ERAWATCH Country Report 2009
Analysis of policy mixes to foster R&D investment and to contribute to the ERA

France

Patrick Eparvier, Flora Giarracca and Léonor Rivoire
The mission of the JRC-IPTS is to provide customer-driven support to the EU policy-making process by developing science-based responses to policy challenges that have both a socio-economic as well as a scientific/technological dimension.
ERAWATCH COUNTRY REPORT 2009: France

Analysis of policy mixes to foster R&D investment and to contribute to the ERA

ERAWATCH Network – Techopolis France

Patrick Eparvier, Flora Giarracca and Léonor Rivoire
Acknowledgements and further information:

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Executive Summary

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 thus at the heart of the Lisbon Strategy. This is reflected in guideline No. 7 of the Integrated Guidelines for Growth and Jobs. This advocates increasing and improving investment in research and development (R&D), with a particular focus on the private sector. This report aims at supporting the mutual learning process and the monitoring of Member States efforts. Its main objective is to characterise and assess the evolution of the national policy mixes in the perspective of the Lisbon goals, with a particular focus on the national R&D investments targets and on the realisation and better governance of the European Research Area. The report builds on the analytical country reports 2008 and on a synthesis of information from the ERAWATCH Research Inventory and other important available information sources.

In terms of R&D expenditure, France has the second largest research system in the EU. France's GERD amounted to €37.8b in 2006, which accounted for 17.7% of EU-27 expenditure in this field (European Commission, 2009). France belongs to a group of Member States which experienced declining average R&D intensities between 2000 and 2006 (European Commission, 2009). However, with a ratio of GERD to GDP of 2.08% (2007), France is still above the European average (1.84% in 2006), although the R&D intensity is considerably lower than in the early 1990s (e.g. 2.33% 1992).

While financing 36.8% in 2007 of all R&D performed in France, the Government is still the main actor in mobilising resources for long-term investments in research and corresponding infrastructures. All public resources for higher education and research are secured in the form of yearly inter-ministerial budgets.

It is worth noticing that the total public funding of R&D has grown slower over the last 10 years as compared to the GDP (34% against 41%), with growth being restricted to research performed in the higher education sector.

Like most developed countries, economic development is one of the main stated goals of the French government to justify public support for R&D. The renewed importance accorded to research is also reflected in the steady increase in public R&D expenditures: +12.9% since 2002.

In September 2006, the 2006 Progress Report on the 2005-2008 National Reform Programme For Economic and Social Growth was published, evaluating the first year of the programme. In October 2007, a second progress report was published. Concerning the challenges under the Knowledge-based economy, France has only limited results. That is why the new NRP 2008-2010, published in October 2008, focuses more on research and innovation issues. Among the 3 main axes selected by the new NRP, the first one deals with sustainable growth, innovation and the development of competitive businesses. One of the objectives is to move the technological frontier by strengthening the innovation capacity. Generally speaking, the aim is to develop the innovation capacity of France, which requires a financial and organisational effort towards research and innovation, the development of digital
economy and the strengthening of links between science and society. To achieve these goals the actions to be implemented are: to invest more and with more effectiveness in public research, to ensure knowledge transfer of public research towards business and support, to develop a digital economy, to ensure the excellence of higher education, and to ensure primary quality training for all.

In the last few years, a range of governance changes and new policies have been implemented, which have created opportunities for new and better responses to the weaknesses and specific challenges faced by the French research system.

The mode of channelling knowledge demands is increasingly based on competitive project funding by new intermediary agencies. This has very recently been complemented by an increase in the autonomy of universities, which should allow them to better adapt to these changes. The increasing funds programmed by the Agency for Research and the new unified Agency for Research Evaluation also introduce new or improved quality assurance mechanisms for scientific knowledge production. This is accompanied by an extensive and also somewhat controversial public debate. The changes are being boosted by additional public funds. In parallel, a range of new instruments have been introduced which try to ensure knowledge excellence, exploitation and circulation beyond the traditionally focused sectors, such as the thematically advanced research networks, which may provide interesting tools for overcoming fragmentation, the competitiveness clusters and the Carnot institutes. Competitiveness clusters and strengthened tax incentives may leverage private resource mobilisation for R&D.

A policy-related threat in the domain of resource mobilisation is that the very ambitious policy goal of a privately funded R&D intensity, which implies a break with recent trends, seems rather hard to reach. Other policy-related threats relate to the knowledge production domain. In fact, the national system is still characterised by a relatively low mobilisation of private resources for R&D.

As far as the policy mix is concerned, all routes are pursued simultaneously, even if some routes have a greater weight than others. To be more precise, major ways identified to increase national R&D investments are made up of several instruments:

- to promote the establishment of new indigenous R&D performing firms (such as the Research Tax Credit, the Young Innovative Company Status, the Business incubators, the Contest for the creation of innovative business or the Industrial and Commercial Business Services),
- to stimulate greater R&D investment in R&D performing firms (through for example the Research tax Credit, the Competitiveness clusters, the National Research Agency, OSEO agency or the Carnot Institutes),
- to attract R&D performing firms that do not perform R&D yet,
- to attract R&D performing firms from Abroad,
- to increase extramural R&D carried out in cooperation with the public sector and
- to increase R&D in the public sector (through for example the Research and Higher Education Clusters or the Thematic Advanced Research Networks).

A large set of measures has been taken in order to boost private R&D investment and to favour cooperation between public and private research but all in all the range
of instruments is complex and adds to existing mechanisms, increasing to some extent the complexity of the public support.

<table>
<thead>
<tr>
<th>Barriers to R&amp;D investment</th>
<th>Opportunities and Risks generated by the policy mix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private resource mobilisation for R&amp;D is still relatively low</td>
<td>Political willingness to increase resources for R&amp;D is stronger. Increase in the public R&amp;D expenditures for the private sector in particular through increased project funding. Objectives and priorities are in line with the challenge but might be insufficient.</td>
</tr>
<tr>
<td>Low innovative behaviour of companies, especially SMEs</td>
<td>Several incentives have been implemented to support young firms performing research.</td>
</tr>
<tr>
<td>Relatively weak knowledge circulation and transfer</td>
<td>Development and deepening of a large range of instruments able to increase diffusion of knowledge such as competitiveness clusters or Carnot institutes. The challenge of knowledge circulation has clearly been taken into account but efforts might be insufficient. A risk of redundancy of instruments could appear.</td>
</tr>
</tbody>
</table>

Regarding facts as well as rhetoric, the articulation of French research policy with European research policy has always been strong and is seen as one of the main aspects of the ongoing reconfiguration of the French research and innovation system. French research policy could no more be interpreted as an isolated system. It is structured by many interactions with European policies and programmes. Now, the ERA dimension is considered as the shaping element of every research activity, involving researchers, research institutions as well as public decision-makers. The actions in favour of researchers’ mobility and the increased autonomy given to Universities are good examples of this evolution.

<table>
<thead>
<tr>
<th>Short assessment of its importance in the ERA policy mix</th>
<th>Key characteristics of policies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labour market for researchers</td>
<td>• Actions to foster mobility abroad for national researchers and to facilitate foreign researchers’ mobility in France</td>
</tr>
<tr>
<td>• Opening-up the national labour market for researchers is a key point of the French policy mix, since many programmes at different level and addressed to different targets have been developed in order to increase researchers’ mobility.</td>
<td></td>
</tr>
<tr>
<td>• On the other hand, less emphasis has been given to reforms enhancing the attractiveness of research careers</td>
<td>• Regulations to access the social security system, addressed to Member-countries nationals as well as third- countries nationals</td>
</tr>
<tr>
<td>Governance of research infrastructures</td>
<td>• Incentives to develop transnational and intergovernmental RTIs as well as mobility outside France</td>
</tr>
<tr>
<td>• Research infrastructures play a growing role in French ERA-related policies, with a special emphasise in the current crisis context</td>
<td></td>
</tr>
<tr>
<td>Autonomy of research institutions</td>
<td>• Budget and recruitment autonomy</td>
</tr>
<tr>
<td>• The last two years, big emphasis has been given to university reforms, especially concerning university autonomy.</td>
<td></td>
</tr>
<tr>
<td>• It appears to be one of the most important pillars of French ERA-related policies, as well as the most discussed one in the political landscape, since it involves many changes in the French research system.</td>
<td>• Measures to develop the links between universities and the business world</td>
</tr>
<tr>
<td>Opening up of national research programmes</td>
<td>• Universities’ funding reform is under way</td>
</tr>
<tr>
<td>• Although important actions are conducted, this pillar appears to be the most fragmented one and it suffers from certain implementation difficulties, due to the predominance of national strategies.</td>
<td>• Promotion of excellence in research</td>
</tr>
<tr>
<td></td>
<td>• Participation in the European programmes (FP, JTI, Eureka, ERA-Net)</td>
</tr>
<tr>
<td></td>
<td>• Close cooperation with specific countries (Germany)</td>
</tr>
<tr>
<td></td>
<td>• Opening up to third countries, even if less developed but declared as an objective</td>
</tr>
</tbody>
</table>
The national R&D system also moves toward the ERA. However, some challenges have to be overcome. France should conduct voluntary actions in order to promote research careers’ attractiveness, especially in the public sector. In the same way, a national strategy for the opening up of national research programmes has to be implemented, in order to gather the different fragmented actions conducted.
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1 Introduction

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 thus at the heart of the Lisbon Strategy. This is reflected in guideline No. 7 of the Integrated Guidelines for Growth and Jobs.¹ This advocates increasing and improving investment in research and development (R&D), with a particular focus on the private sector. For the period 2008 to 2010, this focus is confirmed as main policy challenge and the need for more rapid progress towards establishing the European Research Area, including meeting the collective EU target of raising research investment to 3% of GDP, is emphasised.

A central task of ERAWATCH is the production of analytical country reports to support the mutual learning process and the monitoring of Member States’ efforts in the context of the Lisbon Strategy and the ambition to develop the European Research Area (ERA). The first series of these reports was produced in 2008 and focused on characterising and assessing the performance of national research systems and related policies in a comparable manner. In order to do so, the system analysis focused on key processes relevant for system performance. Four policy-relevant domains of the research system have been distinguished, namely resource mobilisation, knowledge demand, knowledge production and knowledge circulation. The analysis within each domain has been guided by a set of generic "challenges", common to all research systems, which reflect possible bottlenecks, system failures and market failures which a research system has to cope with. The analysis of the ERA dimension still remained exploratory.

The country reports 2009 build and extend on this analysis by focusing on policy mixes. Research policies can be a lever for economic growth, if they are tailored to the needs of a knowledge-based economy suited to the country and appropriately coordinated with other knowledge triangle policies. The policy focus is threefold:

- An updated analysis and assessment of recent research policies
- An analysis and assessment of the evolution of national policy mixes towards Lisbon R&D investment goals. Particular attention is paid to policies fostering private R&D and addressing its barriers.
- An analysis and assessment of the contribution of national policies to the realisation of the ERA. Beyond contributing to national policy goals, which remains an important policy context, ERA-related policies can contribute to a better European level performance by fostering, in various ways, efficient resource allocation in Europe.

2 Characteristics of the national research system and assessment of recent policy changes

2.1 Structure of the national research system and its governance

In France, the trend for output growth is slowing down since 2000. The growth rate of Gross Domestic Product (GDP) decreased from 2.2% in 2006 to 1.9% in 2007. In 2006, France’s GDP per capita in Purchasing Power Standards (PPS) was 9.9% above the EU-27 average but in relative decline since 2001.

In terms of R&D expenditure, France has the second largest research system in the EU. France's GERD amounted to €37.8b in 2006, which accounted for 17.7% of EU-27 expenditure in this field (European Commission, 2009). France belongs to a group of Member States which experienced declining average R&D intensities between 2000 and 2006 (European Commission, 2009). However, with a ratio of GERD to GDP of 2.08% (2007), France is still above the European average (1.84% in 2006), although the R&D intensity is considerably lower than in the early 1990s (e.g. 2.33% in 1992). The share of GERD financed from abroad culminated in 2004 (8.8% against 8.0% in 1993) but has decreased since: it represented 7.4% in 2005 and even 6.8% in 2006².

Main actors and institutions in research governance

At government level, the Ministry in charge of research coordinates research policy. There is also a range of consultative bodies (see figure 1 below). Besides the Ministry in charge of research, the Ministry in charge of industry, which is responsible for industrial research and energy research, has a specific role to play in relation to research.

Main implementing agencies are as follows:

- The National Agency for Research (ANR), which was created in 2005³ to fund basic research projects on a competitive basis. It is under the aegis of the Ministry in charge of research, but the Ministry in charge of education, the Ministry in charge of health, the Ministry in charge of budget and the Ministry in charge of industry are represented on the Executive Board.

- OSEO innovation (called OSEO Anvar from 2005 to 2006 and ANVAR before 2005), which provides SMEs with support for R&D and innovation projects. The Agency for Industrial Innovation (AII), which was created in 2005 in order to strengthen cooperation between large firms and SMEs on pre-competitive research activities, has been dissolved in 2008. Its duties have been given to the OSEO innovation since. Whereas the projects funded by the Agency for Industrial Innovation were “large programmes”, OSEO innovation now has the responsibility for projects involving medium enterprises, in addition to the follow-up of existing large programmes. The rationale for the inclusion of the Agency for Industrial Innovation’s objectives into OSEO innovation was precisely to increase the

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³ The decree of August 1, 2006 defines its organisation and functioning. On January 1, 2007, the ANR was made an administrative public institute (EPA - Etablissement public administratif).
emphasis put on the medium enterprises and to increase the number of gazelles\(^4\) in France.

**Figure 1: Overview of the governance structure of the French research system**

![Diagram of the governance structure of the French research system]

Source: [ERAWATCH Research Inventory](https://www.eras-watch.org), Technopolis France. For acronyms used in the figure which are not explained in the text see the list of abbreviations.

**The institutional role of the regions in research governance**

Even if research policy remains a national prerogative, regional and local authorities have their own budgets and autonomously decide the amount they spend on R&D support. Although they increased noticeably their budgets dedicated to research and innovation since 2000, nevertheless their total amount still represents under 5% of total public expenses for R&D.

