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ERAWATCH COUNTRY REPORTS 2010: Italy

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The opinions expressed are those of the authors only and should not be considered as representative of the European Commission's official position.

Executive Summary

The country has R&D expenditure underdeveloped when compared with its economic profile. In 2009 GERD/GDP is 2.01 for EU-27 while only 1.27 for Italy. The HERD, R&D performed by Higher education sector as percentage of GDP is 0.48% in Italy, while 0.4% in EU-27 and GOVERD/ GDP is 0.18% in Italy compared to the European average of 0.27%¹.

The present policy mix is facing some of the national system weakness. What is to be remarked is that Italy is far away from the Lisbon target and that a strong pro active government behaviour is asked, including an efficient implementation of the measures (availability of resources, less time gap between demand and fund allocation), continuity of policy and revision based on a systemic (regular, interesting institutions and projects and open to evaluate the effect of measures devoted to similar aims) evaluation. Two specific aspects can be underlined: the coordination between the Ministry for University and Research and the Ministry of Economic Development needs to be improved, for overcoming the traditional separation of the national system between research and innovation; the Structural Funds play a key role in the present policy mix, and a good monitoring of their use towards more R&D based initiatives needs to be assured. A new and more structured interest for the financial institutions' role in R&D activities has emerged and this shows a cultural change in the national policy making. The national R&D system needs to be pushed out of its simple reproduction; a modernisation of the national productive and technological specialisation needs a larger contribution and the SMEs, which innovate mostly in process, need to be re oriented towards product and R&D based innovation.

Knowledge triangle

The effectiveness of the knowledge triangle can be assessed following the recent policy changes in Italy and their strength and weaknesses.

Effectiveness of knowledge triangle policies

	Recent policy changes	Assessment of strengths and weaknesses
Research policy ²	<ul style="list-style-type: none"> • 2010-2012 NPR sustains basic research and upgrading of research oriented to socio economic application, at medium and short term. Particular attention is devoted to enabling technologies and their diffusion within industrial innovation programmes. An increasing orientation towards targeted and mission oriented programmes characterises the R&D policy. • There is also an emerging attention and support to new technology based firms. 	<ul style="list-style-type: none"> • All these changes go in the right direction of supporting a structural change of national economy. The problem is their implementation: lack of resources or of application rules can make this policy a wishful thinking. At present there isn't an attribution of resources to the planned interventions. • At present only the Fund for the Competitiveness is operative. The problem is the implementation of the policy instruments (time, continuity, resources).

¹ <http://appsso.Eurostat.ec.europa.eu/-Eurostat-Data>

² Research policy – Policies designed for funding public research organisations and programmes, including the stimulation of science-industry linkages

	Recent policy changes	Assessment of strengths and weaknesses
Research policy	<ul style="list-style-type: none"> • A simplification and a coordination of governance have been pursued through the unification of different funds and measures. • The 2010-2012 NPR envisages concentrating resources of PON Research and competitiveness on a small number of large interventions, where public and private actors could operate with shared objectives. • In recent years, the system has witnessed a shift from direct support mechanisms based on grants and loans to indirect support, mostly based on tax incentives to R&D. 	<ul style="list-style-type: none"> • 2007-2013 QSN recommends a linkage between the development policy and the R&D and innovation policy, a relevant aspect, since a high bulk of resources in Italy is devoted to Mezzogiorno and underdeveloped areas. But it should be necessary a regular policy of coaching and monitoring of instrument application. The Agency for Innovation should have to develop this task. • Fiscal incentive has been designed to help SMEs in doing more research activity, but this instrument has some drawbacks (it works well for firms doing regular R&D and has a small effect on the R&D level).
Innovation policy ³	<ul style="list-style-type: none"> • Development of innovative industrial sectors through complex, integrated systems such as Technological Districts (now 29 TD have been formally recognised), Excellence Poles and National Technological Platforms. • Technological transfer activity through the support to technology transfer offices within research poles or the restructuring of firm incubators. • The support to the creation of new high tech firms, as a spin off process from academic research (L. 297/99). 	<ul style="list-style-type: none"> • The relation between Universities and local initiatives such as technology parks, which are partly transforming in Excellence Poles, or incubators (where the gap between knowledge supply and demand can be matched) is still not enough developed. The new University transfer policy can be too less oriented towards the needs of SMEs. The scarce differentiation of University in Italy can reduce linkages with local productive demand. (2010-2012) NPR envisages the need of evaluating the experience done with the operating Technological Districts. • The decreasing resources for universities have created problems of personnel shortage also to TTOs.
Education policy ⁴	<ul style="list-style-type: none"> • To improve the education performance the Law 1/2009 includes measures finalised to rationalise tertiary courses, and special incentives for the setting up doctoral schools that are supposed to better the quality and effectiveness of the training for research. 	<ul style="list-style-type: none"> • Factor of weakness is the decreasing trend followed by the resources mobilisation for University research activities in 2000s; there are not yet clear estimations of resource savings neither indication of priority actions, while cuts of resources are already in place. Law 1/2009 introduced a limitation of the possibility of Universities to decide positions to be opened using the resources made available through the turn-over. • There are low career perspectives for researchers and for attracting foreign scholar.
Other policies ⁵	No other policy exists.	

³ Innovation policy: The finance available for innovative business activities; Public procurement and other demand-side policies; Intellectual property registration and protection

⁴ Education policy: policies which affect the labor supply for science, technology and research oriented jobs

European Research Area

The awareness about ERA issues is growing up in Italy. It goes with the reinforcement of the importance given in the policy documents to the internationalisation of research, to the promotion of young brilliant researchers, to the pursuing of excellence of institutions and programmes as well as to the mobility of people around Europe.

The traditional low investment of Italy in R&D, the financial crisis and the lack of adequate funding resources to sustain the reform process toward a more integration of labour market, research infrastructures, research institutions and national programmes, represent strong barriers for the realisation of ERA policies.

Because the economic crisis does not allow substantial mobilisation of resources, Italian government intends to face these constraints through policies mainly aimed at making the system more efficient and effective. Policies will aim at keeping resources to invest through eliminating inefficiencies, avoiding duplication of research effort, as well as to concentrate resources on the most promising initiative in terms of integration at European level. Nevertheless the weak monitoring systems as well as the scarce co-ordination between different Ministries are factors that can inhibit the achievement of good results.

Assessment of the national policies/measures supporting the strategic ERA objectives (derived from ERA 2020 Vision)

	ERA objectives	Main national policy changes	Assessment of national strengths and weaknesses
1	Ensure an adequate supply of human resources for research and an open, attractive and competitive single European labour market for male and female researchers	<ul style="list-style-type: none"> Extraordinary plan for recruitment of researchers at an early stage of career in both Universities and public research institutions was foreseen in the 2009 budget law. 	<ul style="list-style-type: none"> The supply for science and engineering is not adequate and in some fields the training do not match the market demand. Overall low attractive working conditions for researchers, low salaries, difficulties to gain permanent positions, scarce relevance of merit; however the social security protection, including maternity leave is guaranteed.
2	Increase public support for research	<ul style="list-style-type: none"> Public budget for research was reduced due to the general cut to the public expenditures. 	<ul style="list-style-type: none"> Overall, low levels of R&D expenditure, strongly affected by the crisis.
3	Increase European coordination and integration of research funding	<ul style="list-style-type: none"> FIRST should coordinate a range of instruments among MIUR, Ministry of Economic Development and Ministry of Public Administration and Innovation. 	<ul style="list-style-type: none"> The reunification into a single framework-FIRST of the national project funding scheme should ease the coordination of national objectives with the European level. FIRST is still to be implemented.

⁵ Other policies: refer to policies having an influence on innovation, research or education policy'; supportive framework conditions: the business framework, product market regulation and labor market legislation, social, regional policies, defence, health and environment etc.

	ERA objectives	Main national policy changes	Assessment of national strengths and weaknesses
4	Enhance research capacity across Europe	<ul style="list-style-type: none"> No relevant policy change. 	<ul style="list-style-type: none"> Capability of the research base to participate in FP programmes is good as well as the participation in COST actions, ERA-NETs, and joint programmes. Low mobility and openness of the researchers' labour market, and lack of open programmes.
5	Develop world-class research infrastructures (including e-infrastructures) and ensure access to them	<ul style="list-style-type: none"> Starting the development of the national Roadmap for RIs. 	<ul style="list-style-type: none"> Good participation and access to RIs. Difficulties to enlarge the base of RIs (development and access) for the lack of available resources.
6	Strengthen research institutions, including notably universities	<ul style="list-style-type: none"> Law 1/2009 includes measures to favour the recruitment of young researchers in Universities; to support Universities showing good performance in terms of research and teaching performance through a more effective use of the formula funding; to foreseen parameters for the evaluation of professors and researchers; to rationalize tertiary courses, to set special incentives the setting up doctoral schools. A DDL for reforming the University was presented by the Government. The government decree reforming the PROs under the MIUR supervision passed (D.lgs 213/2009). 	<ul style="list-style-type: none"> The law had a positive impact in terms of making universities aware about the need to rationalise their costs and improve the merit of research and teaching performance. The excessive cut of resources and the lack of evaluation might become a strong constraint for introducing changes within universities. The new reform of the University should modify the internal governance and the recruitment rules, but it is still under examination. The effects of the PROs reform are not yet visible. No dedicated resources are available for supporting the changes in the governance and the multiyear planning.
7	Improve framework conditions for private investment in R&D	<ul style="list-style-type: none"> Some recent initiatives include a government's allocation of €210m for research and innovation in the energy sector, an e-government plan 'E-gov 2012' launched in January 2009, the launch of several FIT calls and the launch of the new regional framework 2007-13 (QSN). 	<ul style="list-style-type: none"> Weak aspects are the time for resource allocation and the effective availability of the resources along the years.

	ERA objectives	Main national policy changes	Assessment of national strengths and weaknesses
8	Promote public-private cooperation and knowledge transfer	<ul style="list-style-type: none"> • PON Research and Competitiveness, based on the Agreements of the Framework Programme (QSN) between Ob1 regions and the Ministry for University and Research. The 2010-2012 NPR envisages concentrating resources on a small number of large interventions, where public and private actors could operate with shared objectives. 	<ul style="list-style-type: none"> • The existing separation between the transfer policy of public research institutions based on patents and the SMEs demand might inhibit the impact of public-private cooperation. • The absorptive capacity of SMEs should be further improved.
9	Enhance knowledge circulation across Europe and beyond	<ul style="list-style-type: none"> • No relevant changes. The re-organisation of the incentive system put a special attention to financially support (automatic fiscal measures) SMEs which collaborate or commit research activity to scientific institutions; hire qualified research personnel and their attendance to PhD courses. 	<ul style="list-style-type: none"> • Large interest of SMEs on the new measures: the demand for fiscal support has been higher than the resources availability. • Despite the proliferation of initiatives, the dialogue between research and industry is still not satisfactory.
10	Strengthen international cooperation in science and technology and the role and attractiveness of European research in the world	<ul style="list-style-type: none"> • 2010-2012 NPR recognizes the need of strengthening international cooperation in science and technology in Europe. 	<ul style="list-style-type: none"> • NPR is still in a draft form, and it does not foreseen specific actions with a related budget.
11	Jointly design and coordinate policies across policy levels and policy areas, notably within the knowledge triangle	<ul style="list-style-type: none"> • More coordination between the Ministry for Research and the Ministry of Economic Development. 	<ul style="list-style-type: none"> • The overall research policy framework has a better coordination through the NPR. • Research and innovation policies still need to improve the integration of the actions foreseen; moreover coordination with educational policies at tertiary and secondary level as well should be pursued.
12	Develop and sustain excellence and overall quality of European research	<ul style="list-style-type: none"> • Evaluation is supposed to be a major instrument for pursuing excellence. • ANVUR and VQR, QA and new rules for the accreditation of University courses are actions foreseen. 	<ul style="list-style-type: none"> • The implementation of the policy measures is very low and the retards of VQR impact of the effectiveness of the University law 2009/1.
13	Promote structural change and specialisation towards a more knowledge - intensive economy	<ul style="list-style-type: none"> • No recent policy changes. 	<ul style="list-style-type: none"> • The number of graduates and PhDs is still low. The number of researchers on labour force and on total population is one of the lowest in Europe.

	ERA objectives	Main national policy changes	Assessment of national strengths and weaknesses
14	Mobilise research to address major societal challenges and contribute to sustainable development	<ul style="list-style-type: none"> • NPR foreseen actions to address the major societal challenges in the light of ERA 2020 vision. 	<ul style="list-style-type: none"> • NPR presents a clear planning of actions but it does not include the indication of a dedicated budget for the actions' implementation.
15	Build mutual trust between science and society and strengthen scientific evidence for policy making	<ul style="list-style-type: none"> • Enhancing accountability is a major policy aim to be implemented through the ANVUR activities. Meantime a five years evaluation exercise of Universities and PROs was launched by the MIUR (VQR). 	<ul style="list-style-type: none"> • ANVUR is not yet implemented, VQR was launched (Decree 8 march 2010) but the implementation has been stopped before the setting of the Scientific Panels.

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1 Introduction

The main objective of the ERAWATCH Analytical Country Reports 2010 is to characterise and assess the evolution of the national policy mixes in the perspective of the Lisbon goals and of the 2020, post-Lisbon Strategy. The assessment will focus on the national R&D investments targets, the efficiency and effectiveness of national policies and investments into R&D, the articulation between research, education and innovation, and on the realisation and better governance of ERA. In doing this, the 15 objectives of the ERA 2020 are articulated.

The report builds on the 2009 report streamlining the structure and updating the 2009 policy assessment in the domains of human resource mobilisation, knowledge demand, knowledge production and science-industry knowledge circulation. The information related to the four ERA pillars covered in the 2009 report is also updated and it is extended in order to cover all six ERA pillars and address the corresponding objectives derived from ERA 2020 Vision.

Given the latest developments, the 2010 Country Report has a stronger focus on the link between research and innovation, reflecting the increased focus of innovation in the policy agenda. The report is not aimed to cover innovation per se, but rather the '**interlinkage**' between research and innovation, in terms of their wider governance and policy mix.

2 Performance of the national research and innovation system and assessment of recent policy changes

The aim of this chapter is to assess the performance of the national research system, the '**interlinkages**' between research and innovation systems, in terms of their wider governance and policy and the changes that have occurred in 2009 and 2010 in national policy mixes in the perspective of the Lisbon goals. The analysis builds upon elements in the ERAWATCH Country Report 2009, by updating and extending the 2009 policy assessment in the domains of resource mobilisation, knowledge demand, knowledge production and science-industry knowledge circulation. Each section identifies the main societal challenges addressed by the national research and innovation system and assesses the policy measures that address these challenges. The relevant objectives derived from ERA 2020 Vision are articulated in the assessment.

2.1 Structure of the national research and innovation system and its governance

This section gives the main characteristics of the structure of the national research and innovation systems, in terms of their wider governance.

Main actors and institutions in research governance

In Italy the Ministry for Education University and Research⁶ (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 (R&D) funding. MIUR coordinates the preparation of the triennial National Research Programme (NRP), the main governmental document for R&D planning that sets the strategic lines for the national system. It does this by interacting with all other interested stakeholders, including other Ministries. Since 2007 MIUR has been included in the Inter-ministerial Committee for Economic Planning (CIPE).

CIPE is the highest level of S&T policy coordination, especially competent on inter-sector and medium-term interventions; its role became more effective after a special section dedicated to research and education was created during the last decade. CIPE examines the document of economic and financial policy (DPEF). The document establishes strategic direction and priorities for scientific and technological research, financial resources and coordination among different public administrations, universities and research institutes. It includes the economic and financial measures for the following year, and is submitted by the Ministers' Cabinet to the Parliament each year.

The Ministry for Economic Development (previously called Ministry for Production Activities) supports and manages industrial innovation. In 2007 there was a reform of the Ministry, which is now organised in three Departments, corresponding to the Ministry's three missions: competitiveness promotion; development and cohesion; market regulation. The Department devoted to Competitiveness is in charge of technological innovation and responsible for industrial policy, industrial districts, energy policy, policies for SMEs and support instruments for the productive system. Moreover a new department with the mission of evaluating the support instruments managed by the Ministry has been set up at IPI (Institute for Industrial Promotion) which gives technical assistance to the Ministry.

Other Ministries (Health, Agriculture, etc.) manage research funding in their specific 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. There are ten PRO's acting in the Italian scenario with a major role, out of which the most significant are:

- The [National Research Council](#) (CNR), the main national research organisation working in all scientific disciplines, which acts both as research performer and funder (although its funding role has considerably diminished after 1989, when MIUR became the main actor in R&D).

⁶ After general political elections in April 2006, MIUR (Ministry for Education, University and Research) has been divided into two separate Ministries: the Ministry for University and Research (MIUR) and Ministry for Public Education. The new centre-right coalition merged again the two Ministries.

- The [National Agency for New Technologies, Energy and Environment](#) – ENEA -, operating in the fields of energy, the environment and new technologies to support national competitiveness and sustainable development.
- The [National Institute for Nuclear Physics](#) –INFN- dedicated to the study of the fundamental constituents of matter and conducting theoretical and experimental research in the fields of subnuclear, nuclear, and astroparticle physics. It manages large scale equipments and participates in CERN activities.
- The [Italian Space Agency](#) – ASI- in charge of coordinating all national efforts and investments in the space sector.

