



# JRC SCIENCE FOR POLICY REPORT

## RIO COUNTRY REPORT 2015: France

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Thomas Zacharewicz

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**Abstract**

The 2015 series of RIO Country Reports analyse and assess the policy and the national research and innovation system developments in relation to national policy priorities and the EU policy agenda with special focus on ERA and Innovation Union. The executive summaries of these reports put forward the main challenges of the research and innovation systems.

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## **Foreword**

The report offers an analysis of the R&I system in France for 2015, including relevant policies and funding, with particular focus on topics critical for EU policies. The report identifies the main challenges of the French research and innovation system and assesses the policy response. It was prepared according to a set of guidelines for collecting and analysing a range of materials, including policy documents, statistics, evaluation reports, websites etc. The quantitative data is, whenever possible, comparable across all EU Member State reports. Unless specifically referenced all data used in this report are based on Eurostat statistics available in February 2016. The report contents are partly based on the RIO country report, 2014 (Bitard, 2015).

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## Executive summary

### Context

The 2008 economic crisis has affected France's Gross Domestic Product (GDP) growth rate, albeit less severely than in other EU Member States. In 2007, the GDP growth rate was 2.4%, but this fell sharply to 0.2% in 2008 and even plunged to -2.9% in 2009. France's GDP growth then stood at 0.3% in 2012 and 2013. Foreign trade contribution to GDP growth stood at 0.1% in 2013 but decreased and even turned negative in 2014, at -0.3%.

In terms of R&D expenditures, France's GERD has kept on growing in nominal terms since 2006. Within the EU28, France ranks second after Germany. France's GERD stood at €43.5b in 2010, €45.1b in 2011, €46.5b in 2012, €47.5b in 2013 and 48.1b in 2014, which represents 17.0% of total EU28. The GERD to GDP ratio was 2.26% in 2014. France ranks 8th, above the EU28 average (at 2.03% in 2014), with a general increase of R&D intensity since 2007. This follows the increase of the ratio BERD/GDP from 2007 (1.27%) to 2014 (1.46%, a peak). Total GBAORD has been decreasing since 2009, from €17.5b to below 14.8b in 2014. In terms of percentage of GDP, a steady decrease is apparent over the same period, from 0.93% to 0.7% in 2014. In recent years, the total GBAORD as a percentage of GDP tends to be comparable with the EU average while following a reverse trend.

The French Research and Innovation system is currently being significantly restructured. Among the most salient policy measures adopted are the Law on Higher Education and Research (22<sup>nd</sup> July 2013) with its two core components: the National Research Strategy (March 2015) and the National Higher Education Strategy (October 2015). These key policy documents aim to define broad policy orientations and concrete objectives regarding research, education and innovation priorities in order to meet societal challenges and improve R&I performance. Over the last years, while France has shown an improvement in terms of scientific output, it has remained in an intermediate position in comparison to countries of similar size both in terms of publication volume and impact. Regarding innovation, according to IU scoreboard 2014, France is within the group of "Innovation followers" (i.e. summary indicator above or close to the EU28 average) in terms of innovation performance.

Key developments in the R&I system in 2015 included:

- Adoption of the National Research Strategy, containing a list of policy orientations and priorities for research performers.
- Adoption of the National Higher Education Strategy, which provides a roadmap including an action plan of 40 proposals to improve the French higher education system.
- Submission of the Stability Programme 2015-2018: "A strategy for fiscal consolidation". This strategy includes measures related to R&I funding, such as the promotion of "investment, entrepreneurship and innovation".
- Launch of a new phase of the roadmap "New Face of Industry in France" entitled "Rallying the New face of Industry in France". This new step is meant to accelerate the industrial renewal in France

To foster innovation, France has long made of knowledge transfer and science-industry collaboration one of its main R&I policy priorities. However, in spite of numerous measures and incentives, links between science and industry can still be improved. A number of policy measures have recently been adopted to boost the science-industry collaboration framework and develop innovation. Tangible results of these efforts are still to be seen.

The identified challenges for France's R&I system are:

- (1) Increase the impact of R&D incentives on innovation
- (2) Improve science-industry collaboration
- (3) Strengthen scientific excellence

## **R&I Challenges**

### **Challenge 1: Increase the impact of R&D incentives on innovation**

#### Description

France presents a wide range of policy instruments and public organizations to foster innovation. The *Crédit Impôt Recherche*, the R&D tax credit, the Young innovative company scheme, the Investments for the Future Programme or the newly created public investment bank *BPIFrance* (as of November 2013) are the most well-known examples of a multiplicity of policy initiatives designed to support investment in RDI. These instruments have yielded mixed results so far: France shows a relatively low level of knowledge-intensive services export (15<sup>th</sup> position in the Innovation Union Scoreboard 2015) and of SMEs introducing product or process innovations (17<sup>th</sup> position), highlighting limitations in its innovation capacity. Also, the R&D intensity of the manufacturing industry (i.e. the ratio of R&D expenditure to value added) is of 8 % and the French manufacturing firms were 20 % less likely to engage in product or process innovation than their German counterparts in 2012 (Council, 2015).

This mismatch between the number of policy instruments to support research and innovation and their actual outputs has raised a number of critics in the last few years (Council, 2015, 2014, 2013; OECD, 2014). Among them, the fragmentation and overlap of these support measures are often pointed out as well as their excessive complexity and insufficient gear towards quality and efficiency (Council, 2015, 2014). The French R&D tax credit system is in particular under scrutiny for its high budgetary cost (around 0.26% GDP) and its limited effectiveness (OECD, 2014). Taking steps to simplify and improve the efficiency of innovation policy is widely considered as necessary (OECD, 2014).

#### Policy response

While no evaluation of the complete portfolio of policy instruments in support of research and innovation has been provided as requested repeatedly in the Council recommendations (2015, 2014), the recent creation of the National Commission for the Evaluation of Innovation Policies represents an important step for the identification of systemic weaknesses and necessary improvements.

In addition, a set of measures and policy orientations have been defined to promote a more efficient financing and foster a favourable innovation ecosystem. The French innovation policy is articulated around six main avenues (NRP, 2014):

- Increasing the creation of competitiveness clusters to bring together small and large companies, research laboratories and higher education establishments in a given area and around a given field.
- Stabilising and facilitate the access of small and medium companies to R&D and innovation tax incentives, through the creation of an innovation tax credit for SMEs (NRP, 2013)
- Strengthening financial support to innovative companies through the creation of a public investment bank BPIFrance (November 2013). While originally designed to finance R&D oriented companies, a recent shift has been announced towards the financing of innovation-oriented enterprises (Council, 2015). This aims to improve non-technological innovation expenditures.
- Supporting innovation through public procurement



- Strengthening digital economy in all its components.
- Developing a project-specific financial assistance through the Investments for the Future Programme (*Programme d'Investissement d'Avenir*), with a total budget of €47b for its first two phases. Higher Education and Research priorities only add up to €23b. A third phase of this programme has recently been announced to extend its funding and impact beyond 2017 (NRP, 2015).

These measures are included in a systemic approach to foster an innovation culture that started with the plan "A new deal for innovation" (*Une nouvelle donne pour l'innovation*) in 2013 and evolved into the strategic agenda for research, technology transfer and innovation "France-Europe 2020".

### Assessment

Some efforts are being made both to simplify and to improve the efficiency of most RDI support measures. While a substantial number of policy initiatives have recently been taken in this aim, the overall system is however still excessively complex. Systematic and periodical evaluation exercises are needed to precisely identify the weaknesses and necessary improvements of R&I policy. The new National Commission for the Evaluation of Innovation Policies should be particularly helpful in this regard.

## **Challenge 2: Improve science-industry collaboration**

### Description

France has long made of knowledge transfer and science-industry collaboration one of its main R&I policy priorities. In spite of the adoption of numerous measures and of the achievements since 2000, difficulties in developing links between the academic world and industry persist. In 2014, OECD suggested that the latter resulted mainly from different functional cultures and operating rules. France lags behind similar countries in substantial specific areas. The share of R&D carried out in the French academic sector funded by industry was 2% in 2010, compared to 2.7% in 2000. In 2010, that share was 4.1 in the United Kingdom, 6.4% in the European Union and 6% in the OECD (OECD, 2014). Researchers' mobility between public and private sectors remains also low: public researchers rarely get hired by private companies (OECD, 2014). Reciprocally, public research organizations very rarely recruit research staff from the industry, in spite of the legal possibility to do so (this is due to lower remuneration). However, the CIFRE agreements allow the joint funding of doctoral students between a research laboratory and a private company. As a result, in recent years, about 10% of the PhDs were funded through this modality.

Knowledge transfer mechanisms are supported by a multiplicity of comparable measures and organisations, all aimed at fostering public-private collaboration (e.g. the Carnot Institutes, the Institutes for Research and Technology, the Technology Transfer Accelerating Companies, CIFRE). This variety, though converging, may lead to a lack of clarity, overlaps and potentially extra costs.

Finally, the *Pôles de compétitivité* scheme was often criticised in recent years (Council, 2015; 2014; 2013). This innovation clusters policy was launched in 2005 to develop collaborative projects between public and private research and industrial entities. To date, 71 clusters have been created, with an impact on innovation, job creation or patent registration considered as limited (Council, 2015).

### Policy response

A number of policy initiatives have been taken in recent years to improve the framework for science-industry collaboration and its effects on innovation. . Measures to support research stakeholders and to foster the development of a culture of knowledge transfer, to promote the creation of spin-offs and to further involve innovative SMEs in science-industry collaboration have been included in the Law on Higher Education and Research of July 2013 and taken into account in the elaboration of the National Research Strategy (2015).

More specifically, several National Reform Programs (2015; 2014; 2013) have insisted on the creation of an ecosystem to foster innovation and bring together companies, research laboratories and higher education establishments. The last NRP (2015) reminds that each cluster is committed to a performance contract, laying down the development of closer ties with technology transfer players and better support for SMEs in access to financing, international expansion and strengthening of skills.

### Assessment

Since 2013, a number of major policy documents have been released, such as the Law on Higher Education and Research (2013) and the National Research Strategy (2015), one of the the aims being to improve public-private and science-industry collaboration. While France is still lagging behind in terms of privately funded public R&D and mobility of researchers across sectors, it is still too early to assess the effectiveness of both the Law and the Strategy.

Regarding the specific aspect of the *Pôles de Compétitivité*, little progress has been made with respect to the recommendation made by the Council in 2014 to ensure that resources are focused on the most effective *poles* and further promote the economic impact of innovation developed in them (Council, 2015). However, policy initiative is underway and may be translated into action soon.

### **Challenge 3: Strengthen scientific excellence**

#### Description

The French research landscape is traditionally dominated by large Public Research Organizations (the largest of which is the National Centre for Scientific Research) over smaller-scale universities. The average efficiency of public research performers in France was often considered insufficient over the last years (Council, 2015). France's scientific output is in an intermediate position when compared to similar countries (OECD, 2014). Publication figures remain behind those of the United Kingdom and Germany, but show better performance than Italy and Spain. This position has not changed in the last decade. The share of national publications among the top-10% most cited publications is one of the main impact indicators. As of 2012, it has improved to reach 11.9%, but France lags behind Germany (13.0%), the United Kingdom (13.3%), the Netherlands (15.7%) and Denmark (15.6%). It is slightly ahead of Italy (11.4%) and Spain (10.9%) (OECD, 2014). The share of grants awarded per country by the European Research Council gives comparable results: with percentages around 12% to 13% over the period 2007-2012, France stands behind the UK, Germany and Northern European countries and shows better results than Southern Europe (OECD, 2014).

#### Policy response

Over the last 10 years, many reforms have been implemented to modify the public research structure. This is meant to positively affect scientific performance and reach excellence. Successive governments have made substantial efforts to further influence research orientations, to increase the role of universities and foster the use of project funding.

One of the most important policy decisions in this regard was the creation of the National Research Agency (ANR) in 2005. Its role consists in allocating competitive funding to PROs and universities, thus complementing their budget allocation. Through this allocation of funding and the management of the Investments for the Future Programme from 2009 onwards, the ANR has been playing a role in the implementation of the national strategic research priorities.

The creation of the ANR has been complemented by the setting up of the High Council of the Evaluation of Research and Higher Education (HCERES, previously AERES). Its main mission consists in evaluating research and higher education institutions, PROs, research units, higher education programmes and degrees to link the allocation of institutional funding to a performance assessment.

To bring together PROs and universities, at local level Higher Education Institutions and University Communities (COMUE) have been created (RIO Country Report, 2014).

### Assessment

France's scientific impact has not substantially improved over the last 10 years, indicating that the reforms undertaken to date have had a limited effect on scientific output (OECD, 2014). ). According to the European Commission, there are several bottlenecks, among which the low level of competitive funding and the lack of quality-related criteria in allocating funds to public institutions (EC, 2015).

Although the share of project funding has been increasing, from 7% in 2008 to 12% in 2012 for universities and from 7% in 2008 to 10% in 2012 for PROs (Futuris-ANRT, 2013; OECD, 2014), France is still among the OECD countries with the lowest proportion of this type of funding. The allocation of performance-based funding is also being enhanced, but most funding still remains based on education metrics (ie. Institutional block funded).

The efforts towards the modernization of the research landscape through structural links between PROs and universities should be maintained. So far, the process has proven complex and costly. OECD (2014) stressed that the integration of the various functions of steering, funding, implementing and evaluating into the PROs are likely to be sub-optimal (OECD, 2014).

## 1. Overview of the R&I system

### 1.1 Introduction

With 66,6 million inhabitants in January 2016, France is the second largest country of the EU28 after Germany. It is home to 13% of the total EU28 population. The 2008 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 2.4%, but this fell sharply to 0.2% in 2008 and even plunged to -2.9% in 2009. But, unlike other countries which quickly recovered after the plunge, France's GDP growth stood at 0.3% in 2012 and 2013. Foreign trade contribution to GDP growth stood at 0.1% in 2013 but decreased and even turned negative in 2014, at -0.3%.

In terms of R&D expenditures, France's GERD has kept on growing since 2006. Within the EU28, France ranks second after Germany. France's GERD stood at €43.5b in 2010, €45.1b in 2011, €46.5b in 2012, €47.5b in 2013 and 48.1b in 2014, which represents 17.0% of total EU28 expenditure (as compared with the share of Germany: 29.3%).

The GERD to GDP ratio was 2.26% in 2014. France ranks 8th, above the EU28 average (at 2.03% in 2014); it has been increasing since 2008. This compares with the steady increase of BERD to GDP from 2007 (1.27%) to 2014 (1.46%, a new peak). Total GBAORD has been decreasing since 2009, from €17.5b to below €14.8b in 2014. In terms of percentage of GDP, a steady decrease is apparent over the same period, from 0.93% to 0.7% in 2014. In recent years, the total GBAORD as a percentage of GDP tends to be comparable with the EU average while following a reverse trend.

**Table 1.** Main R&I indicators 2012 - 2014

Indicator	2012	2013	2014	EU average
GDP (in €) per capita	31800	32100	32200	27300
GDP growth rate	0.2	0.7	0.2	1.3
Budget deficit as % of public budget	-4.8	-4.1	-4	-2.9
Government debt as % of GDP	89.6	92.3	95.6	86.8
Unemployment rate as percentage of the labour force	9.8	10.3	10.3	10
GERD in €m	46,519.037	47,480.452	48,107.800 (e)	10,107.478 (Total for EU 28)
GERD as % of the GDP	2.23	2.24	2.26 (p)	2.03
GERD (EUR per capita)	712.6	724.2	730.7 (p)	536
Employment in high- and medium-high-technology manufacturing sectors as share of total employment	4.6	4.3	4.5	5.6
Employment in knowledge-intensive service sectors as share of total employment	44.5	44.7	46.2	39.2
Turnover from innovation as % of total turnover	13.5	n.a.	n.a.	11.9
Value added of manufacturing as share of total value added	21.7	21.6	n.a.	n.a.
Value added of high tech manufacturing as share of total value added	2.3	2.2	n.a.	n.a.

## 1.2 Structure of the national research and innovation system and its governance

### 1.2.1 Main features of the R&I system

#### **The French balance of centralisation and decentralisation in the R&I system**

The French R&I system relies on a mix of a powerful central government at national level and regional and devolved institutions. In practice, interactions between the regional authorities and the central government are organised through 6-year contracts called State-Region Plan Contracts (CPER). CPERs set out the financial aid provided by the central government to meet regional policy objectives. One chapter of these contracts is dedicated to research and innovation. The design of the new generation of CPERs has been harmonised with the European Structural Funds programmes (2007-2013; 2014-2020, see. smart specialisation strategies). CPERs focus on competitiveness, on attractiveness of territories as places to do business, on the promotion of sustainable development and on territorial and social cohesion. Hence, research and innovation policies are also defined and implemented at regional level. Even though regions have increased their budgets dedicated to research, technology transfer and innovation by 42% since 2007, regional funding remains limited when compared with national funding<sup>1</sup>. In 2013, French regions (i.e. regional councils) devoted approximately €918m to research and technology transfer; this was about 68% of the total spending of all local authorities. The overall budget of local authorities (i.e. regions, departments, municipalities) amounted to €1.34b in 2013. Regional and local authorities have their own budgets and they have been granted 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 (RIS3) with the aim of ensuring a more effective steering of its regional innovation system. The design of RDI policies at sub-national level is the responsibility of regional councils, which may be supported in the implementation stages by regional innovation agencies. Regions are allowed to develop a Regional Research Strategy (SRR) or a Regional Research and Higher Education Strategy (SRESR).

