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Executive Summary

Since 2006 France's GERD has continued to grow and the country now ranks second after Germany. The ratio of GERD to GDP was 2.26% in 2010 and France remained above the EU27 average (which was 2.00% in 2010). Over the last 30 years, France's R&D intensity has fluctuated between 2% and 2.37% and has been rising again since 2007. In the most recent national survey on innovative companies, around 30 % of the turnover of innovative companies was linked to innovative products[1]. This nevertheless relatively low R&D intensity is the result of the shift from manufacturing to services, where R&D and innovation is less easy to capture, but is also linked to the moderate orientation of the country towards high-tech manufacturing sectors. France relies less on high-tech goods for its trade balance than the EU average[2] and is more specialised in goods and services of medium to high innovation and education sectors[3]. Funding of GERD by the French business sector remains stable at slightly above 50% (52.2% in 2009) but remains low compared to competitor countries such as Germany, US, Japan and Korea innovation-driven economies.

Two main government ministries share the overall responsibility for research and innovation policy in France:

- The Ministry of Higher Education and Research (MESR[4]) designs and co-ordinates research policy. It is assisted by diverse consultative bodies including the High Council for Science and Technology (HCST). The HCST advises the French Prime Minister and provides recommendations on national research and innovation strategies.
- The Ministry for Economy, Finance and Industry (MEFI[5]) is responsible for industrial and energy research and plays a specific role in relation to private sector research.

The following agencies are responsible for implementing research and innovation policy in France:

- The National Agency for Research (ANR[6]). The ANR was created in 2005 to fund research projects on a competitive basis. The ANR covers basic research, applied research, and innovation and technology transfer, which it promotes through public/public and public/private partnerships.
- OSEO[7] innovation. OSEO provides businesses, in particular SMEs, with support for R&D and innovation projects;

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[1] http://www.industrie.gouv.fr/sessi/enquetes/innov/cis2006/resultats.php?page=T5.html

[2] European Commission (2011), Innovation Union Competitiveness report 2011 - country profile France

[3] European Commission (2011 competitiveness), Innovation Union Competitiveness report 2011 - country profile France

[4] See http://www.enseignementsup-recherche.gouv.fr online.

[5] http://www.economie.gouv.fr/

[6] http://www.agence-nationale-recherche.fr/en/project-based-funding-to-advance-french-research/

[7] http://www.oseo.fr/

- The Agency for Environment and Energy Management (ADEME[8]). ADEME was created in 1991 to support and fund partnership-based environment and energy research activities;
- Public research organisations (PROs). PROs, such as the National Centre for Scientific Research (CNRS), are also involved in policy implementation.

There have been no changes to the direction of French policy for developing its innovation system in 2010-2011. Government action has remained focused on strengthening and deepening the structural reforms already embarked upon since the mid-2000s. These have included the creation of competitiveness clusters ("*pôles de compétitivité*"), the clusters for Research and Higher education (PRES), and the implementation of the law on the autonomy of universities. The French research and innovation system is currently being further strengthened by a new dedicated investment plan (the "*Programme d'investissements d'avenir*"), which was launched at the end of 2009. All programme calls for proposals related to research and higher-education were closed in March 2012 and projects have been selected.
The current French 'National Research and Innovation Strategy' was launched in January 2009. The strategy, which runs for five years, guides policy decisions in the field of RDI. It addresses three main priority areas, which correspond to key societal challenges:

- Health, care, nutrition and biotechnology;
- Environmental urgency and eco-technology;
- Information, communication and nanotechnology.

The French R&D&I system is characterised by a satisfactory level of public investment but a relatively low level of business investment in R&D, which reflects the structure of the economy described above. France must therefore address a number of challenges:

1. Structural change impacting French industrial specialisation and a need to create new firms in high tech sectors: France suffers from a low level of business R&D expenditure, mainly because of its relative industrial specialisation in medium technology and medium-high technology sectors. France suffers from a lack of new technology-based firms. The challenge is to create the environment for new high-technology companies to develop and reach a critical size.
2. Support the R&D activities of mid-size SMEs (250 to 5000 employees) and strengthen the culture of innovation. A number of measures should be taken to increase the R&D effort in this category of companies. These could include focusing on SMEs and Economic and Technological Intelligence (ETI) in the governance of competitiveness clusters, for example. The Research Tax Credit also provides an opportunity to focus support on SMEs and the OSEO innovation budget should also be stabilised.
3. Knowledge transfer from the public to the business sector. A key challenge is to better connect public research with business innovation activities, and in particular to increase support for the exploitation of research outcomes in a business perspective.

The current policy mix focuses on i) R&D spending by firms, and ii) on fostering collaboration between the public research and business sectors. The implementation

[8] http://www2.ademe.fr/servlet/getDoc?id=38480&m=3&cid=96

mechanisms rely mostly on tax incentives (the research tax credit). All national priorities are in line with the National Strategy for Research and Innovation and with the structural challenges identified above.

A wide range of measures has been taken to boost business R&D investment and to foster cooperation between the public and private sectors within the French innovation system, but the range of organisations and policy instruments involved is broad, adding to an already complex policy landscape and, by the same token, decreasing, to some extent, the effectiveness of public support.
Overall, the individual policy instruments that have been introduced are consistent with the challenges. However, to date, neither the efficiency nor the effectiveness of the broader policy mix has been demonstrated, and success will depend very much on the overall governance of the national innovation system as well as the future economic environment and the resulting public budgetary constraints. A key success factor will be the ability to carry out a system-level evaluation of all the policies involved in view of ensuring any necessary streamlining and coordination.
In a European perspective, the French policy mix focuses more on some of the pillars of the European Research Area strategy than on others. In particular, it addresses the challenges faced by the labour market and attractive career prospects for researchers, research institutions, and public-private partnerships. International cooperation and knowledge circulation across Europe have also been identified as central issues by the National Research and Innovation Strategy but no major policy initiatives have been taken in the last three years.
Major recent initiatives include the 'Investments for the Future' programme, the purpose of which is to strengthen national research infrastructures, increase the visibility of French research and higher education institutions, and foster project-based public-private partnerships.

The French policy mix has undergone profound change in the last few years. In the short and medium terms, therefore, France should focus on deepening existing measures and above all focus on the coherence between all the measures that have been introduced recently and, by the same token, on the clarity of the policy mix as a whole.

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1 Introduction

Overview

With 65 million inhabitants in 2011 (January), France is the second largest country of the EU27 after Germany. It is home to 12.9% of the total EU27 population. Since 2008, the economic crisis has affected France's Gross Domestic Product (GDP) growth rate, as it has in other EU countries, albeit less severely. In 2007, the GDP growth rate was 2.3%, but this fell sharply to 0.1% in 2008 and to -2.7% in 2009. However, the EU27 average annual growth rate for 2009 was -4.2% (Eurostat). From 2010, France's GDP growth rate began to climb again and reached 1.5% in 2010, and then 1.8% in 2011. But economic projections for 2012 are for a lower rate of growth.

In terms of R&D expenditures, France's GERD has continued to grow since 2006. Within the EU27, France ranks second after Germany. France's GERD stood at €41b in 2008, €42.7b in 2009 and reached €43.6b in 2010, which represents 17.7% of total EU27 expenditure (the figure for Germany was 28.5%). The ratio of GERD to GDP was 2.26% in 2010. France ranks 7th and remains above the EU27 average (which was 2.00% in 2010), even though R&D intensity has steadily decreased since the end of the 1990s (it stood at 2.38% in 1992). GBAORD[9] has continued to grow since 2007 and reached €16.8b in 2011 (€14.1b in 2007), which represents 0.85% of GDP.

In most OECD countries, the impact of the crisis resulted in a decline in the real growth rate of R&D expenditures in 2008 (-8.6% for Japan, -2.9% for Finland, -0.6% for the UK, and -0.4% for Germany). France is one of the few OECD countries that have increased their R&D effort during the crisis (+1.9% in 2008 and +3.5% in 2009)[10].

France's R&D&I system is characterised by a satisfactory level of public investment but a relatively low level of investment by business. A major objective, therefore, is to better link public and business research, and in particular to increase the support for the exploitation of research outcomes in a business perspective.

A recent report suggested that France's gap with the USA in R&D intensity is due to two main factors: patterns of French industrial specialisation, on the one hand, and a lack of R&D-intensive enterprises of intermediary size (ETI)[11], on the other (CAS, 2010).

The three most R&D intensive sectors in France are:

- Pharmacy and biotechnology,
- Software and computer services and,
- Material and technological equipment.

These three sectors represent 5.5% of the total net sales of French businesses, whereas they represent 23.3% in the USA. Also, low R&D intensive sectors represent half of French firms' net sales, which is twice the rate recorded in the USA[12]. In addition, French companies with more than 25,000 employees contribute about 89% of R&D

9 GBAORD is composed of the MIRES budget plus the "hors-MIRES" (non-MIRES).

10 http://www.strategie.gouv.fr/content/levolution-recente-des-systemes-de-recherche-note-danalyse-275-avril-2012?xtor=EREC-1014-[13042012-Newsletter026-L%27%C3%A9volutionr%C3%A9centedessyst%C3%A8mesderecherche(Noted%27analyse275-Avril2012)]

11 *Entreprises de Taille Intermédiaire* (ETI): an enterprise with between 250 and 5000 employees and either less than €1.5b turnover or a balance sheet of less than €2b.

12 See Erawatch Country Report 2010.

expenditures in France, compared to 83% in the EU, and 64% in the USA, which implies that France suffers from a lack of R&D-intensive SMEs.
In 2011, about one third of Government budget outlays for research and development (GBAORD) was focused on four objectives: defence (6.8%), the exploration and exploitation of space (12.9%), health (6.8%), transport and telecommunications and other infrastructures (6%). French spending on the first two objectives is especially high compared to the EU average and represents a national characteristic (Eurostat).

Research and innovation governance

Research governance, development and innovation (RDI) policies have not changed since the reforms of the 2000's, which aimed at establishing three clear separate levels of action, namely: i) policy making, ii) implementation (funding and programming) and iii) execution (enforcement of regulation).
At the policy making level, two main government ministries share the responsibility for research and innovation policy in France:

- The Ministry of Higher Education and Research (MESR[13]) designs and co-ordinates research policy. It is assisted by diverse consultative bodies including the High Council for Science and Technology (HCST[14]). This consultative body advises the French Prime Minister and provides recommendations on national research and innovation strategies.
- The Ministry for Economy, Finance and Industry (MINEFI[15]) is responsible for industrial and energy research and plays a specific role in relation to private sector research. Innovation is the responsibility of both MINEFI and the Ministry of Higher Education and Research (MESR).

All funding devoted to research and innovation is channelled through the general budget of the Research and Higher Education Interministerial Mission (MIRES). The MIRES brings together funding from the Ministry of Research and Higher Education, the Ministry for Economy, Finance and Industry as well as a number of other ministries (Defence, Culture and Communication, Ecology, Energy, Sustainable Development and Sea, Food and Agriculture and Fishing). The Ministry for Higher Education and Research is the leading ministry within the MIRES and is responsible for implementing the agreed budget plan. It proposes public policy priorities for all research programmes by, on an annual basis, defining objectives and the means necessary to achieve them.
The general trend in research innovation governance has been to bring research and innovation stakeholders together and to coordinate their activities as much as possible, particularly through the creation of Research and Higher Education Clusters (PRES) and the "*Alliances*". The 2007 Law on the autonomy of universities combined with the development of Research and Higher Education clusters (PRES) since 2006 is designed to give higher education institutes, specifically universities, a central position in the research and innovation system through a better linking of universities, PROs, "*Grandes Ecoles*", and other stakeholders. In 2010, coordination institutions called "Alliances" were created. Their aim is to bring together the different stakeholders in a given research domain to better coordinate research programming. Currently, five alliances are in place in the fields of: life sciences and health, energy, the environment, marine sciences, ICT and SSH (Social Sciences and Humanities).

