



# ERAWATCH Analytical Country Report 2007: Italy

Valentina Pierantozzi



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European Commission  
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## Executive summary

Research-related policies aimed at increasing investment in knowledge and strengthening the innovation capacity of the EU's economy are at the heart of the Lisbon Strategy. The strategy reflects this in guideline No. 7 of the Integrated Guidelines for Growth and Jobs. This aims to increase and improve investment in research and development, with a particular focus on the private sector.

As part of ERAWATCH, the JRC-IPTS is producing analytical country reports to support the mutual learning process and the monitoring of Member States' efforts. The main objective of the reports is to characterise and assess the performance of national research systems and related policies in a structured way that is comparable across countries. In order to do so, the analysis focuses on key processes relevant to system performance. Four policy-relevant domains of the research system are distinguished, namely resource mobilisation, knowledge demand, knowledge production and knowledge circulation. This analytical approach was tested in 2007 by applying it to a number of countries, of which Italy is one. This report is based on a synthesis of information from the ERAWATCH Research Inventory and other important publicly available information sources.

The main findings of the analysis are summarised in the table below:

Domain	Challenge	Assessment of system strengths and weaknesses
Resource mobilisation	Securing long term investment in research	High level political process to secure long term investment in research but a lack of continuity from one year/government to the next
	Dealing with barriers to private R&D investment	Lack of private investments and innovative finance to R&D
	Providing qualified human resources	Insufficient number of PhD students Unattractive to foreign researchers
	Justifying resource provision for research activities	Widespread justification for fostering national competitiveness and meeting EU Lisbon objectives has not helped increase national R&D spending.
Knowledge demand	Identifying the drivers of knowledge demand	Strong role of coordination by the Ministry of University and Research, however little participation of non-public stakeholders in knowledge demand articulation
	Channelling knowledge demands	Centralisation of demand within the National Research Programme. However, there is a multitude of priorities and instruments. Weak links between assessments/evaluations and inputs into knowledge demand
	Monitoring demand fulfilment	Weak tradition of evaluation
Knowledge production	Ensuring quality and excellence of knowledge production	Strong university and public research organisation basis as well as national centres of excellence
	Ensuring exploitability of knowledge	Increasing number of patent applications from universities. However, the tradition of creating public-private partnerships remains weak
Knowledge circulation	Facilitating circulation between universities, public research organisations and business	Increasing number of initiatives to support technology transfer practices, however still weak linkages between private and public sectors due to cultural barriers.
	Profiting from international knowledge	Strong commitment to fostering international R&D collaboration
	Enhancing the absorptive capacity of knowledge users	Limited absorptive capacity

Long-term R&D investment in Italy is secured through a high level political process, culminating in the approval of the main national strategic document for R&D, the National Research Programme. While the high level political process ensures medium-term planning and inter-ministerial coordination, it does not yet ensure satisfactory participation by non-public sector stakeholders.

Mobilisation of private resources for R&D lacks dynamism, with a declining relative contribution to national R&D expenditure between 2000 and 2004. Also, the research system remains relatively unattractive to both national and foreign researchers.

Knowledge demand is mainly driven by central government and policy assessment and evaluation remain weak, which is not helping efficient resource allocation and planning. One of the consequences of this is the way the implementation of policy measures and actions tends not to be sustained over time.

Scientific knowledge is mostly produced by Universities and Public Research Organisations, which constitute a large and solid basis for excellence, but are still operating in relative isolation from actors outside the public sector.

Italy has a strong commitment to creating and fostering international collaboration in research. The attempt to align national standards with European and international "best practice" is a constant strategic objective for the government. Knowledge circulation is limited by business's lack of absorptive capacity, partly as a result of the fact that traditional SMEs account for a disproportionately large share of businesses.

The 2007 Financial Law has underlined the strategic role of research policy for the economic growth of the country by including the Ministry of University and Research on the high level inter-ministerial committee for the economic planning (CIPE, *Comitato interministeriale per la Programmazione Economica*) for the first time.

To encourage private R&D investments, the government reintroduced tax incentives for enterprises investing in R&D in 2007. The implementation of twelve strategic programmes for research in key thematic areas and the Industry 2015 initiative to increase industrial innovation can also be seen as additional opportunities to increase business participation in R&D. These initiatives could also foster private-public partnerships in economically useful knowledge production and favour knowledge circulation.

The far-reaching debate on the need for more effective evaluation practices led to the establishment of the National Agency for the Evaluation of the University System and Research (ANVUR, *Agenzia Nazionale di Valutazione del sistema Universitario e della Ricerca*) in 2006. Although the agency is not yet operational it could represent a real opportunity to promote quality among university and research organisations through systematic evaluation activities, data collection, training and the promotion of a general cultural change within the system.

Additional policy initiatives with a potential impact on knowledge production and circulation include the creation of two new bodies: the Italian Institute for Technology (IIT) in 2005 and the Agency for the diffusion of technologies.

However, there are also some policy-related threats. Despite a proliferation of policy initiatives, human resource mobilisation remains a challenge and important new measures envisaged to enhance the attractiveness of the research system, for both national and foreign researchers, have still not been implemented.

The country's large public debt poses constant threats to public resource planning and thus also constitutes a severe constraint on publicly funded R&D.

There is also a risk that the private sector fails to respond adequately to the government's measures and that new avenues need to be explored in the future.

Domain	Main policy-related opportunities	Main policy-related threats
Resource mobilisation	<ul style="list-style-type: none"> <li>- Tax incentives for private R&amp;D</li> <li>- Additional R&amp;D funding e.g. through twelve strategic programmes for research and Industry 2015 initiative</li> </ul>	<ul style="list-style-type: none"> <li>- Sustainability of public finance and corresponding difficulty of achieving the Lisbon target</li> <li>- Lack of policy measures to increase human resources</li> <li>- Low response by private sector to new measures</li> </ul>
Knowledge demand	<ul style="list-style-type: none"> <li>- Assessment of research results by the newly created National Agency, to help allocate resources efficiently</li> </ul>	
Knowledge production	<ul style="list-style-type: none"> <li>- IIT to increase knowledge production in key areas, bolster excellence and international attractiveness.</li> <li>- Stabilisation of research personnel within Universities</li> </ul>	<ul style="list-style-type: none"> <li>- Insufficient supply of human resources may be a serious limit to implementing new policy measures</li> </ul>
Knowledge circulation	<ul style="list-style-type: none"> <li>- Industry 2015 initiative</li> </ul>	





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## Chapter 1. Introduction

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### 1.1 Scope and methodology of the report in the context of the European Research Area and the renewed Lisbon Strategy

As highlighted by the Lisbon Strategy, knowledge accumulated through investment in R&D, innovation and education is a key driver of long-term growth. Research-related policies aimed at increasing investment in knowledge and strengthening the innovation capacity of the EU economy are at the heart of the Lisbon Strategy. The strategy reflects this in guideline No. 7 of the Integrated Guidelines for Growth and Jobs. This aims to increase and improve investment in research and development (R&D), with a particular focus on the private sector. One task of the JRC-IPTS within ERAWATCH is to produce analytical country reports to support the mutual learning process and the monitoring of Member States' efforts. The main objective of the reports is to characterise and assess the performance of national research systems and related policies in a comparable manner.

To ensure comparability across countries, a dual level analytical framework has been developed and applied. On the first level, the analysis focuses on key processes relevant to system performance in four policy-relevant domains of the research system:

1. Resource mobilisation: the actors and institutions in the research system have to ensure and justify that adequate public and private financial and human resources are most appropriately mobilised for the operation of the system.
2. Knowledge demand: the research system has to identify knowledge needs and how they can be met, thus determining priorities for the use of resources.
3. Knowledge production: the creation and development of scientific and technological knowledge is clearly the fundamental role of any research system.
4. Knowledge circulation: ensuring appropriate flows and distribution of knowledge between actors is vital for its further use in the economy and society or as the basis for subsequent advances in knowledge production.

These four domains differ in terms of the scope they offer for governance and policy intervention. Governance issues are therefore treated not as a separate domain but as an integral part of each domain analysis.

<b>Resource mobilisation</b>	<b>Knowledge demand</b>	<b>Knowledge production</b>	<b>Knowledge circulation</b>
<ul style="list-style-type: none"> <li>• Long term research investment</li> <li>• Barriers to private R&amp;D</li> <li>• Qualified human resources</li> <li>• Justifying resource provision</li> </ul>	<ul style="list-style-type: none"> <li>• Identification of knowledge demand drivers</li> <li>• Channelling of demand</li> <li>• Monitoring and evaluation</li> </ul>	<ul style="list-style-type: none"> <li>• Quality and excellence of knowledge</li> <li>• Exploitability of knowledge</li> </ul>	<ul style="list-style-type: none"> <li>• Inter-sectoral knowledge circulation</li> <li>• International knowledge access</li> <li>• Absorptive capacity</li> </ul>

On the second level, the analysis within each domain is guided by a set of "challenges", common to all research systems, which reflect conceptions of possible bottlenecks, system failures and market failures (see list above).

The way in which a specific research system responds to these generic challenges is an important guide for government action. The analytical focus on processes instead of structures is conducive to a dynamic perspective and eases the transition from analysis to assessment. Actors, institutions – and the interplay between them – enter the analysis in terms of how they contribute to performance in the four domains.

Based on the above framework, the analysis here proceeds in three steps. The first step is to analyse the characteristics of the current research system; the second step is to analyse recent changes in policy and governance. The third step in the analysis aims at an evidence-based assessment of the system's strengths and weaknesses and its policy-related threats and opportunities in the light of the Lisbon process ("SWOT" analysis).

