could be an opportunity for increasing Italy R&I performances and improving the transfer of research results to the market, fundamental for the benefit of the national industry and the economy.
The WG, composed of experts from industry and academia, undertakes in 2012 an assessment of the contribution of KETs in priority technologies for the Italian industry (identified on a regular basis, since the '90s, by AIRI with the contribution of its members).
The assessment of KETs impact on the national industrial landscape is based on activities included in the AIRI report "Tecnologie Prioritarie per l'Industria Italiana: Innovazioni per il prossimo futuro" (in the following "AIRI Report"). The 8th edition, published at the end of 2012, has been completed in parallel to this analysis.
The AIRI report is based on the work of more than one hundred R&D managers, representative of key industry, private and public research centres in Italy (most of them members of AIRI). The report provides an overview of industrial technologies selected as priority for their innovation potential for the impact on national economy in the short to medium time-frame. AIRI report identifies 84 priority technologies in relation to 8 industrial sectors.
Sectors taken into account are (between brackets some examples of families of priority technologies identified):

- **Information and Communication Technologies** (Technologies for ICT-based logistics and mobility services (infomobility), Mobile networks and services, "Home networks" technologies, Technologies for networks security, ...);
- **Microelectronics - Semiconductors** (Silicon electronic system integration, Photovoltaic applications, Materials alternative to silicon, Heterogeneous Integration: processes, fabrication techniques and design methods, Silicon integration of sensors technologies, Silicon Photonics);
- **Energy** (Specific technologies for: energy transport and storage, power generation and advanced materials, use of biomass (electric and thermal energy production), solar energy harvesting, energy efficiency, Smart Grid/Smart Metering/Smart Energy, Carbon capture and storage (CCS));
- **Chemistry** (Technologies for the recovery of polymeric materials from used tyres, Technologies for the production of non sticky chewing gum, Biorefinery processes, II generation biochemical technologies (non for food feedstock), Alternative feedstock for energy and chemical products (biofuels, hydrogen production from natural resources), Nanotechnologies in concrete formulations for the construction sector, Hybrid organic and inorganic materials and nanomaterials as catalyst for chemical processes);
- **Pharma & Bio** (Genomics, proteomics and metabolomics, Technologies for pharmaceutical chemistry, Personalized medicine – biomarkers, Delivery Systems , Biomolecular production, Technologies and methods for the Molecular Imaging, Minimally invasive technologies, Advanced therapies technologies);
- **Aeronautics** (Technologies for materials, production and maintenance processes for aero-structures and engines, for environmental impact reduction, for low emission engines, for conventional and innovative engine design, Simulation methodologies for integrated design, Prognostics and condition – based maintenances systems, Autonomous systems technologies, Advanced Air Traffic Management, Air traffic systems interoperability, Modular avionic, Human machine interfaces, Security Land Side (security management systems));
- **Transport (ground, rail, marine)** (Solutions, Technologies and Green Automotive Materials for energy efficiency and performances of the vehicle, Solution & Technologies for human-machine interface (HMI), New methodologies for ship design and Multi-disciplinary Virtual Analysis techniques (Performances, Logistics, Quality) to reduce time-to-market, Solution & Technologies to improve Energy Efficiency on ship systems, Solution & Technologies to improve Energy Efficiency on railroad systems (Green Technologies) , Improvement in Quality and Efficiency of processes for people and goods transportations, Communication and information management systems);
- **Manufacturing** (Methodologies and standards for the design of complex machinery and manufacturing systems: IT tools and novel design approaches, Technologies for the control, monitoring, maintenance, diagnostic of manufacturing systems to improve life cycle and efficiency, High performance sensors and mechatronics components for manufacturing and final products efficiency and quality, Environmental friendly machines and systems design and architectures, to

optimise energy efficiency and environmental impact of manufacturing systems, Structural materials for components, machines and systems to improve performances, reduce the use of resources and the environmental impact).

The priority technologies have been selected based on the following criteria:

- Impact in the short-medium term on the competitiveness of industries active in the specific sectors;
- Time to market of the technology;
- Qualitative evaluation of the R&D investment needed to reach the demonstration (prototype) or market of the technology;
- Analysis of socio-economical aspects such as: social, environmental and economical sustainability (in the national and global market context) and technical feasibility (from the lab to the market), impact on jobs.