[13] See http://www.enseignementsup-recherche.gouv.fr online.

[14] http://www.hcst.fr

[15] See http://www.economie.gouv.fr/ online

At the operational level, the French research system is mainly composed of the following agencies. They are responsible for implementing R&D and innovation policies:

- **The National Agency for Research (ANR)** created in 2005 to fund research projects on a competitive basis and through public/public and public/private partnerships. The ANR had an amount of expenditures estimated at €728m in 2011 against €807m in 2010[16]). The ANR covers basic research, applied research, innovation and technology transfer. The ANR was created with the aim of providing a new impulse to the French research and innovation system and to: i) develop new concepts with the so-called "white programmes" (*programmes blancs*) through non-thematic calls, ii) increase research on economic and social priorities through thematic calls for projects; iii) intensify collaboration between public and private research by the promotion of collaborative research, and iv) intensify international partnerships.

- **OSEO innovation** provides businesses, in particular SMEs, with support for R&D and innovation projects (with a budget of €5,4m in 2010). **OSEO** is the national agency dedicated to promoting and supporting the industrial development and growth of SMEs, through innovation, especially technological, and to promote technology transfer. Its subsidiary, 'Oseo Innovation', merged with the main structure OSEO in December 2010. The aim of the merger is to reinforce the public effort to promote innovation, especially for SME's.

- The Agency for Environment and Energy Management (ADEME) was created in 1991 to support and fund environment and energy research on a partnership basis (with a budget of €1b in 2010). ADEME is a dedicated public agency with a remit to promote innovation in the field of environment. ADEME's missions consist in encouraging, supervising, coordinating, facilitating and undertaking operations with the aim of protecting the environment and managing energy.

- Public research organisations (PROs) such as the National Centre for Scientific Research (CNRS, €3.3b budget in 2012) also contribute to policy implementation.

Research and innovation policies are also defined and implemented at the regional level. Even though regions have increased their budgets dedicated to research, technology transfer and innovation by 60% since 2003, regional funding remains limited when compared with national funding. In 2010, French regions dedicated €1.2b to R&T. Regional and local authorities have their own budgets and have autonomy to decide the amount they spend on R&D support.

As part of the European cohesion policy for 2007-2013, each French region has developed its own regional innovation strategy (SRI) with the aim of ensuring a more effective steering its regional innovation system. The design of RDI policies at sub-national level is in the remit of Regional Councils, which are usually supported in the implementation stages by Regional Innovation Agencies. Regions are allowed to put in place a Regional Research Strategy (SRR) or a Regional Research and Higher Education Strategy (SRESR).

In practice, relationships between the regional authorities and the central government are organised by the signature of a seven-year contract called a State-Region Projects Contract (CPER). A CPER sets out the financial aid provided by the central government to meet regional policy objectives. One chapter of these contracts is dedicated to research. The design of the new generation of CPERs has been co-ordinated with the European

[16] 2010: ANR's Annual Report 2010; 2011: ANR's presentation (8 March 2012)

Structural Funds programmes, which have the same time horizon (2007–2013). CPERs focus on competitiveness and increasing the attractiveness of territories as places to do business, on the promotion of sustainable development and on territorial and social cohesion.

Research performers groups

The main public research performers (in terms of funds) are higher education institutes (HEI), which comprise a group of 85 universities (2011) and a smaller number of "*Grandes Ecoles*", which are specific to the French higher education system. Government sector research activities are primarily conducted by universities. University expenditure on research increased from €5.2b in 2009 to €5.6b in 2010. Universities are now the largest performance area of public research. Research is also carried out by Public research organisations (PROs). In 2009, the gross domestic expenditure on research and development by PROs grew rapidly to €8.8b, accounting for 57% of public civil research. They can be considered major players in the field of French research. Among them, the National Centre for Scientific Research (CNRS) and the Atomic Energy Commission (CEA) stand out. Indeed, with €5.4b, they together account for more than one third of public civilian research (20% for the CNRS and 16% for the CEA). The other large PROs include the National Institute for Agronomic Research (INRA), the National Institute for Computer Science and Automation (INRIA), and the National Institute for Health and Medical Research (INSERM).

Knowledge production

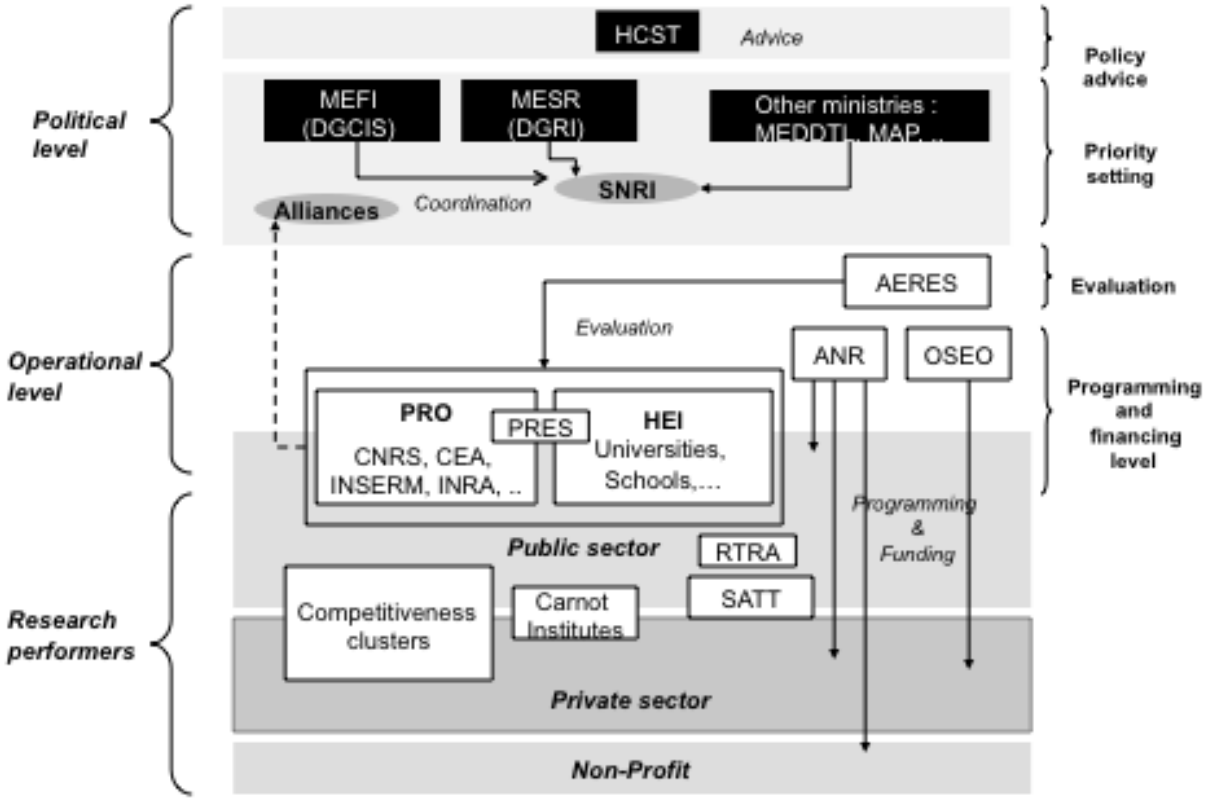
The production of scientific knowledge is the core function that a research system must fulfil. France's R&D&I system is characterised by satisfactory public investment but relatively low business investment. A major policy goal therefore is to better link public and private research, and in particular to increase support for the exploitation of research outcomes. Compared with the EU27, France ranks 6th in terms of world share of scientific publications per researcher (2009 figures). In 2009, France's share in the world output of scientific publications was 4.1%, and its share in quotations within 2 years was 4.3%. Both percentages have been in decline since 1999, particularly due to the entry of new countries on the international scientific stage such as China, India or Brazil[17]. With regard to patents, in 2009, France ranked 4th worldwide according to the European system (6.3% of registered applications) and 8th according to the American system (2% of patents issued). In both systems, France's overall share has been in decline since 2004. This is due to the appearance of new 'players' such as China or South Korea.

Revenues from intellectual property (IP) are decreasing and are highly concentrated between three research organisations, namely the CNRS, the CEA and the *Institut Pasteur*, which account for 90% of national revenues from IP[18]. Universities and other HEIs suffer from a lack of historic institutional capacity in terms of research and patents, resulting in an absence of IP strategies. In order to overcome these weaknesses, the 2011 national policy is geared towards i) awareness raising and promotion of IP policies to public research performers and ii) the identification of a single IP manager in case of co-ownership (as set out in the Decree published in 2009) specifically dedicated to CNRS-University common research units (90% of CNRS research units).

[17] '*L'état de l'Enseignement supérieur et de la Recherche en France*', MESR, 2011

[18] IGF, IGAENR, 2007

Figure 1: Overview of the French research and innovation system governance structure



SNRI: National Strategy for Higher Education and Research; **MESR**: Ministry for Research; **DGRI**: General Directorate for Research and Innovation; **MEFI**: Ministry for Economy, Finance and Industry **MEDDTL**: Ministry for Ecology, Sustainable Development Transport and Housing, **MAP**: Ministry for Agriculture; **PRO**: Public Research Organisation; **RTRA** : Thematic Advanced Research Networks; **HEI**: Higher Education Institution; **CNRS**: National Centre for Scientific Research (the CNRS also funds research); **ANR**: National Agency for Research, **HCST**: High Council for Science and Technology; **SATT**: technology transfer acceleration companies.

2 Structural challenges faced by the national system

France ranks 4th among OECD countries for R&D expenditures. However, France still lags behind EU leaders in private sector funding. In 2009, for example, publicly funded R&D expenditure reached 0.90% of GDP (it was 0.84% in Germany and 0.72% at the EU27 level), while R&D expenditure funded by the business sector reached 1.18% of GDP (above the EU27 average of 1.09, but lower than other countries such as Germany – 1.87% and Sweden – 2.12%)[19].

From a historical perspective, France's public research system has been good at generating new knowledge, thanks to its large public research institutions (such as the CNRS), which are oriented towards specific scientific fields. Public universities have

[19] Source: Eurostat

undergone radical change since the early seventies: they have changed from often being unspecialised to being specialised in a limited number of research fields. These changes have occurred while public research institutions and universities have, since the 1980s, been strengthening their links, through the development of 'mixed research units' (UMR), i.e. research units funded by both the university and a public research organisation. In 2008, a report was published on the effectiveness of the UMR model[20]. Its main focus was on administrative and management difficulties. The author recommended appointing one person to take responsibility for the management of each UMR, although the UMR would retain a mixed scientific steering committee. This new feature is now in place in several UMR but has not been adopted by all. Moreover, no study has to date been carried out on the effect of this change on the management and effectiveness of the UMR model.

Since the mid 2000's, the public research system has undergone profound changes; to its governance (University reforms), to its funding (with the creation of the National Research Agency (ANR) and the Competitiveness clusters), and through the reorganisation of the public research institutions. At the same time, the state funding for public sector higher education and research has increased: the public budget appropriation for research grew from €9.031b in 2002 to €15.087b in 2011 (+67 %). The public effort to support research has also been increased, through the 'Investments for the Future' programme, which is providing €22b of investments for higher education and research.