#### **Better linking public and private research: leveraging public funding of R&I**

In 2014, France's R&D intensity stands at 2.26%, below the 3% target. Both public and private investments remain 25% below their respective goals. Progress has to be made on both sides. A key objective of the recent research and innovation policy is to better connect them so as to increase synergies and investment. Dynamically enhanced linkages allow cross-fertilisation, whereby companies can benefit from highly differentiating applied knowledge, and public research from sources of funding and key research questioning. A specific focus is placed on improving the support for the exploitation of research outcomes in a business setting (hence the creation in 2012 of the SATT, Sociétés d'accélération du transfert de technologie).

The unsatisfactory level of private investment in France is due to the sectorial distribution of the French economy, with R&D intensive sectors insufficiently represented in the productive structure. The country's lowest weight of the industry as a whole in the GDP as compared with Germany for instance (it holds when compared with other OECD countries) partially explains its lower R&D intensity<sup>2</sup>, despite recent increase. This suggests that the modest performance of French industry in innovation is mainly<sup>3</sup> due to the size of the industry rather than to the type of innovation. Policy efforts aiming at

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<sup>1</sup> See "[Le financement de la R&T par les collectivités territoriales :1,34 Md€ en 2013](#)", Note Flash #2, MENSR, Avril 2015

<sup>2</sup> « [Un déficit d'effort de recherche des entreprises françaises ? Comparaison France – Allemagne](#) », Note d'information MENSR, 2012.

<sup>3</sup> Though not exclusively, the composition and an insufficient share of knowledge intensive services tend to play a role too.

improving R&D intensity and stimulating the development of start-ups in new sectors partially derive from that observation...

As shown by Eurostat data, in 2014 – and it is rather stable over time- SMEs account for slightly more than 25% of Business R&D expenditures. In Germany, SMEs account for about 10% of BERD. Large companies (above 1,000 employees) are also those who spend more in R&D; they used to account for 78% of German BERD in 2012, as compared with 61% of French BERD (see. footnote 3).

The branches which invest most in R&D are the pharmaceutical, the automotive and the aerospace construction; they account altogether for 36% of BERD (2012).

In 2014, close to 30% of the government budget outlays for R&D (GBAORD) were allocated to four objectives: the exploration and exploitation of space (9.8%), health (7.3%), defence (6.6%) and energy (5.8%). The French spending on the first two objectives is especially high compared to the EU average and represents a national characteristic (Eurostat).

In 2014, €16.2 of GERD is performed by public research institutions; of which 61% were carried out by HEIs. Expressed as a percentage of GDP, France is ranked 13<sup>th</sup>, in Europe 28, when it comes to universities as the locus of R&D performance, whereas government research organisations are ranked 4<sup>th</sup>. Strengthening French universities capacity to perform more research and better research for the benefits of society is one of the challenges that was addressed by the Law of 2013 on research and higher education.

## 1.2.2 Governance

The governance of the French research and innovation system has been evolving over the last ten years with the objective of clarifying the system's functions to improve its performance. This clarification implies three levels of action, namely: i) policy-making, ii) implementation (funding and programming) and iii) execution (enforcement of regulation). Thanks to simplified missions of execution mechanisms at each level, evaluation may also be facilitated. In 2014, a specific mission of evaluation of innovation policies and of the innovation policy mix was assigned to the General Commission for Strategy and Economic Foresight by the Prime Minister,<sup>4</sup> and a related committee was installed.

### **The Ministry for Education, Higher Education and Research (MENESR), the Ministry for the Economy, Industry, and Digital Affairs**

At the policy level, two main ministries share the responsibility for research and innovation policy in France. In addition, under the direct authority of the Prime Minister, the highly endowed High Commission for Investments (CGI)<sup>5</sup> plays a complementary structuring role.

The Ministry for Education, Higher Education and Research (MENESR) designs and coordinates research policy. It is assisted by a consultative body: the Strategic Research Council (established on 19 December 2013,). According to the Law on Higher Education and Research (July 2013), the implementation of the National Research Strategy shall smooth the system's evolutions for the years to come (notably thanks to a multi-annual programming). The National Research Strategy was developed by the Ministry on the basis of the contributions of French research stakeholders and the Strategic Research Council. The Council is responsible for proposing the broad national strategy for research, and the Parliament for evaluating its implementation. It is chaired by the

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<sup>4</sup> « [La commission d'évaluation des politiques d'innovation créée au sein du Commissariat général à la stratégie et à la prospective](#) », Press Release, Prime Minister, 4 november 2014.

<sup>5</sup> The High Commission for Investment (CGI) was created with the aim of governing and managing the Investments for the Future Programme. It supervises the activities of executive agencies responsible for the implementation of the programme, in close collaboration with the relevant ministries. CGI also provides expertises in relation with the Investment for the Future, including inventories and independent appraisals.

Prime Minister (or by delegation by the Minister for Research) who guarantees a cross-ministerial coverage.

The Ministry for the Economy, Industry, and Digital Affairs is responsible for industrial research and plays a specific role on the subject of business R&D. Innovation policies are shared by the two ministries.

Finally, research and higher education sectors are the main beneficiaries of the Investments for the Future Programme (PIA) seating with the High Commission for Investments (see infra).

### **The Interministerial Mission on Research and Higher Education (MIREs)**

The fundamental channel for research and innovation funding is the general budget of the Interministerial Mission on Research and Higher Education (MIREs). The MIREs brings together funding from the Ministry for Education, Higher Education and Research (MENESR), the Ministry for the Economy, Industry and Digital Affairs as well as funds from several other ministries (Defence, Culture and Communication, Ecology, Sustainable Development and Energy, and Agriculture, Agrifood and Forestry). The MENESR 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 defining, on an annual basis, the objectives and the means necessary to achieve them. In addition, the MENESR has responsibility for controlling the eligibility of the expenditures exposed by companies in the framework of the R&D tax credit (CIR).

### **Governance evolutions**

Recent modifications in the research and innovation structures and governance (e.g. a modification to the Law on Higher Education and Research adopted on 22 July 2013, aim to improve synergies between the different actors of the R&I system.

In recent years, new groupings were implemented, often public-private, combining knowledge creation and knowledge transfer, university education and training and business activities. Part of the solution sought by the French research and innovation policymakers is emulating the knowledge triangle. On the research and higher education side, this movement is well illustrated by the creation of Higher Education Institutions and University Communities (COMUE), by the law of the 22<sup>nd</sup> July 2013. These groupings, which include one or more universities as well as public research organisations (PROs), shall be better equipped to develop efficient strategies; they will also simplify greatly contractual relationships with central government in reducing the number of contracts to 30 (compared to a hundred beforehand). The same rationale prompted the creation of competitiveness clusters (as of 2013, there are 71 of them). Since 2010, a number of schemes have been created with the same aim, many of them under the responsibility of the High Commission for Investments. Autonomous collaboration between research, higher education and innovation organisations gave birth to new long lasting project-like structures such as: Excellence Initiative (Idex), Excellence Equipments (Equipex), Excellence Laboratories (Labex), University Hospital Institutes (IHU) dedicated to health research, Institutes of Technological Research (IRT), Energy Transition Institutes (ITE) to quote some.

Pure coordination bodies (umbrella organisations) were also created such as the five research Alliances (2010)<sup>5</sup>, covering large scientific domains (environment research, energy research, digital research, health and well-being research, social sciences and humanities). In 2013 they were solicited (together with CNRS) for a new mission: to participate in the design and prioritisation of national research and innovation grand challenges so as to assist in the elaboration and implementation of the new National Research Strategy<sup>6</sup>.

## Research agencies

At operation level, the French research and innovation system is structured around a number of agencies. The vast majority of public financing of research (and of higher education) originates from a single interministerial budget, the MIREs (Mission interministérielle recherche et enseignement supérieur). It encompasses ten large programmes; half of them are being run by the Ministry for Education, Higher Education and Research, while the budget is implemented through hundreds of "operators", i.e. agencies and RPOs. Concerning research, about 45 operators account for 87% of the credits allocated (see Table below).

**Table 2.** The 45 main research agencies financed by national research budget

Higher education and agricultural research (14)
Multidisciplinary scientific and technological research (11) <ul style="list-style-type: none"> <li>• Académie des technologies and Académie des Sciences</li> <li>• ANR - Agence nationale de la recherche</li> <li>• CEA - Commissariat à l'énergie atomique et aux énergies alternatives</li> <li>• CNRS - Centre national de la recherche scientifique</li> <li>• Génopole</li> <li>• IHEST - Institut des Hautes Études pour la Science et la Technologie</li> <li>• INED - Institut national d'études démographiques</li> <li>• INRIA - Institut national de recherche en informatique et en automatique</li> <li>• INSERM - Institut national de la santé et de la recherche médicale</li> <li>• OST - Observatoire des sciences et techniques</li> </ul>
Culture research and scientific literacy (1)
Resources management research (6) <ul style="list-style-type: none"> <li>• BRGM - Bureau de recherches géologiques et minières</li> <li>• CIRAD - Centre de coopération internationale en recherche agronomique pour le développement</li> <li>• IFREMER - Institut français de recherche pour l'exploitation de la mer</li> <li>• INRA - Institut national de la recherche agronomique</li> <li>• IRD - Institut de recherche pour le développement</li> <li>• IRSTEA - Institut national de recherche en sciences et technologies pour l'environnement et l'agriculture</li> </ul>
Sustainable mobility, development and energy research (3) <ul style="list-style-type: none"> <li>• IFP Energies nouvelles</li> <li>• IFSTTAR - Institut français des sciences et technologies des transports, de l'aménagement et des réseaux</li> <li>• IRSN - Institut de radioprotection et de sûreté nucléaire</li> </ul>
Higher education and research related to the economy and industry (9) <ul style="list-style-type: none"> <li>• Ecoles des mines (6)</li> <li>• GENES - Groupement des écoles nationales d'économie et statistique</li> <li>• Institut Mines-Télécom</li> <li>• SUPELEC - Ecole supérieure d'électricité</li> </ul>
Spatial research <ul style="list-style-type: none"> <li>• CNES - Centre national d'études spatiales</li> </ul>

**Source :** Rapport général fait au nom de la commission des finances sur le projet de loi de finances pour 2015, adopté par l'assemblée nationale, Tome III, annexe n° 24 ; recherche et enseignement supérieur. p 72.

Details of some of the most influential agencies are given hereafter.

- **The National Research Agency (ANR)** was created in 2005 to fund research projects on a competitive basis and through public-public and public-private partnerships. According to budgetary sources (Senate, Finance Law 2014), the ANR received a budget of €656m for 2013 (a €80 million reduction as compared with 2012). The ANR covers basic research, applied research, innovation and technology transfer. Originally, it was designed to give a new impulse to the French research and innovation system through: i) the development of new



concepts through exploratory research with the so-called “white programmes” (programmes blancs) which are non-thematic calls, ii) boosting research on economic and social priorities through thematic calls for projects; iii) promoting collaboration between public and private research through collaborative research, and iv) increasing international partnerships. Since 2010, the ANR is also the operating agency of the High Commission for Investments, in relation to the actions of the Investments for the Future Programme in the field of higher education and research. Since 2014, ANR has stopped funding research according to “white programmes” and has added Defence as a 10<sup>th</sup> scientific domain. The new policy is to launch mainly “generic calls for projects” (about 69% of the agencies yearly programme). The latter are designed to implement the Ministry’s programming; which corresponds to the priorities of the National Research Strategy.

- **The Agency for Environment and Energy Management (ADEME)**<sup>6</sup> 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 the responsibility to promote innovation in the field of environment. ADEME’s missions consist in promoting, supervising, coordinating, facilitating and carrying out activities aiming at protecting the environment and improving energy savings.
- **Public research organisations (PROs)** such as the National Centre for Scientific Research (CNRS, €3.3b budget in 2014), also contribute to policy implementation.

In addition to these research agencies, Bpifrance (which replaced OSEO), the public investment bank (as of 31 December 2012), provides support for R&D and innovation projects to businesses, especially SMEs. This national agency has benefited from a €21b endowment in 2013. It is committed to promote and support the industrial development, boost SME growth through innovation and promote technology transfer. A network of regional correspondents and private financing partners complements the public bank organisation.

### **R&I evaluation system**

Various types of evaluations are to be carried out within a national research and innovation system. Beyond evaluation of individual researcher, evaluation may examine research units or a whole PRO, research programmes, schemes or policies. The first two types have impacts (on the researchers’ careers and on the research units means), while impacts of the latter have long been described as complex and without visible impacts. The following paragraphs illustrate these, through recent reformation waves that have clarified and improved the system.

The High Council for Evaluation of Research and Higher Education (HCERES, which replaces AERES) carries out regular assessments of institutions, research units and courses and trainings delivered by HEIs. Evaluation mechanisms are also internalised within large research performing organisations.

The Parliamentary Office for Evaluation of Scientific and Technological Choices (OPECST) is to provide a biennial evaluation of the implementation and effectiveness of the National Research Strategy (including public aid to private research). As such, it will regularly contribute to assessing the implementation of the National Strategy (Law of 22 July 2013). The National Research Strategy is to include multi-annual programming (4 years).

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<sup>6</sup> With a budget of €0.7b, ADEME also funds environment and energy related research and innovation projects, for a share of this budget. Its funding originates in the Ministry of Environment, Energy and the Sea. As such, it does not depend upon the MIRE budget, reason why it is not in the table above. In addition, it manages €2.6b on behalf of the Investments for the Future Plan.

The National Commission for the Evaluation of Innovation Policies (set up in June 2014), sitting with France Strategy, is responsible for evaluating innovation policies (including the impact of R&D tax credit). The national Court of Auditors publishes regular reports covering most of the research and innovation policies, which will prove complementary to those of the National Commission for the Evaluation of Innovation Policies. A member of the Court participates in the Commission.

### **1.2.3 Research performers**

In France, as in the majority of OECD countries, over 60% of the R&D is carried out by companies (65% in France in 2013). According to the latest Eurostat data, BERD amounted to €25.77b in 2012 (€24.83b in 2011), 2.9% of which went to public research performers (HEIs and government research institutions), i.e. €745m. This figure is low compared with the EU trend -4.7% in 2012. Nonetheless in 2013 the 34 Instituts Carnot obtained €455m of contract research revenues, which are comparable with that of the Fraunhofer Gesellschaft.

The ASRC (Association des structures de recherche sous contrats / Contract Research Organisations Association) is a representative organisation that gathers a large share of the private research performers<sup>7</sup>. The 40 Private research organisations of ASRC are employers of more than 2,500 Ph.Ds, engineers and technicians. Clients encompass 1,500 start-ups, SMEs, medium-sized companies and large groups. Their total yearly turnover amounts to more than 150m, corresponding to 4,000 R&D contracts. They develop collaboration with public research performers, in as much as 100 contracts per year.

The main public research performers are higher education institutions (HEIs), which comprise a group of about 80 universities (2012-2013) and "Grandes Ecoles"<sup>8</sup>. The latter are a specific trait of the French higher education system; in parallel to universities, Grandes Ecoles are allowed to select their students through a competitive type of recruitment process, whereas universities cannot select students. The new Law on Higher Education and Research encourages university grouping, so there will be probably about 30 larger universities in the coming years. In 2014<sup>9</sup>, HEIs (including CNRS) spent roughly €9.9b on R&D, which amounted to slightly below 21% of GERD. On the other hand, government sector's research represented €6.3b, i.e. circa 13% of GERD. Institutes and research centres in this latter group are of foremost importance to French research. They often collaborate with HEIs in the framework of the 'institutions and university groupings' (also dubbed COMUE, see the Figure below). The National Centre for Scientific Research (CNRS) had a budget of €3.3b in 2014, while the budget for civilian research of the Alternative Energies and Atomic Energy Commission (CEA) amounted to €2.6b in 2014. Other large PROs include the National Institute for Agricultural Research (INRA), the National Institute for Computer Science and Automation (INRIA), and the National Institute for Health and Medical Research (INSERM).

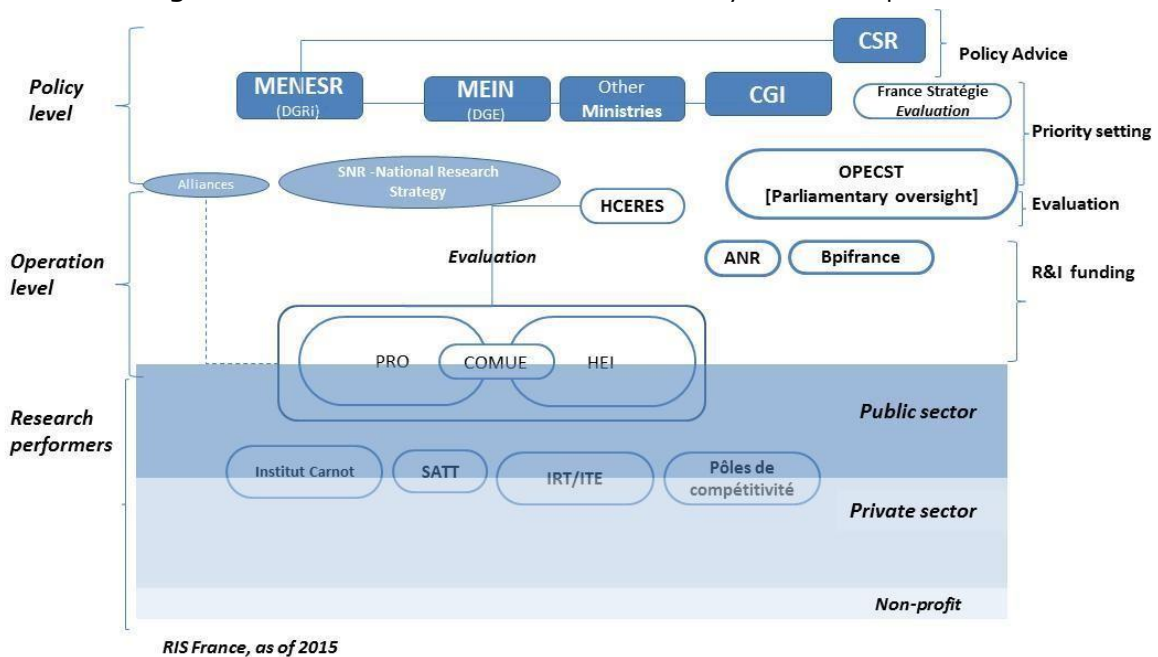
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<sup>7</sup> see [Association des Structures de Recherche sous Contrat – ASRC](#); contains the data herein provided.