The national research system is defined in functional terms as an open system comprising actors, institutions and the processes by which they interact to contribute to the production and circulation of scientific, technical and related knowledge, as well as to the mobilisation of resources and articulation of demand for R&D. Thus, the research system also includes research policy actors, together with actors and institutions at the interface with the wider innovation system. The national dimension remains important, but it has to be seen in the broader context of an increasingly open system. The report focuses here on the European context of the national research system. Many of the challenges analysed also reflect important concerns of the European Research Area (ERA). Where interactions with the EU level are relevant in addressing domain challenges they are explicitly included in the system characteristics and trend analysis – insofar as the information is readily available. In addition, the jointly agreed research-related EU Lisbon Strategy goals serve as a key reference for assessing recent trends and policy developments.

This report is based on a synthesis of information from the European Commission's ERAWATCH Research Inventory<sup>1</sup> and other important publicly available information sources as of autumn 2007. In order to enable a proper understanding of the research system, the approach taken is mainly qualitative. Quantitative information and indicators are used, where appropriate, to support the analysis. After an introductory overview of the structure of the national research system and its governance, chapter 2 analyses resource mobilisation for R&D. Chapter 3 looks at knowledge demand. Chapter 4 focuses on knowledge production and chapter 5 deals with knowledge circulation. Each of these four main chapters contains a subsection on relevant recent policies in the domain. The report concludes in chapter 6 with an overall assessment of the strengths and weaknesses of the research system and governance and policy dynamics, opportunities and threats across all four domains in the light of the Lisbon Strategy's goals.

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<sup>1</sup> ERAWATCH is a cooperative undertaking between DG Research and DG Joint Research Centre and is implemented by the IPTS. The ERAWATCH Research Inventory is accessible at <http://cordis.europa.eu/erawatch/index.cfm?fuseaction=ri.home>. Other sources are explicitly referenced.

## 1.2 Overview of the structure of the national research system and its governance

In Italy the Ministry of University and Research<sup>2</sup> (MiUR) coordinates national and international scientific activities, distributes funding to universities and research agencies, and establishes the means to support public and private research and technological development (RTD) funding. Within MiUR, the key role in policymaking and co-ordination is played by the Chief of the Minister's Technical Secretariat which is in charge of elaborating policy interventions. Since 1989, MiUR has led national S&T policy definition and research funding.

MiUR coordinates the preparation of the triennial National Research Programme, the main governmental document for R&D planning that sets the strategic lines for the national system. This coordination involves interaction with a whole range of stakeholders, including other Ministries.

The National Research Programme is in the last instance approved by CIPE- the high level inter-ministerial committee for economic planning- which since 2007 has included the Ministry of University and Research among its members. Every year, in combination with the preparation of the national Document of Economic and Financial Policy (DPEF), CIPE defines the strategic directions as well as the financial resources devoted to R&D activities. The DPEF is submitted to the Council of Ministers and to the Parliament for approval.

CIPE also has additional strategic tasks in the field of research, including for example: deliberating on a special inter public administration fund for research (FISR), periodically evaluating the National Research Programme implementation, and approving the National Strategic Framework for the cohesion policy (including National Operational Programmes).

The Ministry of Economic Development (previously called the Ministry of Production Activities) supports and manages industrial research. Other Ministries (Health, Agriculture, etc) manage research funding in their specific fields.

Two additional Ministries play a strategic role: The Ministry of Economics and Finance, with its department for development and cohesion policy, and the Ministry of European Policies, with its inter-ministerial committee for European Affairs (CIACE, *Comitato Interministeriale per gli Affari Comunitari Europei*) monitoring and coordinating the Lisbon targets.

Research activity in Italy is mainly carried out by universities (32.8% of total R&D national expenditure in 2004). There are 77 universities in Italy, the majority of which are public.

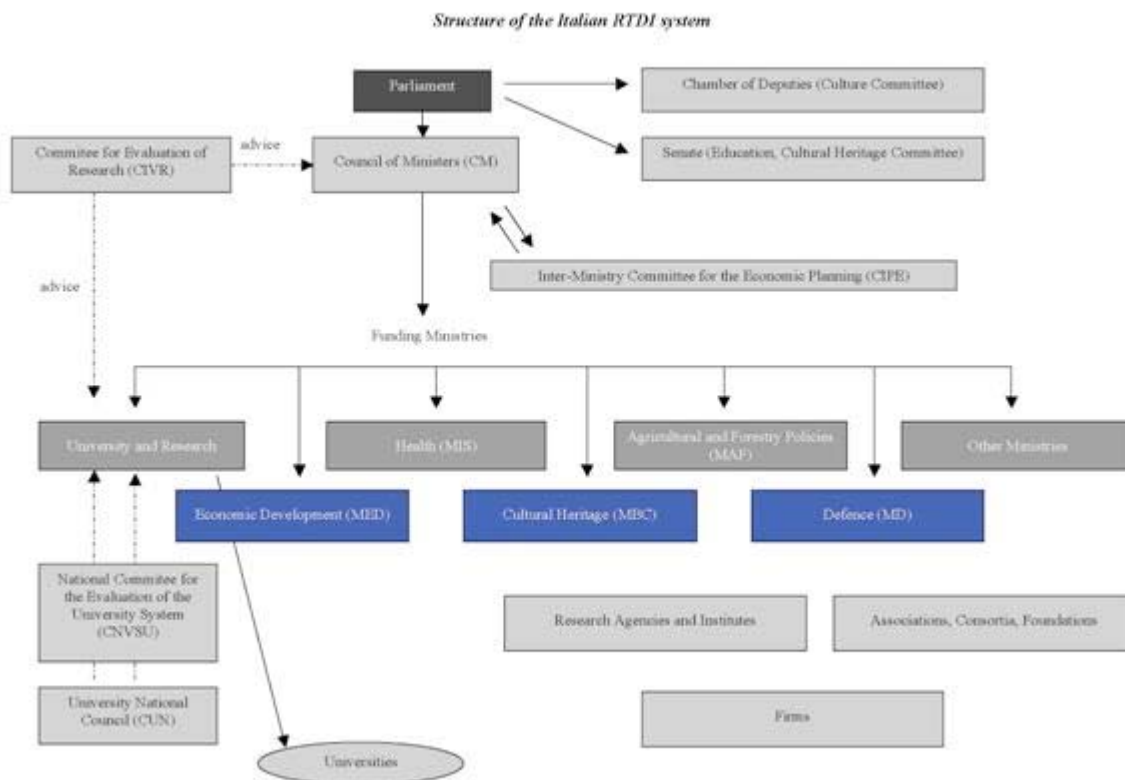
Public Research Organisations (PROs) play a very significant role in the research sphere. There are ten PRO's playing a major role on the Italian stage, of which the most significant are:

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<sup>2</sup> After the general election in April 2006, the MIUR (Ministry of Education, University and Research) was divided into two separate Ministries: the Ministry of University and Research (MiUR) and the Ministry of Public Education

- The [National Research Council](#) (CNR, *Consiglio Nazionale delle Ricerche*), the main national research organisation working in all scientific disciplines, which acts both as research performer and funder (although its funding role was considerably diminished after 1989, when MiUR became the main actor in R&D). Until 1989 CNR also had a formal policy advisory role. CNR operates through 107 Institutes and it underwent a significant organisational reform in 2003, aiming at improving the scientific quality of its research and at enhancing the exploitation of results.
- The [National Agency for New Technologies, Energy and Environment](#) (ENEA, *Ente per le Nuove tecnologie, l'Energia e l'Ambiente*), 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, *Istituto Nazionale di Fisica Nucleare*) 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.
- The [Italian Space Agency](#) (ASI, *Agenzia Spaziale Italiana*) in charge of coordinating all national efforts and investments in the space sector.

**Figure 1: Main institutions of the Italian Research system**



Source: European Commission 2007: ERAWATCH Research Inventory, <http://cordis.europa.eu/erawatch/index.cfm?fuseaction=ri.content&topicID=35&countryCode=IT&parentID=34>

Expenditure by public research institutions in 2002 came to approximately €2,600 million.

The national committee for the evaluation of the university system (CNVSU, *Comitato Nazionale per la Valutazione del Sistema Universitario*) is an advisory body in charge of the evaluation of the university system; the committee for evaluation of research (CIVR, *Comitato d'Indirizzo per la Valutazione della Ricerca*) is an independent body in charge of the evaluation of research. CNVSU and CIVR committees are due to be replaced, and their role and functions will be taken over by a National Agency for the Evaluation of the University and Research (ANVUR). This agency was created by the 2007 Financial Law and given a budget of €5 million. The Agency's regulations and operational functioning are currently being defined.

The division of competences between State and regions in the R&DI field is based on a principle of concurrency in which both central and regional authorities can legislate, although a series of interventions are the exclusive competence of central government. These include:

- Support to academic research and public research institutions;
- R&D Mission oriented Programmes;
- Creation of large public-private laboratories;
- Co-ordination of the national scientific system's participation in European and International R&D programmes;
- Support for research infrastructures.

Within this division of competences, regions have acquired more responsibility through a change in the Italian Republic's Basic Law (L. 3/2003), which enables them, as well as the State, to adopt autonomous Science, Technology and Innovation (STI) policies.

The regional approach to STI policy is based on multiple aspects: EU cohesion policy (research infrastructures and projects), networks of firms (e.g. Initiative 2015), technological districts (National Research Programme), specific regional interventions (e.g. venture capital). The regional approach is characterised by the direct and indirect (surveys on their innovation demands) involvement of local stakeholders.