However, the French innovation system faces several challenges:

Challenge 1: Ongoing structural change in France's industrial specialisation and need to create of new firms in high tech sectors

The level of privately funded R&D in France is linked to its **industrial specialisation**: low and medium technology sectors account for a significant share of employment and added value. This affects the level of R&D expenditure. For instance, only 52% of industrial R&D expenditure is on high technology sectors, whereas it is 62% in the United Kingdom[21] (data for 2008). The size of medium or high technology manufacturing sectors is smaller in France than in other comparable EU countries[22]: The percentage of employment in knowledge intensive activities as a share of total employment is 39.5%, above the EU average, but lower than the percentage for the reference group of the Innovation Union Competitiveness report (France, Belgium, Austria and the UK: 40.9%).

84.1% of business expenditure for R&D (BERD) is carried out by the manufacturing sector, with three industries – automotive, pharmaceuticals, and aeronautics – concentrating 40% of spending. Of the French companies with the largest R&D expenditure, only 6% are high technology intensive companies, the remaining ones being medium or low technology intensive companies[23].

[20] Vers un partenariat renouvelé entre organisme de recherche, universités et grandes écoles (rapport d'Aubert) (French)

[21] CPCI (2010), *Investissement, R&D et innovation – rapport 2009*

http://www.industrie.gouv.fr/p3e/cpci/cpci2009.pdf

[22] European commission (2011), *Innovation Union Competitiveness Report, 2011 edition*

http://ec.europa.eu/research/innovation-union/pdf/competitiveness-report/2011/iuc2011-full-report.pdf#view=fit&pagemode=none

[23] *Centre d'Analyse Stratégique* (2010), R&*D et structure des entreprises, une comparaison France / Etats-Unis*

The idea is to increase the share of the manufacturing sector in the total added value of the economy and the share of high-technology industries in the overall manufacturing sector.
The challenge France is facing concerns the effectiveness of:

- policies supporting the growth of companies in the technological industries of the future (e.g. the Competitiveness clusters' policy)
- policies aimed at supporting the exploitation of research outcomes.

Challenge 2: Support R&D activities of mid-size SMEs and promote a culture of innovation

French private R&D expenditures are highly concentrated in certain categories of firms. A 2011 study from the Ministry of Industry argued that the capacity of companies to innovate is determined by two main factors[24]: the size of the company and its market power. Larger companies have higher capacities to engage in some form of innovation. The results of a survey carried out by the Ministry of Industry in 2007 showed that 81% of the largest companies in the manufacturing sector had engaged in some form of innovation in the immediately preceding years, whereas this percentage was only 30% among companies with less than 50 employees[25]. This phenomenon is related to the employment of R&D staff: in 2009, companies with more than 500 employees performed 71 % of GERD and 53 % of all R&D employees worked in companies with more than 100 employees[26].
One challenge is therefore to grow SMEs into enterprises of intermediary size (ETI) with the capacity to undertake R&D (in comparison with the USA, France has approximately the same percentage of intermediate-sized companies; however, they spend less money on R&D than US firms of the same size[27]).
Another challenge that public authorities face is the low level of interest shown by companies for innovation. This is due to the weak culture of innovation characterising French companies. The 2008 Community Innovation Survey underlined that 43.4% of French companies with more than 9 employees are innovative.
In France, there are two times less ETIs than in Germany or GB. Yet they are successful businesses28. Medium-size companies (ETI) have long been ignored by government: this is demonstrated by the fact that they have only been statistically defined in 2008. Contrary to SMEs and large groups, ETIs are not prime targets for government support to R&D. France is lacking ETIs, and the challenge is to encourage growth and innovation in this type of companies.
Tackling these challenges implies a need for public policy to continue to focus support on SME innovation and research projects, in particular for the enterprises of intermediary size and SMEs that are not part of big conglomerates.

Challenge 3: Transfer of knowledge from the public to the private sector

Challenge 3 is related to the two first challenges and concerns **the insufficient transfer of knowledge from the public to the private sector.** This is explained by

[24] MINEFI (2011), *L'innovation dans les entreprises: moteurs, moyens et enjeux*

[25] CPCI (2007), *Innovation dans l'industrie manufacturière*

[26] MESR Data

[27] *Centre d'Analyse Stratégique* (2010): *R&D et structure des entreprises, une comparaison France / Etats-Unis, Note de veille n°173, Avril 2010*

[28] B. Retailleau (2010), "Les enterprises de taille intermédiaire au coeur d'une nouvelle dynamique de croissance"

the limited capacity of business to exploit public research outcomes but also by a lack of focus on business needs by public research 'knowledge transfer' institutions. For example, a study by Robin and Schubert[29] has shown that cooperation between public and private sectors in France contributes less to companies' innovation capacity than in Germany. The authors based this conclusion on an econometric study on the share of innovative products in total turnover, and linked this to the effectiveness of public-private partnerships. More specifically, it is difficult for private companies to cooperate effectively with public research teams in such partnerships. The reason for this is the complexity of the 'knowledge transfer' system, and in particular that private companies have difficulty in finding the right partners[30]. From the perspective of the public research sector, the challenge is to improve the effectiveness of policy instruments.

The French government has taken measures to overcome these challenges. Two stand out: the competitiveness clusters policy (*pôles de compétitivité*), which was launched in 2005 and the reform of the Universities, launched in 2008. The competitiveness cluster policy has contributed to increasing the number of collaborative projects between public research teams and private companies and the reform of French Universities has changed University governance in that companies are now represented on their boards of directors. The goal of this new representation is to better match higher education qualifications with business needs.

More recently, the 'Investment for the Future' programme has also led to the introduction of instruments to support the exploitation of research outcomes (see section 3.1): e.g. SATT (Technology Transfer Acceleration companies), IRT (Technological Research Institutes), IEED (Institutes for Excellence in the field of carbon-free energies).

All these instruments have been introduced to improve knowledge transfer and cooperation between the public and private sectors.

3 Assessment of the national innovation strategy

3.1 National research and innovation priorities

a) Latest policy developments

While the implementation of the 'Investments for the Future' programme implied significant efforts from both policymakers and the research community, there were no policy developments in 2010-2011. Instead, government action remained focused on strengthening and deepening the structural reforms undertaken since the mid-2000s. Since 2005, the French research and innovation system has been the subject of far-reaching reforms with, among others, the creation of competitiveness clusters, the National Agency for Research (ANR), the strengthening of university autonomy, and all the measures deriving from the 'Investments for the Future' programme, such as the creation of the SATT (Technology Transfer Acceleration companies), the IRT

[29] S. Robin et T. Schubert (2011), "*Partenariats public/privé et innovation dans les enterprises*", in MINEFI (2011), *L'innovation dans les entreprises: moteurs, moyens et enjeux*

[30] *Inspection Générale des Finances* (2007), *Rapport sur la valorisation de la recherche*

http://www.ladocumentationfrancaise.fr/rapports-publics/074000113/index.shtml

(Technological Research Institutes), PFT (Technology Platforms), the IHU (Excellence Initiatives, University-Hospital Institutes) and IEED (Institutes for Excellence in the field of carbon-free energies). The objective has been to increase the performance, the visibility, the international influence and the exploitation of French research.
Since 2009, France has a multi-annual RDI strategy, which is called the National Research and Innovation Strategy (SNRI). The 2009 priority-setting exercise involved individuals from various stakeholder communities (research, business and civil society) organised into nine working groups with a remit to identify France's strengths and weaknesses. The strategy that was developed covers five years from 2009 onwards and is guiding policy decisions in the field of R&D&I. Three main priority areas were identified that address key societal challenges:

- Health, care, nutrition and biotechnology;
- Environmental urgency and eco-technology;
- Information, communication and nanotechnology.

Generally speaking, the national strategy acknowledges the major role of innovation for business competitiveness and puts the emphasis on the necessity to improve research exploitation.
More precisely, in order to create an effective and competitive innovation ecosystem, the National Research and Innovation Strategy laid down the following targets:

- avoid the scattering of resources and aim for excellence by: 1. Incentivising collaboration between universities, research bodies, businesses and competitiveness clusters; 2. Making the research exploitation systems more professional; 3. Simplifying public-private partnerships.
- reinforce the growth capacity of new innovative companies,
- reduce patenting costs,
- strengthen the access to "public procurement" for innovative SMEs,
- promote the spirit of entrepreneurship.

In 2011 France pursued the strategy set out in the 2009 National Research and Innovation strategy (SNRI).
The French context has recently experienced two major institutional and policy developments, namely: i) the creation of "*Alliances*" and ii) the implementation of the "Investment for the Future programme".

The '*Alliances*'

The major recent institutional development was the creation of **the Alliances**. In order to optimise coordination between PROs on the one hand, and PROs and Higher Education Institutions on the other, "*Alliances*", which were launched in April 2009. Their aim is to bring together the different stakeholders in a given research domain to better coordinate research programming. Five *alliances* are currently in place in the fields of life science and health, energy, marine sciences, ICT and the last one created in 2010 in SSH.

Table 1: Five Alliances

Name	Field	Date of creation	Founding members
AVIESAN	Health and life sciences	8 April 2009	INSERM, CNRS, CEA, INRA, INRIA, IRD, Institut Pasteur, CPU, Conférence des directeurs généraux de centres hospitaliers

			universitaires
ANCRE	Energy	17 July 2009	CEA, CDFEI, CPU, CNRS, IFP
ALLISTENE	ICT	17 December 2009	CNRS (Institute for Computer Sciences and Interactions), INRIA, CEA
AllEnvi	Environment	9 February 2010	BRGM, CEA, ~~Cemagref~~, IRSTEA[31], Cirad, CNRS, CPU, Ifremer, INRA, IRD, LCPC, Météo France, Musée national d'histoire naturelle
ATHENA	Social sciences and humanities	22 June 2010	CNRS, CGE, CPU, INED

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The "Investments for the Future programme"

Through the injection of "fresh money", the **'Investments for the Future programme'** is a further key recent policy development designed to boost the effectiveness of the higher education, research and innovation system. Following the economic crisis, the French government decided in mid-2009 to launch a national loan[32]. A Commission was set up to determine the priorities that the loan should address. Projects in these priority areas receive funding to enable them to respond to long-term challenges such as the knowledge economy, business competitiveness and strategic investment in industry.

In December 2009, it was agreed that the national loan would make €35bn available for five priorities: support to higher education (€11b), support to research (€8b), support to industry and SMEs (€6.5b), support to the digital economy (€4.5b), and support to sustainable development (€5b). The loan provides €21.9b for investment in research and higher-education, of which €17.9b will be made available through competitive calls from 2010 to 2012.

The "Investments for the Future" programme includes the following key measures:

- Excellence initiative programme:
- IDEX: the aim is to select 5 to 10 campuses to be flagships for the entire French research and education system.
- EQUIPEX: the aim is to finance equipment for research which is consistent with the national strategy for research and innovation.
- LABEX: aims to select research laboratories that have achieved excellence and provide them with financial resources to compete with international research institutions, attract internationally recognised researchers and perform high level research and education programmes.
- IRT: aims to support the creation of 4 to 6 Technologic Research Institutes, located within existing campuses around France.

[31] The former CEMAGREF became IRSTEA: *National Institute for Research in Sciences and Technologies in Environment and Agriculture*.

[32] The loan has been subscribed on the money market. It has been forecast that the National loan will become self-financing by 2020, thanks to the business activities generated.

- IEED (Excellence Institutes in the field of carbon-free energies): aims to create 5 to 10 IEED on campuses with international visibility, through a series of 2 competitive calls. Each IEED created will benefit from public funding, targeted investments and long-term strategy support.
- IHU: aims to finance high-level research in the field of health and biomedical science. It provides financial support to research teams in order to accelerate research, strengthen the capacity of the biomedical industries and raise the profile of research institutions at an international level.
- "Health and biotechnology" actions: is a comprehensive set of measures which aim to reinforce the capacity and expertise of French research and researchers in the field of health and biotechnologies. The actions will fund the development of research on bio resources, long-term "cohort", nano-biotechnologies, demonstrative sites and bio-computer engineering.