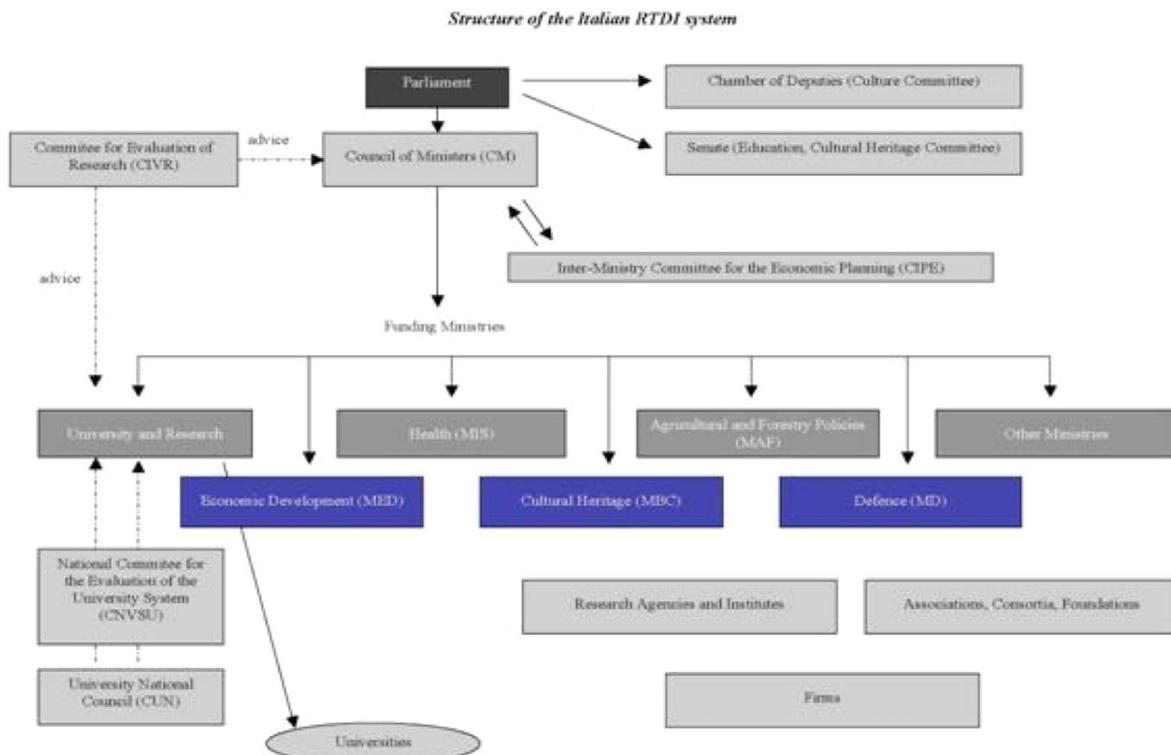
The national committee for the evaluation of the university system (CNVSU), belonging to MIUR, is an advisory body in charge of the evaluation of the university system; the committee for evaluation of research (CIVR) is an independent body in charge of the evaluation of research. CNVSU and CIVR committees will be replaced in their role and functions by a National Agency for the Evaluation of the University and Research (ANVUR), established by the 2007 Financial Law with a budget of €5m. The Agency's regulation and operational functioning have been recently defined by the Decree n.64/2008, but ANVUR is not yet operative. The regulation of the Agency structure and operational functioning has been endorsed by the Parliament and it is now published in the Official Journal the 27 of May 2010. The new Agency will evaluate efficiency and efficacy of the education activity; HE and public research organisations, masters, doctorate schools; quality and results of research projects. Meantime, the Decree n.8 of March 2010 launched the Five years evaluation exercise (VQR) for assessing the research performance of the Universities and Public research organisations (PROs) and of their Departments.

The evaluation of the large, strategic project will follow a procedure including the role of the Techno-Scientific Commission (CTS) established at MIUR.

A National Innovation Agency, foreseen in the 2006 Budget Law, has been officially set up in January 2008. Its role is to evaluate (*ex ante* and *in itinere*) the industrial innovation projects related to Industria 2015.

The 2010-2012 National Research Programme(NRP) introduces the creation of a new structure, a technical secretary of governance (ACR), coordinated by MIUR, with the scope of developing the coordination of the national research activity and the function of receiving and transmitting to the Ministry the demand coming from the scientific system and the institutions which finance R&D activities. These new structure should involve components from the State-Regions Committee and a group of Ministries (MIUR, MISE, Agriculture and Forest, Environment, Health, Cultural Heritage, Public Administration and Innovation). The ACR will implement priority actions and formulate a provisional budget for each area. The operational staff of ACR will be formed by personnel coming from public research organisations. ACR will be supported by Committees of Strategic Direction which will be defined by the same NRP in its definitive version and will include high qualified experts.

Figure 1: Overview of the governance structure of the Italian research system



Source: ERAWATCH Research Inventory

The main research Funds are FIRST, for scientific and industrial applied research (which includes different funding streams like for instance PRIN, FIRB and FAR) under the Ministry for Research and the Fund for Competitiveness, for development and innovation, under the Ministry of Economic Development.

The institutional role of regions in research governance

The division of competences between State and regions in the R&D field is based on the concurrency principle: both central and regional authorities can legislate, however a series of interventions are exclusive competence of the central State,

Three typologies of intervention can be identified:

- 1 Exclusively regional interventions, i.e. those mainly related to local development;
- 2 Exclusively state interventions, those related mainly to the support of universities and public research institutions, as well as to large strategic programmes and their coordination;
- 3 Some simultaneous responsibilities, in the area of regional interventions with larger scope (such as technological districts).

Co-ordination between State and regional policy activities is ensured through the work of a permanent State-Regions committee.

Regional policy at national level, including R&D activities as critical component (horizontal measures for competitiveness), are additional to ordinary budget and consists of co-funding of structural funds (national and regional operational programmes, PONs and PORs) and a fund for under-exploited areas, FAS (recently

included by the 2007 Financial Law within a new larger “Fund for competitiveness and development”).

The National Strategic framework for the regional policy (QSN 2007-2013), which has been approved by CIPE in December 2006, is the product of a long process of interaction among central Administrations, Regions, other Local authorities and representatives of socio-economic stakeholders, followed by a formal negotiation with the European Commission (the QSN final version is of 12 June 2007). This regional policy governance includes actions of strategic coordination between State and Regions and activities of monitoring, evaluation and strategic reporting. One of the aims is to avoid effects of crowding out or competition between geographical areas or incentives.

Main research performer groups

Universities in Italy carries out a high share of national R&D activity, larger than the EU average (31.3% of total R&D national expenditure in 2009, while at EU-27 it is 23.68) (Eurostat, 2010). There are 89 universities in Italy, of which the majority is public (54 State universities). HE sector expenditure in 2009 was equal to approximately €6,048m. The Public research institutions share of the national R&D is decreased in the last years and it is 13.9% in 2009 similar to the EU-27 average (13.2%).

Italy traditionally faces the problem of low business R&D investment, highly concentrated in large firms. 82% of intramural R&D expenditure is made by enterprises with over 250 employees (ISTAT, 2006; updated data not available). The role of the large industrial groups is crucial for the innovative performance of the national system. The top six private Italian R&D investors are: Fiat, Finmeccanica, ENI, Enel, Pirelli and Telecom Italia. Since 2000, R&D activity of two liberalised ex monopolistic groups (Telecom and Enel) decrease. Some medium size groups show now an increasing R&D intensity (Mariotti et al., 2006). The percentage of the national R&D expenditure carried out by business enterprises is 50.36% in 2006, far from the EU-27 average (63.67), while R&D performed by HEIs is higher of about 10 points: 30.2 compared with 21.9 (EU-27).

2.2 Resource mobilisation

Since 2000, Europe has made evident progress towards ERA but at the same time it is clear that Europe's overall position in research has not improved, especially regarding R&D intensity, which remains too low. The lower R&D spending in the EU is mainly a result of lower levels of private investment. Europe needs to focus on the impact and composition of research spending and to improve the conditions for private sector R&D investments.

This section assesses the progress towards national R&D targets, with particular focus on private R&D and of recent policy measures and governance changes and the status of key existing measures, taking into account recent government budget data. The need for adequate human resources for R&D has been identified as a key challenge since the launch of the Lisbon Strategy in 2000. Hence, the assessment includes also the human resources for R&D. Main assessment criteria are the degree of compliance with national targets and the coherence of policy objectives and policy instruments.

2.2.1 Resource provision for research activities

Across the EU-27, GDP per capita averaged €25,100 in 2008. Italy recorded the same average GDP per capita in PPS terms as the EU-27 average in 2008, having been 20% above the EU-27 average ten years earlier. The labour productivity per hour worked diminished from 100 in 2000 to 89 in 2007 compared to the average European value (Europe=15, Eurostat 2010). The country has R&D expenditure underdeveloped when compared with its economic profile. In 2009 GERD/GDP is 2.01 for EU-27 while only 1.27 for Italy. The HERD, R&D performed by Higher education sector as% of GDP is 0.4% in Italy, similar to 0.48% in EU-27 and GOVERD/GDP is 0.18% in Italy compared to the European average of 0.27% (2009). The recession has also worsened the public finances. In 2008 the deficit began to grow again to 2.7% of GDP. Total revenue slowed sharply, while indirect tax receipts diminished. The ratio of the public debt to GDP rose (from 103.8 in 2007 to 103.5 in 2008), returning to its level at the end of 2005. Corporate self-financing continued to shrink, owing in part to the increase in net financial costs. Self-financing fell below 10% of value added the lowest ratio in 15 years. The reduction in self-financing was more pronounced than that in investment, so the borrowing requirement (defined as the difference between gross investment, including stocks, and self-financing) rose sharply, especially in the second half of 2009. In Italy there is a largely shared opinion that the competitive situation of the country is highly deteriorated, diagnosis from which started the National Research Plan (2005-2007) even before the recent economic crisis. Elements related to this diagnosis are mainly structural and in particular the weakness of the productive and technological specialisation of our country (traditional sectors and medium low technologies), which didn't change or worsened in recent years.

The National Research Programme (NRP) is the reference of the multiannual R/S national strategy, but NRP for the period 2010-2012 is still in a draft version at the end of 2010. NPR, starting from an analysis of the International context and of the Italian positioning, has defined its main macro-objectives: increase of the competitiveness in priority technological areas; quality and critical mass of public and private research; valorisation of human capital; realization of a national integrated system of R&D data collection and analysis; strengthening of public-private research collaborations; support to the creation and development of new high tech firms; promotion of R&D infrastructures and networks. To ensure a better efficacy of the instruments the NPR envisages regular checks on the working progress of activities.

The two main funds financing research activity are FIRST (Fund for Investments in Scientific and Technological activity) and Competitiveness Fund, which coordinate a range of instruments and should be sustained by a coordination among MIUR, Ministry of Economic Development and Ministry of Public Administration and Innovation. FIRST include mainly MIUR controlled instruments such as PRIN (Project of National Interest), FAR (Fund for Applied Research DL 297/99), FIRB (Fund for Basic Research- art 104 law 388/2000) and FAS (Fund for the Underdeveloped Areas-only for actions under the MIUR control). Together with instruments devoted to the fundamental research and knowledge progress, NPR sustains the upgrading of research oriented to socio economic application, at medium and short term. Particular attention is devoted to enabling technologies and their diffusion within industrial innovation programmes. Priority is recognised to six enabling (future human activity) technologies: genetic technologies, new material technologies, technologies related to energy, to brain activity, to information and to environment. The Industria

2015 programme of the Ministry of Economic Development is going to include some of these technological areas.

Other relevant areas to which 2010-2012 NPR envisages funding allocation (but for the moment a clear attribution of funds are not defined) are:

- Development of innovative industrial sectors through high tech firms incubators, close to Technological Districts or regional research centre with an international reputation;
- Technological transfer activity through the support to technology transfer offices within research poles or the restructuring of firm incubators;
- The support to the creation of new high tech firms, as a spin off process from academic research (L. 297/99);
- Complex, integrated systems such as Technological Districts (now 29 TD have been formally recognised), Excellence Poles and National Technological Platforms.

Mezzogiorno is another priority of the NPR and the main operational instrument is PON Research and Competitiveness, based on the Agreements of the Framework Programme (ACQ) between Ob1 regions and the Ministry for Education, University and Research. The NPR envisages concentrating resources on a small number of large interventions, where public and private actors could operate with shared objectives and characterised by international scientific quality.

Notwithstanding the priority, one of the main public interventions of the two last years (2008-2010) concerned a reallocation of funds devoted to the Underdeveloped Areas-FAS- and specifically 85% to Mezzogiorno and to the Centre-North of Italy. This reallocation has been characterised by: the use of part of the resources for stabilising the public debt; the reduction (to the half) of the resources devoted to the South, the use for current expenditures instead that for infrastructure investments.

Internationalisation represents another priority area within 2010-2012 NPR through the support to the participation at the European FP and ERA-NET projects.

The draft version of the 2010-2012 NRP does not include figures on the resource allocation by action, but the general aim is to increase the public investment in R&D from 0.56 5 to 0.65% of national GDP within the three years period, for reaching the European average level.

Public-private cooperation is a policy goal included in many different instruments, from the Fund for supporting Research (FAR), and in particular the Strategic Projects, to the Technological Districts, the Excellence Poles and the Technological Platforms. PP cooperation not well described.

Science and society initiatives mainly rest upon the annual Genoa Festival and the Science Week, which represent two major events for the public understanding and public participation of science and technology. A call for proposal under the law 6/2000 has been launched in 2010, for projects aimed at the diffusion of the scientific culture in mathematics, physics and natural sciences. The projects should be targeted for students of elementary, secondary and upper secondary schools. In the current year MIUR also launched a call for proposal for projects aimed at integrating disabled students in public schools and universities, according to the standard of the ICF-OMS Guidelines (International classification of functioning health and disease – Mondial Organisation of Health).

2.2.2 Evolution of national policy mix geared towards the national R&D investment targets

The R&D expenditures of business enterprises in Italy are far from the Lisbon objective. BERD/GDP is 1.25 for EU-27 and 0.65 for Italy in 2009; private funding of GERD represents 45.2% on the total gross expenditure in R&D in Italy, while for EU-27 the average value is 54.8% (2009). The highest level of GERD financed by firms (0.48) has been reached at the end of '90s (1997).

In terms of innovation performance, Italy is below the EU average and its relative position has not significantly improved over the past five years (the synthetic Innovation Index was 0.314 in 2004 and is 0.354 in 2008). According to the European Innovation Scoreboard (EIS), Italy positions itself in the group of 'moderate innovators', showing slow progress and registering a below-average annual growth rate (1.8 in 2008 vs. 2.3 EU average). Within these "moderate innovators" (Czech Republic, Greece, Hungary, Italy, Lithuania, Malta, Norway, Poland, Portugal, Slovakia and Spain) nine countries have managed to improve their performance faster than the EU-27, while the growth performance of Italy and Spain is among the weakest of all countries.

Since the summer 2008, when the crisis started to show its first negative signals on the world economy the government announced the adoption of several measures to sustain the national economy.

One of the measures contained in the anti-crisis decrees is the introduction of an anti-crisis export promotion plan with an overall allocation of €185m in 2009, managed by the Institute for Foreign Trade (ICE). New tax benefits have been granted to enterprises, with an allocation amounting to about €2,900m for the 2009-11 period. The benefits include tax exemptions for productivity contracts aimed at boosting labour productivity and deduction of 10% of the regional tax from company income tax and personal income tax. In January 2009 a refinancing of the Central Guarantee Fund for SMEs was put in place (€1.6b) and a State guarantee as a last-resort guarantee has been provided to this Fund.

The main policy lines of action followed by the current government can be summarised in the following points:

- To modernise and digitalise the public administration. For the current government, innovation is strongly linked to innovation in public administration sector;
- 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);
- To create clusters in order to reach critical mass, especially at regional level, taking advantage of the existing regional competences and 'excellences' (i.e. technological districts, high technology poles, centres of competence);
- The launch of R&D investments in the energy sector.

Direct public support to companies through grants and loans has been the traditional approach for financing research and innovation activities. Although still prevailing, the system has changed since 2006 with the reform of the public incentive system which introduced private banks to the scene to allow for a transition from capital subsidies to a system which hinges on risk-taking by banks.

With this measure, the government was trying not only to involve the private banking sector in the financing of innovation, but also to implement a system based on merit (*merito creditizio*).

Fragmentation and dispersion have characterised the national public incentive system for a long time, based on many measures of small size (launch of several calls with relatively small budgets). This trend is now changing and efforts are directed to concentrate the resources to finance large projects on specific key strategic areas/sectors (e.g. industrial innovation projects).

Measures to promote entrepreneurship and the creation and growth of innovative enterprises are rather limited. Another aspect of weakness is represented by the scarce number of measures for human resources, revealing the low level of attention that education and skills receive in the Italian system (fiscal incentives have been introduced only recently to encourage the recruitment of researchers by firms and to avoid brain drain).

Regarding the estimated budget per policy priority, an elevated budget (€6.2b distributed over the period 2007-13) is attributed to the National Operating Programme-Research and Competitiveness, a framework scheme articulated in several support instruments and calls for tenders addressed to southern regions. Priorities such as R&D cooperation, policy measures concerning excellence, relevance and management of research in Universities and direct support of business R&D represent the largest share of the total estimated annual budget. On the contrary, support to innovative start-ups has a low share.

In absolute figures, the estimated annual volume of public support to research and innovation based on the budgetary data in the fact-sheet amounts to €2.34b. Data from the annual report on support instruments from the Ministry of Economic Development reveal that the amount allocated to the objective R&D and innovation for national and regional measures during 2003-08 was €14b (about €2.33b) per year. When the allocated funding is presented year by year, it reveals substantial growth from 2007 to 2008 (from €1.16b in 2007 to €3.32b in 2008). The introduction of the tax credit for R&D incentive has contributed to this growth.