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

## Chapter 2. Resource mobilisation

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The purpose of this chapter is to analyse and assess how challenges affecting the provision of inputs for research activities are addressed by the national research system: its actors have to ensure and justify that adequate financial and human resources are most appropriately mobilised for the operation of the system. A central issue in this domain is the long time horizon required until the effects of the mobilisation become visible. Increasing system performance in this domain is a focal point of the Lisbon Strategy, guided by the Barcelona objective of a R&D investment of 3% of GDP in the EU as a whole and an appropriate public/private split.

Four different challenges in the domain of resource mobilisation for research can be distinguished which need to be addressed appropriately by the research system and research policies:

- Securing long-term investment in research
- Dealing with uncertain returns and other barriers to private R&D investment
- Providing qualified human resources
- Justifying resource provision for research activities

### 2.1 Analysis of system characteristics

Currently Italy spends €15,253 million per year on R&D (2004)<sup>3</sup>, an amount that has been growing moderately (it was €13,572 million in 2001). R&D intensity, measured in terms of GERD/GDP was 1.10% in 2004, significantly below the EU-27 average of 1.84%. Between 1990 and 2000 this figure dropped from 1.25% to 1.05%, then rose again slightly in 2001 to reach 1.09%. This low figure is a "unique" trend among major industrialised countries, mostly due to a large cut in financial participation for certain national organisations which took place during the 90s (MiUR, 2005).

#### 2.1.1 *Securing long-term investment in research*

Long term investment in R&D is secured through a high-level policy making process. The Italian Government determines the strategic priorities for scientific research and defines the financial resources to be allocated through the National Research Programme (a three-year planning document, which is updated on a yearly basis). The leading actor in charge of the National Research Programme's preparation and coordination with other governmental actors is the Ministry of University and Research (MiUR).

Final approval of National Research Programme is given by the high level inter-ministerial Committee for Economic Planning (CIPE). Every year, in combination with the national Document of Economic and Financial Policy (DPEF, *Documento per la Programmazione Economica e Finanziaria*), CIPE defines the strategic directions and the financial resources devoted to R&D activities. The DPEF is then submitted to the Council of Ministers and to the Parliament for approval.

During the preparation of the National Research Programme, the main public and private stakeholders interact with the leading Ministry of University and Research and

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<sup>3</sup> If not referenced otherwise, all quantitative indicators are based on Eurostat data sourced April 2007.



contribute to the document's preparation. The 2005-2007 National Research Programme represents good practice in multilevel and multi-actor governance, given the high involvement of regional and non-public stakeholders in the preparation process. However, there is still a general consensus that research policy making is the sole responsibility of public actors.

The share of gross domestic expenditure on research and development (GERD) performed by government is 17.8%, while the share of GERD performed by Higher Education is 32.8% and GERD performed by business is 47.8% (Eurostat, 2004).

Public universities are funded centrally through the "Ordinary Fund for Higher Education" (FFO, *Fondo per il Finanziamento Ordinario delle universita*). This fund is assigned through the annual financial law and comprises a fixed amount as well as a percentage assigned on the basis of criteria such as, for example, the number of students or scientific quality. In this respect, one of the main challenges for the Italian University system is to ensure that national evaluation mechanisms are used as a solid and reliable input to financial resource allocation as well as in support of excellence.

The FFO Fund assigned to universities in 2005 was €6,896 million (Ministry of Economy and Finance, 2007).

The National Research Programme is implemented through a series of funds, aimed at various research actors and types of activities, mostly managed by MiUR (i.e. FAR Fund for the promotion of research, FIRB Fund for basic research, FISR Special Fund for research, etc). In an effort to rationalise existing funding instruments, the 2007 Financial Law envisages the creation of a single Fund for investment in Research and Development (FIRST).

Central government has the main responsibility for investment in research infrastructures. Italy has a strong commitment to opening up its national research infrastructures to interested researchers from Italy and elsewhere, as well as to participating in large international infrastructure activities. This is particularly true in the field of basic research and for a number of strategic areas identified by the Italian Government (space, nuclear physics, for example). Until the mid 1990s, a specific fund managed by the Ministry of Research was made available on a yearly basis for investments in large national basic research infrastructure. Currently, only a small portion of the Basic Research Fund (FIRB) is devoted to this objective, along with some areas of the National Operational Programme for Objective 1 areas (2000-2006). In terms of national infrastructure investment, there is a lack of continuity over time. In order to foster a new and effective "national policy for infrastructure", as stated in the National Research Programme 2005-2007, central Government needs to consider an investment of at least €30-50 million to re-establish a national capacity and go back to the favourable situation which existed in the past.

With regards to European Union activities, the Italian Government strongly supports investments and collaboration to strengthen and open up large shared European infrastructure. During its EU Presidency in 2003, Italy proposed widening the use of existing instruments, such as the Trans-European Networks or the European Investment Bank's loans to research activities, to fund investments in research infrastructure.

Italy also plays a very active role in international infrastructure-providing organisations, such as the ESA-European Space Agency, CERN (European organisation for nuclear research), EMBO (European Molecular Biology Organisation), EMBL (European Molecular Biology Laboratory), and ESO (European Southern Observatory for astrophysics).

Regarding the country's participation in the EU Framework Programmes, data from the Sixth Framework Programme shows that Italy received 9.2% of total funding, with the most popular areas being innovation related measures, nanotechnology and nano-science, and information and communication technologies. Among the beneficiaries of this funding, Universities and research centres score the highest, followed by large enterprises (CNR, 2007).

As far as the Structural Funds programming is concerned, over the period 2000-2006, MiUR was responsible for the National Operational Programme for research, technological development and higher education (€1.3 billion EU contribution), while the Ministry of Economic Development (former Ministry of Production activities) was in charge of the National Operational Programme-Local entrepreneurial development-operational programme (€1.9 billion EU contribution).

The new S&T related national operational programme for convergence regions is now called "NOP-Research and Competitiveness" (EU contribution of €3.1 billion) and it is jointly managed by the Ministry of Universities and Research and the Ministry of Economic Development.

The 2007-2013 National Strategic Framework was approved by the European Commission on 13 July 2007. The negotiation of the new operational document, as well as its detailed budget is currently on-going.

The share of public funding in R&D, measured as Government Budget Appropriations (GBAORD) over GDP is 0.59%, which is below the EU 27 average of 0.74%.

Italy has experienced negative growth in real terms in the past few years mainly due to the government's decreased participation in semi-public organisations and partly state-owned enterprises. The general issue of public finance sustainability and budget constraints also needs to be mentioned as a reason for the reduced availability of R&D resources.

### ***2.1.2 Dealing with uncertain returns and other barriers to private R&D investment***

Private resource mobilisation in Italy is considerably lower than that in other EU countries. The share of business expenditure on research and development (BERD) as a percentage of GDP was 0.55% in 2006, compared with an EU average of 1.17%.

Private sector contribution to national R&D expenditure has been diminishing over the years, with a level of 50.1% back in 2000 and 47.8% in 2004 (Istat, 2005). Within the European Union, the share of private funding is higher, on average (54.9% in the EU-27 in 2004). This scenario raises important questions for the future sustainability

of the Italian research system, as the bulk of research expenditure is in the hands of the public sector and private-public collaboration remains weak.

When looking at the business research system one important element that emerges is that private research activities are mostly concentrated in large firms: in 2002 around 82% of intra-muros R&D expenditure was by enterprises with over 250 employees (ISTAT,2005). The top five private Italian R&D investors are: Fiat, Finmeccanica, ENI, Pirelli, Telecom Italia. Foreign investments contribute 11.1% to BERD in Italy, compared with an EU 27 average of 9.8% (Eurostat, 2004).

Private research investment is highly concentrated at sectoral level, with the leading sectors being the manufacturing of chemical products/synthetic fibres, television and communication equipment, clothing, machine tools, and motor vehicles and parts.

The Italian economy is dominated (98%) by small firms (from 1 to 49 employees), a situation which remained unchanged between 2000 and 2005 (Confindustria 2006); but is not entirely dissimilar from that in the other main European countries (Germany 91%; France 96%; Spain 97%). What sets Italy's economy apart is the relative absence of medium sized firms (from 50 to 250 employees): in Italy such firms account for 1.8% of the total, while in Germany the figure is 8%, in France 3% and in Spain 2.8%. This continues to be a problem for the mobilisation of private resources for R&D. Policy makers are trying to tackle this constraint through automatic fiscal incentives and by promoting ties with public research institutions.

The private sector mostly funds its own research: 75% in 2004. Other sources of funding for private R&D include, for example, public subsidies (6%) and fiscal incentives (5%), bank loans and Government backed loans (5% and 3% respectively), while venture capital has a very marginal role representing only around 1% of total funding. Interestingly in Italy, venture capital tends to be involved in business expansion and replacement activities, rather than early stage growth (European Commission, 2007). Large companies tend to find funding relatively easier to acquire, whereas it can constitute a serious barrier for small sized firms.

BERD financed by Government is 13.8%. BERD financed by industry dropped from 80.5% in 2000 to 76.8% in 2005, while BERD financed by Government went from 10.99% to 10.97% over the same period. Other sources of funding, notably international and European funding have taken on greater importance (CNR, 2007).

Little data has been gathered as yet on the commitment of the non-profit sector as an RTDI performer. As a survey carried out by the National Institute of Statistics in 2001 shows there are 2,311 non-profit organisations performing R&D as main activity (0.96% of the total). Only a small part of this sector has an organisational and economic structure of any significance, since 75% of them have no employees and 48% of employees are concentrated in just a few organisations (0.6%). Their R&D expenditure is 1.4% of GERD.

Private tax payers can choose to donate a part of their taxes to support research activities carried out by foundations or universities, for example.