Regions are allowed to set up a regional research scheme or a regional research and higher education scheme.

In practice, relationships between the regional authorities and the central government are organised through the signature of a seven years contract (CPER). CPER defines the financial aid provided by the central government in accordance with the regional objectives. Research represents an explicit chapter in these contracts. Most of the new contracts (2007–2013) were signed by July 2007. The design of this new generation of CPERs has been co-ordinated with the European Structural Funds programmes that have the same time schedule (2007–2013). CPERs focus on competitiveness and attractiveness of territories, promotion of sustainable development and territorial and social coherence. In 2007, the Regions have spent

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\(^{4}\) Cf. section 2.4
€465m on research and technological transfers.

**Main research performer groups**

The most important public research performers in terms of funds are higher education institutes, which comprise 82 universities (as counted by the Conference of Universities’ Chairmen) and the “grandes écoles”.

Alongside higher education institutes, research is also carried out by public research organisations (PROs). PROs are under the supervision of one or several Ministry(ies), in accordance with the research area, which is/are in charge of orienting their strategy. The main PRO is the National Centre for Scientific Research (Centre National de la Recherche Scientifique – CNRS). The CNRS is a publicly-funded research performing organisation that has the objective to produce knowledge and make it available to society. Other large PROs include the National Institute for Agronomic Research (Institut national de la recherche agronomique - INRA), the National Institute for Computer Science and Automation (Institut national de recherche en informatique et en automatique - INRIA), the National Institute for Health and Medical Research (Institut national de la santé et de la recherche médicale - INSERM), and the Atomic Energy Commission (Commissariat à l’énergie atomique - CEA).

### 2.2 Summary of strengths and weaknesses of the research system

The analysis in this section is based on the ERAWATCH Analytical Country Reports 2008 which characterised and assessed the performance of the national research systems. In order to do so, the system analysis focused on key processes relevant for system performance. Four policy-relevant domains of the research system have been distinguished, namely resource mobilisation, knowledge demand, knowledge production and knowledge circulation. The analysis within each domain has been guided by a set of generic “challenges”, common to all research systems, which reflect possible bottlenecks, system failures and market failures a research system has to cope with. The Analytical Country Report for the specific country can be found in the ERAWATCH web site.

The table below summarises the system’s main strengths and weaknesses.

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5 For further information and metadata, see: [http://cisad.adc.education.fr/reperes/public/chiffres/france/reg.htm](http://cisad.adc.education.fr/reperes/public/chiffres/france/reg.htm)
Table 1: Summary assessment of strengths and weaknesses of the national research system

<table>
<thead>
<tr>
<th>Domain</th>
<th>Challenge</th>
<th>Assessment of system strengths and weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource mobilisation</td>
<td>Securing long-term investment in research</td>
<td>Well established mechanisms and high volume of public long-term investment in R&amp;D</td>
</tr>
<tr>
<td></td>
<td>Dealing with barriers to private R&amp;D investment</td>
<td>Significant increase in the public R&amp;D expenditures for the private sector</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Private resource mobilisation for R&amp;D is stagnating and still mainly dependent on a few large companies, a pattern reinforced by public funding</td>
</tr>
<tr>
<td></td>
<td>Providing qualified human resources</td>
<td>Unattractive career prospects for researchers may discourage good students from choosing a scientific career and thus weaken the human resource base</td>
</tr>
<tr>
<td></td>
<td>Justifying resource provision for research activities</td>
<td>Strong public debate on, and support for, resource provision for R&amp;D</td>
</tr>
<tr>
<td>Knowledge demand</td>
<td>Identifying the drivers of knowledge demand</td>
<td>Strong mechanisms to identify knowledge demand drivers and increase involvement of industry in the definition of the strategy of the research programmes and of the Universities (in the context of the Law for autonomy of Universities)</td>
</tr>
<tr>
<td></td>
<td>Channelling knowledge demands</td>
<td>The main sectors’ established knowledge demands are well covered by public support mechanisms, but limited capacity for strategic steering and co-ordination of knowledge demands is restricting adaptation to changing needs beyond established strategic areas</td>
</tr>
<tr>
<td></td>
<td>Monitoring demand fulfilment</td>
<td>If fully implemented, the use of evaluation (of research programmes and research units as benchmarks in the contract process between the State and research organisations) could strengthen the research system</td>
</tr>
<tr>
<td>Knowledge production</td>
<td>Ensuring quality and excellence of knowledge production</td>
<td>Domains of world level scientific and technological excellence exist, but are often specialised in stable/mature research fields</td>
</tr>
<tr>
<td></td>
<td>Ensuring exploitability of knowledge</td>
<td>Low demand from potential new companies of research outcomes</td>
</tr>
<tr>
<td></td>
<td>Facilitating circulation between universities, public research organisations and business</td>
<td>Poor knowledge circulation between academic research (universities/CNRS) and business</td>
</tr>
<tr>
<td></td>
<td>Profiting from international knowledge</td>
<td>High degree of internationalisation of scientific research</td>
</tr>
<tr>
<td></td>
<td>Enhancing the absorptive capacity of knowledge users</td>
<td>A highly qualified labour force is available; however, the entrepreneurial and innovation culture, as well as SMEs’ participation in R&amp;D, are limited</td>
</tr>
</tbody>
</table>

Strong scientific traditions and sustained public support for research have created favourable framework conditions for the French R&D system.

This system is characterised by highly centralised mechanisms of resource mobilisation for R&D by central government and a few large firms beside insufficient medium-dynamic companies. Knowledge demands, together with the production of
excellent and commercially useful knowledge, have tended to focus on a small number of strategic fields and sectors.

Corresponding governance structures and institutions often combined steering, policy implementation and performance of research. This is complemented by a strong role for the CNRS, which is a relatively autonomous actor, in general scientific knowledge production and also, to some extent, in channelling knowledge demands.

However, the system of research has also revealed some weaknesses, such as the recent stagnation of private resource mobilisation, a poor outlook for enhanced human resource mobilisation for R&D, a scientific and technological specialisation in somewhat mature fields and weak knowledge circulation beyond strategic sectors. Several assessments have expressed a need for a reform of the French research system.

According to FutuRis (2008)\(^6\), French research may be even trapped in a systemic dead end if no major reorganisation across system domains is carried out, with the change of governance and co-ordination of knowledge demands as main point of departure.

### 2.3 Analysis of recent policy changes since 2008

The contribution of research and research policies to Lisbon goals (as well as to other societal objectives) goes beyond the fostering of R&D investment. It is therefore important to also analyse how other remaining shortcomings or weaknesses of the research system are addressed by the research policy mix. The focus of the section is on the analysis of main recent policy changes which may have a relevant impact on the four policy-related domains.

#### 2.3.1 Resource mobilisation

Originally, a reform of the research system, which was first outlined in the Innovation Plan presented by the Ministry in charge of research in 2003, was expected to be launched in the second quarter of 2005. Neither the resignation of the Government nor the change of Minister for Education, Higher Education and Research or of the Minister Delegate of Higher Education and Research in May 2005 modified the content of the reform, even though the bill was slightly delayed from the original schedule. Two of the six priorities of the Pact for Research relate to resource mobilisation challenges, aiming at supporting enterprises' research efforts and making scientific careers more attractive. One element of this reform, which culminated in the 2006 Law for Research, was a commitment to increase public R&D funding and to achieve the 3% goal by 2010 (Republique Francaise, 2006).

In this respect, one of the priorities of the new National Reform Programme (NRP) **2008-2010** is also to “Invest more and better in public Research”. The objective of 3% of GDP for R&D investment has been delayed to 2012. According to the NRP, the State will continue to allocate large budgets.

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\(^6\) FutuRIS (2008), *Le système français de recherche et d'innovation: nouveaux instruments et évolution d'ensemble*
Changes in National Reform Programme regarding the role of research in the broader economic growth strategy

The French 2005-2008 National Reform Programme for Social Growth was presented in October 2005 by the services of the Prime Minister. In September 2006, the 2006 Progress Report on the 2005-2008 National Reform Programme For Economic and Social Growth was published, evaluating the first year of the programme. Concerning the challenges under the Knowledge-based economy, France has only limited results. That’s why the new PNR 2008-2010 focuses more on research and innovation issues. Among the three main axes selected by the new PNR, the first one deals with sustainable growth, innovation and the development of competitive businesses. One of the objectives is to move the technological frontier by strengthening the innovation capacity. Generally speaking, the aim is to develop the innovation capacity of France, which requires a financial and organisational effort towards research and innovation, the development of digital economy and the strengthening of links between science and society. To achieve these goals the actions to be implemented are:

1. Invest more and with more effectiveness in public research through:
2. Ensure knowledge transfer of public research towards business and support;
3. Develop digital economy;
4. Ensure the excellence of higher education;
5. To ensure primary quality training for all

For the 2009 budget, the public resources for higher education and research, would reach €27.6b. This includes the MIRES (Inter-ministerial Mission for Research and Higher Education) budget, the funding agencies, and also the estimated volume of fiscal measures. The MIRES budget allocation is €24.6b (against €21.3b in 2007 and €23.4b in 2008). In 2007, the MIRES’ distribution of resources among the 13 programmes and 3 groups was as follows:

1. Programmes under the aegis of the Ministry in charge of research, mainly bringing together the PROs (EPST and EPIC) along with the National Agency for Research (ANR), with a budget of €6.3b. The funding agencies' budget was increased by €280m: €235m for ANR (with a €825m budget), and €45m for OSEO Anvar (which has a €160m budget).
2. Higher education, university research, and student life (€12.5b) with a budget increase of 5.7% compared with 2006. The part on higher education and university research (excluding student life) increased by 2.8%.
3. Programmes under the aegis of other ministries than the Ministry in charge of research (€2.5b).

In addition, it is worth noticing that the first edition of the National Research and Innovation Strategy has started in January 2009 with the participation of stakeholders. The purpose is to get an overview of research and innovation challenges, to establish priorities, to align the action of all players and to optimise allocation of public funding. The idea is to update the strategy every four years.

The Research Tax Credit (Crédit d’impôt Recherche - CIR) is still a key measure in supporting R&D investments within companies. The Research Tax Credit is a horizontal measure, non-discriminatory across sectors of activity, which is aimed at
supporting corporate R&D investments through tax incentives. The budget act for 2008 radically simplified the mechanism by abolishing the fraction calculated over the spending increase and significantly raising the tax credit rate applied to the spending volume, raising it to 30% of R&D expenditure up to €100m (50% the first year and 40% the second). Above that amount, businesses are eligible for a 5% tax credit without cap. Since January 2009, companies can obtain the immediate refund of their research tax credit of 2005, 2006, 2007 and 2008 not yet used or mobilised. To this regards, the NRP 2008-2010 plans the extension of this measure.

Another renewed mechanism aimed at increasing R&D activities and leveraging R&D funding of companies has been a series of large pre-competitive programmes for industrial innovation (Programmes Mobilisateurs pour l’Innovation Industrielle - PMII) which are supported by the Agency for Industrial Innovation. The main purpose has been to support large firms in launching major R&D programmes in areas that go beyond their core activities. With this focus, the measure strengthens a well functioning element of private resource mobilisation rather than addressing the size composition weakness (see also Eparvier, 2007). In April 2006, the first five programmes were selected. Being above a threshold of €10m, they have been notified to the European Commission. Finally, a decree edited 20 November 2007 gave the duties of the Agency for Industrial Innovation (AII) to OSEO Innovation.

Table 2: Main policy changes in the resource mobilisation domain

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Main Policy Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Justifying resource provision for research activities</td>
<td>Research policy matters are still in a high position in the policy agenda especially with the:</td>
</tr>
<tr>
<td></td>
<td>• “New” National Reform Programme for 2008-2010</td>
</tr>
<tr>
<td></td>
<td>• Start of the the National Research and Innovation Strategy in January 2009</td>
</tr>
<tr>
<td>Securing long term investments in research</td>
<td>• No change noticed</td>
</tr>
<tr>
<td>Dealing with uncertain returns and other barriers</td>
<td>• Additional public funds, mainly through increased competitive project funding (in particular through OSEO Agency)</td>
</tr>
<tr>
<td></td>
<td>• Strengthening of Research Tax Credit</td>
</tr>
<tr>
<td>Providing qualified human resources</td>
<td>• Implementation of law of autonomy for universities</td>
</tr>
</tbody>
</table>

2.3.2 Knowledge demand

Two of the six priorities of the Pact for Research responded to challenges in the knowledge demand domain, namely reinforcing strategic orientation abilities and building a unified research evaluation system. Governance changes in May 2007 have strengthened political control over research policy by introducing a specific Ministry in charge of research. This has been complemented by the creation of a high level council, the High Council for Science and Technology (HCST), which was created in June 2006 to advise the president and provide him/her with recommendations on national research and innovation strategies. Up to now its activity was limited. Some criticisms were made that its dependency on political spheres may bias its recommendations and that civil society is not represented.

The growing importance of competitive research funding mechanisms was underlined by the creation of the National Agency for Research (ANR) in 2005. The
Government's goal is to reach 20% project-based funding by 2010\(^7\) (Republique Francaise, 2006). The mission of the ANR is to fund exploratory research projects open to all types of research performers according to the thematic priorities identified by the Government. A share of the government funding for public research is now allocated through this intermediary research agency The National Agency for Research’s calls for projects are organised around seven themes. These themes are Sustainable Energy and Environment, Sciences and Technologies for Information and Communication, Engineering, Processes and Security, Biology and Health, Ecosystems and sustainable development, Humanities and Social Sciences, Non thematic Programmes and Cross Cutting Programmes. In 2008, the National Agency for Research has launched 50 calls for project proposals distributed over a vast group of scientific and technological areas. In 2008 the overall budget of the National Agency for Research reached €839m. The majority of funding (79% that is €665m) was dispensed through calls for project proposals. The remaining amount was distributed for specific actions to which the state had committed itself. The NRP 2008-2010 has planned to continue relying on the funding role of ANR.