The analysis provided then an overall picture of the role of KETs in these key sectors for the Italian economy, with reference to the AIRI report on priority technologies.
From the point of view of the industrial sectors, all technologies related to microelectronics and semiconductors, energy, chemistry, pharma and bio, transports, manufacturing include at least one KET. In the ICT, chemistry and aeronautics sectors the impact (from a quantitative point of view) is lower, and some technologies show no relationships with KETs.

In a nutshell:

- KETs contribute to all the 8 Priority Technologies for the industrial sectors;
- More than 80% of the Priority Technologies includes at least one KET;
- More than 50% of the Priority Technologies includes at least 3 KETs.

This shows the remarkable contribution given by KETs to R&D activities of the national Italian industry.

Their systemic relevance and cross-cutting character is further underlined by examples of technologies and applications where almost all 6 KETs contribute: some are wide and complex areas, such as novel information tech (ICT sector), carbon capture and storage (CCS) (energy sector) and solutions & technologies to improve performances, energy efficiency and reduce environmental impact (transport, aeronautics sectors): other are more specific areas, such as advanced photovoltaic (energy, microelectronics and semiconductors), sensors (ICT, microelectronics and semiconductors, energy, manufacturing), minimally invasive technologies (Pharma and Bio).
In all these areas KETs contribute, and often are enabling, to develop components, devices, systems along the value chain of the technology process or product considered.

1.3. Main policies for Pilot lines

In Italy, various initiatives aim at bridging the gap between academia and industry.
The National Research Programme (PNR) defines the objectives and modes of implementation of specific interventions in priority areas, disciplinary sectors, involved parties, projects which qualify for funding, etc. The goal is to ensure the coordination of research with other national policies, bringing Italian research into alignment with the strategic vision defined at European level and creating the conditions necessary for a progressive integration of public and private research.
The PNR is formulated by the Ministry of Education, Universities and Research (MIUR), after extensive consultation of the scientific and academic communities, economic powers and competent administrations, and it is approved by the Inter-ministerial Committee for Economic Planning (CIPE), a collective government body whose function is to coordinate decisions on economic policy.
The first PNR was formulated for the three-year period spanning 2001-3, and since then the conviction has grown that to obtain results of tangible and lasting effects on the country's social and economic structure, simultaneous action on several levels is necessary: education, basic and applied research, technology transfer and development, and valorisation of intellectual property.

To achieve its objectives, the PNR proposes a set of integrated actions, each of which involves various initiatives over the short, medium and long terms. As well as defining lines of action and allocating funds, the objective is to simplify funding mechanisms, rationalize active mechanisms available to administrations, and identify forms of monitoring to ensure that funding is efficiently applied in pursuit of the stated objectives.
The resources earmarked by the budget for the current three-year period are distributed across the following sources of national funding:

- Ordinary fund for research institutes and bodies (Fondo Ordinario per il finanziamento degli Enti e degli istituti di ricerca - FOE);
- Fund for investment in basic research (Fondo per gli Investimenti della Ricerca di Base - FIRB);
- Research subsidy fund (Fondo per le Agevolazioni alla Ricerca - FAR);
- Research projects of national interest (Progetti di Ricerca di Interesse Nazionale - PRIN).

As stated in the PNR, regions play a strategic role: as well as having the power to allocate their own funds to research, they participate in the management of European structural funds via the Regional Innovation Strategies and they actively contribute to the more general objective of smart growth. In this framework, the concept of Smart Specialisation Strategy has been issued at European level to improve the national and regional research system effectiveness.
The Italian government has recently adopted two new initiatives within the Smart Specialization initiative to operate in this direction: the creation of "joint labs" between university or public research bodies and industry, in a specific area (i.e. new materials, biotechnology, nanotechnology and other areas crucial to sustain new high –tech industries); and the creation of technological districts in some carefully chosen geographic locations in Italy.
The promotion of enterprises innovation capability through systemic aggregations at territorial level is one of the main priority objective of the S&T Italian policy.
The aim is to foster a stronger competitiveness of the existing productive areas, highly export intensive, by revitalizing them through research and development activities on key technologies, enabling product and process innovations.
In accordance with the EU guidelines to access to funding from the European Regional Development Fund (ERDF) regions will have to identify its own strategy for Smart Specialization, with a characterization distinctive with respect to the strategies and choices defined by other administrations, highlighting their competitive advantages.
The main criteria adopted for the creation of new technological districts are:

- The availability of a well structured project incorporating extended foresight studies in the chosen area of interest, the definition of vision, mission and of the regulatory processes for the management, rules for the protection and distribution of intellectual property.
- The coherence of the project with the strategic fields identified in the "guidelines" of the national S&T policy.
- The participation in the district of public stakeholders (University and/or research bodies) provided with the necessary experience in the field of interest and a background of collaboration with industrial partners.
- The presence in the proposed district of private relevant stakeholders, i.e industries with a long record of activity in the field, willing to establish a joint collaboration with public actors, and whose activity is mainly located in the same regional and local environment.
- The existence of a group of individual leaders, with proven experience in the field, belonging to the private and the public partners.
- A well defined structure for the governance of the district, which should involve the main stakeholders and regional and local institutions (i.e. regional or municipal authorities).
- A definite and explicit participation of private Foundations, venture capital or similar organisations able to provide seed money or early stage capital to foster the spin off creation.
- A definite legal entity, "ad hoc" created to represent and manage the new district.

So far, ten districts in various Italian Regions have been created and reported below, according to MIUR.
Although some of the district are not explicitly citing key enabling technologies, all can be correlated to the six KETs.

Italian Region	Technological district	Website
Campania	Technological district on Polymeric and Composite Materials	http://www.imast.biz/
Emilia-Romagna	HI-MECH-high-tech district of Networked Laboratories for Advanced Mechanics	http://www.hi-mech.it/
Friuli-Venezia Giulia	Molecular Biomedicine	http://www.cbm.fvg.it/
Lazio	The high-tech Aerospace District	http://www.lazio-aerospazio.it/
Liguria	Integrated Intelligent Systems	http://www.siitscpa.it/
Lombardy	Advanced Materials Biotechnologies Information and Communication Technologies	http://hubmiur.pubblica.istruzione.it/web/ricerca/ricerca-internazionale/technological-district/lombardia
Veneto	Veneto NanoTech	http://www.venetonanotech.it/it/
Piedmont	Torino Wireless	http://www.torinowireless.it/

The table in the next page reports some examples of case history projects or initiatives, divided by Technological district.

To the previous initiatives we can add the QSR (Quadro Strategico Nazionale - National Strategic Framework) which is based on structural funds, a funding mechanism available through European regional policy, with funds managed and allocated by the state in conjunction with the European Union. The programme for 2007-13 has the objective of "convergence", and involves the implementation of seven programmes, three of which specifically addresses funding for research and development projects:

- National operative programme (Programma Operativo Nazionale - PON) for Research and Competitiveness 2007-2013;
- Regional operative programme (Programma Operativo Regionale - POR) for Research and Competitiveness 2007-2013;
- Inter-Regional operative programme (Programma Operativo Interregionale - POIN) for Research and Competitiveness 2007-2013;

Within the PON it is possible to cite the following examples of measures aiming at bridging the gap between research and industry:

- Innovative Investments

A means of subsidising investments for the industrialisation of qualified research and experimental development projects, and provide incentives to measures undertaken by SMEs and large enterprises to improve competitiveness and environmental protection.

- Technological Innovation

Mise funds interventions relating to strategic innovation by means of tenders that provide incentives to the business system for the implementation of programs in high technological research, development and innovation business sectors.

- Smart Cities and Communities

Projects to improve the services and the quality of the communities we live in through research and technology.

Technological district	Case history project or initiative	Brief Description
Technological district on Polymeric and Composite Materials	Tri.Po.De.	Public-Private laboratory for the development of technologies for research and integration of polymers into electronic devices
	Po.Di.Me.	Polymeric materials and polymeric circuits for memory devices
HI-MECH-high-tech district of Networked Laboratories for Advanced Mechanics	PRISMA	Experimental facility for the study and application of metallic foams
Molecular Biomedicine	SMD	Single or few molecules detection by combined enhanced spectroscopies. Integration on the same device an atomic force microscope (AFM) or an optical tweezer (OT), with Raman/SERS/IR/TeraHertz microscopy so to perform simultaneously - and in a dynamic way - force and spectroscopic measurements.
The high-tech Aerospace District	Business Lab	Business Lab is a "laboratory" for the creation of enterprises starting from innovative ideas created by Universities, Research Organisation and Companies. Through an operative system and an easy path to do business it aims to increase and qualify the birth rate and success of innovative businesses and generate jobs and new opportunities for technological development.
Integrated Intelligent Systems	Precompetitive development and technology transfer	The project has operated on the same thematic axes of the Industrial Research call, with the goal of achieving technology transfer projects for SMEs. The value of completed projects was about € 6 million with Regional funding.
Advanced Materials	New Materials park	The parks works in the following areas of technology: innovative ceramic materials, metal based composites, polymer based composites, innovative materials for electronic components, micro and nano structured materials
Veneto NanoTech	Nanofab	The Nanofabrication Facility is one of the first European laboratories for nanotechnology applications to industrial production. Created to promote and facilitate the meeting between the research system and the business world, it provides companies advanced laboratories for the transfer of scientific know-how, technical expertise and practical solutions for the development and business innovation. In this way it acts as a reference centre for scientific consultancy both through its own facilities or through coordination with local and international academic institutions.
	LaNN	LaNN is the Research Laboratory for Nano-fabrication and Nano-devices based on nano-lithography. LaNN objective is to to create a nanofabrication and nanoscience centre, to promote the application of nanotechnology in the industry.