For the first time in 2003 (l.269/2003 "tecno-Tremonti"), specific nationwide measures to promote R&D private investment were introduced for all types of enterprises. These consisted of a tax deduction of capital expenditure. R&D tax incentives

allowed firms to reduce their taxable income through a combination of R&D expenditure (10% of yearly current and capital expenditures) and R&D increment (30% of the incremental annual spending over the average of three previous financial years) for process, product and organisational innovations. These tax measures were applied automatically when taxes returns were filed. They affected firms' profits in 2004 and are no longer in place.

The financial law approved by the Parliament in December 2006 has introduced a tax allowance for firms performing R&D equal to 10% of the cost of research (15% in the case of a contract with a university or public research agency). The ceiling is set at €15 million/year. The foreseen budget for these incentives is € 300 million/year over a period of three years.

Private research is mostly oriented towards applied research (49.3% in 2001) and experimental development (45.5% in 2001), while only a small percentage is devoted to basic research.

Looking towards the future, one of the major challenges for the Italian research system is to encourage private R&D spending.

### **2.1.3 Providing qualified human resources**

In the 2003-2004 academic year, the total number of PhD students was about 37,000, 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 National Research Programme (2005-2007) proposes to concentrate the resources for PhDs in strategic sectors, to increase the number of PhD courses carried out on a cooperative basis by universities, public agencies and foreign agents, to promote firms' participation into PhD courses, enhance the international mobility of PhD students and, finally, to improve pay and increase the number of positions for PhDs, and also improve their legal status within the research institutions.

The total number of researchers was 72,012 in 2004 compared to, for instance, Spain (101,000), the United Kingdom (157,000) or France (200,000), (CNR, 2007).

The number of foreign researchers who choose Italy as a place to do research is still less than the number of Italian researchers who decide 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). 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.

A regulation to increase the number of PhD students, which is at present 4,000 new students a year on 1,200 courses, is still being defined. The objective, which is to make the system more attractive (both to national and international students), is a priority for the government; however, concrete measures to increase researchers'

mobility and the internationalisation of universities are still the main challenges and also a matter of concern identified by the European Commission during the Italian National Reform Programme's first assessment exercise.

#### **2.1.4 Justifying resource provision for research activities**

The guidelines for S&T governmental policy (2002) and the National Reform Programme 2005-2007 attribute a central role to R&D activity to ensure that the country:

- meets the challenge of globalisation within a knowledge society
- takes an active part in the implementation of the Lisbon Strategy
- maintains/re-gains international competitiveness.

In Italy the link with EU related activities and with the Lisbon objectives is often strong and is present in the public debate. The need to meet European commitments is often used as an argument in support of mobilising R&D resources.

Public awareness and stimulation of public debate is also explicitly mentioned in official documents as an important support for resource mobilisation in the R&D field: only a system where public opinion is aware and participative can be successful and pervasive in its messages, and supported by long-term investment strategies.

The need to maintain and "defend" the Italian system's competitiveness in Europe and in the world is also a frequently used argument to support resource mobilisation, given the country's high level of export activities and the popularity of products with the "made in Italy" label around the world.

The share of GBAORD as a percentage of total general government expenditure has increased over the last few years, going from 1.3 in 2000 to 1.5 in 2005 (EU-25 1.56 in 2004).

## **2.2 Analysis of recent changes and policy initiatives**

### **2.2.1 Relevant recent trends**

The economic globalisation phenomenon is mentioned in the National Research Programme as a drive to support mobilisation of research resources. The economies that have suffered most from the impact of globalisation are those with rigid economic structures, low growth rates and a lack of investment in R&D; a group to which Italy belongs. Mobilising R&D resources is one of the actions needed to maintain competitiveness in the international market and meet the challenges of globalisation.

The overall allocation of structural funds in Italy has declined slightly in the new 2007-2013 programming period, compared to 2000-2006 (€28.8 billion against €29.6). Two regions, previously part of Objective 1 areas, are undergoing a change of status.<sup>4</sup>

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<sup>4</sup> The region of Basilicata is phasing out of the "convergence" regions and the region Sardinia is phasing into the "competitiveness" regions

## 2.2.2 *Role and expected impact of recent policies*

The current centre-left coalition government led by Romano Prodi separated the competences of the Ministry of Research and University (MiUR) from those of the Ministry of Public Education.

The 2007 Financial Law underlined the strategic role of research policy for the economic growth of the country by including for the first time the Ministry of University and Research on the CIPE, the high level inter-ministerial committee for economic planning.

The progress report on implementation of the Italian National Reform Programme, submitted to the European Commission in October 2006, set a quantitative target for R&D spending to be achieved by 2010. This report presents a clearer strategy as well as defining quantitative targets, which were lacking in the original National Reform Programme document. Through new initiatives and a bolstering of existing instruments, the new, more ambitious, target is set at 2.5% R&D spending/GDP by 2010, 2/3 of which is to be financed by the private sector. The most promising policy initiatives that have a potential role in helping achieve this target are the following:

- Implementation of twelve strategic programmes for research, with a total budget of €1.1 billion. These programmes aim at fostering private-public partnerships in key strategic export-oriented and high-tech areas. Enterprises, universities, public research centres are encouraged to jointly participate and submit project ideas in the twelve areas identified (Health, biomedicine, advanced materials, for example).
- Private-public partnership initiatives (so called "private-public laboratories") in selected thematic areas. The funding available is €344 million: 104 for centre-northern regions and 240 for southern regions.

The objective is also to consolidate and enhance public-private collaborations previously supported through other Funds (i.e. FIRB basic research, ex Objective 1 areas, etc)

- Promotion of enrolments on scientific courses at university ("*Progetto Lauree scientifiche*") in particular in Chemistry, Physics and mathematics: including workshop, work placements, teacher training, and grants.
- National Aerospace plan: €2.85 billion for the period 2006-2008
- Support to SMEs, in particular through a tax credit mechanism for small businesses hiring research personnel and contracting out research work to Universities and/or public research centres and to those financing PhD grants. About €50 million/year.
- Tax credit measures for enterprises investing in R&D, up to 10% of costs (the percentage can be raised to 15% in the case of collaboration with universities and public research centres. The ceiling is set at €15 million/year. The total budget for this measure is €300 million/year over three years.

The provision of fiscal incentives in Italy has been somewhat intermittent. Measures of this kind were introduced in 2003, with a duration of one year. Then, after an interruption, they were made available again through the Financial Law in 2007. The current tax incentive scheme was implemented for a period of three years, so is due to run until 2009.

As far as the programming of Structural Funds is concerned, the new S&T related national operational programme for convergence regions is called "National Operational Programme-Research and Competitiveness" and foresees an EU contribution of €3.1 billion. It is jointly managed by the Ministry of Universities and Research and the Ministry of Economic development.

The negotiation of the new operational document, as well as its detailed budget is currently on-going.

Additional actions that could improve the system's quality are:

- Rationalisation of various existing funding instruments, by creating a single Fund for investment in scientific research and development (FIRST), which foresees an additional €300 Million/year for 2007 and 2008 and €360 million for 2009.
- A series of reforms, designed by the current Government, proposing a new system for recruiting PhD students (high quality selection criteria, more focus on excellence, increased presence of international evaluations in the recruitment panel, for example). The proposed reform is under discussion.

Potential blocking mechanisms to the implementation of these initiatives could be the unavailability of public resources and/or the delay in their implementation. In general, measures foreseen in the financial law are followed up by actions for which the relevant Ministry is responsible. In some cases, a delay in implementation or the negative opinion from the Ministry of Economy and Finance may put these resources on hold or, in the worst case, reassign them to another budgetary item.

There is also a risk that the response from private sector is not satisfactory.

### 2.3 Assessment of resource mobilisation

The main strengths and weaknesses of the Italian research system in terms of resource mobilisation for R&D can be summarised as follows:

<p><b><u>STRENGTHS:</u></b></p> <ul style="list-style-type: none"> <li>- High level political process to secure long-term investment in research</li> </ul>	<p><b><u>WEAKNESSES:</u></b></p> <ul style="list-style-type: none"> <li>- Lack of continuity from one year/government to the next</li> <li>- Lack of private investments as well as innovative finance to R&amp;D</li> <li>- Small number of PhD students</li> <li>- Unattractive to foreign researchers</li> </ul>
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In the context of the Lisbon Strategy, the main opportunities and threats for resource mobilisation in Italy arising from recent policy responses can be summarised as follows:

<p><b><u>OPPORTUNITIES:</u></b></p> <ul style="list-style-type: none"> <li>- Tax incentives for private R&amp;D</li> <li>- Additional R&amp;D funding, e.g. through twelve strategic programmes for research and Industry 2015 initiative</li> </ul>	<p><b><u>THREATS:</u></b></p> <ul style="list-style-type: none"> <li>- Sustainability of public finance and corresponding difficulty of achieving the Lisbon target</li> <li>- Lack of policy measures to increase human resources</li> <li>- Low response by private sector to new measures</li> </ul>
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## Chapter 3. Knowledge demand

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The purpose of this chapter is to analyse and assess how knowledge demand contributes to the national research system's performance. It is concerned with the mechanisms used to determine the most appropriate use of, and targets for, resource inputs. Main challenges in this domain relate to governance problems stemming from specific features of knowledge and the need for priority setting. These include:

- Identifying the drivers of knowledge demand
- Co-ordinating and channelling knowledge demands
- Monitoring and evaluating demand fulfilment

Responses to these challenges are of key importance for the more effective and efficient public expenditure on R&D aimed at in the Lisbon Strategy Integrated Guideline 7.

### 3.1 Analysis of system characteristics

The sectoral structure of the Italian economy mirrors several of the system's characteristics: 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.

Looking at shares of total value added, the sectors with highest figures are social and personal services, manufacturing and real estate.