The Law for Research passed in April 2006 enacted a change in the evaluation system with the creation of the Agency for the Evaluation of Research and Higher Education (AERES) which will, among other things, unite the missions that were formerly in the hands of other bodies. The extension of its functions in 2007 has significantly strengthened the public research quality evaluation system and the new NRP plans the pursuit of AERES role. The aim is to assess the quality of all public research entities before the end of 2010.

### Table 3: Main policy changes in the knowledge demand domain

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Main Policy Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identifying the drivers of knowledge demand</td>
<td>• No change noticed</td>
</tr>
<tr>
<td>Co-ordinating and channelling knowledge demands</td>
<td>• Improvement of research programming and growing importance of competitive research funding mechanisms (particularly through the increase budget of ANR)</td>
</tr>
<tr>
<td>Monitoring demand fulfilment</td>
<td>• Reinforcement of AERES evaluation activities</td>
</tr>
</tbody>
</table>

#### 2.3.3 Knowledge production

Several measures can be highlighted insofar as they may contribute to improve the quality and the exploitability of knowledge produced by the French system of research and innovation.

The first measure is the rationalisation of the evaluation of the research system. The Pact for Research drafted in 2005 put a strong focus on the rationalisation and the diffusion of evaluation procedures. The aim was twofold: the enhancement of the use of evaluation on the one hand and the harmonisation of evaluation procedures on the other hand. As planned in the Pact, a new agency was created in 2007, the dubbed Agency for the Evaluation of Research and Higher Education which encompassed the different previous agencies in charge of evaluation of research. The duties of the AERES are more limited than those mentioned in the Pact for

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\(^7\) In 2004, most of the public funding to businesses was project-based, but less than 3% of PROs funding was project-based (excluding international, European or industrial contracts). The objective to double project-based public funding would be linked to the increasing budgetary power of the ANR which would raise PROs’ project-based funding to 10% of PROs’ national resources.
Research. After several researchers and researchers unions voiced their disagreement on the possibility to apply the same rules to different research activities, AERES’ duties were limited to the evaluation of research teams, research institutions and education institutions.

The second measure corresponds to the role of the National Agency for Research (ANR) in the area of knowledge production which was reasserted by the French National Reform Programme 2008-2010.

The third measure is the strengthening of research capabilities and excellence by Research and Higher Education Clusters (Pôles de recherche et d’enseignement supérieur - PRES) and Thematic Advanced Research Networks (Réseaux thématiques de recherche avancée - RTRA). Both have the objective to foster public research actors on scientific projects. Participants of the Clusters or of the Networks are given extra resources. The logic is to increase research excellence and reverse the fragmentation of research activities. These instruments have become effective in the past two years:

- The PRES provide Public Research Organisations and Higher Education Institutes with extra resources to incite them to increase their cooperation with each other in order to boost efficiency at the regional level, and raise the international profile and attractiveness of the French research and higher education system. Their legal form can be flexible and their status and activities are not limited in time. In 2009, France counts 12 PRES.

- RTRA also aims at federating resources but with a focus on scientific excellence with international recognition. Its thematic nucleus of research units must also be geographically close\(^8\). Selected projects will be given the status of Foundation for scientific cooperation (FCS – Fondation de coopération scientifique). The criteria for the creation of a RTRAs are: (i) a critical mass of very high level researchers, superior or equal to the best world research centres in a given field; (ii) Plurality of specialisation within a given theme; (iii) a strong international dimension; (iv) openness to other disciplines and/or the socio-economic sectors; and, (v) definition of a common strategy. In 2009, there are 12 RTRA.

The fourth change relates to the deep reform of the public research system. In 2007, the law about the universities (labelled Law of autonomy for universities) has been published and mainly provided (within 5 years) that all French universities get the autonomy concerning budget matters and human resources issues. The law also changes universities’ governance system (reducing of administration councils and increasing role of the University chairman). A first group of 20 universities applied for and were given the status of autonomous University in January 2009. The reform aims to:

- Grant universities more autonomy to decide their budget and staff, allowing universities to create foundations, to collect money and put in place their own recruitment processes; in particular, it includes the possibility of proposing short-term contracts to researchers;

- Give universities more competence in opening their administration to external staff, allowing, for example, representatives of the business world to take part in university governance;

\(^8\) In the Law for Research that was passed in April 2006, the Thematic Networks for Research were called Campuses of Research (Campus de recherche).
• Strengthen the state’s legal control.

Concerning the French university system, a first reform has been implemented (since 1 January 2009) which would lead to a new way of allocating resources to universities paying more attention to performance.

As a follow-up of the reform, the government initiated a reform of the teacher-researcher status. The objective was to give the possibility to the Presidents of the Universities to attribute time for each researcher-teacher to be spent on research and on teaching. The scientific community is strongly fighting against this proposal. Demonstrations were organised in February 2009 which led the Government to delay the reform.

Still regarding the reform of the research system, the Government is pushing for a reform of the role and the place of the PROs within the research system. The main idea is to create Institutes of research which would take over from the existing structures. The rationale is to fight against the fragmentation of research teams and to pool research competences belonging to the same PRO into a single well-identified Institute. The first step was the transformation of the CNRS’ departments in Institutes in 2008. It is worth noticing that the research community in large does not approve these changes.

Finally, in 2008, the Government identified Very Large Research Infrastructures (VLRIs) identified as a tool aimed at performing research on a large scale. A reorganisation of the office in charge of VLRIs aimed to provide the Minister with the tools necessary to pilot these research instruments within 10–25 years. Moreover, a roadmap of French VLRIs was issued in 2008 by the Minister for higher education and research, following the ESFRI roadmap. It aims at determining and planning an accurate strategy for the country’s research infrastructures. The roadmap also lists 92 VLRIs (46 existing RIs, 19 planned and 25 in project).9

In line with the National Reform Programme 2008-2010, the French government has recently launched the second phase of the competitiveness cluster policy for a further 3 years period (2009-2011) with a total budget of 1.5 billion. Most of this amount will be earmarked for R&D projects, channelled through the Single Interministerial Fund for competitive clusters.

Table 4: Main policy changes in the knowledge production domain

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Main Policy Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improving quality and excellence of knowledge production</td>
<td>• New increase in competitive funding distributed by ANR</td>
</tr>
<tr>
<td></td>
<td>• Access to autonomy of 20 Universities in January 2009</td>
</tr>
<tr>
<td></td>
<td>• Identification of VLRIs in order to better monitor research</td>
</tr>
<tr>
<td>Ensuring exploitability of knowledge production</td>
<td>• Launching of the second phase of the competitiveness cluster policy (2009-2011)</td>
</tr>
</tbody>
</table>

2.3.4 Knowledge circulation

The issue of the circulation of knowledge between academic and business actors was given high priority in the Pact for Research and in the 2006 Law for Research, which represents the legislative part of the Pact for Research.

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9 Minister for higher education and research, Les très grandes infrastructures de recherche, French roadmap, 2008.
Two main measures aiming at improving this collaboration are:

- The former programmes of the late Agency for Industrial Innovation (taken over by OSEO innovation from 2008 on), which were put in place in order to support and subsidise large pre-competitive programmes for industrial innovation. Networking between large firms and SMEs has a crucial role. Apart from these actors, the Agency had also the task of enhancing public and private co-operation in the field of research. In 2008, OSEO Innovation’s activity was enriched with an industrial strategic innovation programme. Innovation Stratégique Industrielle (ISI), born from the merger with the former Agence de l’Innovation Industrielle (AII, industrial innovation agency) at the beginning of 2008. The 2008 appropriations for this programme should be around €300m for partnership-based projects with a large R&D component (between 3 and 10 million each). As planned by the National Reform Programme 2008-2010, the range of OSEO’s financing guarantees for innovative projects will be extended. In partnership with the European Investment Bank (EIB), OSEO will be implementing the Risk Sharing Finance Facility (RSFF) as part of the 7th Research and Development Framework Programme.

- The Competitiveness Clusters (see 2.3.3) that pool public and private resources on specific research areas depending on regional strengths.

Another new measure to improve inter-sectoral knowledge circulation, building upon the model of the German Fraunhofer Institutes, was the creation of Carnot Institutes in 200610 which are supported by the National Reform Programme 2008-2010. These have the following characteristics:

- A clearly defined research structure (partners, activity, critical mass)
- A clear research strategy (technological challenges, competitive positioning, partnership strategy)
- Clearly defined governance and organisation (budget allocation, strategic orientations, human resources)
- Demanding quality criteria
- A strong partnership spirit with the private sector, with at least 10% private funding
- Management of IPR on behalf of partners.

The Carnot label, granted for 4 years, acknowledges their capacity to collaborate effectively with businesses and gives them the right to an additional ANR endowment based on the amount of revenue from research contracts in partnership with businesses. The objective is two-fold: prompting public research entities to develop partnership-based research and allowing them to launch projects with the Carnot endowment awarded by ANR. In 2007, Carnot endowments totalled €62m.

As a new means to improve access to European and international knowledge the ANR and the former project of the AII (taken over by OSEO innovation from 2008 Onwards) are encouraged to support projects that may be put forward by research actors to benefit from European funding.

10 The first call for applications was launched in October 2005.
Table 5: Main policy changes in the knowledge circulation domain

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Main Policy Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facilitating knowledge circulation between university, PRO and business sectors</td>
<td>• Second phase of the competitiveness cluster policy (2009-2011)</td>
</tr>
<tr>
<td></td>
<td>• Support of the National Reform Programme 2008-2010 to Carnot Institutes</td>
</tr>
<tr>
<td>Profiting from access to international knowledge</td>
<td>• No change noticed</td>
</tr>
<tr>
<td>Absorptive capacity of knowledge users</td>
<td>• No change noticed</td>
</tr>
</tbody>
</table>

2.4 Policy opportunities and risks related to knowledge demand and knowledge production: an assessment

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

Regarding the resource mobilisation domain, it is worth noticing that research has a more significant place in the policy agenda than it had in the past and benefits from additional public funds mainly due to the increase of competitive project funding. Moreover, incentives to support young firms performing research have been implemented or reinforced. However these might not be sufficient to reach Barcelona/Lisbon objective for private R&D, if private investments do not increase at the same rate or worse do not increase at all.

A policy-related threat in the domain of resource mobilisation for R&D is that the very ambitious policy goal of achieving a private R&D funding intensity of 2% of GDP, which implies a break with recent trends. Other policy-related threats are related to the knowledge production domain.

Since the last ten years, research and innovation has received a stronger focus from the successive Governments as compared with the previous period. Research, innovation and human capital are consensually perceived as a key driver for the competitiveness of the domestic companies.

Outstanding efforts have been made to deeply reshape the French research and innovation system:

- increase in public budget for public as well as for private R&D
- design of a long-term strategy for research and innovation policies
- increase in competitive funding in order to increase research excellence
- set up of instruments in order to reduce the fragmentation of the public research institutions.

However, in spite of substantive efforts, the French research and innovation system still suffers from the same pitfall: the worrying lack of small and medium companies and in particular of “gazelles”, those technology-based companies with a potential high rate of growth.

The French research and innovation system has been based on large public-owned companies for decades that were the main entry point of any research and innovation policy with the idea that spill-overs will benefit the medium and small companies afterwards.
Governmental authorities have changed their strategy. Several instruments (see below) were recently set up in the benefit of the small and medium companies. However, large companies still benefit from the lion’s share of public support to private R&D (the reform of the research tax credit as well as the competitiveness clusters seem to mostly benefit large companies despite they were not explicitly oriented towards large companies).

Governmental efforts in favour of research are acknowledged by economic and research actors. For example, in October 2008, the Conference of the President of Universities voiced their satisfaction with the increase in the budget for Universities. However, the increase in the public budget for R&D raises many discussions, in particular as regards the increase in budget of the Research Tax Credit or the increasing importance given to the project-based research.

As compared with what was the tradition in France, the set-up of new instruments or the reforms of existing instruments show a strong coherence with the overall strategy. The period when new instruments were put in force whereas similar instruments were maintained seems to be over now. Each and every policy is now clearly defined in the context of the existing instruments even if the FutuRIS 2008 report notes that the articulation of new instruments with each other is still questionable.

Even if the situation is not perfect, the current institutional set-up undeniably benefits from the increased role given to strategy. For example, the Pact for Research in 2005 paved the way for policies implemented since. The Ministry in charge of Research was reorganised in 2007 and a dedicated Department in charge of strategic studies was created. In addition, it is worth noticing that a national research and innovation strategy is currently in development with the participation of all stakeholders. The purpose is here to get an overview of research and innovation challenges, to establish priorities, to align the action of all players and to optimise allocation of public funding.

The willingness of the Government to better shape research and innovation policies goes in hand with its willingness to increase its control on the funding flows. The National Agency for Research (ANR) is the main instrument in its hands to that regard as well as the Competitiveness Clusters’ funding to a lesser extent (to a lesser extent since the identification of the projects follows a bottom-up approach even if it is up to the inter-Ministerial ad hoc committee to decide which projects will be funded and which will not).

As regards the increased control of the State on the design of research priorities, the least that can be said is that the scientific community does not unanimously accept it. Individual researchers as well as research directors within PROs consider that this activity should follow scientific needs and therefore cannot be the responsibility of the State.

The mode of channelling knowledge demands is increasingly based on competitive project funding by new intermediary agencies. This has very recently been complemented by an increase in the autonomy of universities, which should allow them to better adapt to these changes.

The increasing funds programmed by the Agency for Research and the new unified Agency for Research Evaluation also introduce new or improved quality assurance mechanisms for scientific knowledge production. This is accompanied by an
extensive and also somewhat controversial public debate among the scientific community. The changes are being boosted by additional public funds. In parallel, a range of new instruments have been introduced which try to ensure knowledge excellence, exploitation and circulation beyond the traditionally focused sectors, such as the thematically advanced research networks, which may provide interesting tools for overcoming fragmentation, the competitiveness clusters and the Carnot institutes. Competitiveness clusters and strengthened tax incentives may leverage private resource mobilisation for R&D. However it is worth noticing that this set of new measures is complex and adds up to existing mechanisms.