In addition, the 'Investments for the Future' programme launched a first call in 2010 to identify 5 to 6 Technology Transfer Acceleration companies – (SATT)[33]. The idea is to create an interface between academia and industry, one which will provide support with patent applications, technology transfer, public-private research projects or for the creation of start-ups. A further aim is to increase the size of Knowledge Transfer Offices (KTO) and to put in place clear protocols for technology transfer. Their business model is based on service provision and investment. The state allocation will mainly be used to finance the maturing of projects and will fund the SATT until they become self-financing, after a decade. After this, the SATT will need to be financially autonomous and be able to fund research projects through their own revenue.

Lastly, the French government has shown a renewed concern towards the manufacturing sector through the "Roundtable for Industry" (*Etats généraux de l'industrie*) which took place in 2010. The roundtable included a national committee, ten sectoral and transversal working groups, regional committees and an open internet consultation. The national committee comprised 45 members originating from various stakeholder groups (such as unions, academia, senators, thinks tanks and businesses) and was headed by the President of the pharmaceutical company Sanofi-Aventis.

A diagnosis of the weaknesses of the French manufacturing sector was presented: 1) a decline in industrial employment, 2) a decline in the international ranking of French industry 3) unsatisfactory trends in investment and innovation, 4) the structural weakness of France's large SMEs (also called intermediate businesses (ETI)). As a result, 23 measures were identified[34].

b) Assessment of the consistency of the national research and innovation strategy

In France, in most cases, there is no policy evaluation plan in place, and evaluations, if any, are carried out on an *ad hoc* basis. Evaluation of innovation policies remains rare and far from systematic (*Centre d'Analyse Stratégique*). The Centre highlights "the inexistence of a systematic evaluation approach"[35] regarding public support measures for businesses R&D and innovation.

[33] http://www.caissedesdepots.fr/actualite/toutes-les-actualites/toutes-les-actualites-hors-menu/pia-creation-des-premieres-societes-dacceleration-du-transfert-de-technologies.html

[34] See TrendChart Mini Country Report for France 2011.

[35] *Centre d'Analyse Stratégique* (CAS, 2011), *Les aides publiques à la R&D: mieux les évaluer et les coordonner pour améliorer leur efficacité*, Note 208. (Publicly funded R&D: Toward better evaluation and coordination for improved effectiveness).

The major policies have been evaluated externally at least once since 2005 (including the 'Young innovative enterprises' and 'Competitiveness clusters' programmes), but the full reports are usually unavailable and results are retained for internal use. Evaluations carried out in 2010 and 2011 (such as the evaluation of the public policy in favour of skilled craft and SMEs innovation clusters) have not yet been published, or have only been so in short (4 pages) summary format.
As a result, evidence on the effectiveness of innovation policies can only be reported for the research tax credit (see Table 2), the flagship and largest measure implemented in France to support business R&D&I. The Research tax credit was the subject of two evaluation reports that were produced in 2010 by two different public bodies: *La Mission d'Evaluation et de Contrôle* (MEC), which is part of the Commission of Finances, General economy and Budget control[36] (June, 2010) and the *Inspection Générale des Finances* (IGF) (September, 2010). Their main finding was that the measure has had a positive impact on business R&D spending, even though this has not been sufficient to reach the 3% Europe 2002 target. The reports note that, after three revisions and improvement, the Research tax credit has become the costliest instrument targeting businesses active in R&D in France[37]. Nonetheless, both reports recommended continuing to support business R&D&I through the Research Tax Credit.

Table 2: The Research Tax Credit (CIR)

The Research Tax Credit was adopted in 1983 with the objective of promoting research activities in firms across all sectors. It was a specific response to an identified weakness of the French research and innovation system, namely, traditionally weak private R&D expenditure. It underwent significant changes in 2004 when it was renewed for an undefined period of time to include a volume component in its calculation. On the basis of a simple declaration, companies can benefit from a tax reduction for a large range of research-related spending, such as R&D personnel expenses, R&D subcontracting or patenting costs. Modifications in 2004, 2006 and 2008 have made the Research tax credit France's most powerful innovation support tool. Due to the financial and economic crisis, a 'decommitment' procedure means that companies may need to refund any research tax credits granted in 2005, 2006, 2007 and 2008 and which have not yet been used or committed.

Source: Erawatch, IGF and the French Assemblée Nationale (2010)

Even though, at (0.54 PPS€), French patent applications in societal challenges per billion GDP in France are lower than the EU average (0.64)[38], France has been very active in driving forward the research agenda in societal challenges. France has been part of the leading countries on several topics including 'neurodegenerative diseases and Alzheimer's', 'Agriculture, food security and climate change', 'A healthy diet for a healthy life' and 'Cultural heritage and global change'[39].
To conclude, French policy priorities have not changed since 2009, and the measures and new policy trends that emerged through 2010 and 2011 had the objective of

[36] *La Commission des finances, de l'économie générale et du contrôle budgétaire.*

[37] http://www.enseignementsup-recherche.gouv.fr/pid24835/credit-impot-recherche.html (French)

[38] European Commission (2011), *Innovation Union Competitiveness report 2011 - country profile France*

[39] MESR (2010), *Rapport sur les politiques nationales de recherche et de formations supérieures* (French)

strengthening the public policy response to a number of challenges, particularly business R&D and the connectivity between the public and private sectors on R&D. It worth noting that the 'Investments for the Future programme' are clearly in line with the 3 main priority areas identified by the National Strategy for Research and Innovation (SNRI) : i) health, care, nutrition and biotechnology ; ii) environmental urgency and eco-technology ; iii) information, communication and nanotechnology.
Broadly speaking, all national priorities are consistent with the National Strategy for Research and Innovation and with the structural challenges identified earlier in this report.

3.2 Trends in R&D funding

Within the EU27 and in terms of R&D expenditures, France ranks second after Germany. French GERD amounted to €39.3b in 2007, €41b in 2008, and reached €42b in 2009 which accounted for 17.7% of total EU27 expenditures (the figure for Germany was 28.5%). The ratio of GERD to GDP was 2.21% in 2009 and France remained above the EU27 average (which was 2.0% in 2009), even though R&D intensity has steadily decreased since the end of the 1990s. In 1998, GERD/GDP was 2.14%, this increased to reach 2.24% in 2002, after which it steadily declined to 2007. Since 2007 the ratio has again been increasing (Eurostat).

Table 3: Basic indicators for R&D investments in France

	2008	2009	2010	EU average 2010
GDP growth rate	-0.1	-2.7	1.5	2,0
GERD as % of GDP	2.11	2.26	2.26	2.0
GERD per capita	641.6	663.1	674.2	490.2
GBAORD (€ million)	13.3	13.7	14.0	92,729.05
GBAORD as % of GDP	0.69	0.72	0.72	0.76
BERD (€ million)	25,761.21	26,341.39	26,683.83.	151,125.56
BERD as % of GDP	1.33	1.39	1.38	1.23
GERD financed by abroad as % of total GERD	8,0	6.9	7.3	N/A[40]
R&D performed by HEIs (% of GERD)	20,0(2)	20,6(2)	n/a	24.2
R&D performed by PROs (% of GERD)	15.9(2)	16.4(2)	n/a	13.2
R&D performed by Business Enterprise sector (as % of GERD)	62.7	61.7	61.2	61.5

Source: EUROSTAT

(1) = the sum of the breakdown does not add up to the total; 'Education' and 'Culture, recreation, religion and mass media' are included elsewhere; 'Political and social systems, structures and processes' includes other classes.

(2) = Source: OECD Main Science and Technology Indicators: Volume 2009

The most dynamic sector over the last ten years has been higher education whose R&D expenditures have increased by 74%. Business and government sector expenditures have grown by less than 50% over the same period.

[40] 8.4 (2009), 9.04 (2005)

Since 2009, the Higher Education and Research budget has become the top government priority, receiving an additional annual allocation of 1.8b Euros in 2009, 2010 and 2011. This breaks down as an extra annual €1b for higher education and €880m for research. In 2010, an additional €840 million+ of public funding was allocated for the reform of public research. In 2011, the total budget for higher education and research reached €25.3b: with €15.1b allocated to higher education and 10.2 allocated to research programmes (MIRES 2011).

Direct funding to universities and public research organisations by government ministries (especially the ministry for research and higher education) provides the lion's share of national funding for research. The total budget and resources allocated to universities has recently seen an unprecedented increase. Universities' operating funding was increased by 3% on average in 2011, representing an aggregate increase of €78.4 million relative to 2010[41].

Block grants are traditionally the main funding mechanism and amounted to €16.4b in 2009. However, in the last five years, the funding streams from the public sector have evolved from block grants and subsidies to a greater role for tax incentives and competitive funding. The research tax credit represents by far the most frequently used R&D support for firms. In 2009, the research tax credit reached €4,7b, which means 60% of the total public funding allocated to businesses. In 2011, it accounted for €5,09b.

Regarding competitive funding, one of the rationales for the creation of the ANR in 2005 was to increase the share of competitive funding available to the scientific community. The budget managed by the ANR varied in the range €800-850m between 2007 and 2010[42]. The ANR's project based funding amounted to €398m in 2010. Overall, project based funding (ANR funding and EU programmes) represented about 12.7% of the overall public funding in 2010.

Table 4: Type and sources of public research funding in 2009 (€m)

	Volume of public research funding in 2009 (€m)		
	Block grants in 2009	**Contracts in 2009**	**Own funding in 2009**
Public administration	9,649	1,747	858
Higher Education Sector	6,714	1,815	461
Non-for-profit Institutions	88	319	312
Total	16,450	3,880	1,631

Source: Ministry for Higher Education and Research, 2010

In addition, funding is being made available for research at the national level through the 'Investments for the Future' programme. Investment in research and innovation amounts to €21.9b out of which €17.9b will be granted through competitive calls from 2010 to 2012 (see Table 5). While funding mechanisms are heavily geared towards tax incentives, it is worth observing that through the 'Investment for the Future' programme, a new intervention model is developing. This can be described as the the

41 Ministère de l'Enseignement supérieur et de la recherche (2011) *French National Reform Programme 2011-2014*

42 http://www.performance-publique.budget.gouv.fr/fileadmin/medias/documents/ressources/PLF2012/Jaune2012/Jaune2012_Recherche_Ens_Sup.pdf

'holdings model'. In this model, the French central administration (State) retains or acquires a financial stake (through the provision of different funds or directly) in innovation bodies (such as the newly created technology transfer acceleration companies - SATT). The beneficiaries cannot use the funds directly, but may use the revenues created.

Table 5: Investments for the Future

Clusters of excellence *€15.4b*		**Projects of excellence** *€6.6b*	
Campus operation **€1.3b**	Plateau de Saclay **€1b**	Space **€0.5b**	Aeronautics **€1.5b**
Excellence laboratories **€1b** *(Labex)*	Hospital-university Institutes **€0.85b**	Excellence Equipment **€1b** *(Equipex)*	Tomorrow's nuclear energy **€1b**
National fund for the exploitation of research outcomes **€1b**	Technological Research Institutes (IRT) **€2b**	Health and biotechnologies **€1.5b**	Excellence Institutes in the field of carbon-free energies **€1**b
Excellence initiatives **€7.7b** *(Idex)*	Carnot Institutes **€0.5b**		

Source: *Investissements d'avenir mode d'emploi*
Note: in grey, competitive calls
Note: The programme is composed of two sub programmes: the "Clusters of Excellence" programme (€15.4b) and the "Projects of Excellence" programme (€6.55b).