The manufacturing sector is characterised by the highest R&D intensity, although it is still low compared to other countries: 2.1% in Italy against for instance 7.4% in Germany. The lack of R&D intensity in mature and traditional sectors provide a good explanation of the decreased level of competitiveness of the Italian system, particularly for sectors such as textiles or clothing that account for a large share of Italian exports. (MiUR 2005)

BERD specialisation has changed over the last 10 years with many sectors attracting private investments in R&D. The trend is clearer in services, where other business activities, financial intermediation, hotels and trade have gone from being non-specialised to specialised. In manufacturing this change is observed in low-to-medium and medium-to-high tech sectors with the exception of instruments (examples include textiles, wood, food, furniture and other machinery). In three high-tech sectors Italy retains its specialisation, namely pharmaceuticals, aerospace and R&D while it has lost its specialisation in motor vehicles, in which the country has a strong tradition (ERAWATCH, 2006).

The share of high tech in manufacturing BERD is 40.9%, against an EU average of 41.4%

The industrial sectors with the largest share of total value added in Italy are trade and real estate.

GBAORD by socio economic objectives is strong in the areas of human health and space, where productivity and quality of outputs are high in comparison with the European average.



### **3.1.1 Identifying the drivers of knowledge demand**

The principal knowledge demand driver is central Government, with an increased presence, in recent years, of non-state actors. The most significant process where knowledge demand is identified is the preparation of the (triennial) National Research Programme, currently covering the years 2005-2007, which sets the framework, the general objectives and areas for possible interventions.

The leading governmental actor is the Ministry of University and Research, which coordinates all the inputs from other Ministries as well as from regions, business, trade unions and other non-governmental actors. The preparation of the current National Research Programme is an example of good practice in multilevel and multi-actor governance, given the high level of participation by regional and non-public actors, together with their shared strategic vision and prospective evaluations.

The main advisory bodies on issues relating to the impact of knowledge demand on human resources are the Conference of Italian university rectors (CRUI, *Conferenza dei Rettori delle Università Italiane*) and the National Committee for Universities (CUN, *Consiglio Universitario Nazionale*).

Regions play a key role in driving knowledge demand through direct and indirect (survey to identify innovation demands) interaction with local industrial stakeholders, in particular SMEs.

The first national evaluation of research results, carried out in 2003, has played a minor but significant role in shaping knowledge demand within the current National Research Programme, particularly in terms of resource allocation to universities. The recent creation of the National Agency for the evaluation of research, which reflects the increased importance attributed to evaluation practices, is foreseen as playing a major role in channelling and shaping future knowledge demand for national research policy.

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.

### **3.1.2 Co-ordinating and channelling of knowledge demands**

The National Research Programme 2005-2007 is the main strategic document used to identify national priorities in scientific research.

The current document identifies the following priority areas: Production systems, IT and telecommunications, new materials, biotechnology, energy, transport, environment, cultural heritage, agrofood, health.

In 2005 the main socio-economic objectives receiving Government funds were industrial production and technology (12.8%), and protection and improvement of human health (9.3%, see figure above).

**Figure 2: GBAORD distribution by socio-economic objective, 2005**

<b>Nomenclature for the analysis and comparison of scientific programmes and budgets (NABS)</b>	<b>Euros (millions)</b>	<b>% of total</b>
01 Exploration and exploitation of the earth	257.55	2.7
02 Infrastructure and general planning of land-use	91.03	1.1
03 Control and care of the environment	250.59	2.7
04 Protection and improvement of human health	743.59	9.3
05 Production, distribution and rational utilisation of energy	373.47	3.8
06 Agricultural production and technology	328.23	4.6
07 Industrial production, and technology	1128.73	12.8
08 Social structures and relationships	454.44	4.6
09 Exploration and exploitation of space	767.04	7.5
10 Research financed from general university funds (GUF)	3863.5	37.7
11 Non-oriented research	540.43	9.7
12 Other civil research	0	0.0
13 Defence	353.73	3.4
<b>99 Total appropriations</b>	<b>9152.33</b>	<b>100</b>

Source: Eurostat

The Italian government is strongly committed to internationalising national research activities, as stated in the 2005-2007 National Reform Programme.

The collaboration with European partners, in particular in the context of the Framework Programme for research, is very active and strongly pursued.

With reference to the preparation of the various EU Framework programmes, over the years Italy has played a significant role in areas such as support to SMEs, transport or cultural heritage, and collaboration between Mediterranean countries.

The elaboration of national thematic priorities is also strictly linked to the European debate and priority settings. The National Research Programme 2005-2007 is a key instrument in the country's commitment to realising the European Research Area and in strengthening its scientific basis and competitiveness.

In many cases the document was shaped by the priorities set by the European Union.

Funding from national sources is open to collaboration with other EU countries, usually with some limitations in terms of the role, contribution and share of total project cost.

Programme implementation focuses on a large number of thematic sectors. Besides strategic areas for the Italian system, there are traditional/mature sectors that also require support to their research and innovation capacity.

The high number of priorities addressed (as well as the variety of available instruments), without (yet) an efficient system for evaluation of research activities and resource allocation, raises important questions about how knowledge demand is prioritised and set.

### **3.1.3 Monitoring and evaluating demand fulfilment**

Italy has a weak tradition of evaluation practices. The Ministry of University and Research, which is the main actor responsible for evaluation of research activities, regularly collects information on statistical participation in various instruments (funding, number of applications, etc). However, there is no systematic assessment of policy impact which feeds back into the preparation of National Research Programmes or resource allocation strategies.

In 2003, for the first time, the Ministry of University and Research established a triennial evaluation exercise covering the years 2001-2003 and assessing the research results achieved by Universities and PROs. The results have been published in 2006 by the CIVR Committee for the Evaluation of Research – CIVR conducting the exercise on behalf of MiUR. Some of these results have been used as an input to university funding allocation (FFO, Ordinary Fund for Higher Education). The full and systematic incorporation of assessment results into policy planning is not yet a stable and widespread practice. Another evaluation exercise covering 2004-2006 is planned.

The far-reaching debate on the need for more effective evaluation practices led to the establishment of the National agency for the evaluation of the university system and research (for short, ANVUR), through Law-decree 3-10-2006 no. 262.

ANVUR will be in charge of carrying out external evaluation of universities and research agencies' research; it will set out guidelines for the units responsible for the internal evaluation of these bodies; provide results on which the allocation of public funds for research and innovation projects is to be based; and approve PhD courses.

When ANVUR becomes operational, other important agencies that previously dealt with evaluation will be suppressed; the most important of these are the Steering committee for research evaluation (CIVR) and the National committee for the evaluation of the university system (CNVSU) (ERAWATCH 2007).

### **3.2 Analysis of recent changes and policies**

Among recent policies to support the articulation and channelling of knowledge demand is the creation of the National agency for evaluation of research (ANVUR), to promote the quality of universities and research organisations through evaluation activities, data collection, training and promotion of a cultural change within the system.

The Agency will be responsible for:

- Evaluation activities, including the preparation of the bi-annual report on the status of universities and the research system;
- Data collection, training and promotion of cultural change;
- Proposing the criteria to assign institutional funding to universities and research organisations to the Ministry of University and Research;
- Determining the average cost per university student;
- Signalling to the Ministry of University and Research, universities and research centres that have performed particularly well and might be eligible for additional institutional funding;
- Publishing its findings.

The Agency will also help to coordinate two previously separate components, namely the evaluation of teaching and the research activities carried out by universities and PROs.

The Agency is not yet operational and its establishment is taking longer than expected. In order to ensure maximum benefits, the newly created independent body will require a light and non-bureaucratic structure, as well as full autonomy and transparency in carrying out its tasks.

### 3.3 Assessment of knowledge demand

The main strengths and weaknesses of the Italian research system in relation to knowledge demand can be summarised as follows:

<p><b><u>STRENGTHS:</u></b></p> <ul style="list-style-type: none"> <li>- Strong central and co-ordination role by MIUR</li> <li>- Strong government and public support to EU</li> </ul>	<p><b><u>WEAKNESSES:</u></b></p> <ul style="list-style-type: none"> <li>- Scarce participation of non-public stakeholders in knowledge demand articulation</li> <li>- Weak links between assessments/evaluations and inputs into knowledge demand</li> <li>- Weak tradition of evaluation practices</li> </ul>
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In the context of the Lisbon Strategy, the main opportunities and threats for knowledge demand in Italy arising from recent policy responses can be summarised as follows:

<p><b><u>OPPORTUNITIES</u></b></p> <ul style="list-style-type: none"> <li>- Assessment of research results by the newly created National Agency, to help efficient allocation of resources</li> </ul>	<p><b><u>THREATS</u></b></p>
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## Chapter 4. Knowledge production

The purpose of this chapter is to analyse and assess how the research system fulfils its fundamental role of creating and developing excellent and useful scientific and technological knowledge. Any response to knowledge demand has to balance two main challenges:

- On the one hand, ensuring knowledge quality and excellence is the basis of scientific and technological advances. It requires considerable prior knowledge accumulation and specialisation as well as openness to new scientific opportunities, which often emerge at the frontiers of scientific disciplines. Due to the expertise required, quality assurance processes are here mainly the responsibility of scientific actors, but may be subject to corresponding institutional rigidities.
- On the other hand, there is considerable interest in producing new knowledge which is useful for economic and other problem solving purposes. Spillovers which are non-appropriable by economic producers as well as the lack of possibilities and incentives for scientific actors to link to societal demands lead to an exploitability challenge.

Both challenges are addressed in the research-related Lisbon Strategy Integrated Guideline.