Technological district	Case history project or initiative	Brief Description
	Ultrasensitive piezoelectric fabric	It consists of fibres of piezoelectric polymers, made thanks to a special method of 'nano-spinning' by researchers of CnrNano of Lecce and leads to predict a variety of applications, from self-powered devices to interfaces of future humanoid robots.
Torino Wireless	E-wine, tracing the bottle	Wine bottles are provided with a electronic ID card, made by a simple adhesive label with a 2-dimensional bar code or standard QR, able to host and to transmit to consumers, distributors, restaurateur, numerous and more complete information on the wine within the bottle.
	Trace cheese	The project has created a technological solution of traceability for the dairy industry, by nature poorly oriented to technological innovation, consisting in a sort of electronic identity card for alpine pasture cheeses that allow to access to the information of traceability of the cheese inside of a management system by reading an RFID tag from mobile and fixed locations (totem).

Another initiative that is currently on-going is the one proposed by the MiSE (the Ministry of the Economic Development) under the name of National Innovation Fund (FNI)
FNI was created in 2012 to facilitate the financing of innovative projects based on the exploitation of industrial designs and patterns.
The FNI is a tool designed to address the challenges that the current economic scenario poses to small and medium enterprises: difficulties in accessing bank loans and risk capital for innovation in the absence of guarantees and the need to have mechanisms evaluating innovation valid and recognized by all market operators. The FNI offers shared operational solutions with all the actors of the innovation processes (financial intermediaries, firms and public research sector) both to evaluate the innovation and to create financial instruments that take advantage of the risk-sharing by the public sector and are built around the needs of SMEs safe for the market and society.
The financial resources of the fund amount to € 80 million arising from the payment of fees for the continued life of the patents assigned to the Ministry of Economic Development (MiSE) with the objective of strengthening the competitiveness of Italian SMEs making them take full advantage of the system of industrial property.
The Fund has two lines of activity: one dedicated to venture capital or investment capital companies (for patents) and one dedicated to debt financing (for patents and design). Its activation is divided into two phases:

- identification of the financial intermediary that makes the instrument through a public tender;
- opening of the financial instrument to companies.

Beneficiaries of the FNI are SMEs wishing to bring to market innovative products developed on the basis of patents or designs. To bank loans can also be accessed via network contracts aimed at the economic exploitation of patents or designs.
In this case also a company not directly owning a patent or a design but participating in a contract network dedicated to the economic exploitation of a patent or a design can benefit from the funds of the FNI.

Italy is also addressing various cross-cutting research issues considered crucial for enhancing economic growth, e.g. research on the natural and cultural heritage and on the complex systems of smart cities.
Finally the government provides a number of incentives for renewable energy production. The Energy Account (Conto Energia) initiative promotes solar photovoltaic, and a Kyoto Fund was set up to finance measures to reduce greenhouse gas emissions. Green Certificates (CV) promote electrical energy produced from renewable sources and White Certificates – energy efficiency labels (TEE) – encourage energy-saving measures. A package of fiscal incentives for energy efficiency interventions in existing and new buildings was approved by Parliament in 2011.