The most important non-financial innovation policy measures relate to intellectual property. A first attempt to reinforce the patent and IP systems started with the launch of the new Industrial Property code, an important piece of legislation for the Italian system since it simplified the procedures for obtaining or transferring industrial property rights. Recently the patent and IP system has been further strengthened through the introduction of the anteriority search/novelty assessment (operative since 1 July 2008) left up to the European Patent Office (EPO).

New support measures have been introduced during the period July 2008 – July 2009:

Tax exemption on capital gains from start-ups: this measure is oriented to reinforce the role of private investors, especially business angels. In a national context characterised by scarce funds for innovative SMEs this is an incentive to attract funds to finance new entrepreneurial initiatives.

National Fund for Innovation: this fund is endowed with €60m and has been created by the Ministry of Economic Development to promote innovative projects based on strengthening and exploiting industrial property. The Fund's main goal is to support SMEs and to reinforce Italian patents. It will act as an instrument to reduce

investment risk for banks and financial intermediaries that participate in the funding/financing of innovative projects based on strengthening and use of patents.

Risk capital fund for SMEs: the Ministry of Public Administration and Innovation has launched the fund for risk capital for the SMEs located in the South of Italy. This is one of the measures included in the e-government 2012 Plan and its objective is to favour the flow of risk capital in the regions. The fund – endowed with €160m – will support the creation and development of SMEs involved in investment programmes related to product and process innovation through the use of digital technologies.

'Brain-return' measure: the 'anti-crisis decree' launched by the Italian government last November 2008 foresees a tax incentive (10% tax applied to personal income) during the first five years of fiscal residence in Italy as of 10 January 2009 to attract Italian researchers living abroad.

Funds for research and innovation in the energy sector: the new plan for the research in the energy sector (2009-11) launched by the Italian Ministry of Economic Development has allocated €210m to research centres and universities to strengthen research in the fields of production, rationalisation and electricity savings, as well as nuclear energy and environmental protection.

Funds for innovation projects in start-ups : with the introduction of this measure, the Ministry of Economic Development finances innovation projects proposed by start-up firms operating in medium and medium-high sectors in the following areas: biotech, ICT, materials, robotics and energy. The funding allocated €55m to this initiative.

In December 2010 the Ministry of Economic Development has allocated €64.5m for two programmes (Industry 2015): “Made in Italy”, which was applied by a high number of proposals and Energy. At this date 166 projects for the “Made in Italy” programme (1,207 firms were involved of which 941 were SMEs), 37 projects for “Energy efficiency” (241 firms were involved of which 146 were SMEs) and 29 for “Sustainable mobility” (306 firms were involved of which 185 SMES) were financially sustained. On the whole, the public intervention has promoted investments for €2,179,023,801.10 on which the financial relief was of €852,688.442.12: €668,249,998.95 supported by national Funds and €184,438,443.17 by PON Funds.

The current mix of policy measures is highly concentrated on providing direct funding (mostly grants) to firms engaged in applied industrial research, product development and prototype creation as well as on measures to improve R&D cooperation between public/academic/sector research institutions and enterprises. The number of policy measures addressing SMEs' specific needs is still low as well as the number of measures to improve education and skills and to promote entrepreneurship and the creation and growth of new firms (financial support for the creation and early development phase of innovative enterprises, service provision to spin-offs, gazelles, support to risk capital etc.).

2.2.3 Providing qualified human resources

One of the major challenges of government R&D policy is to enhance University capabilities to produce researchers and post-graduates, mostly in science and engineering sectors, which are supposed to be able to sustain the competitiveness of the national economy. In 2007 in the EU-27 64.5 million people were employed within science and technology occupations; this represented the 29.8% of total employment. Between 2004 and 2007 the increase in the relative importance of HRST within the EU-27 workforce was modest, as their share rose by 0.9 percentage

points. Italy was one of the country that in the same period registered one of the most rapid growth in HRST (in relation to total employment), since the relative weight of people working in ST occupations rose by at least 2 percentage points, from 29.9% to 32%. This percentage, higher than the European average, is still nonetheless far from other country such as Sweden (39.9%) or Germany (36.4%). The HRST 'core' – made up of people with a university level degree who also work in a science and technology occupation – amounted to 35.2 million persons in 2007 in EU-27 (i.e. 16.3% of the total number of persons employed). This indicator shows a more modest increase in Italy, going from 10% in 2004 to 12.1% in 2007, which is still far from the European average.

The total number of researchers as percentage of labour force in 2009 was 0.94 in Italy, lower than the EU-27 average of 1.03. These data show the low availability of research position in Italy, which affect more the private sector than the public one, given the low propensity of the business enterprise to hire graduates. The contribution of the private sector to this demand is far lower than the European average: in 2007 33.9% of researchers were employed in the business enterprise sector in Italy, while in the same year they were 48.8% of the total number of researchers at EU-27 level.

The number of graduates in science and technology is another weakness of Italy: in 2007 the number of ST graduates as% of 1000 persons aged 20-29 years was 13.4% at EU-27 level, while only 8.2% in Italy (with an increase of 1.2 points from 2002 to 2007). To improve the education performance in terms of general quality and of producing more research oriented and more science and technology oriented scholars the Law 1/2008 includes measures finalised: to favour the recruitment of young researchers in Universities; to support Universities showing good performance in terms of research and teaching performance; to foreseen parameters for the evaluation of professors and researchers; to rationalise tertiary courses. On the supply side, the total number of PhD students increased from 2003-2004 academic year (37,000) to 2006-2007 (40,100) in Italy, but the number of PhD students in the Science and Engineering fields in 2007 was 36.5% on the total of PhDs students, while the EU-27 average was 42.5%.

The 2010-2012 National Research Programme gives high relevance to the human resources in science and technology and propose the following actions:

- To reserve a quota of 20% of funds for basic research to young people;
- To offer to young researchers and post docs an experimental route for being integrated in permanent careers (procedures for placing young researchers into university roles have been introduced under the Extraordinary Plan for Recruitment of Researchers contemplated by the 2009 Budget Law, for which €40m has been allocated);
- To favour the return of Italian researcher from abroad and the cooptation of scientific foreign competences.
- To sustain the international doctoral schools;
- To sustain the present doctorate courses, after a performance evaluation.

The Action number 1 of the (2010-2012) PNR is the support to creativity and excellence in all the knowledge fields, through the sustain given to basic and fundamental research, finalised to the development of knowledge in a medium term perspective. This measure should have to include the support to the national public

research organisations' activity and should devote to young researchers (under 40 years old) a quota of 25% of the funds for the knowledge driven projects.

Lifelong learning initiatives are not well developed in Italy. Data from the National Institute of Statistics show that in 2006 only 2.050 thousands of people on a population aged 25-64 of 33 million participated in training activities. The participation is strictly concentrated on the population, which obtained the highest educational level (PhDs holders and graduates), and have a high level working position (Directors, functionaries). Moreover systematic monitoring of lifelong learning activities is not developed, and the supply of training courses is fragmented and dispersed between many different public and private providers etc.

2.3 Knowledge demand

The demand structure of the Italian research system can be analysed by making reference to three main drivers, namely the economy, the society and the research sector itself. As to the former, the sectoral structure of the Italian economy is characterised by the large number of small firms; the low value added accounted for by the high tech sector, and its small contribution to overall employment; the low level of technology transfer and patent production. The demand structure in Italy can be sketched out also by using some basic data highlighting the R&D spending per inhabitants of the private vs. spending of public sector: intramural expenditure of Business sector was €165.3 per inhabitant in Italy in 2009 while it was €294 at EU-27; the same indicator for GOVERD in Italy was €44.6 and for HERD was €100.7, while it was respectively of €62.5 and €111.1 at EU-27 level. The Business sector appears even less R&D oriented when looking at the R&D expenditure by source of fund: 39.7% vs. 50.7% of the government sector, while the relative values at EU-27 are respectively 54.6% and 34.2% in 2006. The BERD as% of GDP, giving the intensity of R&D expenditure of the private sector in Italy was 0.54 in 2002 and 0.65 in 2009, while at EU-27 the values were of 1.20 in 2002 and 1.25 in 2009.

The lower level of business R&D intensity in Italy is partly linked to the structural composition of its economy: the share of high-tech industry in total manufacturing value added is low. Italy remains non-specialized in all high-technology sectors (except chemicals), although in some cases it shows a scientific specialization (such as in pharmaceuticals) or a high concentration of patents (such as in other machinery and electrical equipment). A change should include a move towards a higher share of high-tech companies and research-driven clusters.

As to the public demand expressed by GBAORD, it is mainly concentrated in research financed by general university funds (GUF), industrial production and technology, and protection, improvement of human health, and exploration/exploitation of space (respectively 37.7%, 12.8%, 9.3% and 7.5%). A significant quote is also devoted to non-oriented research (9.7%).

The relevant concentration of government funding on aerospace, health and industry is also reflected on government funding of business expenditures on R&D, which represent more than 12% of BERD. Among the sectors, aerospace attracts the highest share amounting to 29% of the total government funding, while pharmaceuticals is at the sixth position with 4.3%. Although scientific specialization (expressed by publication in SCI journals) is compatible with government funding, it does not fit with BERD and industrial specialization.

The growing importance of EU Framework Programmes and the relevant participation reinforce the importance of Europe as driver of knowledge demand for both public and private sectors.

Different mechanisms try to identify the drivers of knowledge demand. The government is seeking a more efficient involvement of the private sector by managing the complexity of the national innovation system with its multiple levels of decision making and a better coordination among regional and state initiatives. The Decree for Economic and Financial Planning 2007-2009 provided recommendations for improving multi-level governance in Italy. In recent years, both sides have made an effort to increase collaboration, searching for greater leverage from investing in the research public sector, developing research networks and creating joint initiatives in priority action fields. Nonetheless, the main type of interaction remains advisory. As for other kinds of stakeholders (trade unions, other social representatives), their involvement in the policy process was mainly linked to events, such as conferences and debates, with the participation of scientific, social and industrial delegates. These events are designed to maintain a dialogue among the parties and to collect suggestions and proposals for the presentation of political documents or to build consensus on reforms or political choices. Such practices are largely adopted by regional governments, as well as some ministries strongly committed to research and development.

Foresight is not particularly widespread in Italy, despite some sporadic but important national examples, which have also produced significant inputs to document preparation and policy shaping. Apart from national exercises, some regions have incorporated the foresight approach into their policy developments practices. Some leading examples of this are the regions of Lombardy and Emilia Romagna.

Research policy decision making is mainly a responsibility of the public sector, an efficient planning and evaluation system being a key instrument to ensure that research policy gives appropriate contributions to the benefit of both the private and the public sides. Coordination and channelling within Government and between different sectoral and societal domains is carried out by CIPE (see par. 1) through the National Research Programme (NPR).

The implementation of the NRP is developed through the DPEF (2009-2013) and the Annual Budget Laws (2007 and 2008). Thus, Italy has a typical "top-down culture" for coordinating knowledge demands. This culture is partly mitigated through the consultative process, which can go with the formulation of the NRP.

The role of public procurement as factor shaping the knowledge demand is still low, due to the scarce demand for innovative services, which is more driven by consumers than by firms and Public Administration needs. A supplementary role is played by the national business association "Confindustria" and also by AIRI (Italian association for the promotion of industrial research), as body representative of the demand coming from the national productive system. A major role is also played by regions at the local level, channelling knowledge demand, which is more linked to the socio-economic priorities of the local environment.

2.4 Knowledge production

The production of scientific and technological knowledge is the core function that a research system must fulfil. While different aspects may be included in the analysis of this function, the assessment provided in this section focuses on the following

dimensions: quality of the knowledge production, exploitability of the knowledge creation and policy measures aiming to improve the knowledge creation.

Recent (2008-2009) policy changes deal with a higher attention to supporting the high tech start ups and to improve the national patent system, through the establishment of a fund for public participation in risk capital of enterprises operating in high technology sectors (information technology, electronics, nanotechnologies and micro technologies, electromedical instruments, high technology mechanics for industrial automation). Announced in the Second Action Plan for ICT launched in 2005 (IT 55, High-tech funds for SMES) the measure become operative in 2008. The available fund amounts to €86m.

The Italian Patents and Trademarks Office coordinates a project for the re-qualification of national patents, thanks to the introduction of the anteriority search (operative since 1 July 2008) left up to the European Patent Office (EPO). The introduction of this new, important element has been flanked by other developments to ensure the efficiency of the process.

A 2008 initiative deals with channelling towards the national Fund for basic research projects (FIRB) national projects positively evaluated by the ERC-IDEAS programme, but not funded.

The Agency for the evaluation of the University and Research System (ANVUR) (see 2.1) will be charged with the task of evaluating the quality of the research activities carried out by universities and public and private research entities. The results of the assessment activities will serve as the criterion of reference for the allocation of state financing to universities and research entities. The objective is to reward the most meritorious entities by driving the allocation of an additional amount of resources (representing 7% of FFO).

Since 2005 there has been the implementation of the mission oriented or targeted measures, foreseen in the National Research Plan (2005-2007), such as the large Strategic Programmes. This line (top down R&D funding) has been further improved by the Industrial Innovation Projects (Industria 2015).

2.4.1 Quality and excellence of knowledge production

The university system is characterised by good performance indicators, and by the presence of important isles of excellence, but it suffers for a low mobilisation of financial and human resources. Interesting changes are driven by the diffusion of an evaluation culture that nonetheless is constrained by the academic corporation resistance to a deeper change in the system governance and specifically to a move from an academic system based on the power of the bureaucracy and the professorship, to a system where the power is exerted at the institutional level for identifying research strategies and for managing the areas of autonomy guaranteed by the latter (CRUI, 2004). Here in the following there is a more detailed analysis.

The Italian university system is characterised by a low degree of differentiation in education (absence of professionally oriented universities, differently from Germany; absence of universities specialized to supply of high quality education, differently from France) and by few research-specialised universities. It has continued to expand and has reached highly diffused presence: 89 universities, of which 61 public institutions (MIUR/ Cineca, 2009). Better performance in terms of scientific productivity and degree of internationalization are not correlated with the universities size; geographical localization is the main factor of differentiation between

universities (E. Reale, 2008). But it remains also true that the Italian academic system is weak in terms of financial and human resources in comparison with European average and there aren't signs of change.

A channel for an increasing orientation towards academic quality of knowledge production is represented by the growth of competitive funding of academic research expenditure, through State funded projects (PRIN; FIRB) and European or international organisation funded projects, which follow an evaluative process. (VTR-CIVR); they represent respectively the third and the fourth source of funding different from the State ordinary Fund (FO).

Other indicators of quality or excellence orientation are represented by the international collaborations and the international researchers' mobility within the academic system. Both are strongly influenced by the type of disciplines involved and are more important for the universities localized in the North of the country (Bressan, Reale, Primeri, 2008). International collaborations represent still a minor component of the total R&D financial resources (different from ordinary fund) for universities and non-academic research organisations and they are relatively more important for medium and small universities.

The process of evaluation has a special position, as an instrument devoted to assure control of the scientific performance of the research organisations, both in terms of excellence and relevance. In Italy the first three years evaluation exercise (VTR 2001-2003) managed by CIVR on the whole system of research (universities and non academic research organisation) has produced the following impact at the institutional level:

- A large cultural changes within all the academic research institutions, linked to a new awareness of the need to improve accountability, quality, and competitiveness of research effort;
- The introduction of a self assessment within universities managed by internal units of evaluation, which were not involved in decision-making processes in most cases; within the public research institutes the "internal" units of evaluation have been in effect composed by "external" actors, without any linkages with internal researchers;
- But no relevant changes in policies (internal funding allocation), neither rewards (external fund allocation linked to evaluation results).

Italy is involved in the "Bologna process" since 1998, but the formal adoption of an evaluation system of education and research has not yet found a full realization; in particular there is a gap in Italy between legislation and its implementation (Report from a working group appointed by the Bologna Follow-up Group to the Conference of European Ministers Responsible for Higher Education, Bergen, 19-20 May 2005).

Scientific specialisation (as expressed by bibliometrics) is compatible with the R&D public funding policy (ERAWATCH Country Specialisation Report, 2006), in particular the concentration of government funding (GBAORD) on aerospace and health is rather coherent with the scientific specialisation profile, with EU-15 as reference: pharmacology, space, physics, engineering, clinical medicine, which seems to fit enough well with the scientific citation specialization profile. Nevertheless performance indicators show that the low level of resources (Italy has the lowest number of researchers for unit of GDP among industrialised countries and the lowest percentage of researchers on the active population, impacts on the gap between the quantity of the knowledge produced (4th position within EU-25) and the quality

recognition, in terms of ratio between citations received and given (10 position within EU-25, above the EU average) (CRUI, 2005).

New scientific opportunities are often at the cross border of disciplines and of technologies; the National Research Plan (NPR 2010-2012) and the new incentive system give large place to collaborative actions between different actors and competences. A recent opportunity has been given to Italian researchers who participated to the ERC selection with high quality and open to new opportunities proposals and who were selected but didn't get the grant. The Fund for Basic Research (FIRB) has now opened its evaluative procedure to these kinds of projects.

A good indicator of openness to scientific opportunities is the international co-authorship in which Italian scientists are involved: their weight on the total of national publications for Italy is not far from that of other European countries such as Germany or UK (National Science Foundation, S&E Indicators, 2008, Tab 5-44). These collaborations are mainly established with colleagues working in national systems who are positioned at the frontier of R&D in many fields.

Looking at the relation between the quantity of national scientific products as percentage of world scientific production and the level of citation impact compared with the world average (CRUI, 2005), our country is better positioned in terms of quantity of scientific products than of balance between received and given citation. This can be due to a mix of factors influencing the quality of knowledge production and its recognition, among which the low level of resources seems to be relevant.