## 4.1 Analysis of system characteristics

### 4.1.1 *Ensuring quality and excellence of knowledge production*

Knowledge production in Italy is mostly concentrated in Universities and public research organisations. 65% of public R&D expenditure is through universities and 28.7% through public research centres (ISTAT 2002). University R&D expenditure has been growing in the last few years (2000-2005), although this growth has been more modest recently, due to the constraints on hiring personnel imposed by budgetary legislation.

In general, the level of University R&D expenditure in Italy is well above the EU average (in 2004 it was 30.3% compared with an average of 17.4% in the EU-25).

The 2007 Financial Law has re-introduced the possibility for Universities to hire research personnel and has also established that current temporary personnel who have been working for at least three years on a temporary basis are to be given a permanent position. This provision is having a momentous impact on the way public research personnel are recruited. It marks a transition from a system based on competition-based selection to one organised on a tenure track basis (ERAWATCH 2007). This change has the potential to boost the scientific excellence of research output and stabilise teaching activities in universities.

To ensure the promotion of excellence and concentration of resources in key sectors, the Ministry of University and Research has funded national Centres of excellence selected on a National competitive basis for a period of three years. In January 2005 there were 55 centres of excellence, 23 in biotechnology and bio-medicine, 7 in new materials, 12 in ICTs, 4 in Environment, 2 in Logistics, and 7 in economic and social disciplines. The possibility of launching a second competitive call and to continue funding these centres of excellence should draw on the experience and evaluation of the current phase.

The number of publications per million inhabitants was 626 in 2004, just below an EU 25 average of 664 and with an annual average growth of 4% between 2000 and 2004. Earlier calculations by the Ministry of Research show that if the number of publications is based on the number of researchers, the figure is higher (346 compared with an EU average of 269) (MiUR, 2005).

The problem in Italy seems to be the low number of researchers available rather than their inefficient use.

In terms of specialisation of publications according to scientific fields, Italy shows the highest levels in Pharmacology, Engineering, computer science and space science (ERAWATCH, 2006).

### 4.1.2 *Ensuring exploitability of knowledge*

As mentioned in chapter 2.1, both national spending in Italy on R&D and business sector participation are below the EU averages. The majority of research is carried out by universities and public research centres, which have for a long time operated in relative isolation from the private sector on the assumption that research would automatically generate applications and knowledge transfer.

It is only in the 90s that ideas about directly fostering public-private partnerships and increasing the mobility of researchers into the private sector started to be discussed in a significant way.

From the late 90s, data show a considerable shift in the public sector's attention to applied research: in 1998 basic research amounted to €1 billion, whereas applied research amounted to slightly less than €1 billion. In 2002 basic research was below €1 billion while applied research went up to €1.4 billion (more than half of total R&D expenditure) (ISTAT 2006).

In the private sector, the balance between basic and applied research did not change over the period 1998-2002: in 2002 the private sector was devoting over 50% of its R&D spending to applied research and 4.6% to basic research (ISTAT, 2006).

In terms of incentives for applied research, Law-decree 297/97 represents a fundamental innovation in the legislative panorama, by funding industrial research with a strong focus towards private-public collaboration, spin-off activities, mobility of researchers into industry. Many research funding mechanisms and initiatives have focused their attention on the need to ensure the exploitability of knowledge produced, for example:

- Implementation of twelve strategic programmes for research, with a total budget of €1.1 billion. These programmes aim at fostering private-public partnerships in key strategic export-oriented and high-tech areas. Enterprises, universities, and public research centres are encouraged to jointly participate in and submit project ideas in the twelve identified areas (Health, biomedicine, advanced materials, for example). The funding mechanism is based on facilitated access to credit (bank loans) for project participants, which means that the funded amount is reduced by the sum to be repaid to the bank. In September 2005, 744 project ideas had been submitted to the Ministry of Universities and Research, for a total value of €10 billion, with a very significant involvement by SMEs. Out of these project ideas, 196 were short-listed for the submission of full proposals in subsequent phases (total project costs amount to €3.104 million). The impact on business participation in these R&D activities is expected to be high.
- Private-public partnerships initiatives (so called "private-public laboratories") in selected thematic areas. The funding available is €344 million: 104 for centre-northern regions and 240 for Southern regions.
- "Industry 2015" Initiative, aiming at fostering partnerships between universities, centres of excellence, and small and large enterprises (see section 5.2 for more details).

In terms of patent applications to the EPO, Italy had 4,747 in 2002, a number that has been increasing every year since 1995. Patents per million inhabitants were 87,266 in 2003, well below the EU 27 average of 127.95.

As far as university patents are concerned, the number has increased between 2002 and 2005: in 2002 there were 112 applications in Italy, 21 applications in the US and 33 applications to the EPO. As a result, 18, 7 and 8 patents were issued, respectively.

In 2005 there were 129 applications in Italy, 39 applications in the US and 52 applications to the EPO. As a result 40, 8 and 13 patents were issued, respectively (NetVal 2006).

Public research performers are exempt from paying registration tax duties on patents, while for all other actors they have been re-introduced by the latest financial law (they had previously been abolished).

Looking at patents by industrial sector, Italy has a high level of specialisation in furniture, machinery, plastics, and textiles (ERAWATCH 2006). Furniture and machinery also match the country's economic specialisation.

## 4.2 Analysis of recent changes and policy initiatives

A recent policy initiative that could have a significant impact on knowledge production is the creation of the Italian Institute for Technology (IIT) in 2005, a foundation established at the behest of the Ministry of Education, Universities and Research (formerly MIUR) and the Ministry of Economy and Finance to promote Italy's technological development and training in high technology. The Foundation has forged links with similar bodies in Italy and enhances the contribution of Italian and foreign researchers working for research centres of excellence.

The Foundation's scientific programme includes the launch of research programmes on three different technological platforms: Robotics, Nanobiotechnology and Neuroscience. These three platforms are running synergistic and highly interdisciplinary research activities with the common objective of studying and developing humanoid technology. The Foundation has its headquarters in Morego (Genoa).

The Italian Institute of Technology (IIT) is gradually developing its research activities, thanks to financial support from the State and local authorities. The IIT already employs more than 120 researchers and 400 other staff. Some 35% of the researchers are foreign, thus confirming the international vocation of the Institute; what is more, the average age of its researchers is under 30, which is a striking difference from other Italian public research agencies, where the age is generally much higher.

During the period 2004-2006 the IIT had a budget of €181 million.

The creation of the Agency for diffusion of technologies for innovation is another initiative that could have a significant impact on knowledge exploitation by business, in particular by SMEs. The Agency was established by the 2005 financial law, although it is not yet operational. The 2007 financial law foresees funding for €5 million starting from 2007. The Agency will be operating under the supervision of Presidency of the Council of Ministers.

The decision to create a national agency for the evaluation of research activities (ANVUR) in 2006 could have an important role in supporting the systematic assessment of the results achieved and their exploitation within the socio-economic sphere.

### 4.3 Assessment of knowledge production

The main strengths and weaknesses of the Italian research system in terms of knowledge production can be summarised as follows:

<u>STRENGTHS:</u> - Strong university and PRO basis	<u>WEAKNESSES:</u> - Weak tradition of creating public-private partnerships
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In the context of the Lisbon Strategy, the main opportunities and threats for knowledge production in Italy arising from recent policy responses can be summarised as follows:

<u>OPPORTUNITIES:</u> - IIT is due to increase knowledge production in key areas, strengthen excellence and international attractiveness. - Stabilisation of research personnel within Universities	<u>THREATS</u> - Insufficient supply of human resources may be a serious constraint on the implementation of new policy measures
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## Chapter 5. Knowledge circulation

The purpose of this chapter is to analyse and assess how the research system ensures appropriate knowledge flows and sharing between actors. This is vital for its further use in the economy and society or as the basis for subsequent advances in knowledge production. Knowledge circulation is expected to happen naturally to some extent, due to the mobility of knowledge holders, e.g. university graduates who go on to work in industry, and the comparatively low cost of reproducing knowledge once it is codified. However, there remain three challenges related to specific barriers to knowledge circulation which need to be addressed by the research system in this domain:

- Facilitating knowledge circulation between university, PRO and business sectors
- Profiting from access to international knowledge
- Enhancing the absorptive capacity of knowledge users

Significant elements of Integrated Guideline 7 relate to knowledge circulation. To address them effectively requires a good knowledge of the system's responses to these challenges.

### 5.1 Analysis of system characteristics

#### 5.1.1 *Facilitating inter-sectoral knowledge circulation*

The need to ensure knowledge circulation among Higher Education, Government and Business emerged in Italy over the course of the 1990s, when the national and European debate placed greater emphasis on activities aiming to obtain greater value from research results and promote their commercial exploitation.



This new emphasis prevails in many European countries and is driven by various factors: a decline in public research funding, which has created a stronger need to look for alternative financial resources, and the identification in various strategy documents of the lack of innovation and technology transfer as weaknesses of the European system.

Following this debate, in the 90s public research organisations showed a growing interest in patenting, spin off activities and in the diffusion of results in general.

The main public research centres started discussing and designing significant reforms (e.g. the National Research Council and ENEA), which, among other goals, aimed to give their scientific results a stronger market and industry focus. Since that time the National Research Council has set up a series of initiatives to link its activity to the private sector: collaboration with private consortia, companies, foundations, spin offs, and increased patents filing.

Many Italian universities have set up technology transfer offices and started promoting the circulation of knowledge in the private sector. The first university technology transfer office was created in 1997. Before that time, these activities were only managed in an informal and non-systematic way. The number of technology transfer offices and activities has grown considerably over the years, from 11 in 2000 to around 40 in 2007 (Netval, 2006).