Other funding sources for research and innovation are the European Union and French regions.

The **EU** also makes a contribution. One of the main funding channels for R&D is the ERDF. The focus and scale of structural funds in the field of RDI activities for the period 2007-2013 differs by region (EDATER, 2009). The 2000-2006 expenditure data show limited mobilisation in most French regions for investments in R&D and innovation (less than 5% of European Regional Development Funds (ERDF), almost three times less than in other Member States) (ADE, LLA, 2010).

ERDF funding for innovation under the 2007-2013 programming period has increased substantially in all EU countries compared to the previous period. However, with 31.4% of ERDF funding targeting innovation, France lags behind its counterparts (Denmark (65.1%), Finland (54%), Austria (47.4%), UK (43.2%) and Sweden (45.6%)).

At the regional level, even though regions have increased their budgets for research, innovation and technology transfer by 60% since 2003, regional public funding for research and innovation remains limited when compared to national funding. The regions allocated €769.2m to research, innovation and technology transfer in 2008[43], which represents 5% of total public expenses for R&D. Regional and local authorities have their own budgets and have autonomy to decide the amount they spend on R&D support. It is worth noting that in 2008, 16.7% of the budget for research and transfer of technology in the regions was granted through the competitiveness clusters located in their respective areas.

France is characterised by a strong geographic concentration of R&D spending. In 2009, *Ile-de-France* accounted for 40% of the total R&D spending (€16.9b), *Rhône- Alpes* for

[43] This figure comprises R&D spending of Regional councils, General councils and cities. Data of the ministry in charge of research: http://cisad.adc.education.fr/reperes/public/chiffres/default.htm

11.8% (€5.1b), *Midi-Pyrénées* for 7.8% (€3.3b) and *Provence-Alpes Côte d'Azur* for 6.5% (€2.8b). It is worth emphasising the relative decline of *Ile-de-France* over the last 10 years as it had accounted for 49% of total R&D spending in 1997[44].

Innovation was traditionally not placed at the heart of French regional strategies. This is why, between 2008 and 2009, French regions made a commitment to draw up consolidated Regional Innovation Strategies. French regions, which do not usually have a remit to implement RDI policies, for the first time undertook needs analyses and mapped the players and processes in the innovation systems at the regional level. Even if this regional dynamism was not always translated into clear and operational strategy, the overall exercise was beneficial (ADE, LLA, 2010) because French regions are now committed to a genuine ongoing policy development and review process and have gained knowledge of the strengths and weaknesses of their territories enabling them to make better policy choices.

Thematically or sectorally focused support measures are more concerned with research than innovation. Still, even if, for instance, the ANR calls for proposals are thematic, 48.2% of the funded programmes are non-thematic[45]. Similarly, support provided by OSEO agency (the French agency for businesses and innovation) to SMEs' R&D&I projects is not thematically focused.

Lastly, strengthening public-private partnerships for leveraging additional funding for innovation is a priority of the "Investment for the Future programme". Projects are to be co-financed by the State—to the tune of €35 billion—by other public players, and by the private sector. This public-private co-financing has been designed to help leverage private investment as opposed to providing purely public funding. But above all, the public-private partnerships have a growing importance insofar as they: ensure the development of a high level industry-research ecosystem, encourage technology transfer and boost the exploitation of research outcomes.

3.3 Evolution and analysis of the policy mix

Over the past few years, France has made significant efforts to improve the effectiveness and performance of its research and innovation system. The French research and innovation policy mix now in place offers a wide range of public support measures in support of public and business research. Public support to R&D is also increasingly provided on a competitive basis.

The French system has a number of weaknesses, such as stagnating private expenditure, a poor outlook for R&D employment growth, a scientific and technological specialisation in relatively mature fields and weak knowledge circulation beyond strategic sectors.

The set of measures developed over the last three years have had the goals of strengthening the public policy response to the challenges facing business R&D and connections between public and private sector R&D efforts.

The current policy mix is focused on i) stimulating private R&D investment, with a particular focus on SMEs; ii) increasing the attractiveness of scientific careers and, iii) fostering collaboration between public and private sectors.

Stimulating R&D private investments

Over the last three years, France has increasingly focused on incentivising private research and to this end has developed a set of measures to stimulate greater private R&D investments, in particular through the research tax credit scheme,

[44] See Erawatch Country Report 2010.

[45] ANR (2010), *Rapport annuel d'activité*

competitiveness clusters and the Young Innovative Companies programme (*Jeunes Entreprises Innovantes*, JEI).

The **Research Tax Credit** (*Crédit d'impôt Recherche* - CIR) is the most important measure for supporting business R&D investment. In 2009, the Research tax credit reached €4.7b, which is equal to 60% of the total public funding allocated to businesses. In 2011, it accounted for €5,09b. The 2008 reform of the Research Tax Credit (see Erawatch country report 2010) was designed to encourage companies that already perform R&D to increase their efforts and it has succeeded in doing so. In a recent document[46], the French Ministry for Higher Education stated that this measure has been effective in mitigating some of the consequences of the economic crisis, especially in tackling offshoring. Procedures have been eased and according to the government, almost all SME's involved in R&D activities now use the research tax credit scheme. The 2011 Budget Act has also refined the eligibility conditions for the research tax credit in order to avoid possible windfall effects. To avoid potential abuses a number of modifications have been adopted regarding the basis and methods for calculating the tax credit and on reporting requirements[47].

Competitiveness Clusters are also an important policy and are seen to be a means of encouraging greater R&D investment by companies. The goals are: to support the strategic governance of clusters, finance structuring projects — such as innovation platforms — and develop other aspects of cluster ecosystems such as competence management, international development, IPR management and introduce incentives to leverage more private funding to support the growth of SMEs. Competitiveness clusters bring together companies, training centres and public and private research organisations around innovative collaborative projects. Industry and public research institutions collectively identify innovation projects with an international dimension which are then supported by public funds. France launched its national competitiveness cluster policy to make businesses more competitive, to build up employment in promising markets and to strengthen the regions. The total budget of the second phase of the competitiveness clusters policy (2009-2011) amounts to €1.5 billion.
The **Young Innovative Companies** initiative (*Jeunes Entreprises Innovantes*, JEI), is another major support measure for innovation. It was reformed by the 2011 finance law. The JEI status is applied to innovative SMEs (innovative being defined as 15% of turnover devoted to R&D) of less than 8 years in age. Companies that enjoy the JEI status become eligible for a series of tax rebates including exemptions on corporate earnings taxes, local taxes and social charges associated with the employment of highly qualified personnel. There were 2,273 JEI in 2009 (1,353 in 2004); the total tax break amounted to €121,7m in 2009 (€62,3m in 2004); data shows that tax reductions have on average contributed to the work of 5 employees in a JEI; the average number of employees in such companies is 8 (for 2009). The main change is that the tax-break on R&D

[46] *Ministère de l'Enseignement supérieur et de la recherche* (2011), *Crédit Impôt Recherche, un outil anti-délocalisation*

[47] For instance:

- The temporary measure of anticipated reimbursement of the tax for 2010 is limited to SMEs and SMEs with the Young Innovative Entreprises status (JEI);
- The bonus for research tax credit newcomers is lower from 50% tax break the 1st year to 40% and from 40% the 2nd year to 35% staring January 2012;
- The overall calculation scheme is modified (75% to 50% for R&D employees' wages).

employees' wages are degressive starting from the fourth year of the company's life (the tax-break was previously fully applied from the 8th year).
France's innovation policy also recognizes the importance to SMEs via the **OSEO Agency,** which supports SMEs in their innovative activities (mainly through measures such as support to innovative projects, support to strategic industrial projects and the single inter-ministerial funds that finances R&D projects within the competitiveness clusters through calls for projects). One of its roles is to distribute subsidies and loans. OSEO Innovation focuses on supporting innovative projects undertaken by a single business where the maximum cost does not exceed €3 million. OSEO's funding to innovation reached €650m in 2010 (compared to 560 in 2009). OSEO has a wide range of tools and instruments to support R&D and innovation in SMEs and ETIs and a very wide spectrum of funding from 15000 € to about €3 million.
In addition to this, the lion's share of the **"Investments for the Future"** programme is devoted to innovation. Indeed, €3.09b is allocated to business financing measures[48]. The management of the funds is delegated to national agencies. In the field of innovation the ANR, OSEO and the ADEME are the three main operators.

Increasing the attractiveness of scientific careers

According to the National Strategy for Research and Innovation (SNRI), increasing the **attractiveness of scientific careers** is one of the keys to improving the R&D&I system. Over the past few years, the French government has introduced several measures to improve human resource management in the public research sector. For instance, the *Plan Carrières 2009-2011* raises the salaries of young researchers, introduces flexibility in the teaching/research balance and offers "excellence" bonuses and Chairs. The autonomy of universities should also allow them to recruit under more attractive conditions, which can also be more easily adapted to individual situations. Furthermore, the **Investments for the Future programme** also contributes to the researcher's employability and mobility. As part of this programme, the IDEX Projects (Excellence initiatives) aim to attract the best researchers and students from foreign countries. In part for this reason, the selected IDEX projects devote from 10 to 25% of their funding to human resources. The IDEX projects also seek to improve the hosting conditions of researchers (salary, work environment). Gender balance has also started to be taken into account both by research institutions and universities through the impulse and coordination of the ministry for higher education and research.
The government is seeking to strengthen the link between education and research. Indeed, a better 'fit' between education and the labour market has received a greater focus in recent years than in the past. The 2007 **law reforming universities,** which provides greater autonomy to French universities, also reaffirmed their mission to support their current students and graduates with entry into the labour market. In this context, closer ties are being built between universities and enterprises. The business sector is represented in the university's board and Universities are diversifying their sources of funding.

Fostering collaboration between the diverse public and private players

France has been very active in reinforcing knowledge circulation between universities, PROs and the business sector. The key measures aiming at strengthening public-private collaboration and the exploitation of research results in France are the **Competitiveness Clusters** ("*poles de compétitivité*") as well as the Carnot Institutes and foundations (Partnership Foundations and University Foundations). The

[48] http://investissement-avenir.gouvernement.fr

Investments for the Future programme also plays a very important role in this field of inter-sectoral knowledge circulation, in particular with implementation. It earmarks €3.4b[49] to improving the exploitation of research.
Moreover, PROs, HEIs and research units all actively participate in the Investments for the Future calls. Several new programmes have been brought in: a national fund to support the exploitation of research outcomes has been endowed with €1b; an additional endowment of €500m has been granted to the Carnot Institutes; Technological Research Institutes (IRT) have received €2b in grant for the coordination of public and private labs; Carbon-free Excellence Institutes (IEED) have been endowed with €1b and the national Seed Fund has received €400m.
The Investments for the Future programme is establishing a range of new organisations and the French landscape for research and innovation collaborations is likely to change with this. However, the relationship between pre-existing and new organisations is being questioned as there is a risk of unhelpful competition between them.