<sup>8</sup> According to their Association, there are 221 Grandes Ecoles in France in 2016.

<sup>9</sup> Eurostat, 2015.

**Figure 1.** The French research and innovation system: a simplified view



**Acronyms used in the chart above**

**ANR:** Agence nationale de la recherche / National Research Agency

**Bpifrance:** Public Investment Bank

**CGI:** Commissariat général à l’investissement / General Commission for Investments

**CSR:** Conseil stratégique de la recherche / Strategic Research Council

**COMUE:** Communauté d’universités et d’établissements / Higher Education and Research Institutions and University Clusters |

**DGE:** Direction générale des entreprises au MEIN / Directorate-General for Entreprises at Ministry of the Economy, Industry and Digital Sector

**DGRI:** Direction générale de la recherche et de l’innovation (au MENESR) / Directorate-General for Research and Innovation (within the MENESR)

**HCERES:** Haut Conseil de l’évaluation de la recherche et de l’enseignement supérieur / High Council for Evaluation of Research and Higher Education

**HEI:** Higher Education Institution

**Instituts Carnot:** Research network of 34 institutes dedicated to fostering enterprise innovation through public-private collaboration

**IRT:** Institut de recherche technologique / Technology Research Institute (Investments for the Future Programme)

**ITE:** Institut pour la transition énergétique / Energy Transition Institute (Investments for the Future Programme)

**MEIN:** Ministère de l’Economie, de l’Industrie et du Numérique / Ministry for the Economy, Industry and Digital Affairs

**MENESR:** Ministère de l’Education nationale, de l’Enseignement supérieur et de la Recherche / Ministry of Education, Higher Education and Research

**OPECST:** Office parlementaire d’évaluation des choix scientifiques et technologiques / Parliamentary Office for the Evaluation of Scientific and Technological Choices

**Pôles de compétitivité:** Competiveness clusters

**PRO:** Public Research Organisation / Organisme public de recherche

**SATT:** Société d'accélération du transfert de technologies / Private company (full public capital) dedicated to boosting technology transfer from universities through intellectual property

**SNR:** Stratégie nationale de recherche / National Research Strategy

**NB :** The 'bottom layer' encompasses Instituts Carnot, SATT, IRT and 'Pôles de compétitivité' ; it forms the policy base from which closer connections between academic research and industries are to be developed. The layer was built up in three stages ; the 71 Clusters – inspired by Porter's approach- were launched in 2005, the 34 Instituts Carnot, in 2006, and the 14 SATTs and 8 IRTs in 2010.

## 2. Recent developments in Research and Innovation Policy and systems

### 2.1 National research strategy

The most significant changes of the research and innovation system are intertwined with the evolution of the legal policy context. The Law of 22 July 2013 mainly deals with public research system changes. The new [National Research Strategy](#) (published in March 2015) contains orientations according to which research performers shall alter their research priorities in order to better meet societal challenges, in the context of the European research policy framework.

The Law on Higher Education and Research of 22 July 2013 contains the provisions as regards the National Research Strategy. It should be noted that a Higher Education strategy (Stratégie Nationale de l'Enseignement Supérieur, [StraNES](#)) was published on 8 September 2015<sup>10</sup>. The latter, entitled, "Fostering a learning society" is meant to complement the former. It contains forty proposals, which correspond to 5 broad orientations: "Building a learning society and strengthening the economy"; "Increasing the European and international components of the higher education system"; "Boosting social mobility and furthering social inclusion; "Designing 21st century higher education"; "Responding to the young people's aspirations". The Ministry for Education, Higher Education and Research (MENESR) was responsible for developing both; and so will be to implement them.

As stipulated in the Law, the "National Research Strategy is "a National Research Strategy, with a multi-annual programming [...] developed and revised every five years under the coordination of the Minister for Research [...]. This strategy aims to meet the scientific, technological, environmental and societal challenges while maintaining a high level of basic research. It includes the transformation of research results [...] and oversees the development of innovation, technology transfer, capacity and expertise.

Priorities are adopted after consultation with the scientific and academic community, social and economic partners [...] relevant ministries and local authorities, in particular the regions. The Minister for Research ensures consistency of the national strategy with that developed in the framework of the European Union and that sensitive information for strategic competitiveness and national interests are preserved".

Concerning the set of societal challenges that are meant to drive the National Research Strategy, the connection with Horizon 2020 is rather straightforward as the following table illustrates.

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<sup>10</sup> Eventually published on 8<sup>th</sup> September 2015. Link to the English version of the [Synthesis and main proposals](#).

**Table 3** Correspondence table: “France Europe 2020” – “Horizon 2020” grand challenges

#	FRANCE EUROPE 2020	#	HORIZON 2020
1	Reasoned resource management and adaptation to climate change	5	Climate Action, Environment, Resource Efficiency and Raw Materials
2	Clean, Secure and Efficient Energy	3	Secure, Clean and Efficient Energy
3	Stimulating industrial renewal	<b>KETs2</b>	Leadership in Enabling and Industrial Technologies [Key Enabling Technologies (KETs)]
4	Health and wellbeing	1	Health, Demographic Change and Wellbeing
5	Food Safety and the demographic challenge, biotechnologies	2	Food Security, Sustainable Agriculture and Forestry, Marine, Maritime and Inland Water Research and the Bioeconomy
6	Sustainable mobility and urban systems	<b>KETs3</b>	Smart, Green and Integrated Transport
7	Information and communication society	4	Information and communication technologies
8	Innovative, integrating and adaptive societies	<b>KETs1</b>	Europe in a changing world - Inclusive, innovative and reflective societies
9	A spatial ambition for Europe	6	Space
10	Freedom and security in Europe	<b>KETs4</b>	Secure societies – Protecting freedom and security of Europe and its citizens
		7	

**Source:** Alain Quevreur, *Lettre Européenne de l'ANRT*, #258, 2013.

“The National Research Strategy and the conditions for its implementation are subject to a biennial report of the Parliamentary Office for Evaluation of Scientific and Technological Choices [...], which includes an analysis of the effectiveness of public aid to private research. [...] Multi-year contracts with research organisations and higher education institutions, the programme of the National Research Agency and other public research funding contribute to the implementation of the national strategy for research. The Parliamentary Office for Evaluation of Scientific and Technological [...] contributes to the assessment of the implementation of this strategy.”

The national strategies, one for higher education and one for research, are presented by the government to the Parliament every five years, in the form of a White Paper on higher education and research. The preparation of the National Research Strategy is a permanent process, for which a new Council was set up: The Strategic Research Council:

“The Strategic Research Council is responsible for proposing the broad national strategy for research and [...] involved in the evaluation of their implementation. [It] is chaired by the Prime Minister or by delegation by the Minister for Research.”

The Strategic Research Council was established on 19 December 2013, replacing the High Council for Science and Technology (HCST), founded in 2006. The Council includes 264 members, strictly respecting gender equality. The Strategic Research Council meets at least once a year at the initiative of its President, who determines the meeting agenda. Meetings may also be held at the initiative of the Vice-President, including when dealing with a question from the Prime Minister or the Minister for Research.

As regards its designing process, the [National Research Strategy \(SNR\)](#) derives from a foresight exercise managed by the Ministry of Education, and Higher Education and Research and developed by dedicated expert groups, one for each selected societal challenge. Designing the SNR followed a process for which the basic components are presented here: the five research Alliances and the National Centre for Scientific Research (CNRS) submitted their respective strategic roadmaps to the Ministry for Research in July 2013; in addition, a working group composed of the relevant directorates of the Ministry, ANRT and AT conducted a “state-of-the-art” and benchmark

exercise related to existing national R&I agendas and international foresight exercises. Derived from their outputs, ten working groups were established. Each of them was composed of renowned experts from both public and industrial research. The expert groups proposed lists of priorities which were presented in a seminar (April 2014) and, in parallel, posted on the Ministry's website to allow a public consultation process. Priority actions were elaborated, some of which to be funded by the second wave of Investments for the Future Programme.

The March 2015 SNR report sketches an "analysis matrix proposal", aiming at defining a preliminary set of evaluation indicators (cf. pp.213-215). Those indicators were meant to be used both for selecting the strategic priorities and for assessing the strategy's impacts in terms of science, economy and society. In addition to the 'impact criteria' - such as e.g. the basic science advances per domain as a consequence of the programme -, there are 'maturity criteria: consistency of the programme with other existing schemes, from other policy sectors; existence of a scientific critical mass; readiness of the programme (short/ medium/ long term). The report on the National Strategy for Research, presented on December 14, 2015, to the Prime Minister, sets 10 challenges and 5 priority action programs.

## 2.2 R&I policy initiatives

As suggested above, most R&I policy measures implemented during the last three years stem from the orientations given by the Law on Higher Education and Research adopted on 22 July 2013. The following five action-lines are encapsulated in the legal basis.

- **"Site policy" and higher education and research entities clusters.** Clusters of higher education and research clusters (COMUE, Communautés d'universités et d'établissements) consist of a board of directors, an academic council and board members. A single contract per site is to be signed with the Ministry. This shall greatly simplify implementation since there will be 30 contracts instead of a hundred today. This "site contract" includes a "common component" and "the specific features of each institution". Three types of groups are planned: mergers, university communities and associations. As of October 2015, all higher education groupings are embedded in clusters of higher education and research entities.
- **Roles of regions.** The Law transfers both the mission and the budget to develop and disseminate scientific, technical and industrial culture to regions, especially among young audiences<sup>11</sup>. The regions also define "regional plans for higher education, research and innovation, which determine the principles and priorities of their activities"; the regions' initiatives shall fit into "the context of national strategies". In addition, regions shall be associated with the preparation of the multi-year site contracts.
- **University governance.** One of the most remarkable and much debated novelties is the acceptance of "externals" as voters - the list of which may evolve over time - for the election of the president of the university<sup>12</sup>. In addition, an Academic Council is established (chaired, or not, by the president of the university); the latter is the reunion of the Scientific Council and the Board of Studies and University Life, and it is given a decisive role. The Academic Council is responsible for the allocation of resources, the adoption of rules for examinations and rules of evaluation of teaching, laboratory operation or examination of individual issues relating to recruitment, placement and career of teachers and researchers. Board composition is rebalanced in favour of students, technicians and support functions. Gender balance is set for the elections. A board of directors of entities (institutions parts of the whole) complements the university governance.

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<sup>11</sup> See Article 19 of the Law of 22 July 2013.

<sup>12</sup> See [Article 47 of the Law of 22 July 2013](#) ; among the external administrators, there is at least one company CEO, and a representative of a 500 employees company.

- **High Council for Evaluation of Research and Higher Education.** The French Evaluation Agency for Research and Higher Education (AERES) has been replaced by a High Council for Evaluation of Research and Higher Education, as an independent administrative authority. The High Council is responsible for the evaluation of institutions, research units and courses and trainings delivered by and it "assesses or guarantees the quality of evaluations conducted by other agencies." Regarding staff evaluation, the High Council shall "ensure that it takes into account all of their missions." It is run by a 30 member- board, consisting of 9 staff proposed by the evaluation bodies, 8 proposed by public research institutions, 2 student representatives, 9 qualified persons (3 of whom must come from private research) and 2 Member of Parliament.
- Regarding PhDs, and knowledge and technology transfers.
- **PhDs.** The law requires that the competitions for civil servants "A Class" with a minimum of three years of higher education are adjusted to allow the participation of PhDs and to follow up on this through an annual report to Parliament. A new possibility is also given to PhD holders to access the National School of Administration (ENA or Ecole Nationale d'Administration, the French highest graduate school for public administration) provided that they have at least three years of professional experience. PhD holders are also allowed to access ENA internal competition provided that their PhD was funded through a "doctoral contract". In the private sector, negotiations for the recognition of the PhD in sectorial agreements should be completed by 1 January 2016.

Year 2015 was quite busy on the topic from a policy viewpoint. An extended public consultation was carried out on behalf of the MENESR so as to revamp the legal basis concerning "doctoral training" (content, modalities and organisation). A decree is to be published in the coming months. Among other reasons for postponing it, a complementary decree on the "doctoral contract" is planned to be published at the same time.

The National Strategy for Higher Education (StraNES) recommends to increase the number of PhDs up to 20,000 in 2020 (to be compared to circa 12,000 in 2014-2015). A suggested way to reach this level, in spite of the current declining curve, is to make the obtaining of the R&D tax credit conditional to the recruitment of a PhD.

- **Knowledge transfer.** The transfer of research results to the service of society is added to the mission of higher education and public research. A new book on transfer activities has complemented the Code of Research<sup>13</sup>, within a year after the publication of the Law. The law provides that inventions resulting from publicly-funded research should preferably be commercialised through SMEs and ETIs on European territory. This addition to the Code of Research (Book 5) specifies all legal provisions on the use of research results and on technology transfer in the business sector, and to associations and foundations of public benefit: incentives, cooperation structures, and the participation of research staff in the creation of businesses and in existing businesses and the protection of intellectual property.

In addition to these changes that affected higher education and research entities, a number of innovation policy initiatives have occurred over the last three to four years, which may be cited here. A large part of those initiatives were suggested in the [National Pact for Growth, Competitiveness and Employment](#) (November 2012). The [tax credit for employment and competitiveness \(CICE\)](#) is to be mentioned; innovation expenses are an essential part of the eligible scope<sup>14</sup>. Implemented as of January 2013, it amounted to

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<sup>13</sup> See « [Livres v : la valorisation des résultats de la recherche et le transfert de technologie en direction du monde économique et des associations et fondations, reconnues d'utilité publique](#) », Code de la Recherche.

<sup>14</sup> « As the CICE is intended to finance improvements in the competitiveness of businesses through investment, research, innovation, training, recruitment, exploration of new markets, and the recovery of working capital, firms' financial statements must reflect the fact that the tax credit has been used in pursuit of these goals. Firms may not use the CICE



€12b in 2013, and to €18b in 2014; €20b are foreseen in 2015. Other key measures include the creation of a national public investment bank Bpifrance (as the merger of pre-existing structures, namely OSEO, CDC Entreprises, the Strategic Investment Funds and the Region FSI), the [shift of the competitiveness clusters policy](#) (pôles de compétitivité) towards the objective of delivering new products and services (vs. new R&D projects). "[34 Plans for Industrial Reconquest](#)" were launched by the Minister for Industry on 7 October 2013; it is a by-product of the "Filières strategy" implemented by the National Industry Council. The "34 plans" partially rely on the Investments for the Future's budget. They were gathered into 10 solutions in May 2015.

The French R&I system continues its transformation, started ten years ago. Research institutions' staff and governance bodies at large get increasingly accustomed with the idea of participating in a system that has to be effective because society demands it. A consensus is emerging on two specific issues where there is room for improvement (see 2.2.1. below): autonomy of the various components of the R&I system; evaluation institutions and processes. As the framework conditions of R&I are being modified, prevailing equilibria are necessarily being changed: clustering of universities and research entities, excellence policy (e.g. Idex) in the framework of the Investments for the future programme, volume and impacts of research project funding, etc. Policy efforts are being made to pursue coherence.

### **Evaluations, consultations, foresight exercises**

In July 2012, the French government launched the so-called "Assises" (conference) on Higher Education and Research. The Assises resulted in a report which was eventually used as a basic input for the Law enacted on 22 July 2013. The consultation process involved a wide range of stakeholders. Major French HEIs and PROs contributed to it. Over that consultation period representatives of 106 institutions were auditioned by the National Steering Committee; regional round tables were organised to debate the propositions; more than 3,000 organisations and individuals contributed on the website; finally, on 26 and 27 November, the concluding national round table gathered over 600 people, who debated the propositions that emerged from the regional "round tables". The Law on Higher Education and Research was built on these proposals.

In the purpose of modernizing the national framework for higher education and research, an evaluation was carried out between November 2012 and april 2013 by a commission chaired by Jean-Luc Beylat (CEO of Alcatel Lucent Bell Labs France) and Pierre Tambourin (CEO of the Genopole). The assessment aimed to identify options for optimising the French technology transfer and innovation system, which was reported to "look like an incoherent millefeuille"<sup>15</sup>. On the beginning of April 2013, the report was submitted to three ministers, the Minister for Higher Education and Research, the Minister for Economic Regeneration and the Minister with responsibility for SMEs, Innovation and the Digital Economy. Entitled "[Innovation, un enjeu majeur pour la France \(a major challenge for France\)](#)", it proposes an original reflection on the multiplicity of levers of innovation (including taxation, culture of innovation, support structures, etc.). Although the applicability of the recommendations has been disputed<sup>16</sup>, it nonetheless provides solid evidence of the relevance of a systemic approach on national innovation policy implementation issues.

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either to pay out larger dividends or to increase executive pay. » ; see. <http://www.economie.gouv.fr/ma-competitivite/tax-credit-for-encouraging-competitiveness-and-jobs>.