Table 1: Classification of policy measures and Italian examples

A. Policies for knowledge base support	**B. Policies for commercialisation support**
1. Instruments to encourage applied research (e.g. R&D tax credits, public funding, venture capital) 2. Instruments for strengthening co-operation among stakeholders and disciplines (e.g. specifically founded transfer agencies/platforms, staff exchange programs between research and private businesses, public research agencies) 3. Instruments in favor of projects from start-ups in areas of high and medium-high technology (Fund for technological innovation under the 46/82 Law) 4. Instruments to encourage the access to credit and the financial market (Fund for the corporate finance to rationalize the	1. Instruments to build up technological capabilities for the industry (e.g. subsidies, tax concessions for investments) 2. Instruments to encourage the collaboration between public and industrial research. (e .g. visit programs, funding of collaborative projects, Organization of best practice contests) 3. Instruments to build up collaborative commercialisation networks (e.g Business network funds)

functioning of the public guarantee funds and participation in venture capital, with the aim of facilitating businesses to access credit and the financial markets.) 5. Instruments for R&D infrastructure (e.g PON Research: loans for purchase of infrastructure and equipment for scientific and technological labs)	
C. Demand oriented polices 1. Public procurement (e.g. procurement of innovative goods, R&D procurement) 2. Support of private demand (e.g. Support to communication initiatives, Subsidies for the use of new technologies, voucher schemes) 3. Standardization 4. 3.4. Support to specific industrial sectors (e.g. FIT - REACH: experimental development programs to eliminate chemicals; PON Research :creation of districts for high technology and public-private –initiative; POI Energia :Grant for production of electricity from renewable sources)	**D. Legislation** 1. Deregulation activities 2. Procurement directives for public institutions to stimulate demand

In Italy, access to funding is a major concern; during the past year, the situation is even worse. Enterprises - especially the medium and small - must face tighter credit conditions.
At the same time, for the first half of 2012 banks report a dramatic decrease in credit requests made by enterprises, the cause is due to the general slowdown in the economy and in the lean growth prospects.
Consequently, according to the Bank of Italy, loans to non-financial companies decreased significantly in December 2011 and then again between March and July of 2012.
The Central Guarantee Fund for SMEs is the main public instrument designed to support businesses in this area and in recent years has been an increase in the number of applications (especially for the liquidity needs of SMEs rather than for investment); it was refinanced and it has been expanded.

As for the Public Administration, a serious problem in Italy are late payments; the average time for payments is one of the longest of the EU and the amount of commercial debt currently fluctuates, according to estimates, between 60 and 80 billion EUR. In late May of 2012 was introduced, with specific ministerial decrees, a mechanism that certifies claims against the government and allows offsetting tax debts.
In addition, access by enterprises to finance for research and development is strongly influenced by long waiting times and decision-making, where the body responsible spent nine months between the submission of the proposal and the (possible) acceptance.
The bureaucracy is very heavy, especially in the case of amendment of the contract. It is not uncommon to receive the Grant Agreement ("Decreto di Concessione") after a few years and having to wait any longer to receive the first tranche of funding.

2. Business perspective

The relevance of KETs for the national Italian industry is evident: According to AIRI report, KETs contributes to all industrial sectors and in the majority of priority technologies, with a cross-cutting impact on the value chain of various applications and products.
There are drivers and challenges shared amongst sectors and technologies, in close relationship with the priority set in Horizon 2020:

- Competitiveness: R&I as a leverage for industry growth;
- Responsible Research and Innovation: priority to societal issues, responsibility, safety and regulation;
- Sustainability: quality, efficiency, environmental aspects, reducing the use of non renewable resources, recycling.

Concerning the stage of maturity of the KETs identified in that report, the situation is diversified: some have a strong innovation potential in the medium or long-term (often promising real technological breakthrough), while others are already in a demonstration or market phase.

These results underlines the need for a coordinated and synergic approach on KETs amongst national stakeholders, in order to appraise strengths and opportunities and allow comparing and interacting with EU initiatives in the most structured and efficient way.
Moreover, cooperation between public and private research is essential to foster technology transfer and intellectual property appraisal on KETs, and moving from the lab to the market.
In conclusion:

- The national industry has a relevant activity in the technology domains (KETs) identified as a priority for industrial growth at European level (Horizon 2020);
- Public-private cooperation is instrumental for KETs development, both on R&D and on sustainability and responsibility aspects;
- Coordination amongst the national stakeholders and with EU initiatives on KETs is a short term priority;
- The different stage of maturity of KETs might ask for different development and cooperation approaches and models;

The Italian Association for Industrial Research, within its scope and mission, is in charge to promote and foster these initiatives.

2.1. Implementation of multi-KETs pilot lines

Main success factors that can help the implementation of a pilot activity, identified during the interviews are: the possibility to patent production process and/or equipments expressly designed or if already secured, the proprietary IPR.
Trusted partners if working in a JV and solid cooperation is a key element. Another key aspect is reliable and high quality human capital capable of managing highly innovative projects from an innovation, engineering and commercialisation perspective.
Projects based on technologies that are developed with a market oriented perspective (reduce time to market and increase interest of potential users already in the testing piloting phase) might accelerate the process of implementation of a pilot activity.
Already known great performances of the product can be a driver.
In case of pilot lines dedicated to a more than one product, the efficiency and the ability of the equipment to be recalibrated according to the current needs can help a lot the success of a pilot line.
Also preliminary activities such as CFD simulations can be very useful because they enable to predict the behaviour of the prototype thus providing objective evidence to perform the detailed design.