3.4 Assessment of the policy mix

Policy objectives and priorities — notably increasing the private sector R&D effort — are in line with the challenges facing France but significant effects are not yet demonstrable. Indeed, despite the increase in the public funding for private R&D expenditures (mostly through increased project funding), the private resource mobilisation for R&D is still relatively low (1.39% of GDP in 2009[50]/ 1.27% of GDP in 2008). Funding of GERD by the French business sector has decreased compared with 2006 and stood at 51.0% in 2010. As a consequence, the percentage of GERD financed by the business sector in France is still below the overall objective of having two-thirds of GERD financed by private enterprises (laid down in Lisbon). However, this policy goal implied a significant break with recent trends and was probably too ambitious.
Moreover, private resource mobilisation for R&D is still dependent on a few large companies operating in relatively low R&D-intensive sectors. In 2008, companies with more than 25,000 employees accounted for about 89% of R&D expenses in France compared to 83% in the EU and 64% in the USA (CAS 2010). Compared to the USA, France suffers from a deficit in R&D intensive intermediate-sized companies (ETI). Several studies on this category of company were published in 2009 and 2010 and advocated specific public support measures targeting them.
The challenge of increasing business R&D spending is clearly addressed through the Research Tax Credit[51]. As noted earlier, this instrument has been an effective tool for softening some of the consequences of the economic crisis, especially in tackling offshoring. Following the simplification of its procedures, almost all SME's involved in R&D activities now use the Research Tax Credit scheme. Recent econometric studies suggest that the measure effectively impacts business R&D spending even though it is not enough to comply with the 3% Lisbon target. After three revisions and improvement, the Research tax credit is the costliest tool addressed to any business active in R&D in France[52]. According to the Ministry for Higher Education and Research[53]

[49] http://investissement-avenir.gouvernement.fr/content/action-projets/les-programmes/valorisation-de-la-recherche

[50] MESR-SIES Pôle Recherche et INSEE

[51] http://www.enseignementsup-recherche.gouv.fr/pid24835/credit-impot-recherche.html

[52] See TrendChart 2011, Mini Country Report France.

http://www.enseignementsup-recherche.gouv.fr/cid49931/cir-statistiques-rapports-et-etudes.html

the CIR was instrumental in stabilising the level of business R&D investment in 2008 (about €15bn). The simplified CIR mechanism results in the increased use of the credit by business. Moreover, a substantial number of businesses (53%) have increased their R&D expenditures thanks to the CIR. With the exception of the automotive (-20%) and the aeronautics (-20%) sectors (particularly affected by the economic crisis from 2008), French manufacturing sectors have increased their expenditures (+2%). According to a survey carried out in 2008 the CIR has also generated a number of other positive impacts: 58% of businesses consider that the reformed CIR encourages the increase of R&D expenditures; 34% recognize that the CIR fosters joint research; and 29% that it encourages the hiring of PhDs qualified personnel.

Since 2009, a substantial amount of money has been invested in the research and innovation system, in particular through the fresh money injected by the Investment for the Future programme. It is too early to judge what the real effects and impacts of this programme on the French system will be. The Investment for the Future funds have not yet been distributed, even though the most of the calls for projects are now closed. It is unlikely that such an investment will be renewed in the next 5 to 10 years. It is clearly expected that the public money should trigger a strong leverage effect and that the private sector should react massively and positively. The challenges ahead deal with the management and the leverage effect of this investment[54].

At the same time, the two flagship measures in support of business R&D (Research tax credit and Young Innovative Companies – the JEI) have been affected by targeted cuts. There are now lower tax breaks for first time applicants and there has been a tightening of conditions regarding sub-contract tax breaks for CIR and lower tax breaks after 5 years for JEI. A close monitoring of the impacts of these reforms should be undertaken in order to assess their appropriateness, notably in light of the challenges France faces.

There have been efforts to tackle the long-standing barriers relating to the weakness of knowledge circulation and transfer through the development and deepening of a large range of instruments aimed at increasing the diffusion of academic knowledge (Competitiveness Clusters, SATT, Carnot Institutes). However, these instruments have not produced immediate results, and if they have, they have not yet been assessed. However, long term effects can be expected. An evaluation of the competitiveness clusters policy is currently underway.

The Investments for the Future programme was designed to bring clarity to the French research and innovation system, but so far the increase in the number of support measures resulting from this programme seems to have had the opposite effect.

In addition, considerable efforts have been made to improve the attractiveness of academic careers. As noted by the NRP assessment 2011, although much remains to be done, France has implemented measures (*Plan Carrières*, Autonomy of universities) that are heading in the right direction but are too recent to be assessed. Universities have been assigned a third mission, namely, assisting their graduates to enter the labour market. A 2010 report commissioned by the minister for higher education and research used international benchmarks to identify the success factors that lead a university to become excellent in job market matching (Aghion P., 2010). The report proposes three recommendations for France to improve the current situation: i) increase the financial resources going to higher education (to reach 2% of GDP), use of the Investments for the Future programme for innovative teaching projects, ii) a more balanced governance of

[53] See TrendChart 2011, Mini Country Report France.

[54] TrendChart 2011 Mini Country Report France.

universities by setting up boards of trustees open to individuals from outside academia, and iii) promote the development of university colleges to be responsible for all undergraduate courses[55].
All in all, a large set of measures has been taken to boost private R&D investment and to foster cooperation between public and private research. Even if most of these measures are considered useful and beneficial, the fact remains that the new instruments are many and complex and add to existing mechanisms, increasing to some extent the complexity of public support. Overall, the priorities of the policy mix are in line with the challenges. However, their efficiency and effectiveness are not yet demonstrated, and success will depend very much on the future economic environment and the resulting public budgetary constraints.

Table 6 below presents an overall assessment of the policy mix over the last three years in terms of relevance, efficiency and effectiveness.

Table 6: Assessment of the policy mix

Challenges	Policy measures/actions[56]	Assessment in terms of relevance, efficiency and effectiveness
Structural change in the French industrial specialisation and creation of new firms on high tech sectors	Competitiveness Clusters ANR - rising budget for project based research OSEO Agency subsidies and loans for business driven innovation projects+wider range of diverse support instruments and financial engineering	Relevant and appropriate Policy objective and priorities are in line with challenges but significant effects are not yet in evidence. The results do not match the strong political will. Low efficiency and effectiveness: no significant change of sectoral structures of the French economy. Context is still not conducive to an increase in business R&D. Effectiveness is not proven insofar as private resource mobilisation for R&D still depends on few large companies that are operating in relatively low R&D – intensive sectors.
Strengthen innovation in French companies	Research Tax Credit	Relevant and appropriate but challenges Effectively impacts business R&D spending. But it is still not enough to comply with France's 3% target laid down by the Europe 2020 strategy
	ANR rising budget for project based research OSEO Agency subsidies and loans for business-driven innovation projects	Relevant and appropriate but challenges Effective increase in the public R&D expenditures towards the private sector in particular through increased project based funding mechanisms. Efforts may be insufficient.
	"Investment for the Future" programme	Relevant and appropriate but challenges Too early to assess the effects and impacts of this programme A large part of the programme is dedicated to innovation and in particular to funding business innovation.

[55] Erawatch Country Report 2010

[56] Changes in the legislation and other initiatives not necessarily related with funding are also included.

Transfer of knowledge from the public to the private sector	"Investment for the Future" programme (IRT; Carnot Institutes; IEED; National Seed Fund)	Relevant and appropriate but challenges Too early to assess the effects and impacts of this programme There has been a good uptake by public and private stakeholders of the support measures for enhancing knowledge transfer.
	Competitiveness Clusters /SATT	Relevant and appropriate but challenges Development and deepening of numerous instruments able to increase diffusion of knowledge. The challenge is clearly addressed
	"Reform of universities/ "Plan carrières 2009-2011"	Companies have representation in the board of directors. This helps to improve the relevance of higher education qualifications to business needs. It is appropriate and in line with challenges insofar as the objective is to reach a better fit between education and the labour market and to strengthen the link between education and research. Is in line with challenges but effectiveness is not yet proven. Effects can be expected in the long run.

4 National policy and the European perspective

After the adoption of the National Strategy for Research and Innovation (SNRI), which focuses on building a medium-term strategy and choosing priorities, the major developments in the last three years relate to the 'Investments for the future' programme, which was launched in 2010. Investments for the Future used a competitive calls for proposals procedure, which is now closed. The general goal has been to equip France to compete with the leading players at a global level. This is consistent with the EU strategy of focusing on R&D&I to create growth and jobs. This programme aims to strengthen France's research infrastructures, increase the visibility of French research and higher education institutions and foster public-private partnerships.

Through this programme, the French policy mix focuses more on two European research Area (ERA) pillars: 'strengthen research institutions, including, notably, universities', and 'facilitate partnerships and productive interactions between research institutions and the private sector'.

In regard to other dimensions of the ERA, efforts have been made in the last few years to increase the attractiveness of scientific careers and to foster coordination between the national and European levels. With respect to the attractiveness of scientific careers, a *'Plan Carrières'* (Career Plan) was introduced in 2009, with the idea of attracting more people into a scientific career in the public sector, including the best scientists from other countries. The plan is related to strategy of increasing the autonomy of French universities, which includes more freedom regarding human resources management.

Turning to the theme of international cooperation, coordination at the national level is a real challenge for France, because most of the international agreements are

decided at the institutional level. The same challenge exists for cross-border cooperation, where agreements are made at the local level. International cooperation and knowledge circulation across Europe have been identified by the National Research and Innovation Strategy (SNRI) as central issues. The objectives are:

- To reinforce the role of France and Europe in international scientific organisations
- To increase France's attractiveness to researchers worldwide
- To develop France's public and private exploitation policy abroad
- To intensify cooperation with international scientific partners
- To increase research for development.

The first focuses are China, India, Japan, South Korea, Brazil and Russia. Those countries have strong scientific potential and an improvement in scientific relations will result in greater economic exchanges and closer diplomatic relations in light of major global economic change and development.
Some of the SNRI objectives relate to the creation of a general framework for international cooperation, with a special focus on the BRICs and developed countries in Asia, because of their high potential in the field of R&D and their increasing economic strength. In this respect the new Alliances may take the initiative of organising international cooperation on behalf of their members. In this way, French research organisations are collaborating with a view to engaging in international collaboration.

On the question of infrastructures, in 2008 France adopted a national Roadmap for research infrastructures. Combined with certain measures supported by the 'Investments for the Future' programme, it should reinforce France capacities to perform leading-edge research.

Because most of these developments have come in the last few years, it is difficult to assess their effectiveness. However, they are consistent with national priorities and some of the major challenges the country is facing in R&D&I. Concerns exist: University reform, the creation of the National Agency for Research (ANR) and the 'Investments for the Future' programme have led to increasing complexity in the French policy mix and national authorities have to focus on the overall coherence of these new measures.