<sup>15</sup> A common expression in the milieu when mentioning the impressive variety of R&D&I support schemes and measures; used by the [Minister for Higher Education and Research in June 2012](#).

<sup>16</sup> Some of the 19 recommendations were deemed often too broad to be implemented. They dealt with cultural dimensions, sometimes considered beyond the Minister's power. For instance, the authors recommended to encourage large companies to be more active in favouring spin-offs –.

On 27 June 2014, the OECD delivered the "[OECD Review of Innovation Policy: France](#)", commissioned by the High Commission for Investments. A complete account of this report is beyond the ambition of this paragraph; it recommends finalising the structural changes partially implemented to promote excellence in research and higher education, to improve research evaluation and to foster synergies between industry and the public sector. It also recommends that universities should be strengthened. On the whole, the OECD review provides a set of about 20 recommendations, grouped according to six major components of the French R&I system (plus a focus the Investment for the Future programme, *per se* a set of implemented recommendations). The latter are also the system's key challenges. A selection is hereafter proposed:

- **Human resources:** excellence in university teaching linked to research would usefully be further encouraged, while those universities which are not usually involved in international-level research need also be pushed forward to develop their own assets (scientific or economic)
- **Public research:** furthering both "site policy" and project funding of public research, based upon systematic and periodic evaluations (including of researchers);
- **Knowledge transfer:** knowledge transfer indicators would be part of the researcher career track, so as to encourage them to go beyond science impact factors; incentives should also be implemented to improve professionalism within KT offices staff, who need to be able to properly respond to market signals;
- **Companies' RDI:** make the R&D tax credit less generous, especially for large companies, and diminish the corporate tax rate accordingly; develop a services-oriented innovation policy, focusing of France's assets such as tourism and agro-industries.
- **Entrepreneurship:** based on an analysis of the conditions for start-ups development in the US – notably the Small Business Innovation Research and the functioning of the venture capital market-, periodically review the funding allocated to young companies so as to maximise their chances of success;
- **Governance:** the Strategic Council for Research should be given a genuine functional independence vis-à-vis the research institutions (notably the PROs); independence should also be further developed for evaluations, in particular as far as the High Council for Evaluation of Research and Higher Education (HCERES) is concerned; evaluation should be made more effective in directly influencing the evaluated entities.

The day when the OECD report was submitted, the National Commission for the evaluation of innovation policies (see above) was officially set up. This new body aims at:

- o Evaluating the various components of innovation policies in terms of economic impact (growth, employment, etc.)
- o Analysing their coherence
- o Making proposals to enhance their effectiveness
- o Raising awareness on best practices, at regional, national and international levels, in the areas of innovation policies

The commission comprises twenty members: economists (foreign and national), experts from government and local authorities, as well as innovation practitioners from highly innovative companies, or from transfer and research-industry offices, and financiers of innovation.

Two additional foresight-based recent policy documents are worth mentioning: "34 Plans for Industrial Reconquest"<sup>17</sup> and "A principle and 7 ambitions for innovation".

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<sup>17</sup> Also known as « the new face of industry » (la nouvelle France industrielle); the first version can be found [here](#) (in English)

Presented on 12 September 2013 by President Hollande, the 34 sector-based initiatives were chosen after a thorough analysis of global growth markets and a detailed examination of the role of France in each of these world markets. The preparation was supported by McKinsey in connection with the *pôles de compétitivité* and strategic committee sectors (*comités de filières*) within which companies, social partners, governments and professional associations are active. Each plan is to be run like an industrial project, with a project leader coming from the industry (in 80% of the instances) with a direct interest in the commercial success of the endeavour. The “industrial plans” deal for instance with smart grids, the 2-liter-per-100km car or biofuels and green chemistry. According to President Hollande, the plans will provide “new ways to move around, new ways to heal us, to carry us, new ways of producing, of consuming, to feed us, to dress us...”. Whereas the overall budget cannot be fixed beforehand, and is still not known in April 2015, the estimate of the Ministry for the Industry was €4b, when cumulating inputs from various sources, including the Investments for the Future Programme. In September 2014, the plans roadmaps were presented to President Hollande. Even though a few prototypes can be displayed, implementations along validated action lines are still expected. Detailed funding of each plan remains to be made by participants. And this is but one obstacle (the allocated €4b of Investments for the Future Programme should help), since hurdles are also legal when it comes to electric planes, drones, autonomous cars, industrial wastes recycling, etc.

The policy report “A principle and 7 ambitions for innovation” results from the Innovation 2030 Committee, chaired by Anne Lauvergeon (former president of Areva). The Committee was installed by President Hollande on 19 April 2013. The Committee was to identify sectors and technologies in which France is likely to occupy leadership positions in 2030, focusing on the activities that meet the future needs of society, create the greatest value and more jobs in France. Published on 11 October 2013, the report suggests seven “disruptive ambitions”: storage of energy, recycling of materials, exploitation of marine resources (metals and desalination of sea water), vegetable proteins and plant chemistry, individualised medicine, silver economy and innovation for longevity, and big data. The proposal is also disruptive in its form since it includes an appeal to foreign investors through seven international open competitions. The latter was launched on 2 December 2013. Project leaders had three months to file a case. The winners –a few dozens– have had a year to mature their project, supported by a grant of €200,000. In 2015, the most promising projects, eventually selected, started. Welcoming foreign holders of projects, provided that they invest in France, is quite a break in France’s usual practices. On the whole, public funding will amount to €300 million, coming from Investments for the Future Programmes 1 (started in 2010) and 2 (as of 2014), in similar proportions.

## **2.3 European semester 2014 and 2015**

### **The main R&I related measures included in NRP 2015 and 2014**

Regarding R&I actions, the French Reform Programmes for 2013 and 2014 reveal a remarkable consistency, illustrated by the 2014 report. The European target of 3% of GDP invested in R&D is a systemic performance indicator, the achievement of which implies the improvement of national behaviours in many sub-domains. The European R&I strategy is so relevant for the French system that the correspondence of the French research agenda and of the France Europe 2020 matches perfectly that of the Horizon 2020 grand challenges. The government has been committed over the last years to comply with Europe 2020’s objectives. Given the lack of budget flexibility, the government developed new tools such as the Investments for the Future Programme 1 and 2 and the tax credit for employment and competitiveness (CICE). These efforts confirm the French commitment to the European knowledge economy.

In [National Reform Programme \(NRP\) 2015](#), 'Investing and supporting innovation' is dealt with as a specific chapter. The Government's main lines of actions were the following:

- Promoting the financing of SMEs. Thanks to the stability of the French financial system and to the creation of Bpifrance. In 2014, more than 15,000 SMEs and about 1,600 mid-tier companies benefited from innovation loans, from Bpifrance only. Those innovation aids and loans amounted to €12.5b.
- Creating an ecosystem favourable to innovation. The "Poles de Compétitivité" (French competitiveness clusters policy) allowed their SMEs and mid-tiers members to invest more in R&D than non-members, with higher economic impacts.
- Encouraging the funding of innovation. Many schemes are implemented, including the research tax credit and the innovation tax credit (dedicated to SMEs) and the exemptions granted to young innovative companies. The main one remains the Investments for the future programme, amounting to €47 billion for the first two tranches only. A third tranche -of an additional €10b- was announced by the President of the Republic, starting in 2017. After preparatory work, PIA 3 will start, with the same high level policy priorities: innovation and digitalization, modernization of industry, energy and ecological transition, research and training. A stronger connexion is to be sought with the Juncker Plan.
- Organising the 'filières' (i.e. approximately 'value chains') of the future. A new phase of the "The new face of industry" policy, dubbed 'Rallying the new face of industry', was to be launched<sup>18</sup> to accelerate deployment of the Industry of the Future and the nine industrial solutions in France and internationally.

Leveraging the Juncker plan to extend the efforts at national level and amplify the impact on the economy. As its first projects were to be funded during the second half of 2015, the French government has committed to provide € 8 billion in co- financing via Bpifrance and the Caisse des Dépôts. This effort was meant to strengthen the impacts of the European plan, in the priority domains of ecological and digital transitions

### **Policy developments related to Council Country Specific Recommendations**

The [2013](#) and [2014 Council recommendations](#) on France and the [National Reform Programmes](#) and [Stability programme for 2013-2017](#) emphasised a key objective that can be associated with an increase of the performance of the French research and innovation system: the improvement of non-price competitiveness (though cost-competitiveness is not excluded).

As put forward in the 2013 CSR, "[as] regards non-price competitiveness, while the government has recently renewed its export strategy, supporting the development of export-oriented networks and partnerships would promote the internationalisation of SMEs. More generally, measures could be taken to ensure that the business environment is conducive to SMEs' growth. Despite considerable efforts deployed by firms in R&D-intensive sectors and sizeable government support (e.g. the R&D tax credit), high- and medium-high-tech sectors represent only a modest and declining share of the French economy. Hence, there is a need to foster the creation and growth of SMEs and mid-tier companies (ETI) in these sectors by improving the framework conditions that encourage innovation and entrepreneurship. The cluster policy that has been developed to link public research and private companies might also be further geared towards commercial exploitation of R&D&I, positive externalities between private companies located closely to one another and internationalisation of SMEs. In addition, PhD studies and research

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<sup>18</sup> As announced by the Ministry of Economy and the Digital sector, on 18 May 2015, see [here](#).

experience should be made sufficiently attractive to further foster linkages between private companies and research institutions.”

Improvements of the framework conditions for innovation are therefore at stake. Many measures were taken within this area of progress from 2012 up till 2014 a number of which will continue to deliver results beyond 2014. Many are consequences of the implementation of the National Pact for Growth, Competitiveness and Employment (November 2012). To mention some of them:

- The tax credit for employment and competitiveness (CICE) is in place since January 2013, and amounted to €10b in 2013, €15b in 2014 and €20b in 2015.
- The creation of a national public investment bank in 2012, Bpifrance, with an endowment of €21b devoted to the improvement of access to finance, in terms of capital risk and capital development (including exports) for SMEs and mid-tier companies.
- The shift of the competitiveness clusters policy, whereby the pôles de compétitivité should become “factories of future products and services” (vs. factories of new projects), as described by the Communication of the Council of Ministers on 9 January 2013. Although impacts are not visible yet, this shift is expected to further promote the economic impact of innovation. The clusters shall also contribute to the strengthening of the relations between SMEs and large groups, paying particular attention to the area of procurement. Efforts and progress will be more carefully monitored for the next six years, with a “contract of individual performance” for each Pole.
- “34 Plans for Industrial Reconquest” (also known as ‘The new face of industry in France’) were launched by the Minister for Industry, on 7 October 2013, partially relying on the Investments for the Future budget, and as a by-product of the “Filières strategy” of the National Industry Council. The 34 sector-based initiatives were gathered into 10 solutions in the phase 2 of ‘The new face of industry in France’.
- R&D tax credit (CIR): As noted by [OECD \(2014\)](#) and by the [National Court of Auditors \(2013; pp. 34 – 35\)](#), thanks to the R&D tax credit, average R&D labour costs in France become lower than most in Europe and equal to world average, thus maintaining attractiveness for R&D activities. In line with country specific recommendations, the official and comprehensive ex-post assessment of its effectiveness on R&D, taking into account the latest reforms, was published by the Ministry in July 2014<sup>19</sup>. To quote but a few evidence provided by the evaluation<sup>20</sup>:
  - Based on econometric impact studies, there is “additionality”: 1 euro of public support triggers more than 1 additional euro of business R&D expenditures.
  - The report observed that R&D tasks outsourced to public research institutions rose sharply: the doubling of the rate of R&D tax credit for expenses assigned to public laboratories may have enabled SMEs to outsource (6 times) more R&D to public research labs.
  - In spite of deindustrialisation, the intensity of private R&D has increased since 2008, reaching a peak in 2012; as put forth in the report: “If R&D intensity would have remained constant since 2001, the structural effect of de-industrialisation would have resulted in a decline of business R&D expenditures to €18b in 2011 while observed R&D expenditures in 2011 amounted to €29b. This gap of €11b is more than twice the amount of the 2011 R&D tax credit (i.e. €5.2b). From 2008 on, increased R&D in economic sectors became strong enough to cause an adjustment of the intensity of R&D at the macro level, reaching 1.48% in 2012.” (cf. p. 47)

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<sup>19</sup> For the series of documents, see: <http://www.enseignementsup-recherche.gouv.fr/cid80816/developpement-et-impact-du-credit-d-impot-recherche-1983-2011.html>

<sup>20</sup> «Développement et impact du crédit d’impôt recherche : 1983-2011 », MENESR, April 2014.

The 2015 « [Evaluation de l'impact du dispositif jeunes docteurs du credit d'impôt recherche](#) » report also showed that reforms of the R&D tax credit have had a positive impact on employment of graduates right after their diploma in business R&D, the extra tax credit for hiring young doctors has had a positive impact after the 2008 reform.

Overall, there are a number of satisfactory effects of the R&D tax credit, with its current design, on the framework conditions for R&D. It strengthens R&D investors by reducing the relative cost of the R&D expenses; it contains provisions that encourage public-private R&D connections. Newcomers are SMEs (including in some service sectors). The overall efficiency of the R&D framework conditions does not lie only within this scheme. The quality of the research and innovation ecosystems matters more.

As the French R&D tax credit represents important volumes of foregone public revenues (i.e. a stable €5.5b per year), it is key for all stakeholders and policymakers to have access to a thorough - evaluation based on recent data. In 2015, [France Stratégie](#) organised a seminar with the presentation of several studies. It concluded that further studies would be necessary to complete the evaluation of the impact of the 2008 reform. A number of authorised institutions<sup>21</sup>, including the OECD (2014), have expressed scepticism not to say critics: *"The CIR tax credit is among the most generous in the world. In itself, the CIR is a good measure – which is one of the reasons most OECD countries, and other countries, have adopted it. It has a positive impact on corporate R&D, although this probably does not match its cost to the State. Cost is, in fact, only one of the determinants of R&D, and lower cost would not entirely remove the other obstacles to R&D growth (i.e. enterprise capacity, demand, industrialisation costs, etc.) Rather, the real impact of the CIR seems to be in helping firms that do R&D to survive better than those that do not. Its generosity is justified largely by a tax environment (corporate tax, etc.) that is difficult and complex for enterprises, but with limited adverse effects on R&D firms"* (p.15).

## 2.4 National and regional R&I strategies on Smart Specialisation

In France, interactions of regional, national and European research and innovation policies follow a series of principles and mechanisms. These include contracts dubbed 'State-Region Plan Contracts' (Contrats de plans Etat-Région – CPER) for 2015-20; the latter organise most relationships, since CPERs set financial credits to meet regional policy objectives. One chapter of these contracts is dedicated to higher education, research and innovation; another is dedicated to innovation and the economy.

Smart specialisation has become an important concept in French innovation regional policy. In 2013, regional stakeholders ordinarily cite smart specialisation strategies (S3) as a guiding principle for their innovation strategic plans. The need to formulate regional projects for European regional funding in the framework of a smart specialisation strategy represents a strong incentive to develop such a strategy.

National public policies have also contributed to the wide spreading of smart specialisation. In the first place, the Interministerial Commissariat général à l'égalité des territoires (CGET) has developed public measures for supporting regions in their transition from former regional innovation strategies (SRI) towards smart specialisation strategies. DATAR issued in November 2012 a call for proposals to elaborate a didactic and methodological guide on smart specialisation for preparing future operational programmes 2014-2020 in the framework of a strategy of smart specialisation. This guide<sup>22</sup> is designed for:

- Introducing the concept of "smart specialisation",

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<sup>21</sup> Cf. notably the collection of [papers](#) presented at the meeting on the topic organised by France Stratégie on 27 May 2015,

<sup>22</sup> [Guide pour la préparation des stratégies de spécialisation intelligente des régions françaises](#), DATAR, November 2012.

- Clarifying the function assigned to the "S3" in the implementation of the future European policies and the strengthening of their synergies,
- Presenting the logic of "smart specialisation" in the vision of the next generation of policy cohesion and future operational programme,
- Identifying the evolution from regional innovation strategies to smart specialisation-based innovations strategies,
- Providing step-by-step methodological elements for developing S3.

Above all, national policies have already laid bases that will foster smart specialisation. The regional innovation strategies elaborated by all French regions in 2008-2009 provide a sound stepping stone for smart specialisation. As the box below illustrates, French regions are now focusing on some of sub-fields of these areas.