2.4.2 Policy aiming at improving the quality and excellence of knowledge production

The promotion and strengthening of S&T excellence poles in key sectors is a relevant aim in the 2010-2012 National Research Programme, with the aim of attracting investments and excellent human resources. At October 2007, 38 projects had been accepted for funding and technological districts were under realization within 18 Regions in the North-Centre and in the South of the country. These are complex initiatives, which have to balance an international level of research capacity and competences with collaboration and embedment in local productive contexts. They have been supported by a mix of ordinary national budget for research and additional resources for regional policy, deriving from the European budget (structural funds) and the national budget (co-funding of structural fund and fund for under-exploited areas- FAS). Their aim is to realize research and innovation networks territorially embedded, on specific technologies with the collaboration of small and large firms, and with a strong orientation to the socio economic valorisation of results.

The other instrument is the creation of joint labs between Italian and foreign institutions, attracting foreign direct investments (FDIs) for strategic research.

The aim of the internationalization of the productive system has found another support in a new policy instrument: the technological platforms. They are new organisational models, with a concentration of resources on critical technological sectors, cooperation between public and private actors and State and regions, training of human resources and support to patenting and result valorisation. The national technological platforms should have to be connected with the FP.

2.5 Knowledge circulation

Tackling the challenges that European society faces in the 21st century will require a multi-disciplinary approach and coordinated efforts. Many debates and conferences, e.g. the Lund Declaration recognise that such complex issues cannot be solved by single institutions, technology sectors or MS acting alone. Hence strong interactions within the "knowledge triangle" (education, research and innovation) should be promoted at all levels. Moreover, in the context of increasing globalisation, cross-border flows of knowledge are becoming increasingly important. This section provides an assessment of the actions at national level aiming to allow an efficient flow of knowledge between different R&D actors and across borders.

2.5.1 Knowledge circulation between the universities, PROs and business sectors

The weight of the industrial funding of High Education R&D activity is not changed and it is much lower than the EU-27 or EU-25 average (% of HERD funded by business is 1.4 for Italy and 6.3 for EU in 2005, last data available; it is 14.1% for Germany). Slightly higher is the quota of Government R&D funded by industry (2.4% in Italy, 8.3% EU-27 and 8.1% in EU-15. But this is only a partial indicator of the university-industry linkages, since informal relations and consulting activities, which are relevant channels of inter-institutional cooperation, are not included.

The Italian industrial structure is largely composed of small and medium sized firms, which represent over 95% of the total number of enterprises. A special attention has therefore always been devoted to the enhancement of their R&D activities.

The law decree 297/99, the main national instrument for supporting industrial research, foresees additional financial contribution whenever a project proposal is submitted by small and medium enterprises.

The re-organisation of the incentive system puts special attention to financially support (automatic fiscal measures) SMEs which:

- Collaborate or commit research activity to scientific institutions;
- Hire qualified research personnel and their attendance to PhD courses

These measures have received large interest by SMEs: the demand for fiscal support have been higher than the resources availability.

At decentralised level, regions have introduced a large number of support measures to foster both research and innovation-related activities within SMEs. For example, in Lombardy there is a measure to support participation of SMEs in EU Framework Programmes; or in the region of Veneto there is a measure to support feasibility studies preliminary to research projects (similar to the exploratory award funded within EU schemes).

The need to increase private-public dialogue and partnership is indicated as strategic for the country in many documents and declarations; however, many barriers are still connected to cultural resistance.

Moreover the new measures for sustaining SME collaboration with scientific institutions have found a large acceptance, mainly given their automatic character, but SMEs' demand for fiscal support has not found enough coverage by the available public resources.

The separation between scientific and industrial research does not concern large firms and the presence of a long lasting participation of scientific inventors in industry owned patents is a good example of this collaboration.

2.5.2 Cross-border knowledge circulation

The international researchers' mobility (more than 3 months) from and to University is on average low. In the period 2001-2003 there has been a total mobility of 1,059.8 years/ person for the 14 disciplinary areas; in scientific disciplines the inward mobility has been higher than the outward, demonstrating a positive visibility and recognition at international level.

The central government has always strongly pursued openness towards all European and non European countries through scientific bilateral agreements and through financial support for joint international scientific projects.

A relevant role is played by scientific bilateral agreements, signed by MIUR: these agreements cover both scientific and financial collaboration with the main research institutes of countries such as United States, India, Japan, Russia, and China for example.

Despite the low presence of foreign researchers within the national territory, the number of scientific publications carried with foreign colleagues is considerable: 37% of SCI publications, most of which is with USA and UK (National Research Programme, PNR 2005-2007).

The participation in the EU Framework Programmes is highly successful, considering that Italy is - after France, Germany and UK - the country with the highest number of projects under the Sixth Framework Programme.

Italy has played a very active role in the EUREKA programme, a European network, involving private and public actors, oriented to a direct commercial use of research result: it has been third for participation in now concluded EUREKA projects (since 1985) and it had 80 new projects open in 2007.

The national R&D policy includes incentives for foreign owned firms to invest in Italy, not only allowing their access to financial aid for applied research projects, but also offering higher support in terms of type of incentive (weight of grants in comparison with refundable loans) and level of supported costs of the project.

The scientific community participation to international collaborations and networks, the collaboration to the international knowledge production certainly contribute to the quality and recognition of our national knowledge production. There is a large participation of scientific community in international programmes.

The national financial incentives for attracting foreign investment in R&D don't appear really effective, given the characteristic of uncertainty in terms of up and down financial resources availability and, strictly dependent on that, the low efficiency of the process in terms of time between the company's demand presentation and the public agency decision. Notwithstanding the success in being selected if foreign firm, multinational companies, so as national firms, have had to face a long block in R&D public funding (2002-2005), with the only availability of resources for R&D projects from regional policy.

2.5.3 Main societal challenges

The 2010-2012 National Research Programme (NRP) addresses some national needs of strategic relevance from a point of view of sustainable development: renewable energies, agriculture and environment, made in Italy, artistic and cultural production, mobility, homeland security, health and life sciences. The NPR takes also into consideration as priority six habilitating technologies, which are at the forefront of the scientific-technological development, and which have the role of sustaining the future human activity. These specific research fields prioritised for the inter-sectoral and cross-border knowledge include: technologies for energy, for new materials, for the brain functioning, for information and environment. MIUR intends to support the development of these technological areas also in the aim of pushing the competitive development of the country at medium term (2025).

2.6 Overall assessment

Following the analysis in the previous section, this section assesses whether the recent policy changes respond to identified system weaknesses and take into account identified strengths.

Table 1: Summary of main policy related opportunities and risks

Domain	Main policy opportunities	Main policy-related risk
Resource mobilisation	<ul style="list-style-type: none"> • Securing long term investment in research, through the new three year national research programme. • Dealing with barriers to private R&D investment. • Providing qualified human resources. 	<ul style="list-style-type: none"> • Securing national long and short term investment through institutional funding suffered for the lack of continuity from one year/government to the next. • R&D private investments as well as innovative financial instruments to R&D are weak. • Lack of career perspectives for researchers and for attracting foreign scholars. • 'Brain-return' measure: the 'anti-crisis decree' launched by the Italian government in November 2008 foresees the introduction of fiscal incentives to attract Italian researchers living abroad, but it has not worked well. Career aspect and other context conditions don't make enough attractive the country.
Knowledge demand	<ul style="list-style-type: none"> • Identifying the drivers of knowledge demand. • Co-ordination and channelling knowledge demands. • Monitoring of demand fulfilment. 	<ul style="list-style-type: none"> • Good capacity of society and research sector as drivers of knowledge demand. • Scarce participation of private stakeholders in knowledge demand articulation and low level of public procurement. • Strong central set of policy instruments aimed to coordinate and channelling knowledge demand, go with weak links between assessments/evaluations and inputs into knowledge demand. • Weak tradition of evaluation and foresight practices.

Domain	Main policy opportunities	Main policy-related risk
Knowledge production	<ul style="list-style-type: none"> Ensuring quality and excellence of knowledge production. An Agency for the Evaluation of university and research (ANVUR). Even with a certain delay, a new Agency regulation has been approved by the Parliament and the impact of evaluation on a quota of the FFO allocation (7%) has been introduced by the recent law on university reform. Ensuring exploitability of knowledge. 	<ul style="list-style-type: none"> ANVUR is not still operating. Gap between scientific and research specialisation on one side and technological/economic specialisation on the other.
Knowledge circulation	<ul style="list-style-type: none"> Facilitating circulation between university, PRO and business sectors. Profiting from international knowledge. Enhancing absorptive capacity of knowledge users. 	<ul style="list-style-type: none"> Scientific community has shown interest for TT incentives; TTOs are diffusely present and the academic patent portfolios increased, but diminishing resources transferred to the university have created problems of personnel employment at TTOs. Moreover the relation between university and local incubators or technological parks is still very weak. The international mobility of researchers is low. SMEs absorbing capacity is still low and the change needs a large set of coordinated instruments.

Table 2: Main barriers to R&D investments and respective policy opportunities and risks

Barriers to R&D investment	Opportunities and Risks generated by the policy mix
<p>The first barrier is the business propensity to invest in R&D. BERD/GDP is 1.25 for EU-27 and 0.65 for Italy in 2009; BERD/GERD represents 40% in R&D in Italy, while for EU-27 the average value is 55.4% (2007).</p>	<p>The Government orientation is to create new opportunities intensifying public-private partnerships to carry out large research and innovation projects through strategic programme managed by MIUR and Industria 2015. Thanks to these investments the Italian total State aid showed a slight upward trend in the most recent years (+1.1%), from 2004 to 2007, even if lower than the average EU-25 (+1.8%).The risk is the block of these large projects for lack of resources.</p>
<p>Italy is positioned (EIS) in the group of 'moderate innovators' and recently has slowed its progress and registered a below-average annual growth rate (1.8 in 2008 versus 2.3 EU average).</p>	<p>Large projects, enabling technologies, the 2010-2012 National Research Programme envisage the necessity of driving the country towards a more high tech oriented and competitive industrial structure,. The risk is the lack of a regular, coordinated and monitored effort. NPR foresees the creation of a new internal organisation supporting the Ministry in these tasks.</p>

Barriers to R&D investment	Opportunities and Risks generated by the policy mix
<p>Recent crisis has worsened economic conditions in manufacturing sector: production fell by 3.1% and the trend continued in the first part of 2009. Most industrial sectors have been in difficulty and those which have suffered first from the contraction of the international demand have been the metal-mechanic and textile industries, the two pillars of the 'made-in-Italy' industries.</p>	<p>One of the measures contained in the anti-crisis decrees is the introduction of an anti-crisis export promotion plan with an overall allocation of €185m in 2009, managed by the Institute for Foreign Trade (ICE). New tax benefits have been granted to enterprises, with an allocation amounting to about €2,900m for the 2009-11 period. The benefits include tax exemptions for productivity contracts aimed at boosting labour productivity and deduction of 10% of the regional tax from company income tax and personal income tax. In January 2009 a refinancing of the Central Guarantee Fund for SMEs was put in place (€1.6b) and a State guarantee as a last-resort guarantee has been provided to this Fund. The risk is here to concentrate on short term measures.</p>
<p>Corporate self-financing is decreased, owing in part to the increase in net financial costs. Self-financing fell below 10% of value added the lowest ratio in 15 years. The reduction in self-financing was more pronounced than that in investment, so the borrowing requirement (defined as the difference between gross investment, including stocks, and self-financing) rose sharply, especially in the second half of 2009.</p>	<p>The national system is characterised by a weak internal financial market and a strong dependence from Bank credit. Measures to improve this situation and also the propensity of Banks to support innovation or risky projects are still weak.</p> <p>Risk capital fund for SMEs: the Ministry of Public Administration and Innovation has launched the fund for risk capital for the SMEs located in the South of Italy and investing in product and process innovation through the use of digital technologies. The risk is that small firms don't use this new fund.</p>
<p>Low number of start ups in high tech sector; need of seed and risk capital.</p>	<p>Funds for innovation projects in start-ups: with the introduction of this measure, the Ministry of Economic Development finances innovation projects proposed by start-up firms operating in medium and medium-high sectors. The reorganisation of the policy towards start ups and venture capitalists offers good opportunities. But two weak aspects concern the time (the foreseen fund is not operative yet), the generally low treatment of capital gains, which doesn't incentive risk investments and the duplication of efforts, since there are also specific measures for high tech firms in South regions.</p>
<p>Low number of SMEs performing R&D.</p>	<p>The policy mix lacks still a clear strategy toward improving SMEs investment towards research activity; fiscal measures, devoted to this scope can reproduce the present specialization of the country.</p>
<p>The contribution of the private sector to the demand of human resources for research is far lower than the European average: in 2007 33.9% of researchers were employed in the business enterprise sector in Italy, while in the same year they were 48.8% of the total number of researchers at EU-27 level.</p>	<p>The fund for research support (FAR) includes an instrument of aid for SMEs which employ researchers, but this instrument hasn't been used diffusely.</p>

3 Interactions between national policies and the European Research Area

3.1 Towards a European labour market for researchers

The [Communication Better careers and more mobility: A European Partnership for Researchers](#) proposed by EC in May 2008 aims to accelerate progress in four key areas:

- Open recruitment and portability of grants;
- Meeting the social security and supplementary pension needs of mobile researchers;
- Providing attractive employment and working conditions;
- Enhancing the training, skills and experience of researchers

The Commission has also launched concrete initiatives, such as dedicated information services for researchers, in particular through the activities grouped under the name of [EURAXESS – Researchers in Motion](#). Based on the assessment of the national situation in the four key dimensions detailed above, this section will conclude if national policy efforts are supporting a balanced ‘brain circulation’, with outward mobility levels matching inward mobility levels. High levels of outward mobility coupled with low levels of inward mobility often signal an unattractive national labour market for researchers and unsuitable research infrastructures. This may trigger, despite the policy efforts supporting the mobility the ‘brain drain’ rather than brain circulation.

3.1.1 Stocks and mobility flows of researchers

The Italian labour market for researchers is characterised by significant weaknesses both on the demand side and the supply side.

Italy has a low investment in R&D comparing with the EU-27 as to both the gross expenditure and the government expenditure. This weak investment goes with a very limited number of people entering the research labour market. Italy has the lowest number of researchers for unit of GDP among industrialised countries and the lowest percentage of researchers on the active population. Table 1 shows the researchers and total R&D personnel as percentage of total employment, and as percentage of active population.

Table 3: Researchers and total R&D personnel as percentage of total employment and as percentage of active population

		% per total employment	% per active population
Total R&D personnel	Italy	1.01	0.94
	EU-27	1.11	1.03
Total researchers	Italy	0.41	0.38
	EU-27	0.68	0.63

Source: Eurostat, 2008, FTE

These data show that the low availability of research position in Italy affect more the private sector than the public one, given the low propensity of the business enterprise to hire graduates.

Other evidences confirm the weakness of the demand side. The average age of university professors is about ten years higher than the aforementioned European countries. The total expenditure for tertiary education per student is 8,000 equivalent to USD; the total expenditure for tertiary education in percentage of GDP is about 1% in 2005, lower than the average EU-27, as well as the financing of the tertiary education demand through bursaries and loans: 0.14% of the GDP (Education at a glance, 2008).

In the 2008-2009 academic years, the total number of PhD students was about 38,300 with a relative concentration in the medical field. In 2001, the situation in the Science and Engineering fields showed the weakness of Italy's position, when measured by the ratio of new PhDs per thousand population aged 25-34. While the EU-15 average was 0.55, the Italian ratio came to just 0.18. The government encouraged with special incentives the setting up doctoral schools within universities, aimed to favouring a simplification of the PhDs courses supply, the internationalisation processes of the courses, and the involvement of the private sector (PNR 2010-2012), but no specific incentives have been introduced.

According to a special survey delivered by Unioncamere (Indagine Excelsior), in 2005 648,000 total persons were hired in the public and private labour market, of which only 57,000 were graduates. Another survey made in 2009 by Almalaurea, a consortium including the Conference of the Dean of the Italian University, shows that one year after graduation about 65% of the graduates entered the labour market, while 20% are unemployed.

The number of foreign researchers who choose Italy as a place to do research is still less than the number of Italian researchers who decides to go abroad. The number of foreign researchers in the Italian system is approximately 1.8% of the total, although in some cases their presence is more significant (e.g. The National Institute for Physics). The share of foreigners among doctoral students is particularly low: in 2001 29,000 foreign students were enrolled on Italian PhD courses, compared with 40,000 in Spain, 226,000 in the UK and 475,000 in France (MIUR, 2005) The foreigners among doctoral students in the academic year 2008-2009 were 2,947 (MIUR, 2009). This seems to be largely due to the fact that courses are mainly given in Italian but also to the scarcity of interaction with private actors, which makes PhD courses less attractive to foreign researchers.

Other indicators about the progress toward the Lisbon objectives show that foreign students enrolled in tertiary (ISCED 5-6) as percentage of all students enrolled in the country of destination in Italy in 2005-2006 is 2.3%; the percentage of students of the country of origin enrolled abroad (European or non-European country) is 1.5-2.0%; inward and outward mobility of Erasmus students and Leonardo da Vinci show in 2005-2006 14,779 inward and 17,195 outward. The same data for teachers and trainers under Socrates schemes and Leonardo da Vinci are 2,335 inward and 1,428 outward (Commission Staff WP, 2005, last comparative data available).