Table 7: Assessment of the national policies/measures supporting the strategic ERA objectives (derived from ERA 2020 Vision)

	ERA dimension	Main challenges at national level	Recent policy changes
1	**Labour Market for Researchers**	Attractiveness of scientific careers was identified in the National Innovation and Research Strategy as a key challenge to improve the R&D&I system. The challenge is for universities to adapt their employment strategy in order to be attractive for high-profile researchers. This also has to do with diversifying career opportunities and prospects (see section 3.3).	Law on University reform: autonomy of Universities to recruit under more attractive conditions (through Foundations) Career Plan ("*Plan Carrières*") Investments for the future programme (IDEX projects)

	ERA dimension	Main challenges at national level	Recent policy changes
2	**Cross-border cooperation**	The main challenge regarding this ERA dimension is to coordinate the different levels of funding. While some major cooperative programmes are overseen by the National Agency for Research (ANR), there is no national strategy for the different levels of funding (i.e. cross border cooperation is still largely monitored at the institutional level).	Policy coordination with Germany (French-German Agenda 2020)
3	**World class research infrastructures**	Research infrastructures are a focus of the National and European strategies for excellence in the fields of research and innovation in Europe. The challenge France is facing is to make these world-class research infrastructures available very quickly, since they are crucial for attracting the best researchers from around the world .They also contribute to the visibility of European research as a whole.	2008 National Roadmap on research infrastructures 'Investments for the Future' programme
4	**Research institutions**	Universities are now the central actors of the research and higher education system. But the national HEI landscape is evolving, with the launch of several competitive calls as part of the 'Investments for the Future' programme and the merger of several large universities. The challenges are to use the new autonomy of universities to improve research performed by HEIs and develop institutions that are competitive at an international level, through the 'Investments for the future' programme.	Law on University reform 'Investments for the Future' programme Alliances

	ERA dimension	Main challenges at national level	Recent policy changes
5	**Public-private partnerships**	Various policies have been introduced in recent years to develop public-private partnerships: competitiveness clusters, new institutions created by the 'Investments for the Future' programme (IRT, SATT) An existing challenge is however to change the way public researchers and private researchers see each other, in order to better work together and to build up bridges between the public and the private sectors. Recent years have seen a number of major developments but the mechanisms for improving knowledge circulation have so far not produced results. If they have, the impacts have not yet been assessed. However, long term effects can be expected. National authorities should focus on increasing cooperation between newly created institutions in order to increase the impact of these individual measures.	'Investments for the Future' programme
6	**Knowledge circulation across Europe**	The challenge here is again to better coordinate actions taken supporting cross-border co-operation.	No change
7	**International Cooperation**	International cooperation is being developed as part of the national strategy for research and innovation. The PROs are coordinating their own strategies within the Alliances. The main challenge is then to better coordinate actions taken at the institutional level in order to gain coherence and foster special links with a limited number of countries.	National level definition (SNRI) of countries targeted for increased cooperation (BRIC, developed countries in Asia)

Annex: Alignment of national policies with ERA pillars / objectives

1. *Ensure an adequate supply of human resources for research and an open, attractive and competitive single European labour market for male and female researchers*

1.1 Supply of human resources for research

According to Eurostat, the number of researchers in France changed from 211,365 in 2000 to 295,695 in 2009. During the 2000-2010 peridod, the share of HRST in the total active population moved from 34.9% to 42.2%.

In 2008, 37% of the young professors recruited as civil servants came from the private sector. The demand for young professor is by far lower than the supply.

Outward mobility of researchers is not precisely documented. One third of the 10,000 annually graduated doctorates enter a post-doc period of three to four years. A majority of post-doc carried out abroad are pursued in the USA or in the EU. The most popular disciplines for mobility are life sciences and chemistry.

Regarding inward mobility, the number of foreign students is increasing among PhD students: they represented almost 4 out of 10 PhD students in 2008, and the numbers are growing. The most popular disciplines are Sciences and Humanities. Efforts have been made in the past couple of years to attract overseas researchers from the EU and beyond. The most important scheme (apart from the schemes of the individual public research organisations) is the fellowships granted by the National Agency for Research for foreign researchers. Every year since 2005, the Agency has launched a Call for Proposals inviting foreign researchers and teachers for a scientific visit in a French PRO or HEI. The programme is called 'Chairs of Excellence'. 73 projects were selected between 2006 and 2009. The programme is ongoing.

1.2 Ensure that researchers across the EU benefit from open recruitment, adequate training, attractive career prospects and working conditions and barriers to cross-border mobility are removed

The French government has put a strong emphasis on increasing the attractiveness of research careers since the 2006 law for research and subsequent laws. For instance, the 2007 law for university autonomy allows universities to manage bonuses and other financial incentives to teachers-researchers and researchers. New measures aim at a better integration of doctoral work or previous public or private jobs in the wage assessment. As a result, in September 2009, the average first wage of a young professor ('maître de conférence') has increased by up to 15% in comparison to the increase that would have been made under the previous legal framework, thanks to the inclusion of the former experience of the candidates. The number of promotions also increased from 822 in 2009 to 1,440 in 2011. The bonus for scientific excellence was established in September 2009, in line with the plan for career improvement in higher education and research, endowed with €2520. This bonus replaces the doctoral mentorship bonus. The minimum bonus is set at €3,500 and can reach €25,000 for researchers who have won an international award.

France ranks 10th among EU countries with regards the average weighted total yearly salary in 2006.

Overseas researchers (both European and/ non-European) are eligible to enter national competitions for recruitment. The Ministry for Higher Education and Research (MESR) set up a website dedicated to foreigners that presents the positions offered in the public sector57. Offers are also presented on the Euraxess website. In the public sector, the share of foreign teachers-researchers in HEI is 6.8% and 13.2% of researchers in PROs (for 2007). This share appears to have continued to increase over the last few years.

[57] http://www.emploi-scientifique.info/

The Scientific Visa has been implemented since 2007 in France. 23 EURAXESS centres are located in France in order to provide foreign researchers with help in order to apply for social securities and other administrative tasks.

It should be noted that most of the public research organisations (including CNRS, INRA, CEA, as well as the Conference of University presidents - CPU) signed the European Charter for Researchers committing them to a better recognition of researchers' status and improvement of recruitment processes.

A €759m plan was decided for the 2009-2011 period in order to increase general wages[58] and to accelerate advancement among researchers and HEIs employees. B Because most of the researchers are offered either a permanent position (as civil servants) or fixed-term contracts within an institution, the portability of grants does not apply in France.

1.3 Improve young people's scientific education and increase interest in research careers

Several actions have been undertaken in order to improve young people's scientific education and increase interest in research careers:
The Institute for Advanced Studies in Science and Technology was created in 2009. Its task is to provide training, to disseminate scientific and technical culture, and to foster public debate regarding scientific and technological progress and its impact on society.
The so-called 'Celebration of Science' action was launched twenty years ago in order to increase exchanges between the scientific community and society as a whole. It consists of exhibitions, debates and other forms of exchanges to show what the job of scientist really is.
CNRS has developed a web page[59] entirely dedicated to pupils interested in pursuing a scientific career. The goal of the webpage is to raise awareness among the population of the role of science and attract people to perform a scientific career.
At the beginning of 2011, the Minister for Education launched a 'Sciences and technologies' Plan for pupils[60]. The plan was set up (among other things) in order to counter the declining number of high school students who register for a scientific curricula in the higher education system. For high-school students, the goals of the plan are:
Make scientific culture a bigger part of general knowledge,
Develop and strengthen vocations among high school students regarding scientific and technical jobs.
Entrepreneurship training and courses, as well as courses involving creativity, problem solving and teamwork are largely available for students graduating from a Business or an Engineering school, while the availability of such courses is rather limited at the University.
Finally, Science Days and the yearly Science Festivals (*Fêtes de la Science*) are also good science promotion tool to the general population and attract the youngest towards scientific careers.

1.4 Promote equal treatment for women and men in research

As far as salaries are concerned, France ranks high among EU countries regarding female-male equality, as there are only small differences in salaries between male and female researchers, relatively to other EU countries, even though the difference is still as high as 22.6%[61]. In 2010 however, only 22.6% of Universities professors were women[62].

National authorities also set up a network of gender correspondents within each PRO. Today most PROs and almost 40 universities have appointed a gender/diversity correspondent or office which works

[58] http://www.enseignementsup-recherche.gouv.fr/pid24661/plan-carrieres-enseignement-superieur-recherche.html

[59] http://www2.cnrs.fr/jeunes/584.htm

[60] http://www.education.gouv.fr/cid54824/le-plan-sciences.html#Pourquoi%20un%20plan%20sciences%20et%20technologies%20%C3%A0%20l%E2%80%99%C3%89cole%20?

[61] http://www.enseignementsup-recherche.gouv.fr/pid24768/parite-et-lutte-contre-les-discriminations.html

[62] http://www.enseignementsup-recherche.gouv.fr/pid24768/parite-et-lutte-contre-les-discriminations.html

together with the Equality and Anti-Discrimination Office (MIPADI) of the MESR on subjects such as equality policies and actions, gender studies and gender in research.

Regarding acts promoting equal gender representation in the three main Universities' boards (i.e the administrative board, the scientific council and the council for studies and university life), the objective is to reach a balanced representation between men and women. However, this is only an objective, which does not have effect on the validity or not of the list.

Overall, taking into account what has been done in the last 10 years, it seems that the 'soft actions' implemented have had little effects.

2. *Facilitate cross-border cooperation, enhance merit-based competition and increase European coordination and integration of research funding*[63]

The main partners of France within ERA are Germany and the UK. Among the 80 objectives in the Franco-German Agenda 2020, published in February 2010, 10 deal with research and higher education, including:

Creation in parallel of two Advanced Studies Institutes on sustainable development
Launch of a satellite for methane detection "Merlin" within a CNES – DLR partnership
Development of cooperation between French Carnot Institutes and Fraunhofer
Pooling of German-African and Franco-African projects.

Recent bilateral programmes mostly deal with exchange of researchers. There are around 510 inter-university agreements resulting in 200 joint PhD programmes[64]. Other structuring programmes have been established in the field of medicine, biology, mathematics, physics, science of the universe, social sciences and humanities, oceanography and agro-research.

The trans-national coordination of programmes is a priority for the French research strategy. But not opening-up national programmes (0 programme truly open to non-resident in france and no intention to have some. The ANR cannot fund and will not fund researchers outside France, except in the few affiliates of some of the French research organisations) This strategy is developed at the national level, as well as at the research performers' level. For instance, in November 2008, the State Secretary of trade and SMEs proposed an initiative to increase sectoral and technological partnerships in order to fight against the lack of European world-class clusters.

Research programmes from the National Agency for Research (ANR) are open to international partners who are eligible to join a project consortium. However, non-French partners have to bring their own national funding to the projects. Indeed, in order to benefit from funding of the National Agency for Research, the partner's bank account must be located in France, all activities must be carried out in France and their legal status must be recognised in French law. An exception to these rules is the agreement the ANR has with the US National Science Foundation (NSF) that allows American research partners to obtain ANR-NSF co-funding for an ANR call for project.

In 2011, there is no national policy supporting coordination and cooperation between national and EU programmes. But the programming process of the ANR does take into account FP programming and thematic priorities. In line with the increased attention paid to RDI issues in France and the implementation of a National Strategy for Research and Innovation, France launched a study in 2010 on the articulation between national and EC programme planning and funding. The results of this study are not available yet.

[63] Promote more critical mass and more strategic, focussed, efficient and effective European research via improved cooperation and coordination between public research funding authorities across Europe, including joint programming, jointly funded activities and common foresight.

- Ensure the development of research systems and programmes across the Union in a more simple and coherent manner.
- Promote increased European-wide competition and access of cross-border projects to national projects funding

[64] MESR (2010), *Rapport sur les politiques nationales de recherche et de formations supérieures* (French)

3. Develop world-class research infrastructures (including e-infrastructures) and ensure access to them

France drew up a roadmap for Research Infrastructures in 2008. This roadmap presents a strategic vision for ensuring access to the best world-class infrastructures. The roadmap describes the existing RIs or RIs for which the implementation has already been decided, i.e. RIs at the planning stage.

France holds participation in the largest inter-governmental research infrastructures. Among the Very Large Research Infrastructures identified by the Government in the 2008 roadmap, 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 trans-national 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: the Earth study, the Universe's observation, particles and nucleus, material's study, ICT, human and social sciences, life sciences and health.

The rationale for the French participation is the necessity to be part of frontier research projects. Participation in Inter-governmental Research infrastructures is also essential for training purposes. French scientists shall be trained in order to be able to use and modify these infrastructures.