Policies are clearly in line with the Lisbon strategy in the sense that the State considers the modernisation of the management of the research institutions and universities, more effective and more efficient public expenditures, an attractive and improved framework for companies, the reinforcement of PP/P and the development of regional policies/strategies as major issues. However, what is desirable is not always feasible. First, the willingness to increase competitive and targeted funding is not unanimously accepted by the scientific community that still considers to some extent that block funding should be the rule and the competitive funding the exception. Secondly, the set-up of regional competitiveness clusters can push some regions to make efforts to build their regional research and innovation system on their strengths, even if these strengths relate to traditional sectors. The risk is that this development is made at the detriment of fast growing technological areas.

Table 6: Summary of main policy related opportunities and risks

<table>
<thead>
<tr>
<th>Domain</th>
<th>Main policy-related opportunities</th>
<th>Main policy-related risks</th>
</tr>
</thead>
</table>
| Resource mobilisation     | • Research is higher in the policy agenda than it was in the past  
  • Additional public funds, mainly through increased competitive project funding  
  • New incentives to support young firms performing research  | • Measures might not be sufficient to reach Barcelona/Lisbon objective for private R&D  
  • Disagreement between the Government and researchers on the most desirable consolidation of the public research system and on the governance mechanisms |
| Knowledge demand          | • Enhancement of strategic steering, e.g. through the increased role for the Ministry in charge of research, could help channel and meet society's demands more effectively  
  • Increase in the policy mix due to efficient inter-Ministerial relationships  
  • Improvement of research programming e.g. through the new Agency for Research and an increase in project-based competitive funding so as to enhance openness to changing needs  | • Effectiveness of new institutional arrangements (so far a limited role of the HCST) remains to be proven  
  • Criticisms on the Governmental willingness to increase the strategic role of the State on the definition of research priorities  
  • Distribution of responsibilities between the State and the Regions not always clear |

11 see for example [http://www.sauvonslarecherche.fr/](http://www.sauvonslarecherche.fr/)
<table>
<thead>
<tr>
<th>Domain</th>
<th>Main policy-related opportunities</th>
<th>Main policy-related risks</th>
</tr>
</thead>
</table>
| Knowledge production | • Combination of new network oriented instruments, competitive basic research funding and modernisation of university management to strengthen excellence and increase the effectiveness of public funding  
• Competitiveness clusters strengthen orientation of knowledge production towards economic uses beyond strategic sectors | • Complexity and strong thematic focus of policy measures might not be beneficial for excellence emerging from new cross-cutting scientific opportunities and the research community may not cooperate wholeheartedly in implementation  
• Policy measures oriented towards existing regional strengths might not be sufficient to prevent a loss of leadership in the fast growing technological areas |
| Knowledge circulation | • Development of promising instruments to increase diffusion of knowledge: newly created Competitiveness Clusters and Carnot Institutes may bridge the persisting gap between academia and business | • Efforts might be insufficient                                                                                                                                                                                                 |

### 3 National policy mixes towards R&D investment goals

The aim of this chapter is to deepen the analysis of national policy mixes with a focus on public and in particular private R&D investment. The Lisbon strategy emphasises an EU overall resource mobilisation objective for 2010 of 3% of GDP of which two thirds should come from private investment. R&D investment is seen as important yardstick for the capacity of an economy to turn the results of science and research into the commercially viable production of goods and services and hence knowledge into growth. Corresponding investment policies are mainly pursued at national level and determined with a national focus.

The chapter is structured around five questions:

1. What are the specific barriers in the country that prevent reaching the Lisbon goal? What barriers exist in the country to prevent reaching the specific targets, particularly related to the private sector R&D investments?

2. Given the above, what are the policy objectives and goals of the government that aim to tackle these barriers?

3. What Policy Mix routes are chosen to address the barriers and which specific instruments and programmes are in operation to implement these policies?

4. What have been the achievements in reaching the above mentioned R&D investment objectives and goals?

5. What are the reasons for not reaching the objectives, adaptation of the goals?

The chapter aims to capture the main dimensions of national policies with an emphasis on private R&D investment. The chosen perspective of looking at investments in R&D is the concept of Policy Mixes. The analysis and assessment follows a stepwise approach following the five questions mentioned above.
3.1 Barriers in the research system for the achievement of R&D investment objectives

Financing 38.4% in 2006 of all R&D performed in France, the Government is still the main actor in mobilising resources for long-term investments in research and corresponding infrastructures. All public resources for higher education and research are secured in the form of yearly inter-ministerial budgets.

Contractual arrangements between the State and universities or public research organisations have traditionally been an important funding mechanism for securing long-term investment in research. These contracts guarantee resources for four years and a statute whereby most of the researchers at the PROs (whose mission is mainly scientific) and teacher-researchers have life-long contracts. Table 7 below illustrates the important role of the government sector and its components on the basis of disaggregated national data on expenditures of the public sector in 2003. CNRS is the largest of the EPSTs and also the largest PRO in Europe, with 32,000 employees of which 26,000 are CNRS tenured employees (11,600 researchers; 14,400 engineers and support staff), and an annual budget which represents a quarter of French public spending on civilian research. Another established mechanism for securing long term investments has been large research programmes (see also section 3.1.2).

Table 7: R&D expenditures of the Public sector in 2003 (million €)

<table>
<thead>
<tr>
<th>Government expenditures (civil + defence)</th>
<th>6,254</th>
<th>44%</th>
</tr>
</thead>
<tbody>
<tr>
<td>S&amp;T public institutes (EPST) excluding CNRS and Institutes</td>
<td>1,654</td>
<td>12%</td>
</tr>
<tr>
<td>Industrial and Commercial public institutes (EPIC)</td>
<td>3,443</td>
<td>25%</td>
</tr>
<tr>
<td>Administrative public institutes (EPA), excluding &quot;grandes écoles&quot; which are not under the aegis of the Ministry in charge of education</td>
<td>162</td>
<td>1%</td>
</tr>
<tr>
<td>Defence</td>
<td>885</td>
<td>6%</td>
</tr>
<tr>
<td>Higher education</td>
<td>7,279</td>
<td>52%</td>
</tr>
<tr>
<td>CNRS</td>
<td>2,689</td>
<td>19%</td>
</tr>
<tr>
<td>Universities and other higher education institutes</td>
<td>4,360</td>
<td>32%</td>
</tr>
<tr>
<td>Private non profit</td>
<td>461</td>
<td>3%</td>
</tr>
<tr>
<td>Total</td>
<td>13,994</td>
<td></td>
</tr>
</tbody>
</table>

Generally speaking, basic mechanisms for securing long-term investment in research in France are well established and functioning effectively. This is also underpinned by the government appropriations for R&D. In 2006, in France, GBAORD, expressed as a percentage of GDP, amounted to 1.01%, well above the European (EU 25) average (0.75%). Also the moderate growth in the share of basic research over the period 1993-2003, reaching 24.1% of GERD in 2003, points in this direction (ERAWATCH Network, 2006).

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12 latest available figures on this level of disaggregation
However, it is worth noticing that the total public funding of R&D has grown slower over the last 10 years as compared to the GDP (34% against 41%), with growth being restricted to research performed in the higher education sector.

In 2006, R&D expenditures performed by the business sector in France corresponded to a share of 61.9% in total GERD (average of 62.5% in EU-27 and 67.9% in OECD countries). However, the private sector financed 52.5% of GERD in France, a share which has declined since 2001. This share is far below the two-thirds target set in the Barcelona objective. (Source of data: OECD Main Science and Technology Indicators, May 2007).

In 2006, large firms concentrated more than one third (39%) of private R&D expenditures. This share has remained constant over the past years (it already reached 38.2% in 2000). Smallest firms (less than 500 employees) spent one fourth (26%) of the total R&D expenditures of the private sectors in 2006 (this share was 20.3% in 2000). Even if an increasing role is played by the smallest firms, however, if the European definition of a SME is used, the share shrinks to 14.1% (2002) which is below EU25 average.

The distribution of public funds is clearly biased towards the largest companies, to the detriment of small businesses: SMEs received 17% of public funds whereas they performed 24% of companies’ R&D.

Generally speaking the lack of recognition of SME’s role in the innovation system and in the creation and diffusion of new technologies has undeniably decreased over the past years. However, SMEs still suffer from a lack of credibility with large companies. The SME Pact was especially implemented in order to reinforce this credibility.

As regards the reform of the Research Tax Credit, in 2007, France Biotech which is the French Association of Biotechnologies Companies, and CroissancePlus made a common press release for voicing their disagreement with the reform of the Research Tax Credit. According to them, the NTBFs suffer from the suppression of the incremental-base scheme since these companies are often characterized by high increase in their R&D expenditures. The loss due to this suppression is not compensated by the enhancement of the volume-based scheme.

To sum up, there is consensus on the necessity for the industry to enhance its R&D efforts. Public expenditures devoted to private R&D have significantly increased in the past (as a consequence of the reforms of the Research Tax Credit in particular). But the private sector is definitely the weakest link of the research and innovation system to that regard. French companies in general and small/medium companies in particular do not devote sufficient resources to R&D.

As a consequence, demand for high level skills remains relatively low. Along the limited opportunities in the public sector, this negatively impacts on the choice for a scientific career by the young people. A recent study made by Technopolis France for the National Association for Research and Technology (Cadiou, Ollivier and Zaporucha, 2008) noted that there is agreement on the need to promote doctorate and increase PhD holders’ employment.

This might become a dramatic issue in the future when the baby-boomer researchers will all have retired. This lack of attractiveness for research careers is also due to a

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characteristic specific to France, namely the dual tertiary education system – in science, engineering and management - with Universities on the one hand and "Grandes écoles" on the other. "Grandes écoles" are uniquely French institutions that offer specialised education of a high standard. This high standard is reflected in the strict admission requirements. "Grandes écoles" generally offer high-quality educational programmes and excellent career prospects. Some of the "Grandes écoles" are also planning to run doctorates. However, their role in research and innovation is limited compared to that of Universities (Veltz, 2007). The outlook for a young person with a university degree in science, engineering and management is on average much less favourable than that of someone leaving the education system with an engineering or business school qualification acquired in a "Grande école", especially one of the leading "Grandes écoles". One result of this is that French firms are not in the habit of employing PhDs, preferring instead to recruit graduates from the leading "Grandes écoles".

In addition to that, the question of diffusion and commercialisation of scientific outcomes is unanimously considered as a critical issue for the French public research institutions. Apart from the strategic sectors, in France, linkages between academic and industrial knowledge production are somewhat weak.

**3.2 Policy objectives addressing R&D investment and barriers**

Several policy objectives have been stressed, namely:

- To strengthen public research. According to the Pact for Research, research should reach excellence in order to gain international visibility and face increasing competition between research units amongst countries. The NRP 2008-2010 displays as well the objective investing « more and better » in public research. France’s objective for R&D investment is 3% of GDP by 2012. The State will continue to allocate large budgets. The reforms will mainly be intended to ensure that the resources allocated produce better public research results and promote corporate research and innovation.

- In addition to implementing research policies oriented towards the public sector, the government has increased its focus on research in the private sector. The share of GERD funded by domestic enterprises being rather low the objective is also to raise private investment in research. The main idea is to incite companies to devote more resources to research. But above all, one of the main challenges of French public and private research is related to the ability to reinforce the links between them.

- To increase the innovative behaviour of companies especially of SME’s.

- To reinforce the linkages between science and society. The overall objective of research activities is to increase the well-being as well as the living standard of the society as a whole. From this point of view, citizens must trust research and technology as well as researchers. According to the Pact for Research, a new impetus should be given to the trust that the society has in research. The NRP 2008-2010 is in line with this trend by reasserting that government will continue initiatives to strengthen the ties between science and society. The idea is to encourage ownership of knowledge by fellow citizens in order to enhance the learning of scientific subjects and to make sure citizens can participate actively in scientific policy debates. The State will in particular continue to support the Institut des Hautes Etudes pour la Science et la Technologie (IHEST, Institute for Higher
Science and Technology Studies) set up in 2007, which organises annual course programmes to teach unregistered high-level students how to disseminate scientific and technical culture.

- To facilitate the transfer of knowledge from research to innovation. Since 1999 successive governments have emphasised the need to design policy measures to facilitate the valorisation of research performed in the public research system. The mobility of human resources was therefore identified as a main means to enable the creation of companies. The NRP 2008-2010 reassert as well the objective of transferring knowledge from public research to the business community and providing support for corporate innovation.

### 3.3 Characteristics of the policy mix to foster R&D investment

This section is about the characterisation and governance of the national policy and instrument mix chosen to foster public and private R&D investment. While policy goals are often stated at a general level, the policy mix has a focus on how these policy goals are implemented in practice. The question is what tools and instruments have been set up and are in operation to achieve the policy goals? The following sections will each try to tackle a number of these dimensions.

#### 3.3.1 Overall funding mechanisms

In 2007, national R&D expenditures (GERD) accounted for €39.4b. GERD accounted for 2.1% of GDP\(^{14}\). In 2006, according to EUROSTAT data, the government sector funded 11.2% of the R&D performed by business enterprises, which have self-financed 80.2% of their R&D expenditures. Alternatively, business enterprises funded 8.0% of the R&D performed by the government sector.

**Table 8: Description of funding flows – 2006 (€m). (Columns: performed by; rows: funded by)**

<table>
<thead>
<tr>
<th></th>
<th>Government</th>
<th>Higher education</th>
<th>Business enterprises</th>
<th>Private non profit</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government</td>
<td>14.2%</td>
<td>17.0%</td>
<td>7.0%</td>
<td>0.2%</td>
<td>38.4%</td>
</tr>
<tr>
<td>Higher education</td>
<td>0.1%</td>
<td>1.2%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>1.3%</td>
</tr>
<tr>
<td>Business enterprises</td>
<td>1.3%</td>
<td>0.3%</td>
<td>50.6%</td>
<td>0.2%</td>
<td>52.4%</td>
</tr>
<tr>
<td>Private non-profit</td>
<td>0.0%</td>
<td>0.1%</td>
<td>0.0%</td>
<td>0.7%</td>
<td>0.8%</td>
</tr>
<tr>
<td>Abroad</td>
<td>0.9%</td>
<td>0.5%</td>
<td>5.4%</td>
<td>0.1%</td>
<td>7.0%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>16.5%</strong></td>
<td><strong>19.2%</strong></td>
<td><strong>63.1%</strong></td>
<td><strong>1.2%</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>

Source: Eurostat

According to the Ministry in charge of research, in 2006, public sector R&D funding amounted to €19.2b of (1% of GDP), of which 82% went to the public sector, 18% to enterprises.