Main barriers faced for the implementation of the pilot lines are: the creation of internal protocol for the passage from the laboratory scale up to the real scale pre-industrial line, the design and the construction of

particular equipment, the initial investments needed, and the high risks in developing new technologies and processes and in identifying the best location in terms of feedstock supply.
Main problems to be faced will be the commercialization of the products, since it implies a deep cultural change in the customers' mind. For market penetration incentive measures for the "last mile" are needed, market competition from the competitors on the customer, usually unfair: dumping, corruption, defamation; and finally cultural barriers on the acceptance of the new products.
There is the need to convince people that the technology is really feasible when it represents a novelty in the field: players are sceptical towards newcomers in the same field.
Other barriers more of a legislative nature are the lack of public support dedicated to leverage the deployment phase of new processes and technologies.
Pre commercialization barriers are related to acquisition of certifications, labels and standards for the medical application, where appropriate.
In case of shared facilities a barrier could be represented by the need to facilitate the requests of production of the companies involved in the pilot line management. Specific rules have to be set for the day to day operation and for the management of the unexpected critical requests.

Usually during the implementation of a pilot line, drivers can be differentiate in two different typologies: internal drivers and external drivers.
Internal drivers are those derived from internal issues like for examples needs to lower production cost, needs to develop innovative products or innovative functionalities, integration with new technologies functional to the development of a current product, a good idea, etc.
External drivers on the other hand, are derived from the external environment, like the demand for a specific product or for specific features, the need of reduce the environmental impact due to worsening of the legislation or for advertising reasons, etc.

As general remark excellence of partnership is the key and the priority. Excellence is needed to achieve the maximum results.
The concept of proximity is in any case related to logistic and accessibility and not in the strict sense of distance.
Proximity can however be a significant critical factor when considering feedstock suppliers.
Suppliers selected for mere vicinity are the spare parts suppliers for obvious reasons.

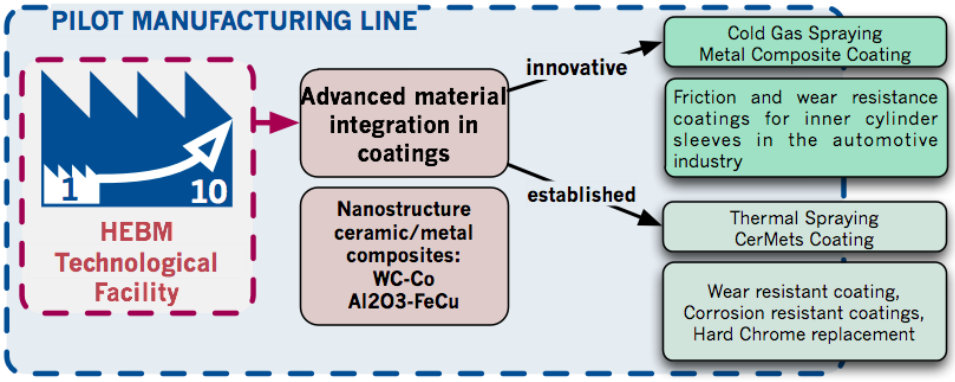
Usually pilot activities are not shared in order to keep the competitive advantage of a company.
In case of sharing two are the options that can be proposed: sharing of secondary facilities like laboratory, testing equipment, usually group in shared research centres or used by company that can also support on research specific topics concerning the pilot line (thus not the core of the invention/pilot line); and in case the companies that share the pilot lines have complementary products, know how or different sectors of application.

In the table below, some examples of Italian pilot lines are reported.