According to a survey conducted by the Network for the commercial exploitation of University research, between 2000-2005, 85% of the respondent universities had set up a technology transfer office. Their main activities related to patent applications and spin off enterprises. In 2005 the total university technology transfer budget was €6.4 million mostly deriving from the institutional budget. The total amount of FTE personnel was 161, on average 4.1 per university. According to the same survey, the total number of patent applications was 217 in 2005: 129 filed in Italy, 36 in the USA and 52 filed with the European Patent Office (Netval, 2006).

Many universities have set up specific incentives to foster knowledge transfer activities and in some cases, for example, run career advancement schemes, provide salary enhancements or make additional funding available for research.

Within the national legislative panorama the main reference is the MiUR legislative decree 297/99 which has completely and substantially reorganised the system of incentives for research and researcher mobility, by placing a strong emphasis on knowledge circulation. The decree provides for incentives for companies hiring research personnel or contracting out research activities to universities and research centres, so as to encourage mobility of research personnel from universities and research centres into industry, and the creation of spin-off companies.

A large of number of additional initiatives have also been promoted in the country, including science and technology parks, innovation relay centres, industrial and technology districts, business innovation centres, networks for the commercial exploitation of university results, liaison offices, etc.

Since 2003, the Italian Ministry of Economic Development has been running the RIDITT (the Italian Network for Innovation and Technology Transfer to Enterprises) initiative, which is aimed at improving the competitiveness of the productive system by strengthening and integrating the available supply of innovation-related services

The legislation on intellectual property rights for researchers has changed in recent years. In 2001, a legislative change was introduced allowing Italian researchers to own the IPR in scientific results obtained while working for their host institution (whether a university or public research organisation). In 2005 the legislation was changed again to make a distinction between research carried out at institutional level (for which the IPR belongs to individual researchers) and research carried out under competitive agreements in collaboration with private actors (for which IPR belongs to the host institution).

However individual researchers can still face obstacles when seeking to exploit their results. These include the difficulty of finding a private actor interested in the patents or creating a spin off (cultural and financial barriers), and the limited ability of host organisations to deal with patent licensing issues, mostly due to their lack of organisational and personnel specialisation.

In general, there is strong cultural resistance to all the measures relating to opening up public institutions to new methods of collaboration with private actors and barriers exist to their implementation.

Despite the proliferation of initiatives and legislative changes in recent years, the need to increase industry's absorptive capacity and enhance the transfer of knowledge is still a crucial issue for the Italian system in the current National Research Programme.

The GOVERD financed by business in 2004 was 2.9% compared with an EU average of 6.1%.

### **5.1.2 Profiting from access to international knowledge**

Italy has a strong commitment to creating and fostering international collaboration in research. The attempt to align national standards to European and international "best practices" is a constant strategic objective of the government.

Central government has always vigorously pursued openness towards all European and non-European countries through scientific bilateral agreements and financial support for joint international scientific projects (as highlighted in section 2.1.1). To date the Ministry of University and Research has signed 70 scientific bilateral agreements. These 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 scant presence of foreign researchers in Italy (as highlighted in section 2.1.3), the number of scientific publications co-authored with foreign colleagues is considerable: 37% of SCI publications, most of which are with USA and UK authors (MiUR, 2005).

Italy's participation in the EU research Framework Programme is very active, coming after France Germany and UK in the ranking of countries with the largest number of projects under the Sixth Framework Programme (MiUR, 2005). Data from the Sixth Framework Programme show that Italy received 9.2% of total funding, with the most popular areas being innovation-related measures, nanotechnology and nano-

science, and information and communication technologies. Universities and research centres were the main beneficiaries, followed by large enterprises (CNR, 2007).

In order to stimulate participation in the EU research framework programmes, Law-decree 297/99 has provided for a premium for research projects that obtain funding through the European Framework Programme.

At national level, participation in European research projects is promoted by the Agency for European Research – APRE- a non-profit organisation that supports MiUR in raising awareness and increasing participation in EU research funding schemes.

National funding schemes are open to participation of other European countries, with some restrictions in terms of roles and funding.

### **5.1.3                    *Enhancing the absorptive capacity of knowledge users***

Italy's industrial structure is largely made up of small and medium-sized firms, which represent over 95% of the total number of enterprises. The development and growth of this largely SME based industry centres on the industrial district approach, which is mostly oriented towards "made in Italy" sectors such as textiles, leather, and foods.

An industrial district in this sense is an agglomeration of enterprises (often very small and family run) operating in a single business sector and in a specific geographical location. Industrial districts are characterised by their close-knit socio-economic links and the specialisation of their firms in different parts of the same productive process. Italian industrial districts often have a strong export and innovation focus and they often benefit from support from the local authorities as well as the trust of the local community.

Law 317/1991 formally defined and supported industrial districts and made them part of the national industrial policy at national level for the first time. Although this legislation has been amended and adapted over time the main responsibility for identifying industrial districts still lies with the regions.

This peculiar industrial structure explains the special attention that has always been devoted to promoting SMEs' R&D activities in Italy.

At national level, Law-decree 297/99 is the main funding instrument supporting industrial research. It provides for an additional financial contribution whenever a project proposal is submitted by a small or medium-sized enterprise. This same law also aims to promote the mobility of personnel from public to private enterprises, and to provide financial support, in the form of subsidies and tax breaks, for the hiring of qualified research personnel and their attending PhD courses.

The technological innovation fund (FIT, *Fondo Innovazione Tecnologica*), managed by the Ministry of economic development, provides incentives for industrial research by giving priority and additional financial contribution to projects submitted by SMEs. The same fund has in the past financed thematic calls (e.g. innovation, ICTs) aimed at promoting innovation and technology take up by SMEs.

In order to foster public-private links and to ensure production of innovative and transferable knowledge, the State funds the so called "private-public laboratories" in

selected thematic areas. The objective is to consolidate and further enhance public-private collaborations previously supported through other financial instruments (e.g. FIRB basic research, former Objective 1 areas, etc.) and provide a stable structure of collaboration between private and public actors in key areas identified (nanotechnology, post genomics, etc).

The creation of the Agency for diffusion of technologies for innovation in 2005 is another significant initiative in fostering knowledge transfer to the business world, in particular SMEs.

At a 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 (the region that invests most in R&D) a measure to support SMEs participation into the EU Framework Programmes; or in the region of Veneto, a measure to support feasibility studies preliminary to research projects (similar to the exploratory award scheme funded by the EU).

However, the Community Innovation Survey 4 data (Eurostat, 2004), reveals that Italy has a relatively small number of innovators in manufacturing industry: 37.6% compared with 74% in Germany (although France and Spain have similar figures, with 37% each)

The percentage share of scientists and engineers in the total labour force is 3.4%, considerably lower the EU-27 average of 5.4% (Eurostat, 2006).

The supply of qualified scientists and engineers is insufficient to meet demand, and this is particularly true for industrial and IT engineers, and in certain medical fields. These profiles are subject to competition from professional profiles with "horizontal" competences and by personnel already in the job market: organisations are increasingly demanding prior professional experience as a condition for hiring new personnel.

## 5.2 Analysis of recent changes and policy initiatives

In September 2006 the Italian government designed a new initiative to re-launch Italian industrial policy. The initiative is called Industry 2015 and it is led by the Ministry of Economic development, in collaboration with the Ministry of Universities and Research and the Ministry of Innovation and public administration reform.

There are several key elements of this initiative: a concept of industry that goes beyond the productive system and extends to highly advanced services and technologies; a forward looking analysis and planning strategy (hence the "2015" in the name); instruments to foster the re-positioning of the Italian industrial system such as a network of enterprises, innovative finance mechanisms and industrial innovation projects.

The 2007 Financial Law has established the Fund for competitiveness and development, with the objective of financing Industrial innovation projects ("*Progetti di innovazione industriale*") in five technological areas considered strategic to re-launching the national industrial system on a competitive footing.

So far, the Ministry has launched three industrial innovation projects in the following areas: energy efficiency, sustainable mobility and new technologies for "made in Italy" branded products, by consulting the industrial world and collecting project ideas in the respective fields to support identification of priority themes and the characteristics of projects to be funded.

The next step will be to identify these projects and determine their financial volume. All these projects envisage the participation of large and small enterprises, universities, research centres, industrial districts and financial institutions, all teaming up to create long-term partnerships and foster the competitiveness of national industry.

Industry 2015 also envisages the creation of a Fund for innovative enterprise financing ("*Fondo per la finanza d'impresa*"), to make it easier for businesses, and SMEs in particular, to access credit and venture capital. The objectives and operational implementation of this Fund, which replaces existing instruments and will include resources from other public administrations and public financial institutions, will be defined in future government decrees.

Another strategic element of Industry 2015 is the support for business networks ("*reti d'impresa*"). The government aims to pass specific decrees to define criteria for the creation and operation of business networks throughout the country, their legal framework and tax status, and collaboration with foreign enterprises.

The 2006 financial law provided for the creation of a national Agency for the diffusion of innovation technologies. The Agency will have the objective of identifying and disseminating knowledge, technologies, national and international patents, among enterprises, and will have a special focus on SMEs.

The purpose is to strengthen the dialogue between industry and the research world. The agency's headquarters will be in Milan but is not yet operational.