The following table presents the total R&D budget of public organisations and services. In 2006, block grants amounted to €14.8b, representing therefore, 77.4% of public research resources.

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Table 9: Types and sources of public research funding in 2006 (€ m)

<table>
<thead>
<tr>
<th></th>
<th>Grants</th>
<th>Contracts</th>
<th>Own funding</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public administrations</td>
<td>9 075</td>
<td>1 399</td>
<td>771</td>
<td>11 244</td>
</tr>
<tr>
<td>Higher education</td>
<td>5 722</td>
<td>1 178</td>
<td>473</td>
<td>7 373</td>
</tr>
<tr>
<td>Non-profit institutions</td>
<td>96</td>
<td>245</td>
<td>283</td>
<td>624</td>
</tr>
<tr>
<td>Total</td>
<td>14 893</td>
<td>2 821</td>
<td>1 526</td>
<td>19 241</td>
</tr>
</tbody>
</table>

Source: Ministry in charge of research – DEPP
(http://cisad.adc.education.fr/reperes/public/chiffres/france/adm.htm)

Table 10: Breakdown of MIRES 2006 funding by objectives

<table>
<thead>
<tr>
<th></th>
<th>Funding (€ m)</th>
<th>Share (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incentive funding</td>
<td>831</td>
<td>7.5</td>
</tr>
<tr>
<td>Large programmes</td>
<td>2,521</td>
<td>21.6</td>
</tr>
<tr>
<td>Basic R&amp;D</td>
<td>2,484</td>
<td>18.4</td>
</tr>
<tr>
<td>Targeted programmes</td>
<td>2,468</td>
<td>19.9</td>
</tr>
<tr>
<td>Training through R&amp;D</td>
<td>3,607</td>
<td>32.6</td>
</tr>
<tr>
<td>Total</td>
<td>11,911</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Ministry in charge of research - DEPP
(http://cisad.adc.education.fr/reperes/public/chiffres/default.htm)

Regarding the institutional funding, it is worth noticing that before the recent Law on University responsibilities and freedom of August 2007, Universities directly managed only 20% of the total state funding dedicated to universities in the annual budget law. The system was in fact very centralised in so far as the Ministry in charge of research uses the 80% left to manage most of the human resources (civil servants), social actions for students, the functioning of central administration. Since the reform Universities should be able to manage a global budget, including staff costs. (see section Higher Education Institutions)

Block grants amount for almost 90% of resources of universities and of the CNRS (basic research performers) and for less than 60% of resources of the other PROs than CNRS (applied research performers). The funding of public research through block grants is increasing over time, however its share in the total budget of public research performers is decreasing (from 81% in 2000 to about 75% in 2008 according to the FutuRIS 2008 report\(^\text{15}\)).

Moreover, the share of research contracts is increasing. In 2006, research contracts represented €2.8b that is 14.7% of public research resources. In terms of funding sources, it is worth noticing that project-based funding increased from 15.2% in 2000 to 22.3% in 2008 in public R&D performed in France. Between 2000 and 2007, FutuRIS shows that public funding increased from 52% to 65% when other sources of funding decreased\(^\text{16}\). The implantation of several new instruments explains the increase of public funding on a project-basis: mainly the National Agency for Research (ANR) and the Competitiveness Clusters.

In 2008 the overall budget of the National Agency for Research reached €839m. In the context of the Competitiveness Clusters, the total budget dedicated by the State

\(^{15}\) FutuRIS (2008), *Le système français de recherche et d'innovation : nouveaux instruments et évolution d'ensemble*  
\(^{16}\) FutuRIS (2008), *Le système français de recherche et d'innovation : nouveaux instruments et évolution d'ensemble*
to the financing of competitive clusters was established at a minimum of €1.5b over 3 years (2006-2008): €830m came from the national budget, €520m from agencies the National Agency for Research, OSEO Innovation, the Caisse des Dépots et Consignations (CDC) and €160m from tax exemptions.

With regard to inflows of funds from abroad, in 2006, French enterprises and administrations received €2.6b from non-French sources in support of research. The private sector gathered 78% of these funds, while the public sector (including the private non-profit sector) obtained 22%. The primary sources of foreign funds were enterprises or organisations (68%) followed by other international organisations (19%) and the European Union (13%).

In 2006, France received 12.9% of FP6 budget distributed as followed: 79% for agriculture, 18% for cohesion (region) and 2.5% for education, training, research, European network, etc. that is 4.8% of French GERD (according to FutuRIS).

3.3.2 Policy Mix Routes

The “Policy Mix Project” identified the following six ‘routes’ to stimulate R&D investment:

1. promoting the establishment of new indigenous R&D performing firms;
2. stimulating greater R&D investment in R&D performing firms;
3. stimulating firms that do not perform R&D yet;
4. attracting R&D-performing firms from abroad;
5. increasing extramural R&D carried out in cooperation with the public sector or other firms;
6. increasing R&D in the public sector.

The routes cover the major ways of increasing public and private R&D expenditures in a country. Each route is associated with a different target group, though there are overlaps across routes. The routes are not mutually exclusive as, for example, competitiveness poles of cluster strategies aim to act on several routes at a time.

Route 1: Promoting the establishment of new indigenous R&D performing firms

In this field, the most remarkable ones are the tax relief for the Young Innovative Companies. The aim is to increase the creation of R&D intensive companies. The objective of the Young Innovative Company status is to help young innovative firms in overcoming the first years of their existence. For that purpose, these companies are provided with tax credits for their R&D investment. The idea is to exempt eligible companies from profit tax for the first three years of financial profit and to reduce the profit tax by 50% for the following two years of financial profit. To be eligible, companies must be less than eight years old and should reach a level of R&D expenditure equal to 15% of their turnover. The status of the Young innovative company is supposed to provide a significant support to new firms very active in the field of Research & Development, and therefore allow them to overcome the difficult early years of their development, subject to specific conditions.

Moreover, it is worth noticing that the objective of the “business incubators” measure is to promote the creation of innovative firms based on the results of public research or in conjunction with public research.
The “contest for the creation of innovative business” aims as well at detecting, generating and developing business creation projects depending on innovative technologies by rewarding the best ones through financial support and appropriate accompanying measures. It is a good mean to promote the establishment of new indigenous R&D performing firms.

The Research Tax Credit is another important means of promoting the establishment of new indigenous R&D performing firms. It is a horizontal measure, non-discriminatory across sectors of activity and aimed at supporting corporate R&D investments by means of tax incentives. The 2008 reform is intended to stimulate R&D investment by companies established in France and to make France more attractive for the research activities of French and foreign companies. The State tax credit is estimated at €3.9b for 2008. The Budget Act for 2008 radically simplified the mechanism by abolishing the fraction calculated over the spending increase and significantly raising the tax credit rate applied to the spending volume, raising it to 30% of R&D expenditure up to €100m (50% the first year and 40% the second). Above that amount, businesses are eligible for a 5% tax credit without cap. Since January 2009, companies can obtain the immediate refund of their research tax credit of 2005, 2006, 2007 and 2008 not yet used or mobilised. As mentioned already, the new scheme is considered as counter-productive for the NTBFs which are characterised by high increases over time of their R&D expenditures (see Section 3.1 and the press release of France Biotech and CroissancePlus (2007))

Route 2: Stimulating greater R&D investment in R&D performing firms

The Research Tax Credit is a measure aiming at stimulating greater R&D investment in R&D performing firms (see route 1). In fact, the recent reform of the Research Tax Credit was motivated by the wish to incite companies that perform R&D to increase their efforts.

Competitiveness Clusters are as well important tools and are seen to be a means of encouraging greater R&D investment by companies. The logic of Competitiveness Clusters is to create regional poles of excellence in accordance with regional strengths. Industry and public research institutions identify collective innovating projects with an international dimension and are supported by public funds. France has launched its national competitive cluster policy to make businesses more competitive, to build up employment on promising markets and to strengthen the local regions. Competitive clusters pool businesses, research centres and training institutes in their area in order to generate synergies and cooperation, primarily through innovative cooperative projects. ANR also encourages the dissemination of knowledge and the commercialisation of research by promoting collaboration between research centres and private laboratories. The French government has launched the second phase of this policy for a further three-year period (2009-2011), with a total budget of €1.5b, similar to the appropriation for the period from 2006 to 2008.

In addition, competitive project funding by intermediary agencies is increasing. To this regard, ANR (National Research Agency) steadily rising budget boosts funding for project based research. The focus will remain on project-based research

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financing. This mechanism encourages research in priority areas and promotes excellence through emulation.

**OSEO Agency**, by providing support and funding, assists SMEs and very small enterprises. OSEO innovation is dedicated to support SMEs in their innovative activities. One of its roles is to distribute subsidies and loans. OSEO Innovation's activity focuses on support for innovative projects carried by a single business with a cost of less than about €3m. In 2008, OSEO Innovation's activity was enriched with an industrial strategic innovation programme, Innovation Stratégique Industrielle (ISI), born from the merger with the former Agence de l’Innovation Industrielle (AII, industrial innovation agency) at the beginning of 2008. The 2008 appropriations for this programme should be around €300m for partnership-based projects with a large R&D component (between €3 and €10m each). The purpose is mainly to boost the growth of medium-sized companies. The range of OSEO's financing guarantees for innovative projects will also be extended.

The **Carnot Institutes** can also stimulate a greater R&D investment in R&D performing firms (as well as in non-R&D performing firms) by encouraging a strong partnership spirit with the private sector, with at least 10% private funding.

**Route 3: Stimulating firms that do not perform R&D yet**

OSEO innovation manages several programmes in order to incite companies to do innovation and R&D.

Technological platforms which have the purpose of facilitating transfers of technology from public Higher Education Institutes to firms and thus stimulate firms to perform R&D.

In order to adapt the technological supply to SMEs’ needs, the State has also implemented regional networks, which are based on the regional industry and technology patterns. This is the case with the over 200 Regional Innovation and Technology Transfer Centres (CRITTs). They are distributed over the French territory in order to increase SMEs’ awareness innovation and/or to provide them with technological services according to their needs.

The **Technological Development Networks** (RDTs) have the duty to support SMEs in their development through a network of public actors (regional as well as the regional delegates of government ministries).

**Route 4: Attracting R&D-performing firms from abroad**

The **Research Tax Credit** is considered as a mean to attract R&D-performing firms from abroad. To this regard, the 2008 reform intended to stimulate R&D investment by companies established in France and to make France more attractive for the research activities of French and foreign companies. The increase of the maximum tax credit threshold is an indirect means to attract large foreign companies.

In addition to that, one of the indirect objectives of the Competitiveness Clusters as well as the Research and Higher Education Clusters and the Thematic Networks for Research is to try to attract R&D performing firms from abroad.

Within the framework of “Competitiveness Clusters”, industry and public research institutions identify collective innovating projects with an international dimension and are supported by public funds. In the European cooperation context and in the context of international competition, Competitiveness Clusters should reinforce the attractiveness of the areas concerned by bringing together their public research units,
training centres and enterprises on projects, whether focusing on emerging or more mature themes.

Concerning OSEO Agency, the range of its financing guarantees for innovative projects has been recently extended. In partnership with the European Investment Bank (EIB), OSEO is implementing the Risk Sharing Finance Facility (RSFF) as part of the 7th Research and Development Framework Programme (RDFP).

Route 5: Increasing extramural R&D carried out in cooperation with the public sector

The Competitiveness clusters are in this domain certainly the most important measure able to increase extramural R&D carried out in cooperation with the public sector and is regarded as the cornerstone of the new industrial policy. The Competitiveness Clusters that pool public and private resources on specific research areas, jointly addressing excellence and exploitability in specific regional clusters.

The Research Tax Credit is also aimed at impacting on the increase in extramural R&D carried out in cooperation with the public sector.

The Carnot Award measure is also in line with the wish to develop greater links and partnerships between public and private research and business in France. The main objective is that basic research performed by public actors can be used by enterprises and SMEs to develop innovations. The principle is to identify research institutes that perform a significant share of their research activities in the frame of contracts with private actors and to provide them with extra resources.

Route 6: Increasing R&D in the public sector

A lot of measures have been implemented in order to increase R&D in the public sector among which: the Research and Technological Innovation Networks, the Research and higher education clusters, the Thematic Network for Research, the Competitiveness clusters, ANR or OSEO interventions.

In fact, the strengthening of research capabilities and excellence in the public sector goes through Research and Higher Education Clusters (Pôles de recherche et d’enseignement supérieur - PRES) and Thematic Advanced Research Networks (Réseaux thématiques de recherche avancée - RTRA). Both are aimed at fostering public research actors on scientific projects. Participants in the Clusters or in the Networks will be given extra resources. The logic is to increase research excellence and go against the fragmentation of research activities.

In January 2008, the government announced the ‘Plan Campus’, a policy aiming to raise ten university competitive clusters of international level (pole d’excellence universitaire).

The importance of education and innovation policies

In 2006, the number of researchers in France (full time equivalent terms) reached 211,000, which represents a rise of 19% in 5 years. Researchers working for the private sector represented 76% of this growing population18.

Despite this expansion, French governments have regularly emphasised (for instance in the recent Pact for Research, which sets out the main challenges that the

research system is assumed to be facing) the need to provide researchers (particularly young researchers) with good conditions in which to work in the public research system, as many people find research careers unattractive. According to a Ministry in charge of research’ statement about the implementation of the Pact for Research, PhD student’s status would be improved through measures such as current PhD education reforms, increasing research assignment or enhancement of professional integration.

This lack of attractiveness is partly due to a characteristic specific to France, namely the dual tertiary education system – in science, engineering and management - with universities on the one hand and *grandes écoles* on the other. The "*Grandes écoles*" are uniquely French institutions that offer specialised education of a high standard.