**Table 4.** Positioning of French regions according to the thematic areas identified in the RIS (updated as of October 2015)

<b>Thematic areas</b>	<b>Regions</b>
<b>Preservation of the environment, Management of resources, Biodiversity, Risk prevention</b>	<i>Alsace, Aquitaine, Auvergne, Bretagne, Centre, Guadeloupe, Guyane, Languedoc-Roussillon, Lorraine, Martinique, Mayotte, Provence-Alpes-Côte-d'Azur, La Réunion</i>
<b>Aeronautics and Space</b>	<i>Aquitaine, Haute-Normandie, Guyane, Midi-Pyrénées</i>
<b>Construction Industry</b>	<i>Alsace, Aquitaine, Auvergne, Bourgogne, Centre, Île-de-France, Languedoc-Roussillon, Limousin, Nord-Pas-de-Calais, Picardie, Poitou-Charentes, Rhône-Alpes, Martinique, Guadeloupe, Guyane</i>
<b>Factory of the future</b>	<i>Aquitaine, Bretagne, Haute-Normandie, Pays de la Loire, Nord-Pas-de-Calais, Lorraine, Rhône-Alpes</i>
<b>Mobility, Transport</b>	<i>Alsace, Aquitaine, Bourgogne, Bretagne, Franche-Comté, Haute-Normandie, Île-de-France, Languedoc-Roussillon, Nord-Pas-de-Calais, Pays-de-la-Loire, Picardie, Poitou-Charentes, Provence-</i>
<b>Innovation through services, Engineering, Social Sciences and Humanities</b>	<i>Bretagne, Picardie, Nord-Pas-de-Calais</i>
<b>Health Care</b>	<i>Alsace, Aquitaine, Auvergne, Basse-Normandie, Bourgogne, Bretagne, Centre, Champagne-Ardenne, Haute-Normandie, Île-de-France, Languedoc-Roussillon, Limousin, Lorraine, Midi-Pyrénées, Nord-Pas-de-Calais, Pays de la Loire, Picardie, Poitou-Charentes, Provence-Alpes-Côte d'Azur, Rhône-Alpes, Guadeloupe, Guyane, La Réunion, Martinique, Mayotte</i>
<b>Tourism</b>	<i>Aquitaine, Bretagne, Centre, Corse, Guadeloupe, Réunion, Provence-Alpes-Côte-D'azur, Rhône-Alpes, Mayotte, Guyane,</i>
<b>Energy</b>	<i>Alsace, Aquitaine, Basse-Normandie, Bretagne, Centre, Champagne-Ardenne, Corse, Franche-Comté, Haute-Normandie, Île-de-France, Languedoc-Roussillon, Limousin, Lorraine, Midi-Pyrénées, Nord-Pas-de-Calais, Pays de la Loire, Picardie, Poitou-Charentes, Provence-Alpes-Côte d'Azur, Rhône-Alpes, Guadeloupe,</i>
<b>Materials, Mechanics, Chemistry</b>	<i>Aquitaine, Basse-Normandie, Bourgogne, Bretagne, Champagne-Ardenne, Franche-Comté, Haute-Normandie, Limousin, Lorraine, Midi-Pyrénées, Nord-Pas-de-Calais, Pays de la Loire, Picardie, Poitou-Charentes, Rhône-Alpes, Guyane</i>
<b>Agrofood, Agro-resources, Fishery</b>	<i>Aquitaine, Auvergne, Basse-Normandie, Bourgogne, Bretagne, Champagne-Ardenne, Corse, Franche-Comté, Languedoc-Roussillon, Limousin, Midi-Pyrénées, Nord-Pas-de-Calais, Pays de la Loire, Picardie, Poitou-Charentes</i>
<b>ICT, Informatics, Digital, Complex Software, Electronics</b>	<i>Aquitaine, Auvergne, Basse-Normandie, Bretagne, Franche-Comté, Haute-Normandie, Île-de-France, Languedoc-Roussillon, Limousin, Midi-Pyrénées, Nord-Pas-de-Calais, Pays de la Loire, Picardie, Poitou-Charentes, Provence-Alpes-Côte d'Azur, Rhône-Alpes, La Réunion, Martinique</i>
<b>Creative industries</b>	<i>Bretagne, Corse, Île-de-France, Limousin, Nord-Pas-de-Calais, Pays-de-la-Loire, Poitou-Charentes, Provence-Alpes-Côte d'Azur, Rhône-Alpes, Guadeloupe</i>

**Source :** [Synthèse des stratégies régionales de l'innovation en vue de la spécialisation intelligente des régions françaises, Commissariat général à l'égalité des territoires](#), 6 August 2015.



In September 2013, Ile-de-France published a first version of its regional innovation smart specialisation strategy, entitled "[Designing the regional version of the S3 to implement the Paris OP 2014-2020](#)". On 4 October 2013, [Rhône-Alpes presented and published its regional innovation strategy with regard to smart specialisation](#). The document details the method used to construct this strategy with elements of "diagnosis of the regional innovation ecosystem". The following box summarises some of the main dimensions of the strategy.

**Box 1. Rhône-Alpes' innovation strategy with regard to smart specialisation for period 2014-2020**

Rhône-Alpes hosts 12 clusters and 12 "pôles de compétitivité", recognised as effective or very effective. The region's support amounts to €15m per year, which led to the completion of more than 350 innovative projects. Other key qualities mentioned are a dense economic network with high potential for technological innovation. However, among the weaknesses are cited a disappointing participation in the Seventh Framework Programme, and room for improvement for investments in public and private R&D, which are still below Lisbon targets. Finally, Rhône-Alpes is the third French region for R&D expenditures (12% of national spending) and ninth in Europe; with regard to patenting activity, the region is the second largest in France and ranks tenth in Europe.

The Rhône-Alpes strategy was built upon the regional innovation ecosystem diagnosis. It was notably carried out through six benchmarks, including three in situ (Baden-Württemberg, Helsinki and Stockholm). As regards consultation and involvement of stakeholders, there have been more than 400 participants, including 20% of companies. 70 written responses were incorporated to the first version of the regional strategy established in July, before sending the final draft to the European Commission in September.

*Areas of smart specialisation*

Region Rhône-Alpes has chosen seven areas of smart specialisation where it has industrial and scientific critical mass and visibility at European level. They will be regional investment priorities until 2020. Moreover, all public support combined, 1 billion euros will be spent in total over the six years to develop the innovation strategy of Rhône-Alpes. When selecting the projects to be supported, the region will check that all stakeholders (universities and research centres, businesses, governments and consumers) are involved. The seven areas of strategic innovation are:

- Personalised medicine, infectious and chronic diseases
- Industrial and eco-efficient factory processes
- Networks and storage of energy
- Intelligent energy-efficient buildings
- Uses of technology and intelligent mobility systems
- Digital and caring systems technologies
- Sports, tourism and development of mountain

**Source:** Selected excerpts from « Stratégie d'innovation de la Région Rhône-Alpes au regard de la "Spécialisation Intelligente ". Innover pour répondre aujourd'hui et demain aux besoins des Rhônalpins », September 2013.

Some of the other regional innovation strategies with regard to smart specialisation were published in 2014 and 2015. None of the contractual documents related to regional commitment to S3 is meant to be published in any way. Some regions may publish some of the preparatory material or the final contractual version. Therefore, collecting relevant and systematic evidence on the content of S3 remains a challenge. In the two examples mentioned here, financial requirements for structural co-funding are dealt with. Measures to stimulate private investment are part of the strategy. Infrastructures are generally considered as key, at regional level at least.

The CGET's latest "Synthèse des stratégies régionales de l'innovation en vue de la spécialisation intelligente des régions françaises », 2015 concludes (pp. 70-71):

« Defining a strategy is only the first stage of the smart specialisation process which will extend to the entire 2014-2020 contracting period. The RIS3 will now give rise to action plans and will be implemented, monitored, assessed, adjusted, notably according to the development of the economic fabric and regional innovation ecosystem. Smart specialisation areas may therefore be altered.

The definition and smooth implementation of action plans consistent with the strategic ambitions identified in the RIS3 is a crucial stage to ensure that the objectives determined by the territories are achieved. Ensuring that the needs of the territory and the diagnosis performed match the definition and subsequent implementation of the action plan is a key requirement for satisfying the expectations of the regional innovation ecosystems. This matching process is all the more important as it will be carried out in consecutive stages, potentially by different stakeholders and structures.

*The implementation of a high-performance monitoring and assessment system is a key stage in the deployment of the strategies (...).*

### 3. Public and private funding of R&I and expenditure

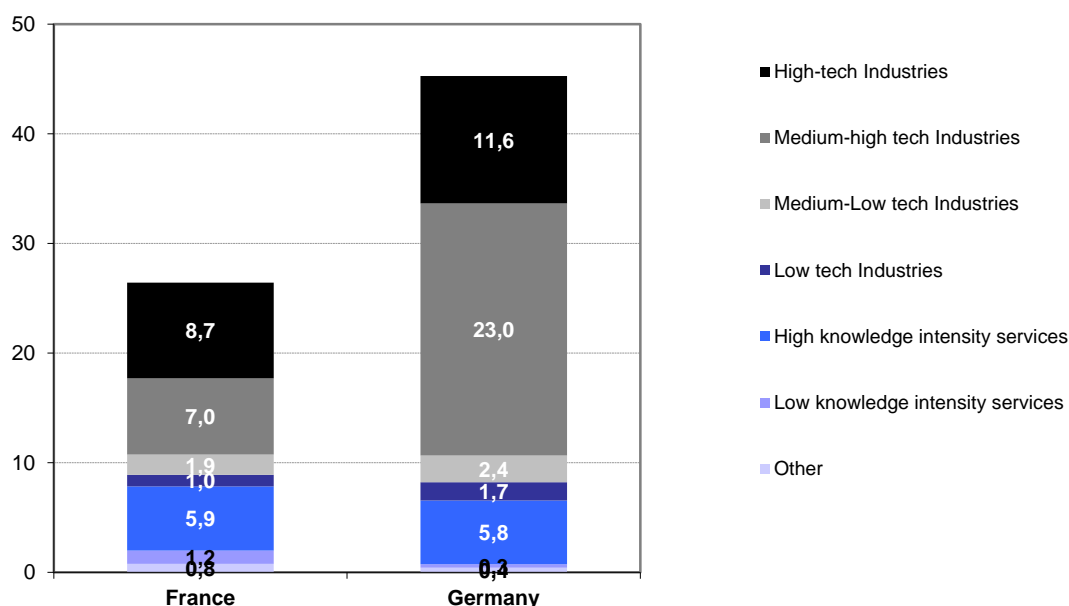
#### 3.1 Introduction

In 2014, French GERD amounted to €48.1b, i.e. 2.26% of GDP. Slightly less than two-third (65%) of which correspond to business R&D (€ 31.2 billion). GERD has been increasing, though quite slowly, both in volume and in relative terms (GDP), at least from 2010. Nonetheless, 2.26% of GDP spent on R&D in 2014, is below the 3% target set by the EU in the framework of the Europe 2020 strategy. In EU 28, France is ranked 8<sup>th</sup> whereas Germany with 2,84% is at rank 5, and closer to the objective.

French GBAORD continues its decrease started in 2009 (it amounted to €17.5b back then), and reached 14.8b in 2014. But this amount is the second largest, though far from the German level of public outlays (€ 25.7b, in 2014). For the sake of the comparison, when measured by the share per inhabitant, France would be at the 11<sup>th</sup> rank.

Business R&D expenditures, although representing two-thirds of the share of GDP, are stable at 41% below the objective of 2%. As this is partially explained by the country's lowest and declining weight of the industry in the GDP<sup>23</sup>: the bulk of R & D is carried out in the industry, which in Germany occupies a more important place in the economy than in France

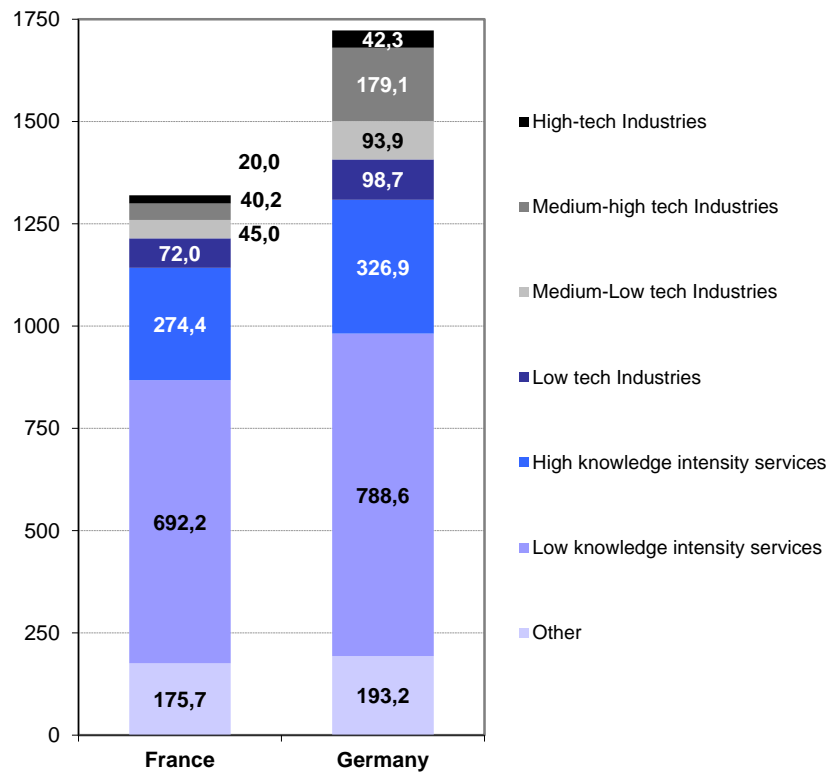
**Figure 2.** BERD, France vs Germany (2009), € billion



**Source :** « [Un déficit d'effort de recherche des entreprises françaises ? Comparaison France – Allemagne](#) », Note d'information 12.09, [July, MESR \(2012\)](#).

<sup>23</sup> « [Un déficit d'effort de recherche des entreprises françaises ? Comparaison France – Allemagne](#) », Note d'information 12.09, [July, MESR \(2012\)](#).

**Figure 3.** Added value, France vs Germany (2009), € billion



**Source :** « [Un déficit d'effort de recherche des entreprises françaises ? Comparaison France – Allemagne](#) », Note d'information 12.09, [July, MESR \(2012\)](#).

**Table 5.** Basic indicators for R&D investments (as of December 2015)

<b>Indicator</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>EU average (2015)**</b>
GERD (as % of GDP)	2.19	2.23	2.23	2.26	N/A	2.03% (EU-28, 2014)
GERD (Euro per capita)	694.3	712.6	724.2	730.7-	N/A	558.4 (EU-28, 2014)
GBAORD (€m)	15 671	14 057	14 038	13 836	N/A	3315.3 (EU-28, 2014)
R&D funded by BES (% of GDP)	1.21	1.23	1.23	N/A	N/A	1.12% (EU-28, 2013)
R&D funded by PNP (% of GDP)	0.02	0.02	0.02	N/A	N/A	0.03% (EU-28, 2013)
R&D funded by government sector (% of GDP)	0.77	0.79	0.79	N/A	N/A	0.66% (EU-28, 2013)
R&D funded by HEI (% of GDP)	0.02	0.03	0.03	N/A	N/A	0.02% (EU-28, 2013)
R&D funded from abroad	0.17	0.17	0.18	N/A	N/A	0.20% (EU-28, 2013)
R&D performed by HEIs (% of GERD)	0.46	0.47	0.47	0.46	N/A	23.2% (EU-28, 2014)
R&D performed by government sector (% of GERD)	0.3	0.29	0.29	0.30	N/A	12.3% (EU-28, 2014)
R&D performed by business sector (% of GERD)	1.4	1.4	1.45	1.46	N/A	64.0% (EU-28, 2014)

**Source:** December 2015 EUROSTAT data

### 3.2 Smart fiscal consolidation

As pointed out in the Council Recommendation of 14 July 2015 (OJEU, 18 August 2015), France is currently “in the corrective arm of the Stability and Growth Pact”. Its 2015 Stability Programme therefore aims at correcting the excessive deficit by 2017 so that a structural deficit of 0.4 % of GDP could be reached by 2018. As a consequence, the Stability Programme 2015-2018 submitted by Agence France Trésor in April 2015 was entitled “A strategy for fiscal consolidation”. As regards the ‘smartness’ in terms of R&I funding, the Stability programme specifies four tax policies focuses, the promotion of “investment, entrepreneurship and innovation” being one of them. It further emphasises that innovative new companies that qualify as innovative start-ups (JEIs) do benefit from a full exemption from corporate income tax in their first three years and a 50% allowance for the next two years’ earnings. This makes the JEI scheme “the most effective innovation tax incentive in the European Union<sup>24</sup>”. At global policy level, R&I and higher education are considered as priorities for the current government; so, in order to keep fiscal consolidation smart while encouraging stakeholders to pursue the Europe 2020 target, tax credits (research; innovation and competitiveness) are the privileged fiscal tools. The R&D tax credit has thus been “ring-fenced”. The subsequent

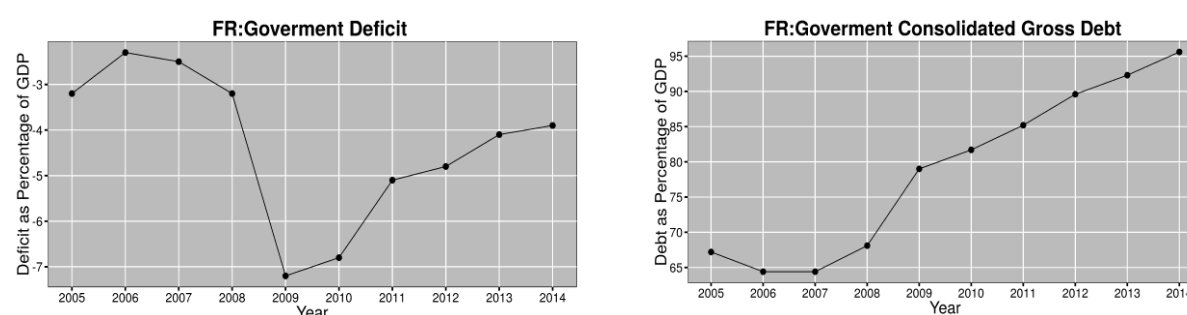
<sup>24</sup> According to “[A Study on R&D Tax Incentives Final report](#)” Working Paper N. 52, EC, 2014

prominent – and exceptional on an international scale – indirect public funding of R&D should be noted though. The long term sustainability of this choice is to be questioned.