Specific measures at national level for attracting national and foreign researchers are included in research programmes (FIRB, FIRB Futuro in ricerca, Levi-Montalcini Programme), which foreseen the possibility to hire researchers working abroad for the purposes of the programme. The results of the mentioned measures are the

participation of some foreign professors and research personnel in national projects (no specific data available).

Regions, especially those in the North, in the last years become more active in order to stimulate the opening up of labour market for researchers. For instance the regional law for research in Piemonte (L.R. 4/2006) open a specific Action for human resource mobility aimed at favouring the brain gain and contrast the brain drain, as well as to attract talented researchers from abroad for carrying out specific research projects. Similar measures are experimented also in other regions such as Lombardia and Lazio.

3.1.2 Providing attractive employment and working conditions

Providing an attractive environment and working conditions is very important in order to avoid brain drain and to gain foreign researchers. In Italy the overall working environment is still not very attractive.

Salaries: According to the EC Report on remuneration of researchers (EC, 2007) in Italy the average weighted total yearly salary adjusted of researchers is €36,201, rather lower than France (€50,879), Germany (€56,132) or United Kingdom (€56,048), and similar to Spain (€34,098). If we look at figures on net country yearly salary average of researchers in terms of PPS (Purchasing Power Standard), we find Italy at €22,372 and the distance with the values of France, Germany and UK. Considering the country total yearly salary average for researchers per level of experience, Italy is below the EU-25 average in all the level selected (0-4 years, 5-7, 8-10, 1-15, more than 15). The ranking of researchers remuneration averages in terms of PPS in Italy, comparing to the EU-25, show that the country has the lowest positioning for salaries of researchers with few years of experience (Italy ranks 25 for remuneration of researchers 0-4 years and 22 for 5-7 years of experience), while the ranking is higher (17) for researchers with more than 15 years of experience.

Remuneration of researchers is not so different between sectors of activity, although in all sectors it is lower than in France, Germany and UK. Researchers' remuneration can be considered as a proxy of the attractiveness of the country for other researchers, assuming that highest salaries are one factor benchmarking attractive research locations. Considering the total yearly remuneration average, Italy is a medium remuneration level country, while France, Germany, UK are high remuneration level countries.

Salary regulation at both national and institutional level does not encourage talented young individuals to pursue a research career. Incentives and premium for brilliant high performing researchers are lacking. An opportunity is given to Italian researchers who participated to the ERC selection with high quality and open to new opportunities proposals, which were selected but didn't get the grant. The Fund for Basic Research (FIRB) has now opened its evaluative procedure to these kinds of projects. At national level, MIUR launched from 2009 a new funding instrument, FIRB Futuro in Ricerca (Future of research), dedicated to PhD holders, tenured and not tenured, aimed to fund on a competitive way three-years projects coordinated by early researchers or young researchers (respectively up to 32 years old and up to 38).

Remuneration policies

Universities and public research institutes (PROs) cannot determine salaries of academic staff, which are regulated by law for the former and by collective bargaining

for the latter. Competition for the most talented researchers is not yet prominent in Italy. Recently, the reform of the competition rules for hiring new researchers (l.1/2009) and the new reform of the Higher Education system (DDL 1387/2009) are supposed to encourage young talented scholars to enter the system. Moreover the salaries progression of professors and researchers will be submitted to an assessment of the research and teaching productivity. ANVUR will be in charge for setting the regulations of the mentioned evaluation.

Careers breaks and promotion of women

Italy has a gender gap not really different from the other European countries. European Commission She figures 2009 show that in 2006 the proportion of female PhD (ISCED 6) graduates in Italy is 52% of the total (45% in EU-27); compound annual growth rates of PhD graduates in the period 2002-2006 is 29.2% for both female and male. The proportion of scientists and engineers in the total labour force in 2007 is 1.0 for women and 2.3 for men, and the percentage of female researchers in 2006 is 33%.

The gender gap in Italy is bettering also at the performance level. Female academic staff at grade A (the highest) of career position in 2007 was 19% (the same as in EU-27), but the percentage of grade 'A' staff among all academic staff is still low: 18% for women and 39% for men. Research funding success does not rate differences between women and men in 2007 in Italy were 5.1, but it is still under the EU level (6.4 in EU-27).

In Italy no specific policy measures or incentives have been implemented aiming at promoting the employability of women in the research labour market. Nevertheless, national laws provide a good level of protection aimed at avoiding detrimental effects on women research career: the restoration back to the same type of work is guaranteed by law, fixed-term contract must be extended due to maternity leave, regulation acts both at national and institutional level in Universities and PROs assure gender representation inside research and academic committees, boards, and governing bodies. Maternity leave applies to both man and women. In principle no detrimental effects should derive from maternity leave; in practice progress in academic career might suffer from maternity, since the assessment is based on absolute performance rather than on performance related to the effective opportunities of the researchers.

In many Universities and PROs a special Committee for the promotion of equal opportunities for women is in place aiming at promoting women's participation and career opportunities as well as to oppose any measures which could create discrimination. The effectiveness of these Committees is more on the promotion of a cultural awareness than on impeding career's breaks.

Uptake of the Charter of Researcher

All the most important research institutions in Italy accepted to commit themselves to introduce principles and measures of the Charter of researchers and the Code of conduct into their own regulations and statutes. This commitment was formalized during a national congress organised in 2005 by the Conference of the Deans of the Italian Universities (CRUI) with the participation of the most important Italian public research organisations and foundations⁷. This act does not imply the obligation for the institutions to apply principles and rules, but it represents one step forward the

⁷ See <http://www.fondazionecriui.it>

implementation of the Charter and the Code. Roughly speaking, the institutions that have accepted to adopt the Charter and the Code represent the 47.5% of the total R&D expenditures in Italy (more or less the whole public sector of research).

National policies do not support the uptake with specific measures. The Government decree reforming the Public Research Organisations (D.lgs 213/2009) explicitly recognised the principles of the Charter of the Researchers must inspire the revision of the internal Statutes. The proposal of University reform presented by the government to the Parliament limits the maximum period of post-doc position and introduces a tenure track like path (6 years maximum contract and access to tenure after positive evaluation). This provision is likely to be included also in most of the Statutes of the PROs.

3.1.3 Open recruitment and portability of grants

Permanent research positions in the public sector are completely regulated by law in the case of University professors and researchers. Researchers belonging to government labs are regulated in part by law and in part (economic conditions) by collective agreements. The law does not hinder the opening towards non-nationals, but there are not positive measures for encouraging it, although all the public research institutes must advertise their publicly-funded positions online on national websites.

Basically it is up to the research institutions (Universities and Public research organisations) to autonomously decide to set up measures aimed at encouraging the participation of non-nationals to competition for hiring researchers, but at this time the system appears basically close. For instance, the knowledge of the Italian language is compulsory, and recruitment and competition procedures (written and oral examination at the site) are only in Italian, discouraging the participation of non-nationals. Moreover, vacancies supported by public funds are not internationally advertising, and generally the announcement is not put on international portals, although concrete measures are ongoing in order to assure that all vacancies would be published on the EURAXESS website, and specific support for foreign candidates is also foreseen (EU-SGHRM, 2009).

Universities and PROs can hire scientists working abroad from at least three years with specific fix-term contracts, on the base of their own resources. The national law set a threshold for the number of contracts allowed. Law 1/2009 foresees the possibility to hire high-level scholars as permanent full professors. A specific proposal should be sent to the MIUR, which will authorize to hire the professors on the basis of the CUN advice. Moreover some Government project funding schemes (i.e. FIRB) foreseen the possibility to give a three-year contract to foreign eminent scholars, whose expenditures can be completely covered by the Government funding.

Research grant portability is still limited to another national institution, while it is not allowed to foreign institutions. Also transferability of social security and supplementary pension rights have not yet a dedicated website, although an information campaign have been launched in late 2009 (EU-SGHRM, 2009).

3.1.4 Meeting the social security and supplementary pension needs of mobile researchers

The Italian social security system provides some benefits, including retirement pensions and benefits for disabled. The quantification of the benefits is based on two

main factors: the number of years during which the worker has paid his social security contributions to the Italian system and the amount of the salary received.

The Italian social security system offers to all people that work in Italy (EU citizens or citizens of third countries), who are employed, self-employed, professionals or entrepreneurs, the opportunity to obtain the following benefits by paying the social security contributions: permits for illness/sickness, maternity leave, unemployment and mobility benefits, family cheques and pensions. For non-Italian citizens, the possibility to benefit of such opportunities is subordinated to the possession of a residence permit or of residence documents.

Health insurance is guaranteed to all the researchers, with no differences linked to the type of position (permanent, fixed-term contract, occasional workers). As to the pension system, the contribution and rules vary according to the sector (higher education, government, or business) and according to the type of position: permanent researchers or tenured researchers have a more complete social security rights than non-permanent ones. Furthermore, bilateral and multilateral agreements on the existing legal framework with third countries are not specific to researchers alone.

As to the taxation system in Italy is generally divided into two different categories: direct taxes (i.e. taxes calculated directly on the total income) and indirect taxes (i.e. on goods, services, importations, on the production of a region, etc.). Taxes are paid on the income received in Italy and for the income received abroad in case the person is a "permanent resident" in Italy. A foreign citizen, employed and residing in Italy, pays his taxes calculated only on the income received while working in Italy. From a general point of view, foreign citizens who stay in Italy for more than 183 days per year are subject to the Italian taxation system. Tax incentives to facilitate the participation in supplementary pension schemes are applied, but a threshold is foreseen calculated as percentage of the total income.

The Council Regulation (EC) No 1408/71, article 17, has been implemented in Italy and regulation has been recently modified by the D.lgs 17/2008; it can also be applied to non-European countries, under certain limitations.

Contracts/fellowships of researchers are subject to social and health taxes. As to social and health taxes, third countries researchers working in Italy are under the same rules as the EU ones, with few exceptions. Contributions paid in Italy can now be transferred to the country of origin of the third country researcher when he/she leave Italy.

The EC Directive 2005/71/EC has been applied in Italy under the D.Lgs n. 17/2008. It regulates the admission in the country of researchers coming from abroad for carrying out a research project within an Italian research organisation. Short-stay VISA for these researchers is in place. Long-term admissions are subject to the existence of a temporary position (often linked to a specific research programmes) within a research institution in Italy. More generally, foreign researchers at their arrival in Italy must request a "Permesso di soggiorno" that legitimate their staying and which must be valid for the same period and the same purposes declared on the visa document; after at least 5 years of regular residence in Italy they can apply for a "Carta di Soggiorno", which will allow them to obtain further rights. Generally, for foreign citizens the entry in the Italian territory is subject to a system of entry quotas established year by year by the Prime Minister depending on the country of origin, on the type of activity and on the nature of the contract. Researches from European do not have to respect any quotas.

Although the legislative framework on social security, health assistance, and admission of researchers is rather complete, the major constraints are the time for fulfilling all the bureaucratic procedures, the scarce possibility to use on-line services, and delays for obtaining the certifications requested by law. These drawbacks are mainly related to the stay of non-European researchers; jointly with the weakness of specific policies for opening out the labour market for researchers, they contribute to make in practice difficult the stay of non-nationals in the country.

3.1.5 Enhancing the training, skills and experience of European researchers

Structures for post-graduate training are widespread in almost all the Universities (Doctoral Schools), although they are organised in very different ways and perform different functionalities and objectives, according to the University internal regulations.

As to the doctoral training programmes, a greater degree of standardisation with those in other countries is still to be achieved. The reform of PhD programmes is an issue in the agenda of the Government, but it has not yet been implemented. Nevertheless, the National Committee for the Evaluation of Universities (CNVSU) uses few indicators for assessing the PhD programmes, which relate to international standard derived from the experiences of other European countries. The last report aimed at assessing the characteristics of the PhD courses (CNVSU, 2007) showed that 90% of the programmes are open to students coming from other national universities and from abroad, and 60% have effectively attracted external students. Nevertheless, the number of students coming from other European countries is still negligible (3% in 2006 for Doctorates; 5.7% for Masters). About 55% of the PhD courses allowed periods for training and working experiences abroad.

Mobility of PhD students during the doctorate is encouraged but it is not compulsory. Sometime University might not have enough resources for sustaining a period of students abroad. Also mobility of permanent staff is constrained by lack of specific investment for mobility at national level. CNR has short-term mobility instruments, with open call for senior and junior researchers, aimed at funding short stay in non-Italian European countries.

According to the recent EC study on mobility and career path (EC, 2010), in Italy the estimated share of International mobile HE researchers is 60% (56% EU-27), mainly concentrated in medical sciences and agriculture. The share of researchers that experienced at least once mobility to a new employer in another country in their research career is 32% (58% EU-27); the share of researcher that experienced at least one research visit to another country in their research career is 88% (78% EU-27). The estimated share of researchers that have worked in industry on a formal placement, internship, apprenticeship or similar is 18% (28% EU-27), and the share of those who have been employed as researchers in both the public and the private sector is 17% (EU-27 16%).

Intra-EU inflow of doctoral candidates is very low in Italy (1% among the total number of doctoral candidates); as to the intra-EU outflows the share in percentage among the total number of doctoral candidates is 10%. Thus, the intra-EU "net gain" has a negative sign (-12%). The low attractiveness of Italy for doctoral candidates is confirmed by their areas of origin: 95.7% are from Italy, 1.5% from EU-27, and 0.6% from other European countries. No data available on mobility of post-doctoral candidates. References to mobility to industry and post doc are not available.

3.2 Research infrastructures

Research infrastructures (RIs) are a key instrument in the creation of new knowledge and, by implication, innovation, in bringing together a wide diversity of stakeholders, helping to create a new research environment in which researchers have shared access to scientific facilities. Recently, most EU countries have begun to identify their future national RI needs, budgets and priorities in the so-called National Roadmaps for Research Infrastructures. These strategic documents also set out a strategic view on how to guarantee and maintain access to research facilities. Although some countries invest heavily in RIs, none can provide all the required state-of-the-art facilities on a national basis. Several large RIs have already been created in Europe. While optimising the use and development of existing RIs remains important, new infrastructures are needed to respond to the latest research needs and challenges. European Strategic Forum for Research Infrastructures ([ESFRI](#)) was established in April 2002 to support a coherent approach to policy-making on RIs in Europe and to act as an incubator for international negotiations on concrete initiatives. This section assesses the research infrastructures national landscape, focusing on the national RI roadmap and national participation in ESFRI.

3.2.1 National Research Infrastructures roadmap

Italy has its own research infrastructures as well as participation and access to international research infrastructures in some disciplinary fields, mainly through the activity of some public research organisations and private institutions.

For instance, the infrastructures of the Nuclear and Sub-nuclear Physics of INFN (Gran Sasso, Virgo, in Italy and CERN, DESY, FERMILAB at international level), the multi disciplinary infrastructures for the Science and Technology of Materials, Bio-materials and Nano-structures (CNR-INFN, consortium INSTM and Sincrotrone Trieste: Laboratorio Elettra in Italy and access to international large scale facilities ESRF, ILL, ISIS⁸) are all examples inter-governmental European infrastructure where the Italian participation play a relevant role.

The European Portal on research infrastructures' services listed 44 RI for Italy, of which 14 are classified in the scientific domain of humanities, 20 in environmental sciences, 6 in energy, 6 in life sciences, 8 in physics and astronomy, 5 in material sciences, chemistry and nanotechnology, 17 in engineering 5 in ICT and materials and no one in social sciences:⁹

As to the national infrastructures, we can signal infrastructures in the engineering sciences (CIRA, ASI e Politecnico di Milano as to the aerospace, ENEA in the anti-seismic engineering, other firms and public research organisations such as OGS, CNR, CONISMA for marine sciences), and infrastructure for the high power parallel calculation (CINECA, CILEA). The governance of national infrastructures is assured through agreements between the institutions in charge and MIUR.

As to the infrastructures for data transmission, GARR programmes and the investment of many public institutions and inter-university Consortia allowed to have a very good Italian network for data transmission, which gave rise to poles of excellence in the ICT sector. Most of these infrastructures are still involved in

⁸ ISIS is the pulsed neutron and muon source at the Rutherford Appleton Laboratory in Oxfordshire of the Science and Technology Facilities Council

⁹ The total number is more than 44 because each RI can be classified in more than one scientific domain.

European programmes (FP6 and FP7) in order to get resources aimed at implementing their opening at the international level within network of researchers.

3.2.2 National participation in the ESFRI roadmap. Updates 2009-2010

The national strategy is traditionally a bottom up one, but it does not imply a dispersion of initiatives. Participation is basically supported by the sectors more integrated at international level, and it is also strictly shaped by the European strategies. According to the European Strategy Forum on Research Infrastructures (ESFRI) recommendations, each country should assure about €5-6m as contribute for sustaining the dedicated European budget. Italy DPEF 2008-2013 includes securing of long term investment for research infrastructures according to these recommendations. Annual budget laws are supposed to implement this measure accordingly.

Until nineties a special fund for infrastructures was set up at the MIUR level (about ITL50b per year, the equivalent of €25,000). Then, from 2000s, it is difficult to assess the national research investment for RI.

According to the 2009 ESFRI Interim Report, no national Roadmap has been already published, but the process to formulate a new one has started.

3.3 Strengthening research institutions

The ERA green paper highlights the importance of excellent research institutions engaged in effective public-private cooperation and partnerships, forming the core of research and innovation 'clusters', mostly specialised in interdisciplinary areas and attracting a critical mass of human and financial resources. The Universities/ research institutions should be embedded in the social and economic life where they are based, while competing and cooperating across Europe and beyond. This section gives an overview of the main features of the national higher education system, assessing its research performance, the level of academic autonomy achieved so far, dominant governing and funding models.