The outlook for a young person with a university degree in science, engineering and management is on average much less favourable than that of someone leaving the education system with an engineering or business school qualification acquired in a *grande école*, especially one of the leading *grandes écoles*. One result of this is that French firms are not in the habit of employing PhDs, preferring instead to recruit graduates from the leading *grandes écoles*. The situation is quite different in the health sciences, in the humanities, in law or in the social sciences, however, where universities are the leading teaching institutions. The five larger institutions of higher education in engineering – INPG, INPL, INPT, Insa Lyon and UT Compiegne – operate as universities although they select their students in the same way as the *grandes écoles*.

There are also a range of measures in place to address the human resource mobilisation challenges, e.g. [CNRS PhD grants for engineers](#) or post PhD recruitment (*Recrutements de post-doctorants*) at the CNRS. In order to induce companies to support research by young researchers and technicians', specific instruments have been implemented, too, such as the [support for the recruitment of PhD candidates on an applied research project within an enterprise - CIFRE convention](#). 75% of CIFRE supported students find a steady work less than 3 months after the graduation (Technopolis France 2008). Initiatives in this area also include a [post- PhD initiative programme (*Programme initiative post-doc*)](#), which started in the wake of the innovation plan to support French PhDs obtaining a postdoctoral fellowship abroad to ease their return to France. Reflections about the attractiveness of careers have also been lead by Schwartz and Hoffmann Committees (Academy of Science). The Hoffmann report released in July 2008 was followed up by the recent plan for improving attractiveness of careers in HE and research announced by government on 20 October 2008. Furthermore, companies' hiring expenses related to researchers and technicians are eligible for the [Research Tax Credit](#). The 2005 reform of the Research Tax Credit has created the possibility for companies to receive as tax credit twice the expenses associated with the recruitment of a PhD holder for the first year (providing that the staff has not decreased and that the PhD holder is given a non-fixed duration contract).

Finally, the [Law of autonomy for universities passed in August 2007](#) is aimed at strengthening the linkages between Universities training and industry needs. Industry participation in the governing board has been increased in order to better articulate training with the industrial needs. The possibility for the (local) industry to voice its needs in terms of competences to the supplier of human resources is seen as a major progress towards stronger coherence between supply and demand of human resources. To be complete, one should notice that the influential role assigned to
industry in the definition of the competences of the young trainees raised criticisms in the scientific community.

Innovation and research policies have been increasingly intermingled over the past years. Indeed, innovation in France is often understood as technological innovation rather than non-technological innovation. Innovation results from research and development processes. Therefore, the policy measures that aim at increasing innovation often interact with or are based on R&D support measures. The policy mix is then composed of direct innovation policy measures based on the competitiveness funds and grants awarded by the OSEO agency and indirect innovation policy measures such as tax credit and other fiscal measures.

**Assessment of the importance of policy mix routes and their balance**

To sum up, in order to raise intramural private R&D expenditures, French research and innovation policies have been modifying their focus. Whereas the focus was traditionally put on route 2, a more balanced policy-mix is being put in place nowadays. Clearly all routes are now explicitly considered.

The reform of the Research Tax Credit was motivated by the wish to incite companies that perform R&D to increase their efforts (route 2) as well as to incite companies that do not carry out or even fund research activities to start doing so (route 3). Hence, companies have the possibility to assign a public or a private research centre or a company to perform research for them and to benefit from tax credit. Route 4 is receiving a stronger attention too. For instance, the increase of the maximum tax credit threshold is an indirect means to attract large foreign companies and to incite large indigenous companies to maintain their research activities in France. In order to attract R&D performing firms from abroad, the Government counts strongly on the Competitiveness Clusters as well as on the Research and Higher Education Clusters and the Thematic Networks for Research. By increasing the visibility of French research, they would incite foreign companies to locate research and/or production units close to or within these Competitiveness Clusters.

In terms of volume public funding, the most important policy instrument is the Research Tax Credit with an annual budget that has regularly increased since 2004 and the introduction of the volume-based scheme. In terms of overall contribution, it is difficult to say which instrument has obtained the best results insofar as instruments and measures are not systematically evaluated.

At last, route 6 has been strongly reinforced with the increasing share of the competitive funding, in particular that distributed by the National Agency for Research and to the Competitiveness Clusters.
Table 11: Importance of routes in the national policy and recent changes

<table>
<thead>
<tr>
<th>Route</th>
<th>Short assessment of the importance of the route in the national policy</th>
<th>Main policy changes since 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Route 1 is given a strong focus.</td>
<td>Reform of the Research Tax Credit in 2008 and 2009: simplification of the mechanism by abolishing the fraction calculated over the spending increase and significantly raising the tax credit rate applied to the spending volume. The 2008 reform intends to stimulate R&amp;D investment by companies established in France and to make France more attractive for the research activities of French and foreign companies. Since January 2009, companies can obtain the immediate refund of their research tax credit of 2005, 2006, 2007 and 2008 not yet used or mobilised</td>
</tr>
<tr>
<td>2</td>
<td>Route 2 is given a strong focus as well.</td>
<td>Launching of the second phase of the competitiveness cluster policy for a further three-year period (2009-2011).</td>
</tr>
<tr>
<td>3</td>
<td>Route 3 is also taken into account but in lower extent than routes 1 and 2.</td>
<td>Reform of the Research Tax Credit</td>
</tr>
<tr>
<td>4</td>
<td>The importance of route 4 in the national policy seems to be increasing.</td>
<td>Reform of the Research Tax Credit Second phase of the competitiveness cluster policy</td>
</tr>
<tr>
<td>5</td>
<td>Route 5 has gained importance One of the objectives of the new National Reform Programme 2008-2010 is: “Transferring knowledge from public research to the business community”. Reform of the Research Tax Credit Second phase of the competitiveness cluster policy Set up of the Carnot Institutes</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Route 6 has considerably gained in importance in recent years</td>
<td>Implementation of the PRES and of the RTRAs Second phase of the competitiveness cluster policy</td>
</tr>
</tbody>
</table>

3.4 Progress towards national R&D investment targets

The French policy mix context is built upon a set of actors (mainly the Ministry in charge of research and the Ministry in charge of industry) that have drawn policy objectives to face challenges.

Concerning private R&D expenditures, we have noted that generally speaking the efforts made by domestic companies are insufficient and that the distribution of public funds is distorted in favour of the largest companies to the detriment of the smallest ones. To face this difficulty the emphasis has been put on the need to increase private R&D through the reinforcement of the innovative behaviour of companies, especially SMEs. Traditionally, French innovation policies were mostly oriented towards large companies, but significant efforts have been made in the last few years in favour of SMEs.

The most important policy instrument in terms of volume to reach this goal is the Research Tax Credit, which aimed at increasing companies’ expenditures devoted to R&D. The Young Innovative Company status is another instrument implemented in order to support the SMEs. It seems that overall, even if the objectives and priorities are in line with this challenge, efforts are not sufficient. In fact these instruments seem to remain insufficient, and policies are still distorted in favour of large companies. The recent absorption of the Agency for Industrial Innovation’s activity by OSEO Innovation, the agency in charge of promoting SMEs innovative activities, may
be a sign that policies will positively evolve for SMEs, and that there is a shift in the French R&D policy to address SMEs issues. Several network structures have also been created to incite and support SMEs in their innovative activities: the Research and Technological Innovation Networks (RRTIs), 20 National Centres of Technological Research (CNRTs), Regional Innovation and Technology Transfer Centres (CRITTs), Technological Platforms (PFTs), Technological Development Networks (RDTs).

As far as the policy mix is concerned, it is worth noting that the recent changes also relate to the increased role given to the regional actors. In the 1990s, several instruments were developed in regions in order to help companies to enhance their technological level. Over time, innovative issues have been more and more tackled at regional level in order to take the regional industrial and research set-ups and actors into account. It has been more and more agreed that the regional strengths were the keys for success and from that perspective it has been more and more accepted that the regional actors were the most suited to identify research and innovation strategies (hand in hand with the national policy actors). The Competitiveness Clusters testified that new approach.

Overall, it seems that objectives and priorities are in line with challenges. For instance, the reform of the French research system was motivated by the wish to increase the stock of knowledge that may give birth to innovation. The focus put on entrepreneurship is also aimed at increasing the creation of companies, including high-R&D intensive ones. In terms of policy mix, the recent years testify an increasing emphasis put on innovation. From this point of view, we can argue that the policy mix is a construction of policy measures that all share the same objective consisting of increasing innovation activities and capabilities of companies.

However, a stronger effort should be placed on SMEs since they are the weakest link in the national system of innovation as regards R&D intensity. The focus on SMEs is not sufficient to really give a new impetus to SMEs' R&D culture and to drastically incite them to raise their R&D investment.

To finish with, in terms of governance, the FutuRIS 2008 report raised concern about the insufficient articulation of instruments with each other which is a challenge the Government will have to tackle in the future.

Table 12: Main barriers to R&D investments and respective policy opportunities and risks

<table>
<thead>
<tr>
<th>Barriers to R&amp;D investment</th>
<th>Opportunities and Risks generated by the policy mix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private resource mobilisation for R&amp;D is still relatively low</td>
<td>The political willingness to increase resources for R&amp;D is stronger. Increase in the public R&amp;D expenditures for the private sector in particular through increased project funding. Objectives and priorities are in line with the challenge but might be insufficient.</td>
</tr>
<tr>
<td>Private resource mobilisation for R&amp;D is still dependent on a few large companies.</td>
<td>Implementation of measures essentially oriented towards SMEs as for example the Research Tax Credit.</td>
</tr>
<tr>
<td>Low innovative behaviour of companies, especially SMEs</td>
<td>Public initiatives might not be sufficient to overcome the barrier.</td>
</tr>
<tr>
<td>Relatively weak knowledge circulation and transfer</td>
<td>Development and deepening of a large range of instruments able to increase diffusion of knowledge such as competitiveness clusters or Carnot institutes. The challenge of knowledge circulation has clearly been taken into account but efforts might be insufficient. A risk of lack of articulation of instruments could appear.</td>
</tr>
</tbody>
</table>
4 Contributions of national policies to the European Research Area

ERAWATCH country reports 2008 provide a succinct and concise analysis of the ERA dimension in the national R&D system of the country. This Chapter further develops this analysis and provides a more thorough discussion of the national contributions to the realisation of the European Research Area (ERA). An important background policy document for the definition of ERA policies is the Green paper on ERA19 which comprises six policy dimensions, the so-called six pillars of ERA. Based on the Green Paper and complementing other ongoing studies and activities, this chapter investigates the main national policy activities contributing to the following four dimensions/pillars of ERA:

- Developing a European labour market of researchers facilitating mobility and promoting researcher careers
- Building world-class infrastructures accessible to research teams from across Europe and the world
- Modernising research organisations, in particular universities, with the aim to promote scientific excellence and effective knowledge sharing
- Opening up and co-ordination of national research programmes

In the ERA dimension, the wider context of internationalisation of R&D policies is also an issue related to all ERA policy pillars and is normally present in the dynamics of national ERA-relevant policies in many countries.

4.1 Towards a European labour market for researchers

The number of total R&D personnel (full time equivalent terms) in 2006 reached 361,000 which represents a rise of 9.2% compared to 200020. For the same year, the number of students enrolled in the higher education system reached about 2.2 million, a figure which has risen by about 6% since 1999. Within this overall rise, it is possible to distinguish between a growth of 18% for the engineering degrees, growth of just 1% in generalist university education and a decrease of 1% at some technical institutes (IUT: *Instituts universitaires de technologie*). Social and Human Sciences attract the bulk of this still growing population of students. They account for about 943,000 students, whereas 543,000 persons were studying natural sciences (including life sciences) (OST, 2006a).

Compared with the EU 27 average, France has a high proportion of S&T graduates, with more than 20 graduates per thousand-population aged 20-29. However, for reasons discussed below this does not translate into a similarly high share of S&T related PhDs. In 2006, 70,400 students attended a PhD cursus, with a growth of 15% compared to 200021, and 39,000 students joined a research Master. In 2005, the French higher education system awarded about 9,600 PhD degrees, as compared

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with 23,000 in Germany and 15,000 in the UK and 91,000 in the EU 25 as a whole (OST, 2006a). Regarding the employment rate, three years after having been graduated, 11% of the PhD students are still unemployed in 2006, compared with 7% in 2001.\(^\text{22}\) However, only 7% of the PhD graduates on an applied research project within an enterprise (CIFRE Convention)\(^\text{23}\) are in search for a job.

Researchers working for the private sector represented 54% of the total number of researchers in 2006, compared with 47% ten years earlier\(^\text{24}\). Between 2001 and 2006, the number of researchers employed by enterprises has indeed increased by 29%, compared to 9% for the public sector. Through the development of CIFRE Conventions, PhD candidates are in the same way more and more supported and integrated by private enterprises. Regarding enterprises, the main demand for researchers comes from the automobile, the pharmaceutical, the communication and the aeronautical sectors. Within administrations, researchers work often into a public research organisation or in higher education. Regarding researchers’ salaries, France offers better conditions than the average of European countries but the level of remuneration is under other lead countries such as Great Britain, Norway, Denmark, Island, Switzerland, Austria, Holland or Sweden. However the level of salaries and the working conditions in the research system are often seen as unattractive for many students. The study mentioned above underlines the gap between researchers’ remuneration and the level of salaries of other professions socially recognised with comparable qualifications such as engineering, business professionals... In addition to this, the French public research system is often even more unattractive than the private sector, with lower salaries and difficult work conditions.

Researchers at public research organisations enjoy life-long employment and a high degree of freedom in setting their research agenda. However the research world is based on cooptation and proximity networks rather than multidisciplinarity and scientific openness. The national scientific profile is specialised in stable research areas. The most important scientific fields measured in terms of publication numbers are clinical medicine, physics and chemistry, which draw up many PhD students and provide work place. The main areas of scientific specialisation, compared with the EU 15 average, are mathematics, physics and geosciences (ERAWATCH Network, 2006). France publishes 7.4% of the world's articles in mathematics, but it only contributes 3.7% of articles in applied biology and ecology, while accounting for 4.7% of the total number of world publications in 2004 (OST, 2006b).

### 4.1.1 Policies for opening up the national labour market for researchers

Through the Bologna process France implements a certain level of standardisation of PhD degree with other European member countries, in order to foster students’ and researchers’ mobility abroad.