Synthesis of nano-materials (metal oxides) starting from nano-suspensions, through microwave. KETs involved: nanotechnologies, advanced materials and advanced manufacturing. The nano-materials extracted is then used for the creation of a 3D inorganic polymer for drug delivery. The second line has a current TRL equal to 7, although the production rate is 1000 kg/ton. The main feature of this line is the use of microwave for the extraction of the nano-powders. The process is in continuous operation. The equipment developed for the main operation (microwave) is patented by the company. Both lines set-up starts in 2004, they employ globally 2 employee that take care of both indifferently. Both lines have a very high level of automation.
Production of nanopowders for tribological surfaces KETs involved: Nanotechnology, Advanced Material, Advanced Manufacturing. The pilot line concerns the production of nanopowders for tribological surfaces (tungsten carbides), the TRL is

currently 6/7 and the production is about 4 ton/year.
MBN Nanomaterialia has outlined a Pilot line that would bring in the market new advanced coating by means of:

- Increase productivity of High Energy Ball Milling plant, a solid state process technology
- Production of nanostructured cermet materials in powder form
- Integration in coatings by standard thermal spray and advanced techniques as Cold Gas Spraying



The Pilot line should lead to a cost efficient production of surfaces with improved wear resistance both in abrasion (WC-Co) and in fretting (FAC-Al) conditions compared to current commercial solutions. Up to 3 times increased wear duration has been measured against best performing hard facing benchmark for WC-Co variants by thermal spray. In the same wear conditions it has been shown that metal composite FAC-Al is performing at the 60-70% (wear depths) of WC-Co while having an improved toughness.

Innovative optical sensors

KETs involved: Micro- & Nano-electronics, Advanced materials, Photonics, Advanced manufacturing

The Pilot line is in Avezzano, for the development of innovative optical sensors, CMOS. The line of Avezzano has been very recently sold to Landshut Foundry, a German silicon foundry. It was mainly a production line for CMOS imagers, but they are now participating in the ENIAC call 9 for KET Pilot Line, for an upgrading as Pilot Line for advanced CMOS sensors for medical purposes.

Initial investment is the main barrier faced during implementation: 1 billion euro needed for the pilot lines, due to the very high cost of the single production machine. The most expensive piece of equipment, a 193nm immersion stepper for lithography can cost up to 45 million euro.

Production of bio BDO

KETs involved: industrial biotechnologies, advanced manufacturing systems

The pilot plant investment of around 50 million euro was dedicated to the build up of a first of a kind flagship plant for the production of bio BDO through fermentation in the framework of a Joint Venture with Genomatica.

The project started in 2012 and demonstration test are ongoing. The expected capacity will be of around 20.000 kt/y, foreseen for 2014.

For what concerns bio based products market pull measures are an essential element capable of triggering the growth of niche sectors and products with low environmental impact. Example like the bio preferred programme in the US shows how market penetration can be achieved without distortion effects.

Laser diode assembly

KETs involved: advanced manufacturing system, new material, photonics and micro/nano electronics

IThe pilot line concerns aser diode assembly with particular interest on diode laser packaging.. Diode laser today has a market price of about 20 $ per watt, and despite the huge market perspectives, the device is very expensive in terms of manufacturing costs.

Main challenge is to embrace elements of flexibility and reconfigurability to match the increasing variety and complexity of diode product family. These features severely increase the production equipment complexity and the risk to reduce the production throughput.

The estimated volume of global investment is 40 Meuro.
Flexible and modular waterbags KETs involved: photonics, advanced manufacturing and nano-technologies. The pilot line concerns fabrication of high strength and watertight zip fasteners and the following assembly of flexible, modular waterbags based on coated textile and sensorized with a fibre optic monitoring system. Waterbags are used to transport bulk quantities of fresh water across the sea to supply islands and coastal municipalities through the use of tugboats. The pilot line is still in its conceptual phase; implementation its foreseen for late 2014 / early 2015. The volume of the investments is still not know, currently partners are investigating the size needed for the implementation of the pilot. Market release is expected for half of 2015. The manufacturing of the final product has been already demonstrated within a research project with the manufacturing of a medium scale prototype. There is the need to convince people that the technology is really feasible, because it represents a novelty in the field. Players are sceptical towards newcomers in the maritime field (none of the partners belong to the maritime environment).

2.2. Evaluation of KET policies/KET innovation eco-System

In Italy, most of State funds allocated for R&D investments remain within the public sphere of research.
Despite the overall system is moving towards a pattern based on the integration with EU research policy and integration of research and innovation with economic policies the main current public funding mechanisms are not changed deeply from previous years.
The recent revision of the public funding established by the DL 83 L134/2012, the introduction of new procedures of ex post evaluation and the earmarking of resources for young researchers may improve accessibility and quality of the R&I public funding.
88% of the government funding is addressed towards Higher Education Institutions Public Research institutions, leaving to business enterprises and non profit organizations only 8% and 2% of the total.
Competitive funding and institutional funding are the main channels for transferring resources to HEs and PROs. The policy of funding is addressed mainly to thematic\targeted projects with a rising relevance of transnational and indirect funding.
The distribution of the R&D funded by industry by sector of performance is a peculiar feature of the Italian scientific and innovative system. The weight of industry is absolutely prevalent and this may suggest a low propensity of the business sector to commit resources for the collaboration with public science. Such a situation is one of the causes of the well-known lack of cooperation between public research and the industrial sector.