3.3.1 Quality of National Higher Education System

There are 65 public universities and 15 private universities in Italy; all universities have the same mission and are involved both in education and research. Among public universities there are four polytechnics, and two universities for foreign students, and 11 universities for distant learning. 40 public universities were funded prior to 1980. The number of private universities remains rather stable while the number of distant learning is growing.

General funding from the MIUR (FFO) is primarily used to pay salaries and other fixed costs. There is no a separate budget for education, but a general estimation is that 50% of financial and human resources (time) should be dedicated to teaching. FFO represents a ratio of more than 65% of the total HEIs income, while third party funding is a percentage of 25.5% (MIUR data, year 2008).

According to the Eurostat data, GOVERD paid to the HEIs 4,732.673; Business 59.356; PNP 58.147 and Abroad 177.204 (all in million of PPS at 2000 prices, data for 2008, source Eurostat). Thus figures show that abroad is a source of funding for HEIs larger than business and PNP. Considering the expenditure on national educational institutions as percentage of GDP at tertiary level (HERD as a share of GDP) for 2005, Italy's HEIs obtained a share of 4.2% from public sources (EU-27

average: 4.73) and a share of 0.44% from private sources (EU-27 average: 0.67) (STC Key Figures Report, 2008).

The number of students strongly increased between 2000 and 2006, from 1 million to 1.78 million, and remained rather stable (with a slight decrease) between 2006 and 2009 to 1.77 million. This evolution may be explained by the introduction of a two tier system since 2000. In 2006/2007 the Erasmus student mobility from Italy involved 17,195 students (10.8% of the total), less than Germany (about 15%), France (14%) and Spain (14.4%).

According to the [METRIS Country Report on Italy](#) the total number of the Italian publications in the ISI-Thompson database grew from 32,547 in 2000 to 43,758 in 2006 (5.1% average annual growth rate). In 2006 Italy had the fourth largest scientific production among the EU-27 countries (10% of the total), behind UK (19.4%), Germany (18%), and France (12.4). The number of publications per thousand researchers is also quite interesting and confirms the good performance of Italy: according to 2006 data, Netherlands (527) is first, Switzerland (424) is second, Italy (319) is third among European countries and second among the EU-27, well above France (213), Germany (194) and Spain (179).

NSF statistics show the following situation for S&E articles in Italy and EU-27 from 2000 to 2007, confirming the positive trend:

Table 4: Science Budget 2010-2015

	EU-27	Italy
2000	222,687	21,409
2007	245,851	26,554
2000-2007	+10.4%	+24%

Source: Eurostat

Although the mentioned figures cannot be attributed completely to the University performance, they can be considered a good indicator of the research performance of the public sector, which mainly contributes to the ISI publications.

Despite the introduction of the autonomy principle in 1989, in Italy the structure of degree courses did not change much until 1999, when the Ministry immediately transposed the principles and criteria of the Bologna declaration. The new degree system deleted the established structures and eased an impressive multiplication of the courses¹⁰. The introduction of requirements and standards even more stringent was seen as the only way to limit such explosion and bring order again. QA in education in Italy is aimed at developing methodologies for setting a quality system inside the academic organisations, mainly oriented to getting information about resources, processes and results of the teaching performance.

The CRUI has developed in the spread of the processes of quality in universities, since the start of the Campus Project aimed at the application of innovative methodologies to Bachelor degrees and at verification activities of the study programmes participating in the trial. Other experiences are the minimum requirements, and the transparency requirements set by the CNVSU for each University course. ANVUR is supposed to be in charge for setting the QA in University; ANVUR should handle the monitoring, verification and certification of the

¹⁰ This occurred also because universities tried to attract more students by labelling the courses with various and appealing names

activities (teaching, research and administration) carried out by universities. In such a way, a better harmonisation between autonomy, responsibility and evaluation will finally reach to maturation.

3.3.2 Academic autonomy

Few indicators can be outlined from recent literature, which allow us to know the level of University autonomy in Italy, in comparison with other countries (EUA, 2007; Reale, 2008b; Paradise et al. 2009, EC, 2010). Italian HEIs are responsible, as many other European countries, for defining their own institutional strategy, their internal academic and administrative structure, the structure of their decision making bodies and academic profile. They own most of their real estate, are entitled to buy and sell their real estate independently, as well as to buy and sell other financial assets, with no restriction on how money can be spent. Universities have the power to decide the overall number of students and the number of students per discipline, to admit special categories of students and to decide on the criteria for student admission.

In Italy universities have partial autonomy for deciding on structure and content of the degree programmes, as well as for opening and closing down study programmes. In both case they have to comply with “minimum requirements” or “quality requirements” settled by MIUR (by the way of CNVSU), which determine certain level of resources and study content of the curricula that the programmes must assure.

Universities suffer also limitations in the power to recruit permanent academic staff (recruitment rules and authorization for hiring new personnel), as well as to establish the salary levels, but gained the power to select researchers directly and to decide positions to be opened using the resources made available through the turn over. Moreover the total cost of the personnel cannot exceed the 90% of the Fondo di finanziamento ordinario (Ordinary Fund, FFO), that is the basic Government funding for Universities, and tuition fees cannot exceed the 20% of FFO. MIUR very recently (law 1/2009) modified few aspects of these rules in a more restrictive way. As to the possibility to use the resources available from the turn over, it was limited up to the 50% of the resources; as to the personnel cost, Universities that do not respect the 90% threshold in the year cannot hire new permanent personnel in the subsequent year.

On the contrary, no specific limitations have been set up for research. Universities can autonomously design their research agenda and topics of research specialisation, although only few of them have a recognizable research strategy as far as available data on funding allocation show us (Reale, 2008a). The Government's will is to reinforce the excellence of Universities. The quoted recent law 1/2009 modified the rules for the recruitment of researchers and professors in order to overcome the actual privilege to local candidates and reinforce the quality of the selection; it also enlarged significantly the share of FFO that will be allocated on the basis of the evaluation of the research performance (up to 7%).

Governance of University does not show strong changes in the last five years. Modification of the University governance is another key element of the government programme for the forthcoming years. MIUR guidelines for reforming the higher education sector put great emphasis on transforming Universities and public research organisations into organisation driven by merit criteria in all their activities (teaching, research, services, training, etc.). A law proposal (DDL 1387/2009) for the modification of the university governance is under the examination of the Parliament.

Law 133/2008 foresees also the possibility for Universities to transform themselves in public foundations if the majority of the components of the governing bodies would be approved it. This transformation is supposed to give a larger autonomy to universities and to make them stronger organisations. At this moment no university used this possibility mainly because of the uncertainties linked to the effects the transformation could produce.

Evaluation is a core element of the new reform process. Law 1/2009 foresees evaluation of University researchers and professors activities in order to obtain salaries improvements, and evaluation of the research institutions (both Universities and PROs) as driver of a significant part of funding allocation. Evaluation of public funding programmes is also mentioned as important item of the government programme. The Agency for the Evaluation of University and Research is still to be implemented. Meantime CIVR and CNVSU should assure the support to the MIUR initiatives. A new five year evaluation exercise (VQR) has been launched in 2010 by the MIUR in order to assess the research performance of Universities and PROs.

3.3.3 Academic funding

Italy has a dual university funding system composed by block grant funding (FFO) mainly covering the personnel cost, and a competitive funding based on different project funding schemes. The funding “formula” for the FFO allocation¹¹ was recently partly modified. Law 1/2009 established that 7% of the total FFO will be allocated on the basis of three criteria: quality of the education supply and educational results, quality of scientific research, quality efficiency and effectiveness of the teaching courses. By the end of March a Ministerial decree will set the rules on how to apply the aforementioned criteria, on the base of the CNVSU and CIVR advice. The third criterion will not be applied in the first year.

As to competitive funding, value and types of research project funding grow up and diversify: the number of programmes and delegation settings are rather fragmented into different schemes (PRIN, FIRB, FISR, FAR, Pus, Centre for excellence, Mixed Labs). From 2007 government foresee to recombine the all schemes into a unified framework, FIRST, but this provision is still to be implemented.

FFO is assigned yearly through the financial law. The low growth of the total amount of FFO along the last five years (from €6.010m in 2001 to €6.866m in 2008) give a very small support to long term R&D investment of Universities. Although this amount is complemented by the government project funding, even in this case we face a decrease of the R&D funding: from €537m in 2001 to €416m in 2005 (CNVSU, 2007). From 2009 to 2011 Government will reduce FFO (the Ordinary Fund) substantially. L. 133/2008 foreseen a stable value for FFO in 2009 and cuts of – 10.2% in 2010 and –12.2% in 2011 with respect to the 2008 amount.

A similar trend can be observed in the financing of public research organisations (PROs): the government block grant funding¹² grew from €1.575m in 2002 to around

¹¹ The funding formula is structured as follows: 30% of the FFO is determined on the basis of the existing educational demand (students enrolled and their characteristics); 30% depends on the results of the educational processes (credits acquired); 30% is linked to the evaluation of the university research results; 10% is linked to special incentives.

¹² The main tool for financing public non university R&D in Italy is the Fondo ordinario per ricerca e sviluppo (Ordinary Fund for R&D) which represents the core funding of the non university institutes. The Fund is a framework included in the national yearly financial law, for programming R&D, by areas, domains, themes and institutions.

€1.666m in 2008. L. 133/2008 did not foreseen reductions of the government financing of PROs.

3.4 Knowledge transfer

The importance of knowledge dissemination and exploitation in boosting competitiveness and contributing to the effectiveness of public research has been increasingly recognised by EC and EU Member States. Following the publication of the [ERA Green Paper](#) in April 2007, the EC Communication "[Improving knowledge transfer between research institutions and industry across Europe](#)" was issued, highlighting the importance of the effective knowledge transfer between those who do research, particularly HEIs and PROs, and those who transform it into products and services, namely the industry/SMEs.

Several Member States have taken initiatives to promote and facilitate knowledge transfer (for instance new laws, IPR regimes, guidelines or model contracts) and many others are planning to intensify their efforts in this direction. However, these initiatives are often designed with a national perspective, and fail to address the trans-national dimension of knowledge transfer. This section will assess the national policy efforts aimed to promote the national and trans-national public-private knowledge transfer.

3.4.1 Intellectual Property Policies

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. Before 2001, the intellectual property was regulated by the R.D. 1127/1939 and in particular by the article 34 which gave the ownership of the invention to the public institutions of research, while the inventor had the right of being recognized as author and received an "equo premio", if the invention was commercialized. This regulation has been substituted by the law 383/2001 and in particular by the art. 7, which makes a difference between public and private organisations and recognizes the ownership of the invention realized within the public institution to the inventor, who is charged of the cost and management of patenting. This law has been modified in 2005 and now for the inventions realized within the public institutions there are two regimes: if the inventions are 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. Notwithstanding the patent regime could be improved and simplified, universities (and public research organisations, which had developed a transfer activities well before academic institutions) since early '90s have produced internal regulations, which included the possibility of an agreement between inventor and public organisation for the transfer of the ownership from the first one to the institution, which assured the management and the cost support of patenting activity. These regulations are now diffusely present within universities and have supported the implementation of the law and an important process of reorganisation and specialization of the internal function of patenting and licensing, together with, less diffused but present, an activity of spin off promotion. Regulation takes into account reward systems for the inventors and aspects related to management, protection and promotion of IP rights. This reorganisation happened through the creation of specific structures, the transfer offices and in 2007 the 90% of universities answering to the national NETVAL survey had created this type of organisation. TTOs have usually a small size, but with the time going more specialized staff is involved.

When using public funds researchers are expected to publish the scientific results and a number of recent studies showed that patenting activity doesn't reduce, but can improve, the activity of publication, especially when the invention is realised within and owned by a public institution. More complex is the case of co-ownership between public and private partners, which is still not regulated by the law neither by internal regulations and depends on direct agreements. As to the policy of patent licensing or selling, a number of studies reveal that firms prefer to buy directly, while universities should prefer to keep the ownership and use a licensing contract.

Even if the law did not establish a financial support for the creation of technology transfer offices, universities have received some financial aid from the State, such as the funding ex art 12, D.M. of MIUR (5/8/2004, n, 262) on the Programme for the university system 2004-2006.

The TTO regulations are fundamentally in line with the Code of Practices for Universities and Public Research Organisations (EC, 2008), which includes three aspects: principles for an internal intellectual property ("IP") policy; principles for a knowledge transfer ("KT") policy, complementing that related to IP by focusing more specifically on the active transfer and exploitation and principles for collaborative and contract research, which concern all kinds of research activities conducted or funded jointly by public and private actors. The valorisation of the scientific activity has two main components: intellectual property rights use for scientific inventions (patents and licenses) and the creation of public research spin-offs, which are high tech companies including almost one scientist and where the academic or public research organisation participate to the equity. In Italy, starting from 1993, there have been a regular yearly creation of spin offs, which increased since 2000 (the number of new spin offs have doubled, from 22 new spin offs in 1999 to 43 in 2000), linked to the new incentive system, which introduced a Government support for spin-offs creation. In the last three years the number of new spin offs have been 116 in 2006, 138 in 2007 and 114 in 2008 (NETVAL, 2009). At present there are in Italy 806 spin offs, mainly localized in the North (62%) and Centre (24%). As to sectors, 35% is in value added services such as informatics; energy (16.4%) and life sciences (14.9%) are the other relevant sectors. Other spin-offs are involved in products and technologies such as electronics (10%), biomedicine (7.2%) and innovation services (7.2%). Among the sources of spin-offs, in the first positions are the Politecnico of Torino (11.1%), the INFM (National institute for new materials) (10.6%), the University of Bologna, the University of Padova, the S. Anna of Pisa, University of Perugia and CNR.

The TTO functions are IPRs management (83% of TTO), spin offs creation (80.9%) and only in a less frequent number of cases the management of R&D collaborations with industry (57.4%), which is a traditional function of the university Departments. One problem is represented by the low number of licenses or selling of public owned patents, therefore the effective valorisation and transfer of R&D results. Licenses are mainly with national firms.

Incentives given to academic personnel for the technology transfer activity vary among Universities. On average the academic personnel can: participate to a spin offs equity; take a quota of the research contracts; receive an economic reward for teaching in programmes of "training"; receive financial incentives for spin offs creation; much less diffused is a linkage with the progression in scientific career.

The results published in the latest survey (March 2010) carried out by NETVAL – the Italian network for strengthening university research valorisation – shows that the

technology transfer system show some improvement of the activities performed: the number and the qualification of the personnel working in the technology transfer offices has increased, with the average budget amounting to 20 million per university (+50% with respect to 2002).

3.4.2 Other policy measures aiming to promote public-private knowledge transfer

The involvement of private sectors in the governance bodies of HEIs and PROs is still low, even if industrial representatives are involved in some administration councils (i.e. CNR) and can play an influential role.

The mobility between the public and private sectors, which could help researchers and managers working in the public sector to identify shared needs with industry, is still very low in both directions.

The EIS (European Innovation Scoreboard) indicators show a poor performance of Italy in the international comparison as to the indicators 'innovative SMEs collaborating with others' and 'public-private co-publications': values are half of the EU-27 average, exhibiting a persisting difficulty of the Italian SME system to activate efficient exchange processes for acquiring new technologies and developing new applications.

The 2010-2012 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, canters of competence).

3.5 Cooperation, coordination and opening up national research programmes within ERA

The articulation between the R&D Framework Programmes, the Structural Funds and the Competitiveness and Innovation Programme is still underdeveloped in terms of coordination, synergies, efficiency and simplification. The policy fragmentation at EU and national level and between EU and national policies can hinder the build of critical masses of research excellence, leads to the duplication of efforts, sub-optimal impacts of the different instruments and unnecessary administrative overheads. Differences between research selection procedures and criteria can also be an obstacle to the overall spread of excellence. This section assesses the effectiveness of national policy efforts aiming to improve the coordination of policies and policy instruments across the EU, all part of the drive to create an integrated ERA.

3.5.1 National participation in intergovernmental organisations and schemes

At present Italy is involved in 144 ongoing initiatives within EU large programmes in sectors such as agriculture and biotechnology (22 initiatives); Telecommunication and Information Science (22); Chemicals (14); Forestry (16) and Medical research (11) (ERAWATCH Research Inventory, 2010).

The MIUR, the Ministry for University and Research, plays the leading role in the management and the coordination of a number of instruments and amount of funds ensuring the financial support for Italian participation to initiatives as [COST](#), [EUREKA](#) and European Framework Programmes. Other Ministries involved, with a limited participation as research funders, are the Ministry of Economic Development, the Ministry of Industry, Trade and Handicrafts (MAP), and the Ministry of Health, this last mainly through the ISS ("Istituto Superiore di Sanità").

The participation of Italian scientists to the Cooperation in Science and Technology in Europe (COST) actions has been considerable since the beginning. COST actions, once approved, are funded by the MIUR which is also the national coordination for the initiative. At present, 222 actions are funded covering different scientific fields.

Strong cooperation emerges in COST actions with Eastern European countries especially for those actions, which cover research in mathematics, robotics, languages and literature.

The participation in the EUREKA initiative is also relevant for Italy since its launch and has emerged as a meaningful instrument for funding international industrial research. Italy participates in 346 on the nearly 1,700 EUREKA projects launched from the beginning of the initiative. Italy's financial commitment in these projects amounts to €2,200m. 42.5% of projects with an Italian participation is concentrated on information technologies, 16% on robotics and 11.6% on the environmental disciplines. The breakdown of financial commitment by technological area shows an amount of 50% in information technologies, 16.3% in robotics and 14.7% in transportation (ERAWATCH Research Inventory, 2010).