Concerning researchers’ mobility, two programmes of the Ministry in charge of research stimulate outward mobility French researcher at PhD level.

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\(^{22}\) Observatoire de l'emploi scientifiques du ministère délégué à l'enseignement supérieur et à la recherche, L'état des lieux de l'emploi scientifique en France, février 2007.


• The first one aims at enhancing international scientific cooperation by organising a thesis under joined supervision of a French and a foreign university.

• The second one distributes fellowships to human and social sciences PhD students for scientist visits, lasting from 3 to 12 weeks, to any country. The purpose is to enable PhD students to receive the training needed for their research activity specialised in a geographical area to conduct research in the field.

The Minister in charge of Foreign Affairs also fosters PhD students’ international mobility through the Lavoisier programme25.

On the other hand efforts have been made in the past couple of years in order to (temporarily) attract foreign researchers (from the EU Member States but not only). The most important scheme (apart from the schemes of the individual public research organisations that cannot be described here) corresponds to fellowships granted by the National Agency for Research for foreign researchers. From 2005 onwards, the Agency launched a Call for Proposals for inviting foreign researchers and teachers for a scientific visit in a French PRO or HEI. The Programme is called “Chairs of Excellence”. At the doctorate level, France appears to be relatively attractive for foreign researchers as 25% of PhD degrees are awarded to foreign students. And the number of foreign PhD candidates grows faster than French PhD candidates. 38% come from European country and 22% from African countries but a growing number is originated from Asia (10%).

The European Union is also an important actor of European researchers’ and European students’ international mobility within the ERA framework:

• through Marie Curie actions, that are aimed at financing researchers that pursue their work in other European countries. Regarding Marie Curie actions, France is the second top-performing host-country after the United Kingdom. And a growing number of professor-researchers decided to attend an Erasmus study programme abroad: namely 18,500 in 2003 compared with 7800 in 1997-1998;

• through Erasmus exchange programme for students and teachers-researchers (“enseignants-chercheurs”).

Some actions are also implemented to organise French researchers’ working abroad come back in the French research system. The programme, called “Post-PhD Initiative Programme” (“Initiative Post doc”) was launched in 2004 and completed by an Internet website in charge of delivering accurate information on available places and exams in the French research system addressed to expatriate researchers. In the same way, some actions were conducted within the framework of the 6th PCRD to encourage researchers involved in Marie Curie programme (European reintegration grants) or researchers working in a non-member countries for more than 5 years to come back in order to share their experience and knowledge in Europe.

From a practical point of view, foreign researchers’ mobility in France is encouraged through regulations, issued from the Article 17 of regulation 1408/71, that facilitate the integration in the national research labour market. Wage earner researchers, either European or not, have access to French social security system and health

insurance and pay social and health taxes. However many researchers are not wage earners but only affiliated. Thanks to the European Health Insurance Card (EHIC), member-countries researchers on a temporary stay are covered for health treatment. Non EU-member countries national have access to the Universal Health Insurance (“Couverture maladie universelle”, CMU). Concerning EU-nationals on long stay and non-member countries nationals that are not eligible for the CMU, private insurance companies provide some special contracts for foreign researchers. Information and help by host-universities are available on the Euraxess website. Certain organisations such as the Fondation Kastler also accompany foreign researcher’s mobility project.

Concerning third-countries researchers, France has signed social security agreements with some countries such as the USA, Morocco, Canada, Switzerland and Cameroon. Moreover a 1998 law (called “RESEDA law”) has simplified the delivery of scientific visa for non EU-member countries national in French higher education institutions. However researchers working in the private sector are excluded from this regulation. Generally speaking, the mobility of foreign researchers seems also easier for EU-countries nationals and researchers working within the public sector.

4.1.2 Policies enhancing the attractiveness of research careers in Europe

In order to meet the Lisbon targets aiming at making Europe the top-performing knowledge-based economy, research careers in Europe have to become more attractive. The European Charter for researchers issued by the DG Research in 2005 sets the general principles and requirements that enable the frame for successful research performance. In France organisations have signed the European Charter of Researchers, among them universities such as Paris 1 Pantheon Sorbonne and Sciences-Po, engineering schools such as INSA Lyon, and public agency such as the French Food Safety Agency (Afssa) or the National Centre of Scientific Research (CNRS). It represents about 17% of French public research organisations. Compared to other countries, France stands for the top-performing country in terms of uptakes number.

In the French public research system remuneration are essentially based on seniority. As previously said, salaries are often seen as particularly unattractive, compared to the private sector. The recent Law of rights and responsibilities of universities initiate some changes since it implements reversionary bonus (i.e. a bonus added to the wages as a share of the institution's surplus profits, usually on a annual basis) and annual premiums.

Regarding gender equality, 46% of PhD graduates are women but they represent only 32% of the researchers working within public organisations and 20% of the researchers working within the private sector. Moreover, 32.9% of the universities’ researchers professors are female graduates and the ratio is stable since 2001. In 2001 a Mission for Gender equality in sciences and technologies and a Committee for gender equality in higher education and research were created, with the aim to

26 [http://ec.europa.eu/euraxess/index_en.cfm?l1=0&l2=2](http://ec.europa.eu/euraxess/index_en.cfm?l1=0&l2=2)
27 [http://www.fnak.org](http://www.fnak.org)
28 Complete list on the Euraxess Website: [http://ec.europa.eu/euraxess](http://ec.europa.eu/euraxess)
strengthen women's place within scientific studies and career, and to act as an observatory of current evolutions. Following the 2002 White paper on women in research, the Mission has published in 2004 a White paper on women in private research. In December 2006, the Committee for gender equality in higher education and research has presented the following recommendations to the Minister in charge of research regarding gender equality in higher education and research:

- The development of attractiveness of scientific careers to women
- The suppression of carriers' barriers for women
- The possibility to better link maternity and carrier development.

Measures are also conducted at institution level. For instance, the CNRS has launched a dedicated committee to promote the place of female researchers in the research community. But either at national or institutions' level, incentives are limited to communication and symbolic actions, and few measures have been implemented so far. Moreover, women's participation in academic and research committees progresses slowly (15% in 1984-1988 compared to 24% in 2005) and few women held great responsibilities within these institutions (15% provided a female presidency and this proportion is stable since 1999). Thus, a gender equality network has been implemented within public research organisms in order to promote equal opportunities for male and female researchers.

Last but not least, it is worthy to note that maternity and family life could have some detrimental effects on women's career, largely due to women's perception in society. And today few regulations are intending to restore equal chances for woman after career breaks for maternity leaves.

### 4.2 Governing research infrastructures

Among the Very Large Research Infrastructures identified by the Government in 2008, some concern global projects constructed and exploited by international organisations (intergovernmental level), especially in the fields of astronomy, high-energy particles and astrophysics (e.g. CERN, ESA). Other RIs are managed through transnational collaboration with the implementation of ad hoc structures (e.g. European Gravitational Observatory, VIRGo programme). For instance, in 2005, it was decided that the future ITER (international thermonuclear experimental reactor) will be built in Cadarache in France. ITER is the experimental step between today's studies of plasma physics and tomorrow's electricity-producing fusion power plants.

The first plasma operation is expected in 2016. ITER is an international project that involves China, the European Union, Switzerland, India, Japan, Korea, the Russian Federation and the USA.

At the beginning RIs were mainly concentrated in the astronomy and physics area. According to the French 2008 roadmap, the new areas of specialisation are, as follows: the Earth study, the Universe's observation, particles and nucleus, material's study, ICT, human and social sciences, life sciences and health.

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30 Mission pour la Parité dans la Recherche et l’Enseignement supérieur, Analyse de la participation des femmes aux instances scientifiques, mars 2006.
France holds membership in 30 intergovernmental European infrastructures listed in the ESFRI Roadmap (on 35 projects), as follows:

<table>
<thead>
<tr>
<th>European intergovernmental infrastructures</th>
<th>Status</th>
<th>Field</th>
<th>Internet website</th>
</tr>
</thead>
<tbody>
<tr>
<td>EURO-ARGO</td>
<td>Existing</td>
<td>The Planet</td>
<td><a href="http://www.ifremer.fr/flotte/index.php">http://www.ifremer.fr/flotte/index.php</a></td>
</tr>
<tr>
<td>BBMRI EMBRC</td>
<td>Existing</td>
<td>Biology, health</td>
<td><a href="http://www.inserm.fr/fr/inserm/infrastructures/">http://www.inserm.fr/fr/inserm/infrastructures/</a></td>
</tr>
<tr>
<td>EATRIS</td>
<td>Existing</td>
<td>Biology, health</td>
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</tr>
<tr>
<td>JHR</td>
<td>Planned</td>
<td>Particles, nucleus, energy</td>
<td><a href="http://www.cadarache.cea.fr/fr/entreprises/projets/rjh/">http://www.cadarache.cea.fr/fr/entreprises/projets/rjh/</a></td>
</tr>
<tr>
<td>IFMIF</td>
<td>Planned</td>
<td>Particles, nucleus, energy</td>
<td><a href="http://www.frascati.enea.it/ifmif">www.frascati.enea.it/ifmif</a></td>
</tr>
<tr>
<td>SPIRAL 2</td>
<td>Planned</td>
<td>Particles, nucleus, energy</td>
<td><a href="http://www.ganil.fr">www.ganil.fr</a></td>
</tr>
<tr>
<td>FAIR</td>
<td>Planned</td>
<td>Particles, nucleus, energy</td>
<td><a href="http://www.gsi.de/fair/index_e.html">www.gsi.de/fair/index_e.html</a></td>
</tr>
<tr>
<td>XFEL</td>
<td>Planned</td>
<td>Material</td>
<td><a href="http://www.xfel.eu">www.xfel.eu</a></td>
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<tr>
<td>ELI</td>
<td>Planned</td>
<td>Material</td>
<td><a href="http://www.extreme-lightinfrastructure.eu">www.extreme-lightinfrastructure.eu</a></td>
</tr>
<tr>
<td>HIPER</td>
<td>Planned</td>
<td>Material</td>
<td><a href="http://petal.aquitaine.fr">http://petal.aquitaine.fr</a></td>
</tr>
<tr>
<td>ILL 20/20</td>
<td>Planned</td>
<td>Material</td>
<td><a href="http://www.ill.eu">www.ill.eu</a></td>
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<tr>
<td>ESFR-Upgrade</td>
<td>Planned</td>
<td>Material</td>
<td><a href="http://www.esrf.eu">www.esrf.eu</a></td>
</tr>
<tr>
<td>DARIAH</td>
<td>Planned</td>
<td>Social and Human science</td>
<td><a href="http://www.tge-adenis.fr">www.tge-adenis.fr</a></td>
</tr>
<tr>
<td>Infrafrontier</td>
<td>Planned</td>
<td>Biology, health</td>
<td><a href="http://www-mci.u-strasbg.fr">http://www-mci.u-strasbg.fr</a></td>
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<tr>
<td>ECRIN</td>
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<td><a href="http://www.eso.org/public/astromony/proj">www.eso.org/public/astromony/proj</a> ects/eelt.html</td>
</tr>
<tr>
<td>ICOS</td>
<td>Planned</td>
<td>The Planet</td>
<td><a href="http://icosinfrastructure.ipsl.jussieu.eu">http://icosinfrastructure.ipsl.jussieu.eu</a></td>
</tr>
<tr>
<td>e-ELT</td>
<td>In project</td>
<td>The Planet</td>
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</tr>
<tr>
<td>CTA</td>
<td>In project</td>
<td>The Universe’s observation</td>
<td><a href="http://www.cta-observatory.org">www.cta-observatory.org</a></td>
</tr>
<tr>
<td>EU-HPC</td>
<td>In project</td>
<td>Data, calculation, services</td>
<td><a href="http://www.prace-project.eu">www.prace-project.eu</a></td>
</tr>
<tr>
<td>Lifewatch</td>
<td>In project</td>
<td>Biology, health</td>
<td><a href="http://www.lifewatch.eu">www.lifewatch.eu</a></td>
</tr>
<tr>
<td>EUFAR</td>
<td>In project</td>
<td>The Planet</td>
<td><a href="http://www.eufr.net">www.eufr.net</a></td>
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<tr>
<td>EMSO</td>
<td>In project</td>
<td>The Planet</td>
<td><a href="http://www.ifremer.fr/esonet/emso">www.ifremer.fr/esonet/emso</a></td>
</tr>
<tr>
<td>SKA</td>
<td>In project</td>
<td>The Universe’s observation</td>
<td><a href="http://www.skatelescope.org">www.skatelescope.org</a></td>
</tr>
<tr>
<td>Km3Net</td>
<td>In project</td>
<td>The Universe’s observation</td>
<td><a href="http://www.km3net.org">www.km3net.org</a></td>
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<tr>
<td>ESS-Neutrons</td>
<td>In project</td>
<td>Material</td>
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</tr>
<tr>
<td>EMFL</td>
<td>In project</td>
<td>Material</td>
<td><a href="http://www.emfl.eu">http://www.emfl.eu</a></td>
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<td>IAGOS-ERI</td>
<td>In project</td>
<td>The Planet</td>
<td><a href="http://www.fz-juelich.de/icg/icg2/iagos76">www.fz-juelich.de/icg/icg2/iagos76</a></td>
</tr>
</tbody>
</table>

The recently launched Economic reflation plan (“Plan de relance”) increases French governments’ investments in VLIRIs by 17%. This measure is seen as a way to reduce the financial crisis’ impact.


4.3 Research organisations

Though relatively low level in comparison with other countries, universities have impressively increased their standing in the public research system in the last decades. The reinforcement of the role of universities in the French research system was documented by many reports. For instance, this was stressed by the FutuRIS project (The French System of Research and Innovation - Proposals for a reform) or by the Report of the Estates-General of Research and Higher Education. This was also underlined by the report of the Court of Auditors in 2003 on research policies and acknowledged by the Ministry in charge of research in the reply it formulated to the report statements.