### 3.2.1 Macroeconomic context<sup>25</sup> and public R&D indicators

With only 0.2-0.7% of growth the French **GDP** has been practically stagnating throughout the last three years. However, due to strengthening confidence, low inflation and prolonged wage growth, consumer spending is expected to grow according to the 2015 EC Winter forecast. Consequently, economic growth is expected to accelerate to 1.1% in 2015, 1.3% in 2016, and 1.7% in 2017.

Government budget deficit was high already before the crisis and it remained excessive ever since. Since 2013 it is declining due to fiscal consolidation measures. However, based on the EC forecast, it is expected to remain above 3% throughout 2015-2017: 3.7% of GDP in 2015, 3.4% in 2016 and 3.2% in 2017. As a consequence of high deficits, government gross debt has increased continuously, accelerating since the crisis, reaching a 95.6% debt-to-GDP ratio in 2014, slightly above the euro area average (94.3%). According to the forecast, the Commission expects that the debt ratio continues increasing to 96.2% of GDP in 2015, to 96.8% in 2016 and to 97.1.% in 2017.



**Figure 4.** Government deficit and public debt

Data source: Eurostat

Total GERD in France was 47,481 MEUR in 2013. There are three main sources of R&D funding: the business sector (26,126 MEUR), the government sector (16,721 MEUR), and the foreign funding (3,808 MEUR<sup>26</sup>). Domestic direct public funding goes to R&D institutes in business enterprises (2,485 MEUR), the government (5,191 MEUR) and the higher education sector (8,733 MEUR).

**Table 6.** Key French Public R&D Indicators

	2007	2009	2013
GBAORD, % of gov. exp.	1.39	1.59	1.24
GERD, % of GDP	2.02	2.21	2.24
out of which GERD to public, % of GDP	0.72	0.82	0.76
Funding from GOV to, % of GDP			
Business	0.12	0.12	0.12
Public (GOV+HES)	0.64	0.72	0.66
Total	0.77	0.86	0.79
EU funding, % of GDP	0.02	0.02	0.03

**Source:** Eurostat

<sup>25</sup> Sources: DG ECFIN, [http://ec.europa.eu/europe2020/pdf/csr2016/cr2016\\_france\\_en.pdf](http://ec.europa.eu/europe2020/pdf/csr2016/cr2016_france_en.pdf)

<sup>26</sup> EU funding in 2013 was 719 MEUR

### 3.2.2 Direct funding of R&D activities

In this analysis the public sector as source of funds is given by the GOV part of the total intramural R&D expenditure (GERD), whereas the public sector as a sector of performance is the aggregation of GOV and HES. Figure 5, below shows the historical evolution of GERD financing in current prices in France.

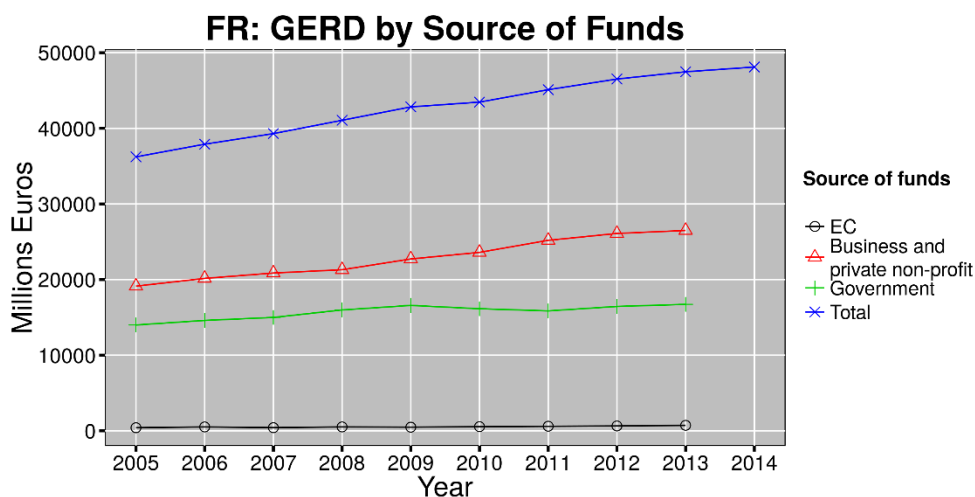


Figure 5. funding of total GERD

The total GERD has increased almost linearly in the period 2005-2013. The effect of the 2008-2009 crises is not very visible on the total GERD due to the increase of the funding from the business and private non-profit sectors from 2008 onwards. The private sector thus remains the largest source of funds for the French GERD. The direct funding from the government has essentially been stagnating over the last few years and the levels of 2012 are approximately the same as in 2008-2009.

The EC contribution represents a much more marginal share of the French GERD with respect to the public and private sector, respectively.

#### 3.2.2.1 Direct public funding from the government

Direct public funding is usually the main source of the total governmental support to R&D. Figure 6, below shows the time evolution of the total R&D appropriations (GBAORD) and the GERD directly funded by the government.

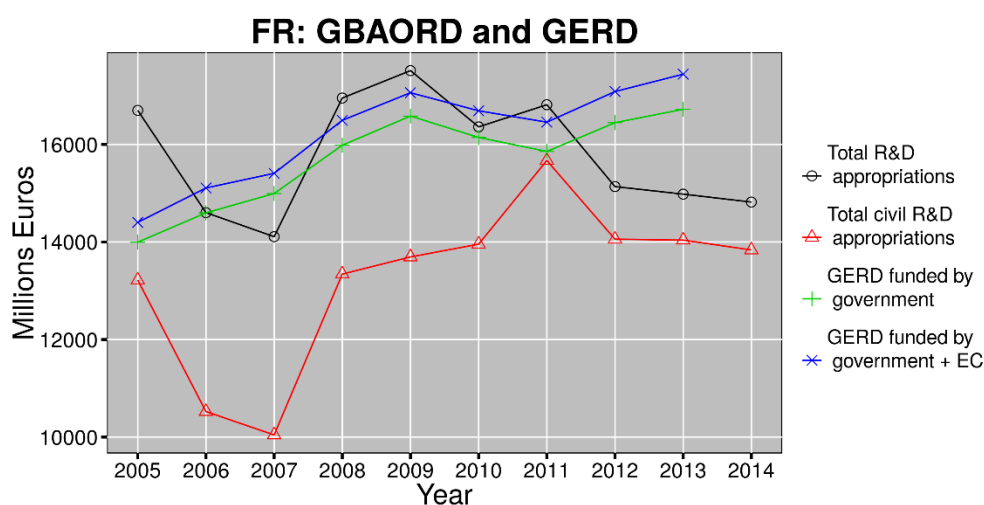


Figure 6. R&D appropriations and government funded GERD in millions of national currency

Data source: Eurostat

The total appropriations have experienced a declining trend ever since 2009. Also from the same year, we observe a shrinking of the gap between the total and civil appropriations, a clear indication of the decrease in the allocations devoted to military R&D. This was not followed equally severe nominal cuts in civil R&D appropriations, which are at similar levels as before the beginning of the economic crisis in 2008. "

The most important reduction regards the National Research Agency (the main RFO) Since 2008, the credits allocated to National Research Agency were reduced by 35.6%.

Section 3.2.3, where the role of indirect funding is discussed, shows that the decrease of the R&D allocations in France in recent years is essentially compensated *in nominal values* by a system of tax incentives. In 2012 we notice that the GERD funded by the government is superior to the total R&D appropriations. This may be an artefact of the accountancy of external budget lines into the government GERD.

### 3.2.2.2 Direct public funding from abroad

The EU and the international organizations are the most important external public sources of R&D funding, as shown in Table 7, below:

**Table 7.** Public Funding from Abroad to French R&D

Source from abroad	2005	2006	2007	2008	2009	2010	2011	2012	2013
Total	2727.41	2645.20	2939.97	3270.75	3013.42	3278.51	3494.76	3533.95	3808.24
BES	1632.90	1663.22	1983.65	2144.02	2017.99	2075.20	2296.56	2337.79	2486.06
EC	405.97	509.51	413.89	511.39	478.13	546.81	600.03	637.70	719.33
GOV	67.73	66.75	64.49	95.42	73.47	117.82	148.65	117.20	120.39
HES	0			0	0	0	0	0	0
International Organizations	620.81	405.72	466.36	519.93	443.82	538.67	449.52	441.27	482.47
Total as % GERD	7.53	6.98	7.48	7.96	7.03	7.54	7.75	7.6	8.02
EC as % GOVERD	2.9	3.49	2.76	3.2	2.88	3.39	3.78	3.88	4.3

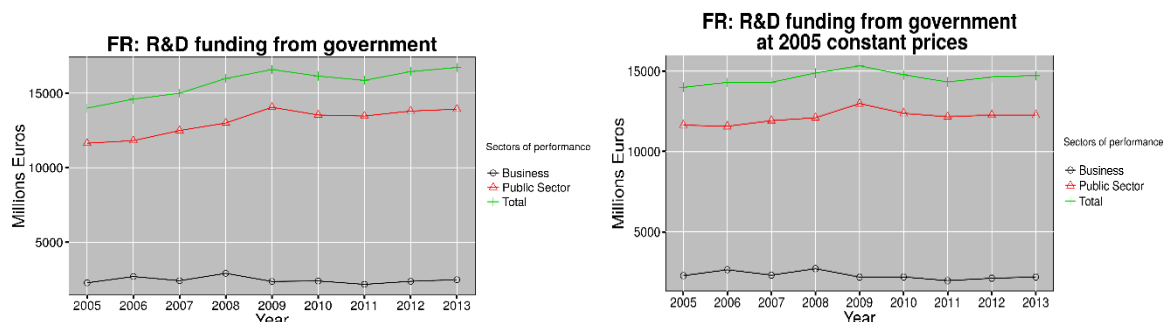
**Source:** Eurostat

It is worth mentioning that the business sector (which of course is not an external source of funds) is by far the most important source of external funds to French R&D. Among the public sources of external funding, the EC is the most important, but, despite some increase in its entity in the years after 2009, the EC contribution continues to amount to less than 4% of the R&D financed by government.



## Distribution of public funding

Figure 7, below shows how the distribution of public funding to sectors of performance evolved over time:



**Figure 7.** Government intramural expenditure by sectors of performance

**Data source:** Eurostat

Unsurprisingly, the public sector (GOV+HES) is the main recipient of the funding from the government. A stagnation of the government funding after 2009 is observed. This is emphasized when expressed at 2005 constant prices.

### 3.2.3 Indirect funding – tax incentives and foregone tax revenues

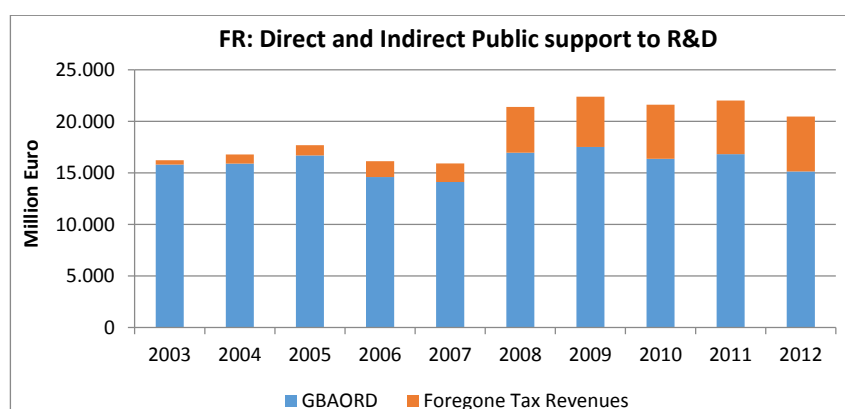
France offers research tax credit since 1983. In 2008 there was a major reform of the French R&D tax credit (the Crédit Impôt-Recherche, CIR). On the basis of a simple declaration, companies can benefit from a tax reduction for a large range of research-related spending. This measure has made the French tax credit scheme one of the most generous countries in the world.

In addition to the CIR, other R&D tax incentives have been developed in France such as the innovation tax credit (Crédit Impôt Innovation, CII, 2013)

**Table 8.** Foregone revenue due to R&D fiscal incentives (CIR).

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Amount (M€)	428	885	992	1,533	1,802	4,452	4,880	5,250	5,210	5,333

**Source:** Base GECIR, June 2014, Ministry of Higher Education and Research



**Figure 8.** Direct and Indirect R&D support

The figure above is based on data from the French Ministry of Higher Education and Research and presents the evolution of the relative size of direct and indirect R&D support by the French government. It can be seen that from 2008, tax credits for R&D account for about 30% of the total GBAORD (28% in 2009, 35% in 2012) compensating to a large extent the decrease in the allocated public funds *in nominal values*.

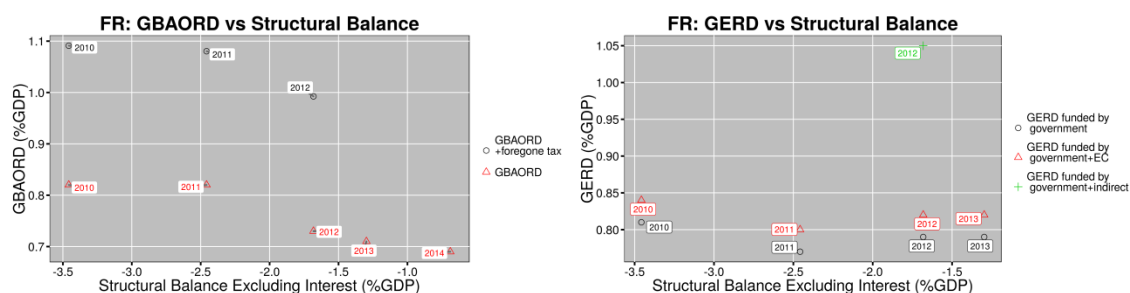
The evaluation of the tax credit incentive is an ongoing debate. Although the effect of the reform on company R&D activities is positive, the impact in terms of efficiency is considered ambiguous<sup>27</sup>. According to the French Court of Auditors, the mechanism leads to an increase in R&D spending beyond the expectations of the government; both the Court and the OECD recommended to reduce the R&D tax credit. A different feedback is provided by an ex-post assessment of the CIR's effectiveness on R&D published by the Ministry of Higher Education and Research in July 2014<sup>28</sup> which presents it as a highly efficient measure.

In a recent fiscal "Stability Programme" released in April 2015, the government has committed to further increase tax incentives to innovation, asserting that:

"Businesses that invest in production capacity in the next twelve months will receive a tax incentive to speed up modernisation of their means of production, to become more competitive and to create more jobs. The incentive will be an additional depreciation allowance for productive investment that already qualifies for declining-balance depreciation. The additional depreciation allowance will be equal to 40% of the cost price of the investment. It will entitle the eligible businesses to immediate reductions of their corporate income tax base by the same amount, spread out over the useful life of the investment. The cost of this measure is estimated at €0.4 billion in 2015 and €0.5 billion in 2016. It is part of a more comprehensive plan presented by the Prime Minister on 8 April 2015 aimed at accelerating and refocusing private and public sector investment<sup>29</sup>."

### 3.2.4 Fiscal consolidation and R&D

The figure below shows the scatterplot of the structural balance and a relevant measure of the R&D (GBAORD as % GDP, left panel and GERD as % GDP, right panel)<sup>30</sup>:



**Figure 9.** Fiscal consolidation and R&D

**Data source:** AMECO, Eurostat

France has not achieved a budgetary consolidation in terms of its headline deficit. However, there seems to be an improvement in structural terms throughout the post-crisis period: from the level of -3.5% of GDP in 2010 the structural balance improved to almost 0% of GDP by 2014.

<sup>27</sup> Between 2007 and 2011, the number of companies using CIR policy doubled, passing from 9,800 to 19,700 companies (+ 101%); the declared spending increased clearly less (+ 19 %, or €15.4 mld in 2007 and €18.4 mld in 2011).

<sup>28</sup> For the series of documents, see: <http://www.enseignementsup-recherche.gouv.fr/cid80816/developpement-et-impact-du-credit-d-impot-recherche-1983-2011.html>

<sup>29</sup> Agence France Trésor, Stability Programme, April 2015.

[http://www.economie.gouv.fr/files/stability\\_programme\\_for\\_france2015-2018.pdf](http://www.economie.gouv.fr/files/stability_programme_for_france2015-2018.pdf)

<sup>30</sup> Structural balance data comes from the AMECO database the other indicators were taken from Eurostat.

Referring to figure 9 (left) one notices that the contribution from the foregone tax revenues (as long as there are available data), measured as percentage of GDP, does not change the declining trend in the GBAORD (0.1% of GDP lost between 2010 and 2014). This is not in contradiction with Figure 8, which shows the stability of the *nominal levels* of GBAORD.

In Figure 9 (left) one observes a negative correlation between the GBAORD and the structural balance both expressed as percentage of GDP. This takes place in the years 2010-2014, a period characterised by a monotonic improvement of the French structural balance.

The picture is similar when comparing the government funded GERD vs the structural balance (Figure 9, right). The government funded GERD levels as percentage of GDP in 2011, 2012 and 2013 are slightly below its 2010 value. The inclusion of the EC funding does not alter the picture and the data on indirect support are very limited. Based on the above discussion it seems that France has not fully deployed a smart fiscal consolidation strategy.

### 3.3 Funding flows

#### 3.3.1 Research funders

Public funding of R&I often combines two main means: direct and indirect aids. France differs from most countries, including European member states, as the indirect mode – via the R&D tax credit (CIR) - represents about 60% of the total. When a company invests on eligible R&D – “eligible” according to R&D OECD Frascati definition<sup>31</sup>-, it qualifies for a reduced corporate tax; the latter relief corresponds to 30% of the R&D spending up to € 100m, and to 5% above this ceiling. R&D Tax Credit foregone revenues are stable at €5.5b in 2014. They benefit more to than 15,000 companies investing in R&D (out of about 20,000 which exposed their R&D expenditures).