Finally, Italy fully participates in the Framework Programmes since their launch, through the Ministry for University and Research, which also influence the priority-setting of the National Research Plan. In FP7 large participation has emerged (13,435 units, with Italy rating second behind Germany) but strong reduction of the proposals admitted to negotiation (1,807 units: Italy rates fourth behind Germany, UK and France). The success rate of Italian participants is 13.4%, while the European average is 17.9%. The financial support requested by Italian applications was €3.9b; the funds granted were €523m (9% of the total budget; 9.85% of the budget available for the EU member states). Out of 2,979 negotiated applications, 1,351 referred to the Cooperation programme and 1,101 to the People one; within Cooperation, the largest participation was related to the ICT programme (467 proposals), then came Health (312) and TPT (128) (ERAWATCH Research Inventory, 2010).

Italy also joins to important collaborative arrangements concerning infrastructural facilities, supporting the establishment and improvement, through financial contribution, of several research facilities of European and national interest.

At example, Italy participates to ESA - European Space Agency - activities with direct contributions from Italian government through the national space agency (ASI-Agenzia Spaziale Italiana). For year 2007 the amount of total Italian contribution to ESA was of €369.95m.

Italy also contributes to several inter-governmental research infrastructures as the CERN (European Organisation for Nuclear Research), the IAEA (International Atomic Energy Agency) and EURATOM in the field of nuclear energy, EMBC (European Molecular Biology Conference), EMBL (European Molecular Biology Laboratory), the ICTP (the International Centre for theoretical Physics) and the IIAS (International Institute of Administrative Sciences). The MIUR participation to these organisations is

envisaged in the frame of the larger multilateral scientific cooperation of the Ministry, which encompasses also the collaboration with organisations as UNESCO and NATO, and is mainly aimed at monitoring the consistency of activities carried out by the organisations with their programmes and statutory objectives.

The participation to several the international collaborative agreements can be also assessed. Italy participation to the EFDA, an agreement between European fusion research institutions and the European Commission to strengthen their coordination and collaboration, is ensured through the MIUR with the scientific and technical support of ENEA –National Agency for new Technologies, Energy and Sustainable Economic Development- and the CNR.

The CLSF - Carbon Sequestration Leadership Forum is a Ministerial-level international climate change initiative which includes 23 countries and the EC, and which focuses on the development of improved cost-effective technologies for the separation and capture of carbon dioxide (CO₂) for its transport and long-term safe storage. For Italy, ENEA provides the technical support and co-financing is ensured by the Ministry of Economic Development and also by the MIUR in the frame of the Law 297/99 (funds for industrial research).

The Human Frontier Science Programme Organisation was founded in 1989 to support international research and training at the frontier of the life sciences with particular emphasis on research at the interface between life sciences and the physical sciences and on creating opportunities for young scientists. Italy supports the Programme with contributions from the MIUR (\$1,550,000 in 2004).

Italy's membership to the ESFR, to create the synchrotron in Grenoble, started in the eighties and it covers the 15% of the ESFR annual budget (for 2009 the whole budget for operating the ESRF is €94m).

Finally, thorough the Ministry of Health and the ISS (National Health Institute) Italy takes also part to several initiatives and infrastructures in the field of medical research as the European Clinical Research Infrastructures Network (ECRIN), a sustainable, not-for-profit infrastructure supporting multinational clinical research projects in Europe.

3.5.2 Bi- and multilateral agreements with other ERA countries

Bilateral agreements have a long tradition as schemes to share research facilities, both public and private, knowledge, human resources and laboratories in the frame of overall strategies to improve research coordination of Italian and foreign scientific organisations. Several bilateral and multilateral agreements, about 70 at present, concerning different scientific sectors, have been established by the MIUR and the MAE with foreign scientific institutions, covering almost all European countries. Cooperation is carried out via the negotiation of Executive Programmes for Scientific and Technological Cooperation in the within of a intergovernmental Framework Agreement on Cultural, Educational, Scientific and Technological Cooperation (Source: Elena Pérez S., De Dominicis L., Guy K., Developing the European Research Area: Opening-up of National R&D Programmes and Joint R&D Policy Initiatives, JRC, 2010).

Recent Executive Programmes on Scientific and Technological Cooperation, which include both types of programmes, issued by the MIUR and the MAE with ERA countries are the following:

- Sweden (for 2010-2013) for the priority research areas of Energy and Environment, Sustainable Cities, Space and Earth Observations, Nanotechnology and Material Science -Neutron and Synchrotron Radiation-, Technologies Applied to the Cultural Heritage-: Archaeological-Wood Conservation);
- Hungary (for 2008-2010 and 2011-2013), for the priority research areas of Basic Sciences (BS), Energy and Environment (EE), Life Sciences (LS), Nano Sciences and Advanced Materials (NSAM), Information and Communication Technology (ITC), Technologies for Cultural Heritage (TCH);
- The French community in Belgium (for 2007 -2008 and 2009-2010), for several priority research areas;
- Poland (for 2007-2009) for the priority research areas of Astronomy, Space Technology, Physics, Chemistry, New Technologies, Agriculture, Energy and Environment, Food Technology and Biotechnology, Medicine and Health, Enhancement of cultural heritage through the use of new technologies.

3.5.3 Other instruments of cooperation and coordination between national R&D programmes

In the National Research Programme 2005-2007 strategic action to strengthen the scientific base of the country are indicated, among which the support of the participation of national science into the EU and other international research programmes (ERAWATCH Research Inventory, 2010). Italy participates to several initiatives at EU level boosting cooperation between national R&D programmes, mainly with the main financial contribution of the MIUR and, to more limited extent, of other Ministries, as the Ministry of Economic Development and the Ministry of Health.

During FP6 106 ERANET projects have been launched with an investment from the Commission of €183,000. These projects involved 1,047 participants from 40 European countries. 29 Italian participants participated in 47 projects and gained a total support of more than €6.5m. The Italian participation to the ERANET projects involved different institutions; it included Ministers (7), Regions (5), public research agencies national (2) and regional (2), public research organisation (9) and other bodies (4). The Italian Ministry of Health participates with its own funds to the ERANET project NEURON to promote and improve a high quality scientific research in medical and services sectors to improve the population welfare state.

At present MIUR participates to the following ERANET projects: ACENET, AIRTN, BIODIVERSA, ERA-PG, EUROPOLAR, HY-CO, MATERA, and NET HERITAGE. Among the most recent ERANET activities, the MIUR participates to the activity named CHIST-ERA (European Coordinated Research on Long term Challenges in Information and Communication Sciences and Technologies). Italy funds projects within one of the two priorities identified by CHIST-ERA, the “Quantum Information Foundation and Technologies” with a maximum contribution of €500,000. MIUR also participates to the support action funded within the FP7 [COSINE2](#) which involves also ministries and agencies from Austria, Belgium, Finland, France, Germany, Israel, Czech Republic, Sweden and Hungary.

It is also worth to mention the programme “Extraordinary Programme in Oncology Research”, launched by the Italian Ministry of Health with the decree 21 July 2006,

which assigned about €30m to a national non profit agency, the “Alliance against the Cancer Association” (ACC). This co-funds national health institutes to strengthen international and European scientific collaborations through the participation to ERA-NET projects, to projects within the European Strategy Forum for Research Infrastructures (ESFRI) and FP7.¹³

As for joint activities undertaken under article 185 of the Treaty of Lisbon (ex. Art. 169 of the EC Treaty) Italy is member, through the participation of the ISS-Istituto Superiore di Sanità-, of the EDCTP- European & Developing Countries Clinical Trials Partnership. EDCTP was created in 2003 as a European response to the global health crisis caused by the three main poverty-related diseases of HIV/AIDS, malaria and tuberculosis. All EDCTP-funded projects are undertaken in partnership with sub-Saharan countries. EDCTP was part of FP6 and at present of FP7. Through the National Metrology Institutes (Istituto Nazionale di Ricerca Metrologica - INRIM) a public research institute of the MIUR, Italy is also involved in the EMRP- European Metrology Research Programme.

Italy also participates, with MIUR co-funding, to two important joint activities: the AAL- AMBIENT ASSISTED LIVING and the EUROSTARS programme. Budget of these initiatives are both from EC and from national budgets (D.L.vo 297/1999 ed il DM 593/2000 (art. 7).

For the AAL initiative, which aims at improving life conditions for aged and disabled person through home technological devices, at the moment 8 projects are going to be funded (call 2008) named Help, Happy ageing, Aladdin, H@H, HOPE, ROSETTA, AGNES, REMOTE, and after the call 2009, 9 Italian research projects are undergoing the evaluation procedure for funding from the MIUR. For the 2010 the financial budget of the MIUR for the AAL initiative will be of €2.5m.

The EUROSTARS programme is stemming from the EUREKA initiative and addresses SME and industries needs for improving R&D activities and collaborations. In 2008 the financial contribution of the MIUR was of €5m and 62 projects have been submitted. 21 projects are going to be funded for a total amount of €6.4m (€5m of the MIUR, 1.4 of the EC). The same amount of MIUR funding in 2009 allowed to funding 14 projects. In 2010 two calls of proposals, for a total amount of €2.5m each, have been launched.

Although the Project funding in Italy is mostly channelled through the MIUR, the Ministry for University and Research, while the role of other Ministries is less relevant and no intermediary funding agencies exist with the exception of the ASI, the CNR has the role of funder in the EUROCORES Programmes (European Collaborative Research Programmes) of the European Science Foundation, besides participating as performer to several international programmes in different scientific sectors.

In 2007 the Ministry of Economic Development, the Ministry for Innovation and MIUR signed an agreement for sustaining the Italian participation to JTIs. In FP7 two JTIs have been launched: ARTEMIS-Advanced Research and Technology for Embedded Intelligence and System, and ENIAC for nanotechnologies. The AENEAS (Association for European NanoElectronics Activities) and 17 Member States (Italy, Austria, Belgium, Czech Republic, France, Germany, Hungary, Ireland, Norway, UK, Portugal, Spain, Sweden, Estonia, Greece, The Netherlands and Poland) participate to the ENIAC. The first call for proposals of the ENIAC initiative in 2008 addressed

¹³ Source: <http://www.salute.gov.it/ricercaSanitaria/ricercaSanitaria.jsp>

Nano-electronics related to specific research topics. Italy contribution to the ENIAC 2008 call has been of €10m. Many initiatives were organised in Italy in order to promote and to support the Italian participation both by MIUR (through APRE) and private industrial association, such as Confindustria.

Finally, a specific field in which joint cooperation is implemented is the Antarctic research. Italy takes part to the PNRA-National Programme of Research in Antartide, with the collaboration of ENEA and CNR. The MIUR decree Prot. 1247/Ric on October 2007 has established the National Scientific Commission for Antartide. The mission is realized in the within of the Antartic treaty of 1981 and activities are carried out by a Consortium for the National Programme of Research in Antartide (Consorzio PNRA S.c.a.r.l.) which started its activities in 2003.

3.5.4 Opening up of national R&D programmes

No specific measures can be identified aiming at opening national R&D programmes to foreign researchers, allowing them to do research in their home countries. Programmes mainly support researchers exchanges and aims at attracting foreign researchers, or Italian researchers working abroad to perform research in Italian Universities and public research organisations.

Main open programmes concern then funds for facilitating the return of Italian scientists from abroad, as the programme “Rientro dei Cervelli” – “Return of the Brains” or “Brain Gain”; funds for attracting foreign researchers, mainly funded with FIRB fund; funds from MIUR to attract young researchers, both Italian and of other nationalities, to work in Italian Universities as the “Montalcini Programme”.

The programme “Rientro dei Cervelli” was born in 2001 (with the Ministerial Decree 26/1/01 no. 13), in order to facilitate the return from abroad of Italian scholars and scientists) and also to encourage foreign scholars to work in Italy. The application is submitted by universities interested in hosting the candidate, and selected fellows are offered a three years contract with university of his/her choice. In 2006, approximately 500 scholars in various disciplines had returned to Italy from abroad; most hold (or held) contracts in scientific fields, although other disciplines are present as well, such as jurisprudence, architecture, and philosophy.

The FIRB funds several initiatives addressed to researchers as the programme “Futuro in ricerca” (Future in research) which is open to young researchers from Italy or from other EC countries, aged maximum 32, without a permanent position in an Italian University or a public research Institute. FIRB funds innovative research project of scientific and technological relevance, the improvement of research infrastructures and the creation of research centres networks also at international level. Proposals undergo an evaluation from a Commission, which includes members of different institutions (CRUI, CNEL, CIVR, and CUN) and six MIUR members.

With the Ministry Decree n. 45 of 23/9/2009 the Italian Ministry for Education, Universities and Research has initiated a €6m funding programmes the Montalcini Programme, to promote the internationalization of Italian Universities by enabling Italian and foreign early stage researchers working abroad to carry out a research project at an Italian University of their choice. Candidates from all disciplines who have completed their scientific training (doctorate) within six years prior to 27 December 2009 and who have at least three years of substantial experience in teaching and/or research in an Higher Education Institution abroad can submit a research proposal and list three public Universities in Italy, where they would like to carry their research project. Successful candidates in the Montalcini Programme will

be offered a 3-year, full-time, fixed-term contract by one of the three Universities listed in the proposal. Contracts can be renewed to up to a maximum of six years.

Finally it is worth to remind that initiatives of open research activities are also decided and carried out autonomously, with MIUR funds, by research institutions and Universities.

3.6 International science and technology cooperation

In 2008, the European Commission proposed the [Strategic European Framework for International Science and Technology Cooperation](#) to strengthen science and technology cooperation with non-EU countries. The strategy identifies general principles which should underpin European cooperation with the rest of the world and proposed specific orientations for action to: 1) strengthen the international dimension of ERA through FPs and to foster strategic cooperation with key third countries through geographic and thematic targeting; 2) improve the framework conditions for international cooperation in S&T and for the promotion of European technologies worldwide. Having in view these aspects, the following section analyses how national policy measures reflect the need to strengthen the international cooperation in S&T.

3.6.1 International cooperation

Bi- and multilateral agreements for S&T cooperation with third countries are carried out in Italy in the frame of the Executive Programmes for Scientific and Technological Cooperation within an intergovernmental Framework Agreement on Cultural, Educational, Scientific and Technological Cooperation. Examples are the Executive agreement with Albania, signed for 2008-2010, which covers several priority research areas as Health, Agriculture, Geology, Environment, ICT, Archaeology, and the executive agreements with Canada, Korea, India, Iran, Uruguay, Uzbekistan, Yemen, Vietnam, Japan and Africa.

In the specific field of sanitary research we could assess a cooperation programme for research purposes, the "Bilateral programme Italy –USA for sanitary and health research". It is based on a Memorandum signed in 2003, renewed recently until 2011, to strengthen the collaboration in the context of medical research between the Ministry of Health and the USA HHS Department (Department for Human Health services). The memorandum includes mobility and exchange of researchers, technologies and information, organisation of conference and joint research projects and scientific programmes to be developed by Italian and America health research institutions.

The memorandum covers medical research in the fields of cancer, infective diseases and rare diseases, bioterrorism. For each topic a coordinating body was identified in both countries. The Italian Ministry of Health indicated the ISS (National Health Institute) for the first two research fields and the Istituto nazionale Lazzaro Spallanzani for bioterrorism. The USA Department for Human Health services involves the Assistant Secretary for Public Health Emergency Preparedness, the National Institutes of Health and the Food and Drug Administration. The Ministry of Health financial contribution for 2006 was of €12,720,000.

3.6.2 Mobility schemes for researchers from third countries

Mobility schemes targeting researchers from third countries are often carried out by Academic Institutions on their own decisions. So far, impact studies have been develop to a very initial stage on joint studying programmes which involve also

mobility of students of EU and non EU countries, but are missing for researchers mobility. Nevertheless, an opening to Far East and in particular Chinese students and researchers can be observed. As an example Italy participates to the ASEM-DUO Fellowship Programme, which supports visiting of professors and students in tertiary education field, aiming at contributing to setting up regular-basis exchange programmes between European and Asian tertiary institutions.

The programme was proposed in 2001 and it involves at present almost all EU countries and several Asia countries (Brunei, Japan, Korea, Myanmar, etc.). Italy also joins to the CEI University Network (CEI UniNet), operational since 2004. It is the specific [Central European Initiative](#) for higher education in order to enhance cooperation among universities and other institutions of higher learning in Central, Eastern and South Eastern Europe, through the mobility of students and teaching staff at post graduate level. No information on the Italian investment is available.

4 Conclusions

4.1 Effectiveness of the knowledge triangle

The present policy mix is facing some of the national system weakness. What is to be remarked is that Italy is far away from the Lisbon target and that a strong pro active Government behaviour is asked, including an efficient implementation of the measures (availability of resources, less time gap between demand and fund allocation), continuity of policy and revision based on a systemic (regular, interesting institutions and projects and open to evaluate the effect of measures devoted to similar aims) evaluation. Two specific aspects can be underlined: the coordination between the Ministry for University and Research and the Ministry of Economic Development needs to be improved, for overcoming the traditional separation of the national system between research and innovation; the Structural Funds play a key role in the present policy mix, and a good monitoring of their use towards more R&D based initiatives needs to be assured. A new and more structured interest for the financial institutions role in R&D activities has emerged and this shows a cultural change in the national policy making. The national RDI system needs to be pushed out of its simple reproduction; a modernisation of the national productive and technological specialisation needs a larger contribution and the SMEs, which innovate mostly in process, needs to be re oriented towards product and R&D based innovation.

The effectiveness of the knowledge triangle can be assessed following the recent policy changes in Italy and their strength and weaknesses.