In September 2007, the Minister in charge of research, introduced an action plan for the reform of Universities\(^{32}\). The government’s action plan has set five priorities:

- to support universities in reaching their autonomy, according to the May 2006 European Commission’s communication making detailed recommendations on how to modernise higher education in Europe;
- to enhance student success rates (focus on living and study conditions);
- to improve the research environment (research conditions and the means for research);
- to increase public funds distributed on the basis of research projects;
- to stimulate private research.

For the funding side, reform is under way. France universities are characterised by block grant’s predominance over competitive funding. On 10 June 2008, the French Senate published however a report proposing changes to the current French university funding system, criticised for its opacity and complexity. It recommends basing university funding more on universities' performance rather than on the number of registered students, whereas the current system pushes universities to enrol more first-year students than they can handle to ensure cash flow. To end this, the senators’ report recommends increasing performance-related funding for research from the current 20% to 30% by 2009 and up to 50% in the long term. As for teaching, performance-related support would be increased from 3% to 10%. To evaluate performance, senators recommend using several criteria including the amount of outside funding attracted by university research laboratories, namely business sources. Another criterion could be to evaluate employment and salary levels of students graduated from different universities at intervals of six months and three years, as well as to allocate university funding on the basis of the number of students actually taking exams rather than the number of registered ones. Those propositions have triggered strong opposition from student’s and professor’s unions.

4.4 Opening up national research programmes

In order to better assimilate national strategies with European policies, the government is willing to increase the participation of French research actors in European research programmes. Three approaches have already been identified:

• encouraging Competitiveness Clusters (during the contract process with the state regarding funding procedures) to be actively involved in the elaboration of European research programmes;

• reinforcing national participation in European Technology Platforms, EUREKA and Joint Technology Initiatives;

• encouraging the National Agency for Research to support projects proposed by research actors that may benefit from European funding.

Opening-up and coordinating programmes are also a priority for French research strategy. This strategy is developed at national level (for instance in November 2008, the State Secretary of trade and SMEs, proposed to increase sectoral and technological partnerships in order to fight against the lack of European world-class clusters), as well as at funding agencies level. The CNRS indeed developed the European Associated Laboratories (LEA) composed of 2 or 3 CNRS labs and 1 or 2 institutes of a European country. Laboratories put resources in common for a four year period. 27 LEA are operational. This tool is also declined at the international level with International Associated Laboratories (LIA)33. Not only EU countries, but also third countries are concerned.

Participation in EU Framework Programmes is another indication of France’s strong presence in international networks and the country has emphasised the importance of European collaboration. Since 2006, France has had a global share of 10.8% of participation in the FP 6 and a particularly strong presence in aeronautics and space (20.5%)35. Additionally, there are a large number of international S&T agreements in force. Together with Germany, the United Kingdom and Spain, France is also one of the most active counties involved in ERA-Net projects. During the 6th FP French funding agencies participated in 47 ERA-Net projects, around 70 projects having been conducted following the call for proposal. For example the public agency OSEO Innovation is the coordinator of the ERA-Net project EUROTRANS-BIO, which has gathered €45m with funding coming from 9 different countries and regions. France takes up an active role in Joint Technology Initiatives, such as the Artemis project.

Apart from scientific cooperation in the framework of European Programmes, France has also developed several scientific cooperative projects with specific European countries such as Germany. There are currently nine of such cooperative French-German projects with regard to the following thematic fields: materials, aeronautics, space, oceanography, medical research, transportation, and vegetal genomics, microelectronics and laser techniques. All these cooperative projects but one consist of supporting common research projects, or exchange of researchers between research labs. There is only one cooperative project that is closed to a common research centre. It is related to medical research. A research unit of the National Institute for Health Medical Research (INRA) has been created within the German Cancer Research Centre in Heidelberg.

The coordination of research policies at European level is however hindered by the national character of research policies. Among the existing barriers to opening up French research programmes, we can list the legal issues and the issues of IP right.

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33 https://dri-dae.cnrs-dir.fr/spip.php?article1142
34 www.cnrs.fr
35 Since 2006, Germany accounts globally for 14.8% of participations in the 6th FP and the UK accounts for 11.2% of participations.
As part of a strategy to increase the mobility of researchers within the ERA, the CNRS has signed the Money Follows Researcher agreement, issued by EUROHORC in 2005. This agreement allows researchers moving to other countries with research funding organisations having signed the MFR letter of intent, to take with them the remainder of a current grant.

4.5 National ERA-related policies - a summary

The Pact for Research put focused attention on the integration of the French research system into the European Research Area. According to the Pact, the assimilation of the national research policy and the European research policy is one of the main aspects of the reconfiguration of the French research and innovation system. The government's point of view with regard to the European Research Area is that the European context holds a comparative advantage in terms of the structuring effects on research systems. In addition, the French government has supported the setting up of the European Research Council, which is seen as an important step towards reinforcing the development of fundamental research within the European Union.

The articulation of French research policy with European research policy has always been strong and is seen as one of the main aspects of the ongoing reconfiguration of the French research and innovation system. This said research policies remain strongly shaped by the national challenges and by the national strategies.

From a rhetoric point of view, European issues have always received a strong emphasis. Until very recently, the ERA dimension as far as research is concerned was always mentioned as a crucial issue for the French policy. In practice however, the actual articulation between the national and the EU policies was highly questionable. To name but an example, the Pact for research devoted a whole chapter to the ERA dimension, the last chapter. One might have expected a more transversal concern and a reference to the ERA dimension in each and every chapter.

However it seems to us that the increasing importance of the ERA in the daily life of the researchers, the companies and the research institutions has changed the situation. Now, the ERA dimension is considered as the shaping element of every research activity and as a matter of fact has gained more attention from the State/research institutes than in the past.
Table 13: Importance of the ERA pillars in the ERA policy mix and key characteristics

<table>
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<th>Labour market for researchers</th>
<th>Short assessment of its importance in the ERA policy mix</th>
<th>Key characteristics of policies</th>
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</table>
| • Opening-up the national labour market for researchers is a key point of the French policy mix, since many programmes at different level and addressed to different targets have been developed in order to increase researchers’ mobility. | • Actions to foster mobility abroad for national researchers and to facilitate foreign researchers’ mobility in France  
• Regulations to access the social security system, addressed to Member-countries nationals as well as third-countries nationals |

| Governance of research infrastructures | • Research infrastructures play a growing role in French ERA-related policies | • 2008 roadmap for the Very Large Research Infrastructures  
• Incentives to develop transnational and intergovernmental RIs |

| Autonomy of research institutions | • The last two years, big emphasis has been given to university reforms, especially concerning university autonomy.  
• It appears to be one of the most important pillars of French ERA-related policies, as well as the most discussed one in the political landscape, since it involves many changes in the French research system. | • Budget and recruitment autonomy  
• Measures to develop the links between universities and the business world  
• Universities’ funding reform is under way  
• Promotion of performance in research |

| Opening up of national research programmes | • Although important actions are conducted, this pillar appears to be the most fragmented one and it suffers from certain implementation difficulties, due to the predominance of national strategies.  
• However, many programmes conducted at different levels are under way. | • Participation the EU programmes (FP, JTI, Eurêka, ERA-Net)  
• Close cooperation with specific countries (Germany)  
• Opening up to third countries, even if less developed but declared as an objective |

5 Conclusions and open questions

5.1 Policy mix towards national R&D investment goals

A real policy-related threat in the domain of resource mobilisation is that the very ambitious policy goal of a privately funded R&D intensity, which implies a break with recent trends, seems rather hard to reach. Other policy-related threats relate to the knowledge production domain. In fact, the national system is still characterised by a relatively low mobilisation of private resources for R&D.

As far as policy mix is concerned, the major ways identified to increase national R&D investments are made up of several instruments able: to promote the establishment of new indigenous R&D performing firms (such as the Research Tax Credit, the Young Innovative Company Status, the Business incubators, the Contest for the creation of innovative business or the Industrial and Commercial Business Services), to stimulate greater R&D investment in R&D performing firms (through for example the Research tax Credit, the Competitiveness clusters, the National Research
Agency, OSEO agency or the Carnot Institutes), to attract R&D performing firms that do not perform R&D yet, to attract R&D performing firms from Abroad, to increase extramural R&D carried out in cooperation with the public sector, and to increase R&D in the public sector (through for example the Research and Higher Education Clusters or the Thematic Advanced Research Networks).

In terms of policy mix, the emphasis has been put on the need to increase private R&D by the reinforcement of the innovative behaviour of companies, especially SMEs. Traditionally, French innovation policies were mostly oriented towards large companies, but significant efforts have been made in the last few years in favour of SMEs. One may argue that a real effort has been done by the government to have, on the one hand, an action for each actor in the research and innovation system, and with several specific instruments on the other hand. A large set of measures has been taken in order to boost R&D private investment and to favour cooperation between public and private research but all in all the range of instruments is complex and adds to existing mechanisms. Overall, it seems that the objectives and priorities are in line with the challenge but are not sufficient.

5.2 ERA-related policies

Regarding facts as well as rhetoric, the articulation of French research policy with European research policy has always been strong and is seen as one of the main aspects of the ongoing reconfiguration of the French research and innovation system. French research policy could no more be interpreted as an isolated system. It is structured by many interactions with European policies and programmes. Now, the ERA dimension is considered as the shaping element of every research activity, involving researchers, research institutions as well as public decision-makers. The actions in favour of researchers’ mobility and the increased autonomy given to Universities are good examples of this evolution.

Not only is the country’s research policy shaped by ERA, but also France takes an active part in the modelling of ERA’s strategy at European level. The country is namely active in many European programmes aiming at developing a European research space through national policies’ coordination. Moreover, it cooperates actively with other European countries through the opening-up of research infrastructures and technology platforms.

The national R&D system also moves toward the ERA dimension. As we have seen in this report, many progresses are under way. However, some challenges have to be overcome. France should conduct more voluntary actions in order to promote research careers’ attractiveness, especially in the public sector. In the same way, a national strategy for the opening up of national research programmes have to be implemented, in order to gather the different fragmented actions conducted.
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List of Abbreviations

ACRI Austrian Cooperative Research Institutes (Vereinigung der kooperativen Forschungsinstitute)
AERES Agence d'évaluation de la recherche et de l'enseignement supérieur (Agency for the Evaluation of Research and Higher Education)
AII Agence de l'innovation industrielle (Industrial Innovation Agency)
ANR Agence nationale de la recherche (National Agency for Research)
ANRT Association nationale de la recherche technique (National Association of Technological Research)
ARC Austrian Research Centers
<table>
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<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>CCDT</td>
<td>Comité consultatif pour le développement technologique (Consultative Committee for Technological Development)</td>
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<td>CGAI</td>
<td>Comité de gestion des aides à l'industrie (Managing Committee for aid to industry)</td>
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<tr>
<td>CIR</td>
<td>Crédit d'impôt recherche (Research Tax Credit)</td>
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<tr>
<td>CIRST</td>
<td>Comité interministériel de la recherche scientifique et technologique (Inter-ministerial Committee for technical and scientific research)</td>
</tr>
<tr>
<td>CSRT</td>
<td>Conseil supérieur de la recherche et de la technologie (High Council for Research and Technology)</td>
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<tr>
<td>DGE</td>
<td>Directorate General for Enterprises</td>
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<tr>
<td>DGRI</td>
<td>Directorate General for Research and Innovation</td>
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<tr>
<td>EPIC</td>
<td>Etablissement public à caractère industriel et commercial (Public institute with a industrial and trade focus)</td>
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<tr>
<td>EPST</td>
<td>Etablissement public scientifique et technologique (Scientific and technological public institute)</td>
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<td>ERA</td>
<td>European Research Area</td>
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<td>ERP Fund</td>
<td>European Recovery Programme Fund</td>
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<tr>
<td>FP</td>
<td>European Framework Programme for Research and Technology Development</td>
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<tr>
<td>HCST</td>
<td>Haut conseil de la science et de la technologie (High Council for Science and Technology)</td>
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<tr>
<td>HEI</td>
<td>Higher education institutions</td>
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<tr>
<td>HES</td>
<td>Higher education sector</td>
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<tr>
<td>LOLF</td>
<td>Loi organique relative à la loi de finances (Constitutional bylaw on the Finance Acts)</td>
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<tr>
<td>MIRES</td>
<td>Mission interministérielle sur la recherche et l'enseignement supérieur (Inter-ministerial Mission for Research and Higher Education)</td>
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<td>NRP</td>
<td>National Reform Programme</td>
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<td>NTBF</td>
<td>New Technology-Based-Firm</td>
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<tr>
<td>PRES</td>
<td>Pôles de recherche et d'enseignement supérieur (Research and higher education centres)</td>
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<tr>
<td>PRO</td>
<td>Public Research Organisations</td>
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<td>R&amp;D</td>
<td>Research and development</td>
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<tr>
<td>RRIT</td>
<td>Réseaux de recherche et d'innovation technologiques (Research and Technological Innovation Networks)</td>
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<tr>
<td>RTRA</td>
<td>Réseaux thématiques de recherche avancée (Thematic Networks for Advanced Research)</td>
</tr>
<tr>
<td>SAIC</td>
<td>Services d'activités industrielles et commerciales (Industrial and Commercial Activities Services)</td>
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<tr>
<td>SF</td>
<td>Structural Funds</td>
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<tr>
<td>SNCS</td>
<td>Syndicat national des chercheurs scientifiques (national researchers union)</td>
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<tr>
<td>S&amp;T</td>
<td>Science and technology</td>
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<tr>
<td>VLRI</td>
<td>Very Large Research infrastructure</td>
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</table>
Abstract

The main objective of the ERAWATCH Policy Mix Country reports 2009 is to characterise and assess in a structured manner the evolution of the national policy mixes in the perspective of the Lisbon goals, with a particular focus on the national R&D investments targets and on the realisation and better governance of the European Research Area. The reports were produced for all EU Member State and six Associated States to support the mutual learning process and the monitoring of Member and Associated States’ efforts by DG-RTD in the context of the Lisbon Strategy and the European Research Area. The country reports 2009 build and extend on the analysis provided by analytical country reports 2008 and on a synthesis of information from the ERAWATCH Research Inventory and other important available information sources.

This report encompasses an analysis of the research system and policies in France.

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