4. Strengthen research institutions, including notably universities

The public service mission of higher education is, as defined by the 2007 law:
Initial training and life long learning
Scientific and technology research, diffusion, valorisation of research results
Advice and support to job market entrants
Diffusion of cultural, scientific and technical information
Participation in the establishment of the European Research and Higher Education Area (ERHEA)
International cooperation
The main development regarding HEIs is the 2007 law on university reform. It grants autonomy for universities to manage their own budget. In parallel, the distribution system for state funding was also overhauled. Until 2008, the San Remo system was used but it became too complex and inefficient. The San Remo principles were based on the calculation of HEI theoretical needs to pay salaries and operational costs (*Assemblée nationale*, 2008). San Remo was not allowing for a regular adjustment of funding according to demographic change. The new system has been designed according to three principles:
The allocation system is simple and transparent.
The system can finance on an equitable basis each of the public universities. 80% of the university funding finances the universities activities as follow:

- For training: most of the funding is allocated according to the number of students attending exams and not according to the number of registered students, as it used to be.
- For research, the distribution is based on the number of teachers and researchers publishing (as defined by the AERES) funded by the university and according to the research discipline.

The academic funding promotes better through a result-based system. Since 2009, 20% of the funding is based on universities' performance against 3% in the previous period. The share of result-based funding is 5% for Bachelor's degrees, 20% for Master's and 37% for the research activities of the universities research units. Various criteria are used in order to combine different aspects of performance. For instance, the AERES criteria of research units and number of doctoral graduates per year are taken into account.

The 2007 law gave universities autonomy over the management budgets and recruitment. Governance is the responsibility of three bodies, the last are consultative bodies:
The administrative board is the strategic body of the university. It has 20 to 30 members representative of university community of 7-8 are external experts (3 representatives from local authorities and at least one CEO). They settle issues by voting. Decisions are made by absolute majority. They can create new research and training units and can propose the creation of schools and institutes within the university.
The scientific council gives opinions on the choice of scientific experts for recruitment committees. It also gives opinions on bonuses for doctoral and research supervision. They ensure the link between teaching and research and the three graduate levels. Third cycle students are part of this council.
The council for studies and university life (CEVU) takes part in the evaluation of teaching.
The university President is elected by the members of the administrative board.

5. *Facilitate partnerships and productive interactions between research institutions and the private sector*

Several actions have been set up in order to facilitate partnerships between research institutions and the private sector:

Spin-offs: the support to spin-offs from academia is a policy launched in 1999 with measures such as the 29 regional incubators or the national competition for technology-based firms.
Inter sectoral mobility: the law on innovation and research of July 1999 allows HEI and PRO researchers to participate in a business as an associate, CEO, member of the board, scientific support and advice, etc. Between 2000 and 2008, 733 public researchers have been granted an agreement by the Deontology Commission to pursue activities in the business sector. The ministry of Research set up an Internet page to provide advice to public researchers on building bridges between the public and private sectors.
Competitiveness clusters: the competitiveness clusters policy is continuing over the 2009-2012 period, with a €1.5b investment. After the mid-term evaluation, some clusters were removed from the programme and new 'green' clusters were selected. The objective if the policy is to foster collaborations within a local innovation system involving public researchers, industry and the administration.
Carnot Institutes: the Carnot label is intended to support partnership research, mainly led by public laboratories in collaboration with socio-economic actors (mainly business). There were 33 Carnot Institutes in 2010(?). A call for applications was launched in December 2010 to select the Carnot Institutes for the next five years.
IRT: This measure aims at supporting the creation of 4 to 6 Technologic Research institutes, within existing campuses among the French territory. These institutes, through public-private partnerships on research, innovation and education, will reinforce existing competitiveness clusters, in order to help the country reaching international level in diverse economic fields, and thus create growth and jobs. These 4 to 6 institutes are selected through competitive calls, with one already closed (early 2011).
The law for the autonomy of universities changed the governing model of HEIs and introduced the possibility for individuals outside research to be part of the university administrative council 7-8 external experts, of which at least one CEO.

6. *Enhance knowledge circulation across Europe and beyond*

Cross border knowledge circulation has historically been a bottom-up process since research collaboration and internationalisation strategies were defined at the level of the research performers, that is to say PROs and HEIs. Numerous bilateral agreements have been signed between national and foreign PROs. The main partnerships in Europe are set up with Germany, the UK, Italy and Norway. Outside Europe, partnerships between France and the USA represent 27% of total French partnerships with foreign countries.
It is hard to provide with a general figure regarding the budget dedicated to international agreements, because of this bottom-up process. The National Agency for Research dedicated €48m in 2010 for international programmes, which represented around 7.5 % of its budget for competitive calls but 11.6% of

the projects financed by the ANR[65]. In 2011, the ANR dedicated €59m to international programmes represented, i.e. 10% of its budget and 16% of its projects. In 2010, the CNRS dedicated €8.04m to international exchanges.

As part of the French strategy to support access to scientific publications and data, the Ministry for Higher Education and Research agreed in 2008 on financing a so-called 'Digital Scientific Library'. This new infrastructure should offer access to extremely large amount of research resources, for the benefit of both the students and the researchers.

7. Strengthen international cooperation in science and technology and the role and attractiveness of European research in the world

The International scientific cooperation in France has the following overall objectives[66] :

- To reinforce the role of France and Europe in international scientific organisations
- To increase France's attractiveness to researchers worldwide
- To develop France's public and private exploitation policy abroad
- To intensify cooperations with our international scientific partners
- Research for development,

in order to reinforce France the international visibility of France and its role as a key player of the knowledge-based economy.

The Department of European and International Relations of the General Directorate for Research and Innovation (DGRI) in the Ministry for Research is engaged in implementing the agenda set out in the National Strategy for Research and Innovation (SNRI) in collaboration with the French stakeholders. The SNRI focuses on specific countries: China, India, Japan, South Korea, Brazil and Russia. These are countries with strong scientific potential and an improvement in scientific relations will result in greater economic exchanges and closer diplomatic relations in light of major global economic change and development[67].

In October 2009, the DGRI set up a mechanism (mainly committees and workshops) aimed at defining an international strategy towards these countries. The first two countries studied in depth are China and India.

France contributes regularly to institutional cooperation with a very wide range of international partners, including Germany, the UK, Italy, Norway, Israel, Brazil, Mexico, Haiti, India, Russia, Morocco and Senegal.

Partnerships between France and the USA represent 27% of total French partnerships with foreign countries (which makes the USA the first French partner). France is the USA's fourth most common partner country).

Partnership activities take many forms, for instance:

- Creation of nine Mixed Research Units (UMR France-USA) of which two are at the INSERM, six with the CNRS and one with the INRIA.
- Within the CNRS: five International Research Networks at the GRDI; seven International Associated Laboratories, at the IAL and 30 international Program for Scientific Cooperation at the PICS – there were only 19 of these in 2004.
- France and the USA also signed various agreements on security issues in 2008, on ocean research between NOAA and IFREMER also in 2008 and on space related issues between NASA and CNES in 2009.

Partnership with Japan is developed through the ANR 'white calls' (non-thematic calls). A framework contract was signed with the JSPS (Japan Society for the Promotion of Science in SSH) and with JST (Japanese Science and Technology Agency) on ICT.

[65] The share of international programmes in ANR programmes is higher in terms of projects than in terms of budget because in international projects, the ANR is a co-funder, hence sharing the cost of the projects with other funders, while in national projects the ANR is the sole funder.

[66] MESR (2010): *Rapport sur les politiques nationales de recherché et de formations supérieures*

[67] MESR (2010): *Rapport sur les politiques nationales de recherché et de formations supérieures*

Health, food and water, quality of life, risks, natural resources, sustainable energy production, are the major issues at the heart of the National Research and Innovation Strategy (SNRI). In the framework of S&T cooperation, the SNRI states that France aims 'to coordinate shared resources in order to mobilize and develop international sectoral issues where it has recognized expertise e.g. water, food, agricultural, health, energy, marine science, science of the universe, and environmental science.'

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List of Abbreviations

AERES	Evaluation Agency for Research and Higher Education
ADEME	Agency for Environment and Energy Management
ANR	National Agency for Research
BERD	Business Expenditures for Research and Development
CEA	Commissariat à l'Energie Atomique
CERN	European Organisation for Nuclear Research
CNRS	Centre National de la Recherche Scientifique
CPER	State-Region Projects Contract
ERA	European Research Area
CIR	Research Tax Credit / Crédit d'impôt Recherche
COST	European Cooperation in Science and Technology
CPER	State-Region Projects Contract
DGRI	General Directorate for Research and Innovation
Equipex	Excellence Equipments
ERA-NET	European Research Area Network
ERDF	European Regional Development Fund
ERP Fund	European Recovery Programme Fund
ESA	European Space Agency

ESFRI	European Strategy Forum on Research Infrastructures
ETI	Economic and Technological Intelligence
FP	European Framework Programme for Research and Technology Development
EU	European Union
EU-27	European Union including 27 Member States
FDI	Foreign Direct Investments
FP	Framework Programme
FP7	7th Framework Programme
GBAORD	Government Budget Appropriations or Outlays on R&D
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D
GOVERD	Government Intramural Expenditure on R&D
GUF	General University Funds
HCST	High Council for Science and Technology
HEI	Higher education institutions
HERD	Higher Education Expenditure on R&D
HES	Higher education sector
ICT	Information and Communications Technoogy
IDEX	Excellence initiatives
IEED	Excellence Institutes in the field of carbon-free energies
IGF	Inspection Générale des Finances
IHU	Hospital-University Institutes
INRA	Institut National de Recherche Agronomique
INSERM	Institut National de la Santé et de la Recherche Médicale
IP	Intellectual Property
IRSTEA	Institut national de recherche en sciences et technologies pour l'environnement et l'agriculture
IRT	Technological Research Institute / Institut de recherche technologique
JEI	Young Innovative Company / Jeune Entreprise Innovante
LABEX	Excellence laboratories
MAP	Ministry for Agriculture
MEDDTL	Ministry for Ecology, Sustainable Development Transport and Housing
MEFI	Ministry for Economy, Finance and Industry
MINEFI	Ministry for Economy, Finance and Industry
MESR	Ministry for Higher Education and Research
MIRES	Inter-Ministerial Mission of Research and Higher Education
PTF	Technology Platforms
PRES	Research and Higher education
PRO	Public Research Organisations
OECD	Organisation for Economic Co-operation and Development
R&D	Research and development
R&D&I	Research and Development and Innovation
RDI	Research Development and Innovation
RI	Research Infrastructures

RTDI	Research Technological Development and Innovation
RTRA	Thematic Advanced Research Networks
S&T	Science and technology
SATT	Technology transfer acceleration companies / sociétés d'accélération de transfert de technologie
SF	Structural Funds
SME	Small and Medium Sized Enterprise
SNRI	National Strategy for Research and Innovation
SRESR	Regional Research and Higher Education Scheme
SRI	Regional Innovation Strategy
SRR	Regional Research Scheme
SSH	Social Sciences and Humanities
USA	United States of America
VC	Venture Capital

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Abstract

The main objective of the ERAWATCH Annual Country Reports is to characterise and assess the performance of national research systems and related policies in a structured manner that is comparable across countries. EW Country Reports 2011 identify the structural challenges faced by national innovation systems. They further analyse and assess the ability of the policy mix in place to consistently and efficiently tackle these challenges. The annex of the reports gives an overview of the latest national policy efforts towards the enhancement of European Research Area and further assess their efficiency to achieve the targets.

These reports were originally produced in November - December 2011, focusing on policy developments over the previous twelve months. The reports were produced by the ERAWATCH Network under contract to JRC-IPTS. The analytical framework and the structure of the reports have been developed by the Institute for Prospective Technological Studies of the Joint Research Centre (JRC-IPTS) and Directorate General for Research and Innovation with contributions from ERAWATCH Network Asbl.

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As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle.

Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new standards, methods and tools, and sharing and transferring its know-how to the Member States and international community.

Key policy areas include: environment and climate change; energy and transport; agriculture and food security; health and consumer protection; information society and digital agenda; safety and security including nuclear; all supported through a cross-cutting and multi-disciplinary approach.

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