On the direct mode side, the major part of public financing of research comes from the MIREs (Mission interministérielle recherche et enseignement supérieur), a unique interministerial budget. In 2015, the research share amounted to €7.7b. Although budget implementation relies on many so-called operators, almost 90% of the credits are allocated through less than 50 operators. Among them, the ANR (National Research Agency) funds research projects, including collaborative and international ones, on a competitive basis; its 2014 budget amounted to €605m (i.e. a small share of the MIREs budget). The ANR also operate as the lead funding agency in implementing the Investment for the Future Programme (PIA 1 &2), for higher education and research financing. Bpifrance is the lead financing agency of the PIA as long as innovation financing is concerned. For instance, it is the exclusive owner of the “Innovation Programme” and of the “Industrial Projects Programme” of the PIA 2, for a total amount of €1.7b.

According to Eurostat data, private non-profit funding of business R&D is low in France, standing at €5.4m (2012, latest available). Higher education and research institutes are entitled to organise their activities in the areas of education, research, and innovation and draw on alternative sources of funding such as philanthropy. A privileged means for doing so is the ‘Fondation de coopération scientifique’ (Scientific cooperation foundation), created by the Programme Law of for Research in 2006. So, a number of HEIs have their own foundations, most of which with too small an endowment to be decisive.

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<sup>31</sup> The legal definition of R&D according to the French law is accessible [here](#), in French.

### 3.3.2 Funding sources and funding flows

National public budget amounted to 92.4% of GERD in 2012 (last available Eurostat data). This figure has remained such, at least over the 8 preceding years. Most of it originates from EU sources (mainly FP funding). Over the 2007-2013 budgetary period, France has been allocated €14.3b originating from the EU regional policy funds, i.e. a yearly support of €2b. As a quarter of those was planned to go to R&I, that would, all things being equal, have amounted to €500m per year.

As visible in the Table below, France is to benefit from €1.7b in RDI structural funds over the period 2014-2020; this represents about €240m per year. Public research and innovation infrastructures, R&I in public research centres and technology transfer primarily to the benefit of SMEs make up to 60% of the total, hence €144m. The remaining 40% are mainly aiming at supporting R&I in companies.

**Table 9.** Structural Funds allocation 2014-2020 - Research, Development and Innovation - France

Categories of Intervention	EU Amount (€)	% R&D&I
Research and innovation infrastructure (public)	368 510 979	21,9
Research and innovation activities in public research centres and centres of competence including networking	348 533 540	20,8
Technology transfer and university-enterprise cooperation primarily benefiting SMEs	286 905 482	17,1
Research and innovation processes in SMEs (including voucher schemes, process, design, service and social innovation)	216 901 458	12,9
Research and innovation infrastructure, processes, technology transfer and cooperation in enterprises focusing on the low carbon economy and on resilience to climate change	118 447 152	7,1
Cluster support and business networks primarily benefiting SMEs	90 112 036	5,4
Research and innovation activities in private research centres including networking	76 424 638	4,6
Investment in infrastructure, capacities and equipment in SMEs directly linked to research and innovation activities	75 884 748	4,5
Research and innovation infrastructure (private, including science parks)	52 516 217	3,1
Research and innovation processes in large enterprises	31 986 149	1,9
Investment in infrastructure, capacities and equipment in large companies directly linked to research and innovation activities	13 214 776	0,8
<b>Total R&amp;D&amp;I</b>	<b>1 679 437 175</b>	<b>100,0</b>
<b>Sources: ERDF data, EC 2015. Cf. <a href="http://ec.europa.eu/regional_policy/en/funding/available-budget/">http://ec.europa.eu/regional_policy/en/funding/available-budget/</a></b>		

As usual, in 2013 (latest available Eurostat data), 97% of the €26.1b of R&D funded by companies go to companies (business enterprise sector). About one per cent go to funding HEIs' R&I, while almost two times more go to government sector R&I (slightly below €500m).

## 3.4 Public funding for R&I

### 3.4.1 Project vs. institutional allocation of public funding

#### Introduction: project funding on the rise in France

Although BERD accounts for about two thirds of French GERD (c. 65% of €48.1b), business R&D stands at about 40% below the 2% Lisbon target: 1.19% out of 2%. This holds true in 2014-2015, in spite of an important public support as the R&D tax credit

illustrates – about €5.5b in 2014. Public funding also is below the 1% target. Project funding is supposed to better stimulate R&D<sup>32</sup>.

The rise of competitive funding is a noticeable feature of the French RIS since 2005, although it remains low according to international standards<sup>33</sup>. The establishment of the National Research Agency (ANR) in 2005 has been essential in this transformation. In spite of this role, the ANR received a reduced budget of €686.6m in 2013 (-€82m in comparison with 2012), and a reduced budget of €605.1m in 2014 (-€80m).

In parallel, the government has nominated the Agency as the Investments for the Future Programme's implementing body. As such, it is responsible for steering the competitive selection and contracting processes for both Investments for the Future Programmes 1 and 2. Under Plan 1, €21.9b are dedicated to higher education and research, out of which €17.9b are to be allocated on a competitive basis. Under Plan 2 (announced by Prime Minister 12 July, 2013), the ANR became responsible for managing an additional budget of €4.015b. The actions to be funded on this budget are Excellence Equipments (Equipex), University Hospital Institutes (IHU), Key Enabling Technologies (KETs) and Excellence Initiatives (Idex); the latter totalling almost 80% of it.

All grants and funding allocated through the ANR, irrespective of the origin of the public money (regular outlays from the Ministry for Research or the Investments for the Future Programme), are on a competitive basis, relying on international juries of peers. That adds up to roughly €2b in 2014.

Not all PROs and HEIs follow the same research funding allocation procedures. To be more specific, due to their legal status, RTOs, such as the Commissariat à l'énergie atomique et aux énergies alternatives (CEA), the oceanographic institute Ifremer (Institut français de recherche pour l'exploitation de la mer), the national aerospace laboratory (ONERA), and the IFP Energies nouvelles (IFPEN) obtain between 30% and more than 50% of the yearly budget through contracts with private and public partners. In any case, the majority of research organisations' budgets for research go to researchers' salaries. As a consequence, RTOs have to sell contract research (to public and private organisations) to both fund R&D projects and cover for their researchers' salaries; the internal funding selection mechanism is quite competitive.

The Investments for the Future Programme is showing the new significance of project-based competitive funding in the French RIS. And indeed, project funding of public research is steadily increasing, from 7.4% in 2009 to close to 11% in 2012 (for total expenses of about €13 billion in 2012, according to ANRT-FutuRIS calculations<sup>34</sup>).

### **Modest on the surface, influential in depth**

Compared to other OECD countries, France is a very modest user of competitive funding<sup>35</sup>. For instance, national public project funding represents more than 50% of public funding to national performers in a number of European countries (e.g. Ireland, Belgium or Finland). In France though, project funding covers project activities and does not cover salaries of permanent staff. Thus, the influence of project funding on public research activities may correspond in reality to twice as much as the 11% indicated above, i.e. roughly 22%. Since most public researchers have permanent positions, an increased part of project-based funding is seen as complex. The researchers often feel that they spend too much of their time in writing and revising research proposals just to

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32 Cf. e.g. Communication from the commission to the European parliament, the council, the European economic and social committee and the committee of the regions a reinforced European research area partnership for excellence and growth. Com/2012/0392 final.

33 Steen, J. v. (2012), "Modes of Public Funding of Research and Development: Towards Internationally Comparable Indicators", OECD Science, Technology and Industry Working Papers, 2012/04, OECD Publishing. Nota: France is not included in this study, therefore refer to OECD Reviews of Innovation Policy: France 2014

34 Anne-Cécile Ollivier, 2013, « Modalités de financement public de la RDI : recherche sur projet », in: La recherche et l'innovation en France, Odile JACOB

35 Cf. J. v. Steen (2012) above.

be able to do research. The latter is being often carried out by young researchers, most often on a temporary contract. At the same time, in some PROs, the search for project funding, "external fresh money", is already compulsory since the organisation's yearly budget – including salaries – depends on it; so, it is rather a matter of survival. Generally, the influence of project-based funding is bigger than what the percentages seem to imply; it is a key driver of the research activities despite its modest apparent value.

Nonetheless, from a system's perspective, one may look for a greater coherence, i.e. a better connection between socioeconomic priorities and the thematic activities of the public researchers. This implies an improved tracing and readability of the public funding R&D flows. This can be obtained by the continuing progress of the evaluation system and by a new and clearer mix of multi-annual research budget programming (employment) and project funding.

Limitations of measurement are numerous, and include the lack of categories and classifications that would be needed for policy analysis. In most countries, the distinction between project and institutional funding is blurred, and delineation tricky. Without sound international comparisons of the effectiveness of the various competitive/institutional funding mixes, averages tend to be poorly significant.

### **3.4.2 Institutional funding**

To start with, one may recall the internationally agreed definition of institutional funding, as the difference between project and institutional block (i.e. non-competitive) funding is not that straightforward in this context. Institutional funding is defined as the total of national budgets in a given country, attributed to an institution, with no direct selection of R&D project or programmes and for which money the organisation has more or less freedom to define the research activities to be performed. Institutional funding can be in the form of non-competitively allocated Block funding. Institutional funding may also be allocated in a variable/competitive manner tied to institutional assessments.

The R&I portion of the MIREs budget for Y2014-2015 stands at €13.8b. Once the R&I expenses related to fiscal measures - the R&D tax credit specifically - are added to this, it makes €19.4b<sup>36</sup>. One must also take into account the fraction of the Investments for the future (PIA) 1 & 2 in relation to R&I. Although significant, this is not the most easily identifiable part. This is due to the very nature of the funds disbursed. They are composed of 'expendable endowment disbursements', 'expendable endowment interest disbursements' and 'transfers of non-expendable endowment' when allowed. Expenses are then to be earmarked to a specific year. As can be drawn from budgetary documents, those expenses that relate to PIA 1 amount to €1.9b in 2015. On the whole, R&I funding would amount to roughly €21.5b. Then comes the question of which part of it can be considered as institutional funding and which part is project funding. By definition, both ANR (€575m) and PIA (€1.9) allocate competitive project-based funding. Fiscal measures, including R&D tax credit, cannot be considered as public project funding<sup>37</sup>. Then, we may assume that the rest of MIREs can be labelled as 'institutional funding'. Our estimate would therefore be €11.3b, i.e. approximately 58%.

### **3.4.3 Project funding**

Based on the reasoning presented above (3.4.2.), project funding of R&I funding in 2015 in France would amount to 42% of the nation's budget allocated to R&I, i.e. roughly €10.2b. The National Research Agency (ANR) is responsible for allocating most public project funding to research, including that coming from the Investments for the Future Programme. Irrespective of the origin of the funding (MIREs or PIA), project funding is

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<sup>36</sup> [Rapport sur les politiques nationales de recherche et de formations supérieures](#), République Française, October 2015.

<sup>37</sup> Even though about €450m are outsourced from companies to public research organisations each year, which might correspond to project research

being attributed to consortia, research units, or institutes to perform an R&D activity limited in scope, budget and time. The ANR does so on the basis of the submission of a project proposal describing the research activities to be done. In the case of typical ANR projects, a yearly plan is developed by the agency and project open calls are launched accordingly. The same functioning holds for specialised research funding agencies such as the ADEME (environment agency).

### 3.4.4 Other allocation mechanisms

Apart from project and institutional funding (e.g. contract research for governmental organisations), the main public R&D funding mechanism is the R&D tax credit (cf. e.g. 2.3.2). The “Jeunes Entreprises Innovantes” scheme (young innovative companies), supported by the MENESR from 2004; would also be in this category (cf. 5.2.). In terms of public funding for innovation, there are mainly Bpifrance’s loans and schemes (cf. e.g. 5.2. or 5.4.); the latter mechanisms have local influences too: like any a bank, bpifrance has a network of agencies, nationwide (43 settlements; 25 regional directorates).

## 3.5 Public funding for private R&I

### 3.5.1 Direct funding for private R&I

The summary table below provides a tentative classification of most public funding streams in France, in 2015, by nature (R&D, “R”, or Innovation, “I” or both), focusing on funding for private R&I.

**Table 10.** Funding streams: from fundamental research to market innovation

<b>Funding for Businesses (SMEs, mid-tier, large companies)</b>	<b>Nature</b>
R&D tax credit	R
Sub scheme for innovation dedicated to SMEs	I
National Research Agency	R
Investments for the future	R/I
<i>Plans for industrial recovery (see below)</i>	<i>I</i>
Bpifrance loans & schemes	I
Regional funding	R/I
European funding (FP, ESIF)	R/I
<i>Innovation 2030 (see below)</i>	<i>I</i>

The two funding schemes above characterised as ‘**innovation support**’ deserve a special attention. The “Plans for Industrial Reconquest”, launched in September 2013, are meant to fund innovative projects with “considerable growth prospects in the global economy” based upon a clearly identified strong position and an ability to develop mass production. The “Innovation 2030” Plan, launched in October 2013, is an original competition opened to international companies’ project-leaders candidates (cf. below for details). Innovation, entrepreneurship and attractiveness are major drivers of competitiveness gains.

### The new face of industry in France

Budgets dedicated to the industrial plans that compose the “New face of industry in France” are not known yet since each plan has to be based upon public-private partnerships, and public funding for innovation will derive from the proposed plans. In any case, their “innovative nature” is doubtless: *“The initiatives underscore the new face of industry in France but also that of a new environmentally friendly, digital and inclusive society in which progress is shared by all. They are at the nexus of three*

*broad transitions: in energy and the environment; in digital technology; and in technology and society" (cf. [The New Face of Industry](#), p. 3).*

As of May 2015, a new phase dubbed "[Rallying the New Face of Industry in France](#)" was launched, building upon the road maps for the industrial renewal' that were identified in phase 1. This new step is meant to "accelerate deployment of the Industry of the Future and the nine industrial solutions in France and internationally". The 'Industry for the future' is a high level policy priority since it is to be "the matrix of France's industrial strategy; it will be heavily funded. Hence, to help companies adapt to the new paradigm, two exceptional measures were announced: "€2.5bn in tax incentives for companies investing in their production base over the next 12 months; and €2.1bn in loans earmarked by Bpifrance for SMEs and mid-tier firms over the next two years: these additional development loans will supplement the €1.2bn already made available to companies investing in Industry of the Future projects (digitization, robotics, energy efficiency, etc.). The nine 'industrial solutions' are listed hereafter:

1. New resources
2. Smart cities
3. Eco-mobility
4. Tomorrow's transport
5. Medicine of the future
6. The data economy
7. Smart devices
8. Digital confidence
9. Smart food choices

These "nine solutions", i.e. thematic priority programmes involving public-private partnerships, are building upon the coordinated efforts done during phase 1 by the 250 companies involved. As a result, more than 330 projects were eventually supported by the end of phase 1. They have received a public support of €1.5b leveraging a total investment of €3.7b. The industrial solutions are coherent bundles of projects, whereby the Ministry for the Economy, Industry and Digital Affairs intends to "more directly address the needs and the markets", "acquire a stronger international dimension and "more effectively manage the overall programme". Notably, the regroupings shall "allow tighter, more responsive and more agile management of the programme".

### **The Worldwide Innovation Challenge**

The €300m Innovation 2030 plan is a second remarkable new initiative; it is a Worldwide Innovation Challenge. The innovative nature of the policy initiative itself is interesting, as illustrated by its description given on the [English website dedicated to it](#): "*In an effort to confront the major challenges of the world of 2030, the Commission singled out a select number of key opportunities with very significant implications for the French economy. Following these efforts, the Commission identified seven goals based on pressing social concerns. These goals can be seen as seven critical pillars to put France on the road to long-term prosperity and employment. This is why the French government is launching a Worldwide Innovation Challenge. The goal is to foster talent and bring out future champions of the French economy. It will accomplish this by identifying and providing support for the growth of both French and foreign entrepreneurs whose innovation projects have significant implications for the French economy. This Challenge will encourage the talents of today in order to create the collective wealth of tomorrow, whether these talents are in France or abroad. The French government thus hopes to attract the world's best talents, so they can complete their projects in France.*"



In practical terms:

- On 18 April 2013: the Prime Minister commissioned Anne Lauvergeon to identify technological and industrial challenges that society will face in 2030 and to propose a method to stimulate the creativity of entrepreneurs around these challenges. Most public investment will come from the High Commission for Investments (the structure that runs the Investments for the Future).
- 11 October 2013: The Commission "Innovation 2030" singled out seven ambitions based on societal expectations and growth sectors: Energy storage, Recycling of metals, Development of marine resources, Plant protein and plant chemistry, Personalised medicine, Silver economy, Big data.
- On 2 December 2013: launch of the call for proposals, under the chairmanship of the President: open to all innovators as long as they want to grow their business in France.
- On 20 March 2014: 58 projects selected for stage 2 (626 proposals received).
- Applications for phase 2 were opened from 2 October 2014 to 2 March 2015.

A 3-stage procedure, with an international jury:

- Stage 1. Seeding/priming: up to €200,000.
- Stage 2. Coaching: up to 10 times the seeding funds to develop the project further: opening of the specific call for proposals on 14 December 2014.
- Stage 3. Development (industrialising and marketing): up to 10 times as much as for stage 2.

On 21 September 2015, new Call for proposals for the seeding/priming stage ('Start-up phase') was launched on (and will be closed on 2 December 2015).