### 5.3 Assessment of knowledge circulation

The main strengths and weaknesses of the Italian research system, in terms of knowledge circulation, can be summarised as follows:

<p><b><u>STRENGTHS:</u></b>          - Strong commitment to fostering international R&amp;D collaboration</p>	<p><b><u>WEAKNESSES:</u></b>          - Limited absorptive capacity          - Weak linkages between private and public sectors</p>
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In the context of the Lisbon Strategy, the main opportunities and threats for knowledge circulation in Italy arising from recent policy responses can be summarised as follows:

<p><b><u>OPPORTUNITIES:</u></b>          - Industry 2015 Initiative</p>	<p><b><u>THREATS:</u></b></p>
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## Chapter 6. Overall assessment and conclusion

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### 6.1 Strengths and weaknesses of research system and governance

In Italy, long-term R&D investment is secured through a high-level political process. Since 1989, the leading actor in charge of R&D policy has been the Ministry of Universities and Research (MiUR), which is also responsible for policy coordination with other governmental actors. The main national strategic document for R&D is the National Research Programme, approved by the high-level Inter-ministerial Committee for Economic Planning (CIPE). While this high-level political process ensures medium-term planning and inter-ministerial coordination, it does not yet ensure satisfactory participation by non-public stakeholders. In Italy there is still a general consensus that R&D policy making is the sole responsibility of public actors.

The private sector contribution to national R&D expenditure has been diminishing over the years, with a level of 50.1% back in 2000 and 47.8% in 2004. These figures are a long way from the Barcelona and Lisbon objective of a two third share of private investment. The private sector is mainly self-financing its own research, with venture capital playing only a marginal role.

The attractiveness of the research system for national and foreign capital remains low. In the 2003-2004 academic year, the total number of PhD students came to about 37,000 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 Italian ratio was 0.18, the EU 15 average was equal to 0.55. The number of researchers who choose Italy as a place to do research is still lower than the number of Italian researchers who decide to go abroad. The number of foreign researchers within 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).

Knowledge demand is mainly driven by central government and it is still accompanied by a weak policy assessment and evaluation. The weak tradition of evaluation and assessment of research results is not helping efficient resource allocation and planning. One of the consequences of weak evaluation practices is the discontinuity in implementation of policy measures and actions over time.

Knowledge is mostly produced by Universities and Public Research Centres, which constitute a large and solid basis for excellence, but are still operating in relative isolation from other players outside the public sector.

The share of scientists and engineers as a percentage of the total labour force is 3.4%, considerably lower than the EU-27 average of 5.4% (2006).

Italy has a strong commitment to creating and fostering international collaboration in the research field. The attempt to align national standards to European and international "best practices" is a constant strategic objective for the government. However the research system is not yet sufficiently attractive to foreign researchers and PhD students.

The main findings of the analysis are summarised below:

Domain	Challenge	Assessment of system strengths and weaknesses
Resource mobilisation	Securing long term investment in research	High level political process to secure long term investment in research but a lack of continuity from one year/government to the next
	Dealing with barriers to private R&D investment	Lack of private investments and innovative finance to R&D
	Providing qualified human resources	Insufficient number of PhD students Unattractive to foreign researchers
	Justifying resource provision for research activities	Widespread justification for fostering national competitiveness and meeting EU Lisbon objectives has not helped increase national R&D spending.
Knowledge demand	Identifying the drivers of knowledge demand	Strong role of coordination by the Ministry of University and Research, however little participation of non-public stakeholders in knowledge demand articulation
	Channelling knowledge demands	Centralisation of demand within the National Research Programme. However, there is a multitude of priorities and instruments. Weak links between assessments/evaluations and inputs into knowledge demand
	Monitoring demand fulfilment	Weak tradition of evaluation
Knowledge production	Ensuring quality and excellence of knowledge production	Strong university and public research organisation basis as well as national centres of excellence
	Ensuring exploitability of knowledge	Increasing number of patent applications from universities. However, the tradition of creating public-private partnerships remains weak
Knowledge circulation	Facilitating circulation between universities, public research organisations and business	Increasing number of initiatives to support technology transfer practices, however still weak linkages between private and public sectors due to cultural barriers.
	Profiting from international knowledge	Strong commitment to fostering international R&D collaboration
	Enhancing the absorptive capacity of knowledge users	Limited absorptive capacity

## 6.2 Policy dynamics, opportunities and threats from the perspective of the Lisbon agenda

The strategic role of research for the country's economic growth was confirmed by an important decision included in the 2007 Financial Law, as for the first time the Ministry of Universities and Research was included among the member of CIPE, the high level inter-ministerial committee committed for the economic planning.

With the aim of mobilising private R&D resources, in 2007 the government reintroduced tax credit measures for enterprises investing in R&D, allowing for a deduction of up to 10% of costs (the percentage can be raised to 15% in case of collaboration with universities and public research centres), up to a ceiling of 15 million euros a year.

The implementation of twelve strategic programmes for research in key thematic areas, with a total budget of 1.1 billion euros, can also be seen as a further

opportunity for private-public partnerships and a way to increase business participation in R&D activities.

A new re-launched industrial policy is being promoted through the "Industry 2015" initiative: this embraces a concept of industry that goes beyond the productive system and extends to highly advanced services and technologies. It includes a forward-looking analysis and planning strategy (hence the "2015" in the name), instruments to foster the re-positioning of the Italian industrial system such as business networks, innovative finance mechanisms and industrial innovation projects.

In 2003 for the first time, the Ministry of University and Research established a triennial evaluation exercise covering the years 2001-2003 to assess the research results achieved by Universities and Public Research Organisations. The broad debate on the need for more effective evaluation practices led to the establishment of the National agency for the evaluation of the university system and research (ANVUR) in 2006. The Agency is not yet operational, but it could represent a real opportunity to introduce systematic evaluation practices and spread the culture of quality within the Italian research system.

Additional policy initiatives with a potential impact on knowledge production and circulation are the creation of two new bodies: the Italian Institute for Technology (IIT) in 2005 and the Agency for diffusion of innovation technologies.

Despite a proliferation of policy initiatives, important measures to support and increase human resources in R&D are under discussion and are being drawn up: in particular, these include measures to enhance the attractiveness of the research system both for Italian and foreign researchers.

The country's large public debt is posing constant threats to public resource planning and it constitutes a severe constraint in the R&D field as well.

There is also a risk that the private sector's response to government measures is not satisfactory and that new avenues will need to be explored in the future.

The main findings are summarised below:

<b>Domain</b>	<b>Main policy-related opportunities</b>	<b>Main policy-related threats</b>
Resource mobilisation	<ul style="list-style-type: none"> <li>- Tax incentives for private R&amp;D</li> <li>- Additional R&amp;D funding e.g. through twelve strategic programmes for research and Industry 2015 initiative</li> </ul>	<ul style="list-style-type: none"> <li>- Sustainability of public finance and corresponding difficulty of achieving the Lisbon target</li> <li>- Lack of policy measures to increase human resources</li> <li>- Low response by private sector to new measures</li> </ul>
Knowledge demand	<ul style="list-style-type: none"> <li>- Assessment of research results by the newly created National Agency, to help allocate resources efficiently</li> </ul>	
Knowledge production	<ul style="list-style-type: none"> <li>- IIT to increase knowledge production in key areas, bolster excellence and international attractiveness.</li> <li>- Stabilisation of research personnel within Universities</li> </ul>	<ul style="list-style-type: none"> <li>- Insufficient supply of human resources may be a serious limit to implementing new policy measures</li> </ul>
Knowledge circulation	<ul style="list-style-type: none"> <li>- Industry 2015 initiative</li> </ul>	



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## Abbreviations

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- ANVUR: Agenzia Nazionale di Valutazione del sistema Universitario e della Ricerca (National Agency for evaluation of the university system and research)
- ASI: Agenzia Spaziale Italiana (Italian Space Agency)
- CIPE: Comitato interministeriale per la Programmazione Economica: Inter-ministerial committee for the economic planning)
- CIVR Comitato d'Indirizzo per la Valutazione della Ricerca (Committee for evaluation of research)
- CNR: Consiglio Nazionale delle Ricerche (National Research Council)
- CNVSU: Comitato Nazionale per la Valutazione del Sistema Universitario (National Committee for the Evaluation of the University System)
- CRUI: Conferenza dei Rettori delle Università Italiane (Conference of Italian university rectors)
- CUN: Consiglio Universitario Nazionale (National Committee for Universities)
- DPEF: Documento di Programmazione Economica e Finanziaria (Economic and financial programming document)
- ENEA: Ente per le Nuove tecnologie, l'Energia e l'Ambiente (Italian National Agency for New Technologies, Energy and the Environment)
- FAR: Fondo Agevolazioni per la Ricerca (Fund for the promotion of research)
- FFO: Fondo per il Finanziamento Ordinario delle universita' (Ordinary Fund for Higher Education)
- FIRB: Fondo Investimenti Ricerca di Base (Basic Research Investment Fund)
- FISR Fondo speciale integrativo per la ricerca (Special Integrative Fund for Research)
- FIRST: Fondo per gli Investimenti della ricerca Scientifica e Tecnologica (Fund for investment in research and development)
- FIT: Fondo Innovazione Tecnologia (Technological innovation fund)
- IIT: Istituto Italiano di Tecnologia (Italian Institute of Technology)
- ISTAT: Istituto nazionale di statistica (National institute for statistics)
- INFN: Istituto Nazionale di Fisica Nucleare (National Institute of Nuclear Physics)
- MiUR: Ministero dell'Universita' e della Ricerca (Ministry for University and Research)

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## Abstract

The main objective of ERAWATCH analytical country reports is to characterise and assess the performance of national research systems and related policies in a structured manner that is comparable across countries. The reports support the mutual learning process and the monitoring of Member States efforts by DG Research in the context of the Lisbon Strategy. In order to do so, the system analysis focuses on key processes relevant for system performance. Four policy-relevant domains of the research system are distinguished, namely resource mobilisation, knowledge demand, knowledge production and knowledge circulation. This analytical approach has been tested in 2007 by applying it to six countries, one of which is Italy. The report is based on a synthesis of information from the ERAWATCH Research Inventory and other important available information sources.

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