The theme of the research results' valorisation is central in any political debate on competitiveness and in the last ten years universities became more proactive in IP management and knowledge transfer activities. For the inventions realised within the public institutions there are two regimes: if the inventions is realised with funding of the same institution the owner can be the inventor, in all the other cases the ownership goes to the public institutions. The technology transfer system put in motion by the university system in 2002 has started to exhibit some progress: the number and the qualification of the personnel working in the technology transfer offices have increased.
The 2011-2013 National Research Programme foresees several interventions to encourage technology transfer such as to implement the technology districts; to intensify cooperation and favour the creation of public-private partnerships to carry out large research and innovation projects (the industrial innovation projects of Industria 2015); the public-private laboratories foreseen in the 2005-2007 National Research Programme; the creation of clusters in order to reach critical mass, especially at regional level, taking advantage of the existing regional competences and 'excellences`'(high technology poles, centres of competence).

Universities favour the generation of spin-offs as a tool for technological transfer, provided that their activities be separate from and non competitive with the researchers' activities within their own university. Besides, FAR funds research projects that will generate spin-offs e start-ups. Firms' incubators are then set up to facilitate and promote the development of innovative SMEs coming from the academic milieu. No recent data on spin offs is available.

3. Conclusions

3.1. Summary of policy perspective

In Italy there are still no policies strictly dedicated to implementation of pilot lines or concerning a specific topic of the KETs or multi-KETs, although the relevance of KETs for the national Italian industry is evident.
Companies get fund for these type of activities through EU work programme or through national generic calls.
Currently AIRI is introducing in Italy the concept of Key Enabling Technologies but it is still in its infancy stage.

3.2. Summary of business perspective

Main success factors are derived from the preliminary work to be done before starting the set up of a pilot line (IPR management, research activities, expected quality of the product, ...).
Most important barriers are related to (pre-)commercialization such as standards, market penetration, cultural point of view of customers, etc. Technological barriers can be present and frequent but at the same time can be easily resolved.
Usually during the implementation of a pilot line, drivers can be differentiate in two different typologies: internal drivers and external drivers.
Excellence of partnership is fundamental to achieve the maximum results. The concept of proximity is in any case related to logistic and accessibility and not in the strict sense of distance.
There is not a specific point of view for facilities sharing.

3.3. Recommendations to support pilot lines

According to the interview performed and the experience of the interviewed, the following measures, coordination mechanisms and targets could realistically be proposed for Horizon 2020

- a creation of a “free zone” in which you can move or establish production or research facilities; it could raise the industry competitiveness, thanks to the lower amount of taxes to be paid and e.g. the exclusion of the VAT taxes;
- tax credit is seen as one of the best policy measure for pre-production pilot lines;
- loosening of DG-Competition policies that regulate the funding and the timeline without taking into account the difference among the sectors and their specificity in terms of time-to-market and amount of funds needed. The true competition should be seen not within EU countries but against China, Japan, Korea or US. Of course this limit is only theoretical in Italy, because no national funding is available, but impacts other European countries with a stronger industrial policy.
- Funding measures on technology development. On one side the Commission is launching new Pilot Lines initiatives that want to be close to applications, and therefore hardly support any technology development. On the other side the allocation of money in Horizon 2020 is privileging the Excellent Science program, which appears to be self-referential and with no link to downstream applications. What is in between seems to be largely uncovered.
- To privilege the medium enterprise (focus on specific requests, labels, financing), in which the technical management owns also the industrial view needed to be leading motor for the innovation
- Set up of key recommendation aimed at leveraging the synergy between the industrial leadership, pillar of Horizon 2020 and pillar dedicated to societal challenges. This could be developed within the KETs debate and within the High Level Group.
- Strengthen more the link between KETs and markets with a systemic and holistic approach which sometimes is missing.
- The role of PPP can become key in light of Horizon in enabling an EU approach to innovation that is market driven, consistent and aligned with the efforts undertaken by the private sectors with the aim to maximise the impact of research and innovation at EU level.

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