Table 5: Effectiveness of knowledge triangle policies

	Recent policy changes	Assessment of strengths and weaknesses
Research policy ¹⁴	<ul style="list-style-type: none"> • 2010-2012 NPR sustains both the basic research and the upgrading of research oriented to socio economic application, at medium and short term. Particular attention is devoted to enabling technologies and their diffusion within industrial innovation programmes. An increasing orientation towards targeted and mission oriented programmes characterises the R&D policy. • There is also an emerging attention and support to new technology based firms. • A simplification and a coordination of governance have been pursued through the unification of different funds and measures. • The 2010-2012 NPR envisages concentrating resources of PON Research and Competitiveness on a small number of large interventions, where public and private actors could operate with shared objectives. • In recent years, the system has witnessed a shift from direct support mechanisms based on grants and loans to indirect support, mostly based on tax incentives to R&D. 	<ul style="list-style-type: none"> • All these changes go in the right direction of supporting a structural change of national economy. The problem is their implementation: lack of resources or of application rules can make this policy a wishful thinking. • At present only the Fund for the Competitiveness is operative. The problem is the implementation of the policy instruments (time, continuity, resources). • 2007-2013 QSN recommends a linkage between the development policy and the R&D and innovation policy. But it should be necessary a regular policy of coaching and monitoring of instrument application. The Agency for Innovation should have to develop this task. • Fiscal incentive has been designed to help SMEs in doing more research activity, but this instrument has some drawbacks (it works well for firms doing regular R&D and has a small effect on the R&D level).
Innovation policy ¹⁵	<ul style="list-style-type: none"> • Development of innovative industrial sectors through complex, integrated systems such as Technological Districts (now 29 TD have been formally recognised), Excellence Poles and National Technological Platforms. • Technological transfer activity through the support to technology transfer offices within research poles or the restructuring of firm incubators. • The support to the creation of new high tech firms, as a spin off process from academic research (L. 297/99). 	<ul style="list-style-type: none"> • The relation between Universities and local initiatives such as technology parks or incubators (where the gap between knowledge supply and demand can be matched) is still not enough developed. (2010-2012) NPR envisages, the need of evaluating the experience done with the operating Technological Districts. • The new University transfer policy can be too less oriented towards the needs of SMEs. The scarce differentiation of University in Italy can reduce linkages with local productive demand The decreasing resources for universities have created problems of personnel shortage also to TTOs.

¹⁴ Research policy – Policies designed for funding public research organisations and programmes, including the stimulation of science-industry linkages

	Recent policy changes	Assessment of strengths and weaknesses
Education policy ¹⁶	<ul style="list-style-type: none"> To improve the education performance in terms of general quality and of producing more research oriented and more science and technology-oriented scholars the Law 1/2009 includes measures finalised: to favour the recruitment of young researchers in Universities; to support Universities showing good performance in terms of research and teaching performance; to foreseen parameters for the evaluation of professors and researchers; to rationalise tertiary courses. Special incentives the setting up doctoral schools. 	<ul style="list-style-type: none"> Factor of weakness is the decreasing trend followed by the resources mobilisation for University research activities in 2000s; there are not yet clear estimations of resource savings neither indication of priority actions, while cuts of resources are already in place. Extraordinary Plan for Recruitment of Researchers contemplated by the 2009 Budget Law goes with a limitation of the possibility of Universities to decide positions to be opened using the resources made available through the turn-over. There are low career perspectives for researchers and for attracting foreign scholar.
Other policies ¹⁷	No other policies exist.	

4.2 ERA 2020 objectives - a summary

The awareness about ERA issues is growing up in Italy. It goes with the reinforcement of the importance given in the policy documents to the internationalisation of research, to the promotion of young brilliant researchers, to the pursuing of excellence of institutions and programmes as well as to the mobility of people around Europe.

The traditional low investment of Italy in R&D, the financial crisis and the lack of adequate funding resources to sustain the reform process toward a more integration of labour market, research infrastructures, research institutions and national programmes, represent strong barriers for the realisation of ERA policies.

Because the economic crisis does not allow substantial mobilisation of resources, Italian government intends to face these constraints through policies mainly aimed at rationalise the system. Policies will be aimed at keeping resources to invest through eliminating inefficiencies, avoiding duplication of research effort, as well as to concentrate resources on the most promising initiative in terms of integration at European level. Nevertheless the weak monitoring system as well as the scarce co-ordination between different Ministries is factor which can inhibit the achievement of good results.

¹⁵ Innovation policy: The finance available for innovative business activities; Public procurement and other demand-side policies; Intellectual property registration and protection

¹⁶ Education policy: policies which affect the labor supply for science, technology and research oriented jobs

¹⁷ Other policies: refer to policies having an influence on innovation, research or education policy': supportive framework conditions: the business framework, product market regulation and labor market legislation, social, regional policies, defence, health and environment etc.

Table 6: Assessment of the national policies/measures supporting the strategic ERA objectives (derived from ERA 2020 Vision)

	ERA objectives	Main policy changes	Assessment of national strengths and weaknesses with regard the specific ERA objective
1	Ensure an adequate supply of human resources for research and an open, attractive and competitive single European labour market for male and female researchers	<ul style="list-style-type: none"> • Extraordinary plan for recruitment of researchers at an early stage of career in both Universities and public research institutions was foreseen in the 2009 budget law. 	<ul style="list-style-type: none"> • The supply for science and engineering is not adequate and in some fields the training do not match the market demand. • Overall low attractive working conditions for researchers, low salaries, difficulties to gain permanent positions, scarce relevance of merit; however the social security protection, including maternity leave is guaranteed.
2	Increase public support for research	<ul style="list-style-type: none"> • Public budget for research was reduced due to the general cut to the public expenditures. 	<ul style="list-style-type: none"> • Overall, low levels of R&D expenditure, strongly affected by the crisis.
3	Increase European coordination and integration of research funding	<ul style="list-style-type: none"> • FIRST should coordinate a range of instruments among MIUR, Ministry of Economic Development and Ministry of Public Administration and Innovation. 	<ul style="list-style-type: none"> • The reunification into a single framework-FIRST of the national project funding scheme should ease the coordination of national objectives with the European level. • FIRST is still to be implemented.
4	Enhance research capacity across Europe	<ul style="list-style-type: none"> • No relevant policy change. 	<ul style="list-style-type: none"> • Capability of the research base to participate in the EU Framework Programmes is good as well as the participation in COST actions. ERANETs and joint programmes. • Low mobility and openness of the researchers labour market, and lack of open programmes.
5	Develop world-class research infrastructures (including e-infrastructures) and ensure access to them	<ul style="list-style-type: none"> • Starting the development of the national Roadmap for RIs. 	<ul style="list-style-type: none"> • Good participation and access to RIs. • Difficulties to enlarge the base of RIs (development and access) for the lack of available resources.

	ERA objectives	Main policy changes	Assessment of national strengths and weaknesses with regard the specific ERA objective
6	Strengthen research institutions, including notably universities	<ul style="list-style-type: none"> • Law 1/2009 includes measures to favour the recruitment of young researchers in Universities; to support Universities showing good performance in terms of research and teaching performance through a more effective use of the formula funding; to foreseen parameters for the evaluation of professors and researchers; to rationalize tertiary courses, to set special incentives the setting up doctoral schools. • A DDL for reforming the University was presented by the Government. • The government decree reforming the PROs under the MIUR supervision passed (D.lgs 213/2009). 	<ul style="list-style-type: none"> • The law had a positive impact in terms of making universities aware about the need to rationalise their costs and improve the merit of research and teaching performance. • The excessive cut of resources and the lack of evaluation might become a strong constraint for introducing changes within universities. • The new reform of the University should modify the internal governance and the recruitment rules. • The effects of the PROs reform are not yet visible. No dedicated resources are available for supporting the changes in the governance and the multiyear planning.
7	Improve framework conditions for private investment in R&D	<ul style="list-style-type: none"> • Some recent initiatives include a government's allocation of €210m for research and innovation in the energy sector, an e-government plan 'E-gov 2012' launched in January 2009, the launch of several FIT calls and the launch of the new regional framework 2007-13 (QSN). 	<ul style="list-style-type: none"> • Weak aspects are the time for resource allocation and the effective availability of the resources along the years.
8	Promote public-private cooperation and knowledge transfer	<ul style="list-style-type: none"> • PON Research and Competitiveness, based on the Agreements of the Framework Programme (QSN) between Ob1 regions and the Ministry for University and Research. The 2010-2012 NPR envisages concentrating resources on a small number of large interventions, where public and private actors could operate with shared objectives. 	<ul style="list-style-type: none"> • The existing separation between the transfer policy of public research institutions based on patents and the SMEs demand might inhibit the impact of public-private cooperation. • The absorptive capacity of SMEs should be further improved.
9	Enhance knowledge circulation across Europe and beyond	<ul style="list-style-type: none"> • No relevant changes. The re-organisation of the incentive system put a special attention to financially support (automatic fiscal measures) SMEs which collaborate or commit research activity to scientific institutions; hire qualified research personnel and their attendance to PhD courses. 	<ul style="list-style-type: none"> • Large interest of SMEs on the new measures: the demand for fiscal support has been higher than the resources availability. • Despite the proliferation of initiatives, the dialogue between research and industry is still not satisfactory.

	ERA objectives	Main policy changes	Assessment of national strengths and weaknesses with regard the specific ERA objective
10	Strengthen international cooperation in science and technology and the role and attractiveness of European research in the world	<ul style="list-style-type: none"> • 2010-2012 NPR recognizes the need of strengthening international cooperation in science and technology in Europe. 	<ul style="list-style-type: none"> • NPR is still in a draft form, and it does not foreseen specific actions with a related budget.
11	Jointly design and coordinate policies across policy levels and policy areas, notably within the knowledge triangle	<ul style="list-style-type: none"> • More coordination between the Ministry for Research and the Ministry of Economic Development. 	<ul style="list-style-type: none"> • The overall research policy framework has a better coordination through the NPR. • Research and innovation policies still need to improve the integration of the actions foreseen, and a better coordination with educational policies at tertiary and secondary level.
12	Develop and sustain excellence and overall quality of European research	<ul style="list-style-type: none"> • Evaluation is supposed to be a major instrument for pursuing excellence. • ANVUR and VQR, QA and new rules for the accreditation of University courses are actions foreseen. 	<ul style="list-style-type: none"> • The implementation of the policy measures is very low and the retards of VQR impact of the effectiveness of the University law 2009/1.
13	Promote structural change and specialisation towards a more knowledge - intensive economy	<ul style="list-style-type: none"> • No recent policy changes. 	<ul style="list-style-type: none"> • The number of graduates and PhDs is still low. The number of researchers on labour force and on total population is one of the lowest in Europe.
14	Mobilise research to address major societal challenges and contribute to sustainable development	<ul style="list-style-type: none"> • NPR foreseen actions to address the major societal challenges in the light of ERA 2020 vision. 	<ul style="list-style-type: none"> • NPR presents a clear planning of actions but it does not include the indication of a dedicated budget for the actions' implementation.
15	Build mutual trust between science and society and strengthen scientific evidence for policy making	<ul style="list-style-type: none"> • Enhancing accountability is a major policy aim to be implemented through the ANVUR activities. Meantime a five years evaluation exercise of Universities and PROs was launched by the MIUR (VQR). 	<ul style="list-style-type: none"> • ANVUR is not yet implemented, VQR was launched (Decree 8 march 2010) but the implementation has been stopped before the setting of the Scientific Panels.

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List of Abbreviations

ACC	Alliance Against the Cancer Association
ACENET	ERA-NET for Applied Catalysis Technical Secretary of Governance for the Coordination of Research Activity (Attività di Coordinamento della Ricerca Italiana)
ACR	
AENEAS	Association for European Nanoelectronics Activities
AGNES	Successful Aging in a Networked Society
AIRTN	Air Transport Net
ANVUR	National Agency for the Evaluation of Research
ASEM-DUO	Asia-Europe Meeting Fellowship Programme
ASI	Italian Space Agency
BERD	Business Expenditures for Research and Development Cooperation and Shared Strategies for Biodiversity Research
BIODIVERSA	Programmes in Europe
BS	Basic Sciences
CEI	Central European Initiative
CERN	European Organisation for Nuclear Research European Coordinated Research on Long Term Challenges in
CHIST-ERA	Information and Communication Sciences and Technologies
CILEA	Lombard Inter-University Consortium for Automatic Computation
CINECA	Inter University Consortium for Computational Applications
CIPE	Inter-Ministerial Committee for Economic Planning
CIVR	Committee for Evaluation of Research
CLSF	Carbon Sequestration Leadership Forum
CNEL	National Council of the Economy And Labour
CNR	National Research Council
CNVSU	National Committee for the Evaluation of the University System
CONISMA	National Interuniversity Consortium For Marine Sciences Coordinating Strategies for Embedded Systems in the European
COSINE 2	Research Area Follow-Up Project

COST	European Cooperation In Science And Technology
CRUI	Conference Of Italian University Rectors
CTS	Techno-Scientific Commission
CUN	National University Council
DDL	Law Proposal (Disegno di Legge)
DESY	Deutsches Elektronen-Synchrotron
DG-RTD	Directorate-General for Research And Innovation
DPEF	Document of Economic and Financial Policy
EC	European Commission
ECRIN	European Clinical Research Infrastructures Network
EDCTP	European & Developing Countries Clinical Trials Partnership
EE	Energy and Environment
EFDA	European Fusion Development Agreement
EIS	European Innovation Scoreboard
EMBC	European Molecular Biology Conference
EMBL	European Molecular Biology Laboratory
EMRP	European Metrology Research Programme
ENEA	National Agency for New Technologies, Energy and Environment
ENIAC	Electronic Numerical Integrator and Computer Joint Undertaking
EPO	European Patent Office
ERA	European Research Area
ERA-NET	European Research Area Network
ERA-PG	ERA-NET on Plant Genomics
ERC	European Research Council
	European Research Council Programme for Investigator Driven Research
ERC-IDEAS	Research
ERP Fund	European Recovery Programme Fund
ESA	European Space Agency
ESFRI	European Strategy Forum On Research Infrastructures
EU	European Union
EU-27	European Union Including 27 Member States
EURATOM	European Atomic Energy Community
	The European Polar Consortium: Strategic Coordination and
EUROPOLAR	Networking of European Polar RTD Programmes
EU-SGHRM	European Steering Group on Human Resources and Mobility
FAR	Fund for Applied Research
FAS	Fund for the Underdeveloped Areas
FDI	Foreign Direct Investments
FERMILAB	Fermi National Accelerator Laboratory
FFO	Ordinary Fund for Higher Education
FIRB	Basic Research Investment Fund
FIRST	Scientific and Technological Research Investments Fund
	European Framework Programme for Research and Technology Development
FP	
FP7	7th Framework Programme

GARR	Italian Research & Education Network (Gestione Ampliamento Rete Ricerca Consortium)
GBAORD	Government Budget Appropriations or Outlays on R&D
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D
GOVERD	Government Intramural Expenditure on R&D
GUF	General University Funds
H@H	Health@Home
HE	Higher Education
HEI	Higher Education Institutions
HERD	Higher Education Expenditure on R&D
HES	Higher Education Sector
HHS	Human Health Services
HOPE	Heritage of The People's Europe
HRST	Human Resources In Science And Technology
HY-CO	Hydrogen And Fuel Cells ERA-NET
IAEA	International Atomic Energy Agency
ICE	Institute for Foreign Trade
ICF-OMS	International Classification of Functioning Health and Disease – Mondial Organisation of Health
ICT	Information and Communication Technologies
ICTP	International Centre for Theoretical Physics
IIAS	International Institute of Administrative Sciences
ILL	Institut Laue-Langevin
INFN	National Institute for Nuclear Physics
IP	Intellectual Property
IPI	Institute for Industrial Promotion
IPR	Intellectual Property Right
ISCED	International Standard Classification of Education
ISS	Istituto Superiore di Sanità –National Health Institute
ITC	Information and Communication Technology
JRC-IPTS	Joint Research Centre - Institute for Prospective Technological Studies
KT	Knowledge Transfer
LS	Life Sciences
MAE	Ministry of Foreign Affairs
MAP	Ministry of Industry, Trade and Handicrafts
MATERA	Era-Net Materials
MISE	Ministry of Economic Development
MIUR	Ministry for Education, University and Research
NET	European Network On Research Programme Applied to the
HERITAGE	Protection of Tangible Cultural Heritage
NETVAL	Network For The Valorisation of University Research
NPR	National Research Programme
NResP	Number of Responses

NSAM	Nano Sciences Advanced Materials
OB1	Objective Area of The Structural Funds
OECD	Organisation for Economic Co-Operation and Development
OGS	National Institute of Oceanography and Experimental Geophysics
PNR	National Research Programme
PNRA	National Programme Of Research in Antartide
PONs	National Operational Programmes
PORs	Regional Operational Programmes
PRIN	National Interest Research Programmes
PROs	Public Research Organisations
PUS	Public Understanding of Science
QA	Quality Assurance
QSN	National Strategic Reference Framework
R&D	Research and Development
REMOTE	Remote Health and Social Care for Independent Living of Isolated Elderly with Chronic Conditions
RI	Research Infrastructures
ROSETTA	Guidance and Awareness Services for Independent Living
RTDI	Research Technological Development and Innovation
S&T	Science And Technology
SCI	Science Citation Index
SF	Structural Funds
SME	Small And Medium Sized Enterprise
STC	Science, Technology and Competitiveness
TCH	Technologies for Cultural Heritage
TD	Technological Districts
TT	Technology Transfer
TTOs	Technological Transfer Offices
UK	United Kingdom
UNESCO	United Nations Educational, Scientific and Cultural Organization
USA	United States of America
VC	Venture Capital
VQR	Five-Year Research Evaluation Exercise
VTR	Three Years Evaluation Exercise