### 3.5.2 Public procurement of innovative solutions

Public procurement in France represents ca. €80b per year (€40b coming from Ministries and State bodies, €20b from hospitals and €20b from local and regional authorities)<sup>38</sup>. Five Ministries (Defence, Environment, Home Affairs, Finance and Justice) totalise 90% of Ministries public procurement contracts.

#### Legal Public Procurement framework

France transposed the two Directives on public procurement (2004/17/CE and 2004/18/CE), including the exemptions for R&D public procurement (art. 16 Dir 2004/18/CE and art. 24 Dir. 2004/17/CE) in 2005 through a modification of two articles of its "*code des marchés publics/procurement guidelines*" (art. 3 and art. 7 modified by the "*ordonnance*" 2005-649).

A second modification was introduced in 2011 in order to clarify the wording (Cf. Decree n°2011-1104 of 14 September 2011), which states that: "*The provisions of the 'code' [on public procurement] are not applicable to the following procurement or agreements [...]: 6° Framework agreements and services procurement of research and development for which the public procurer does not acquire the exclusive ownership of the results or does not integrally fund the delivery.*"

The same exemption is foreseen in the transposition of the defence and securities Directive (art. 13(j) of 2009/81/CE) into the French national legislation.

This new wording was confirmed by the "*Circulaire*" of 14 February 2012<sup>39</sup>, clarifying that the usual/normal rules of public procurement apply only when the public contracting authority is acquiring the entirety of the R&D results, or when it ensures full funding of the research programme.

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<sup>38</sup> SAE, Service des Achats de l'Etat - <http://www.economie.gouv.fr/sae/chiffres-cles>

<sup>39</sup> "Circulaire" on "good practice in public procurement", n° EFIM1201512C, Official Journal of 15/02/2012.

Despite this transposition of the Directive into its public procurement guidelines, France has not set specific schemes, guidelines, or labels for PCPs.

### **The PCP/PPI landscape in France**

The negotiations on the revision of these two Directives<sup>40</sup>, which started in 2011 with the EC proposals, led France to engage in a deeper reform of its public procurement legislation.

The "*National Pact for Growth, Competitiveness and Employment*" adopted in November 2012<sup>41</sup> included a specific measure to "support the development of innovative growth SMEs by mobilising public purchasing" (measure n° 32). The pact announced a national target: "by 2020, the goal is to achieve a volume of 2% of public orders from the State, its operators and hospitals". This would represent Euro 1.6 billion a year, as the French public purchasing sector represents 60 billion Euro a year for the State and its operators (including hospitals), and 20 billion for regional/local authorities<sup>42</sup>.

On 11 April 2013, a conference was organised by the French government in order to launch the debate between public procurers and private companies (SMEs in particular) on public procurement on innovative products.

The draft "*Guidelines for public procurement of innovation*" were submitted to a public consultation (closed on 3 June 2013). The objective was to help contracting authorities building their own methods and channels to identify and capture innovative solutions.

The Inter-Ministerial Committee in charge of modernising public action (CIMAP<sup>43</sup>) decided on 17 July 2013 to adopt a fast track procedure to transpose the new EU Directives on public procurement into national legislation<sup>44</sup>.

The SAE (Service d'Achat de l'Etat) published in September 2013 a new guide on "State and State bodies purchases – objectives and organisation: guide for modernising public purchases"<sup>45</sup> with a twofold objective: (1) better spending of public money, and (2) supporting priorities of public policies, such as promoting innovation.

The guide requires each state service to review its procurement process in order to make place for innovative companies. An annual procurement plan has to be established by each state service, integrating a clear roadmap for innovative purchases.

A final version of the handbook for "*Achats publics innovants*"<sup>46</sup> was presented in January 2014, integrating the results of the public consultation. In addition to innovative products, the guidelines also include R&D activities. The scheme is in fact merging PCP and PPI into integrated guidelines.

The French Government presented the tools put in place to support PPIs (and PCPs, as R&D is integrated into the broader conception of "innovation") on 30 January 2014, during a high-level conference on "public procurement of innovation":

- roadmaps established by Ministries and State bodies<sup>47</sup> (with identification of fields, and targeted number of projects scheduled for 2014-2015): as of 31 January 2014, 124 projects were planned by the Ministries and 144 by State bodies for 2014-2015;

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<sup>40</sup> Directives 2014/24/EU replacing 2004/18/EC and 2014/25/EU replacing 2004/17/EC<sup>40</sup>, voted by the EP on 15.01.2014 and adopted by the Council on 11/02/2014.

<sup>41</sup> <http://www.economie.gouv.fr/files/PR-competitiveness.pdf>

<sup>42</sup> <http://www.economie.gouv.fr/files/PR-competitiveness.pdf>. Page 9.

<sup>43</sup> Comité interministériel pour la modernisation de l'action publique.

<sup>44</sup> [http://www.modernisation.gouv.fr/sites/default/files/fichiers-attaches/releve\\_de\\_decisions\\_cimap3\\_17\\_juillet\\_2013.pdf](http://www.modernisation.gouv.fr/sites/default/files/fichiers-attaches/releve_de_decisions_cimap3_17_juillet_2013.pdf). Page 9.

<sup>45</sup> [http://www.economie.gouv.fr/files/files/directions\\_services/sae/doc/SAE\\_060913\\_guide\\_modernisation\\_achat\\_avec\\_liens.pdf?utm\\_source=actualite-marches-publics&utm\\_medium=article&utm\\_content=crosslink-externe](http://www.economie.gouv.fr/files/files/directions_services/sae/doc/SAE_060913_guide_modernisation_achat_avec_liens.pdf?utm_source=actualite-marches-publics&utm_medium=article&utm_content=crosslink-externe)

<sup>46</sup> [http://www.economie.gouv.fr/files/files/directions\\_services/daj/marches\\_publics/conseil\\_acheteurs/guides/guide-pratique-achat-public-innovant.pdf](http://www.economie.gouv.fr/files/files/directions_services/daj/marches_publics/conseil_acheteurs/guides/guide-pratique-achat-public-innovant.pdf)

<sup>47</sup> <http://www.economie.gouv.fr/sae/feuilles-route-des-ministeres-et-des-etablissements-publics>

these roadmaps enable private companies, and SMEs in particular, to be well informed of public procurers needs, in terms of fields.

- An online platform of public procurers for innovation<sup>48</sup>, which establishes direct contacts between contracting authorities and SMEs (created in February 2014); this platform allows public procurers to be aware and informed about innovative solutions which could potentially answer their needs.
- meetings to be organised between SMEs and public procurers<sup>49</sup>, along the ones already organised in 2013 by three Ministries (Home affairs, Finance, and Defence).

A public consultation<sup>50</sup> on the draft "*Decree on simplification of public procurement and contracts*"<sup>51</sup> took place between 12 March and 11 April 2014. The decree integrates the new provisions of the Directives on public procurement and particularly the following measures:

- the limitation of the turnover required in the specifications by contracting authorities, in order to allow SMEs to participate more easily to the procurement; (cf. Directive 2014/24/EU art. 58 § 3: "*The minimum yearly turnover that economic operators are required to have shall not exceed two times the estimated contract value, except in duly justified cases such as relating to the special risks attached to the nature of the works, services or supplies*"<sup>52</sup>);
- the reduction of administrative burden and limitation of documents to be provided, with the use of a European Single Procurement Document (ESPD) (cf. Directive 2014/24/EU art. 84), the use of standard form for self-declarations, etc.
- the setting up of a new type of public procurement: "*innovation partnership*" (cf. Directive 2014/24 art. 31 and Directive 2014/25 art. 49), which includes R&D products and services as well as innovative products and services. This partnership enables a long term and structured partnership between companies and public purchasers.

The decree was adopted on 26 September 2014 and entered into force on 1 October 2014.

In addition, the ordinance n°2015-899 dated 23 July 2015 implements into national law provisions of EU Directive 2014/24/UE on public procurement and Directive 2014/25/UE on procurement by entities operating in the water, energy, transport and postal services sectors. It also consolidates the different legislative texts relating to public procurement. These are mainly the public procurement code, Ordinance n°2005-649 of 6 June 2005 on contracts awarded by public authorities and private entities not subject to the public procurement code and Ordinance n°2004-559 dated 17 June 2004 on public-private partnerships. The ordinance is to be completed by a decree which has been drafted but has not reached its final version yet, as it is going through a public consultation. The new decree is expected to enter into force/to be adopted? not later than 1 April 2016.<sup>53</sup>

#### PCP/PPI initiatives in France

As already mentioned, France is putting in place several tools for PPI/PCP, like the online platform of public procurers for innovation and innovation partnership. Another important tool is the roadmap (see supra). According to the latter, each ministry

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<sup>48</sup> <http://www.achatspublics-innovation.fr/> (Site with restricted access).

<sup>49</sup> [http://www.economie.gouv.fr/files/files/directions\\_services/sae/doc/dossier\\_de\\_presse\\_web.pdf](http://www.economie.gouv.fr/files/files/directions_services/sae/doc/dossier_de_presse_web.pdf)

<sup>50</sup> <http://www.economie.gouv.fr/consultations-publiques>

<sup>51</sup> [http://www.economie.gouv.fr/files/files/directions\\_services/daj/marches\\_publics/actualites/decret-CIMAP-concertation-mars-2014.pdf](http://www.economie.gouv.fr/files/files/directions_services/daj/marches_publics/actualites/decret-CIMAP-concertation-mars-2014.pdf)

<sup>52</sup> [http://www.economie.gouv.fr/files/files/directions\\_services/daj/marches\\_publics/actualites/tableau-transpo-decret-CIMAP-concertation-mars-2014.pdf](http://www.economie.gouv.fr/files/files/directions_services/daj/marches_publics/actualites/tableau-transpo-decret-CIMAP-concertation-mars-2014.pdf)

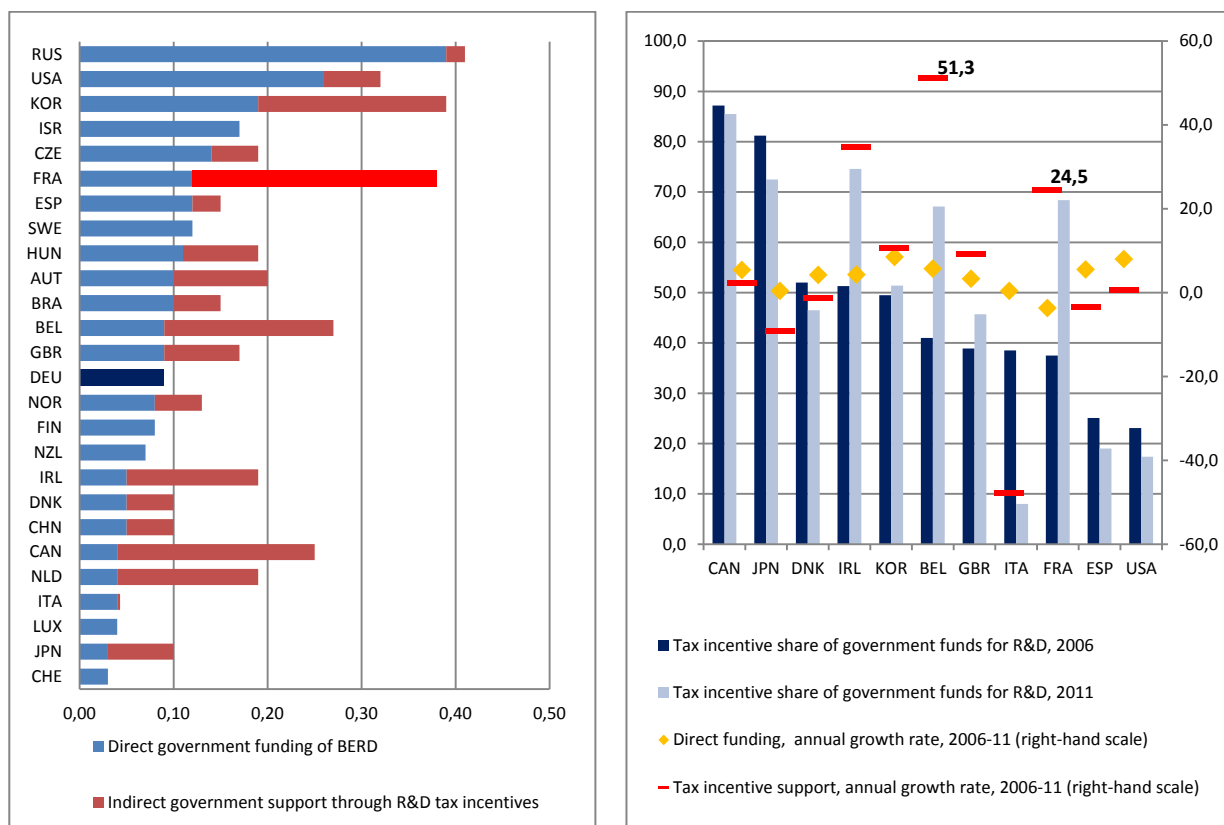
<sup>53</sup> <http://www.hoganlovells.com/files/Publication/53e51296-b4c7-48cd-b80c-6528927ad7e0/Presentation/PublicationAttachment/8323a578-ff27-4771-93d1-f99c34d9413a/French-Legal-and-Regulatory-Newsletter.pdf>

identified the fields in which they would require innovative solutions for future public purchases<sup>54</sup>:

**Table 11.** Public procurement projects in France

<b>Fields</b>	<b>Number of projects (2014-2015)</b>	<b>Ministries</b>
Informatique - Nouvelles technologie - Numérique - RFID - Télécommunication	23	Affaires Etrangères Culture Défense Ecologie Intérieur Services du Premier Ministre
E-learning - Information et communication - Prestations intellectuelles - Services en ligne web	15	Affaires Etrangères Agriculture Education Nationale Finances Intérieur Justice Santé/Travail
Eclairage - Ecoconception - Energie et environnement - Energie renouvelables - Chaudières - HQE	23	Affaires Etrangères Agriculture Culture Défense Ecologie Finances Intérieur Santé/Travail
Equipements individuels de sécurité - Ergonomie des postes de travail - Gestion de crise - Logistique - Sécurité des bâtiments - Textiles - Transport	23	Affaires Etrangères Agriculture Justice Ecologie Finances Intérieur Santé/travail
Processus - Produits et services socialement innovant - Soutien aux politiques publiques - Transformations des relations avec les usagers	18	Affaires Etrangères Agriculture Education Nationale Finances Intérieur Justice Santé/Travail
Agronomie - Santé animale et végétale - Biomédical	5	Agriculture Défense (Santé des armées)
Archivage - Dématérialisation - Gestion des files d'attente - Modernisation - Productivités des administrations - Traduction - Simplification	17	Affaires Etrangères Agriculture La Défense Ecologie Education Nationale Finances Intérieur Justice

<sup>54</sup> [http://www.economie.gouv.fr/files/files/directions\\_services/sae/doc/dossier\\_de\\_presse\\_web.pdf](http://www.economie.gouv.fr/files/files/directions_services/sae/doc/dossier_de_presse_web.pdf) Page 6.



**Figure 10.** Government direct funding vs. indirect R&D funding – France compared to a selection of countries

**Source:** Data from OECD Supporting Investment in Knowledge Capital, Growth and Innovation, 2013; Science, Technology and Industry Outlook, 2014.

### 3.5.3 Indirect financial support for private R&I

France is the OECD country with the highest level of indirect government funding of business R&D as a share of GDP (cf. graphs below; data from OECD Supporting Investment in Knowledge Capital, Growth and Innovation, 2013; Science, Technology and Industry Outlook, 2014). As shown by the ["Rapport sur les politiques nationales de recherche et de formations supérieures"](#) (2015), the amount of foregone tax revenues is stabilised. No direct subsequent reduction of direct public funding for private R&D is observable.

Not only is the French R&D tax credit the most advantageous for companies performing R&D activities, but as analysed by the OECD (2013)<sup>55</sup>, it is also well designed, favouring SMEs over large groups and addressing "high-growth companies" needs (with the "young and growing enterprises" scheme). Its complementarity with the CIFRE scheme (public support for public-private PhDs) is also noticeable<sup>56</sup>. Of course one may aspire that another type of generic and indiscriminate fiscal initiative is taken (so is the case of the OECD); but the whole point of the R&D tax credit (accounting for tight budgets) is preserving attractiveness and competitiveness through a constant support to R&D, in the hope that this will encourage innovation.

<sup>55</sup> OECD (2013), ["New sources of growth: Knowledge-based capital"](#)

<sup>56</sup> A fraction of the overhead costs, once the CIFRE financial support has been deducted, is covered by the R&D tax credit as they concern eligible R&D.

The following two graphs are based on 2014 OECD data. They illustrate French characteristics in terms of direct government funding of business R&D and R&D tax incentives (indirect government funding) as percentages of GDP. On the left-hand side, the figure shows the variety of mixes implemented by States to support R&D activities on their territory. France has the highest level of R&D tax incentive. Russia offers the most advantageous system with a very modest fraction of tax incentives. Germany supports business R&D through direct aid only. The figure on the right-hand shows the evolution of forms of support for business R&D for selected countries, through a comparison between 2006 and 2011 (the bars, left-hand scale) and with the average annual growth rate between the two dates (the small red lines, right-hand scale). A majority of countries have increased tax incentives (see number of red lines above zero), some strongly: Belgium, 51% per year, France, 25%, Ireland nearly 40% per year. Conversely, Italy has reduced the latter form of incentive of nearly 10% on average each year.

## **3.6 Business R&D**

### **3.6.1 The development in business R&D intensity**

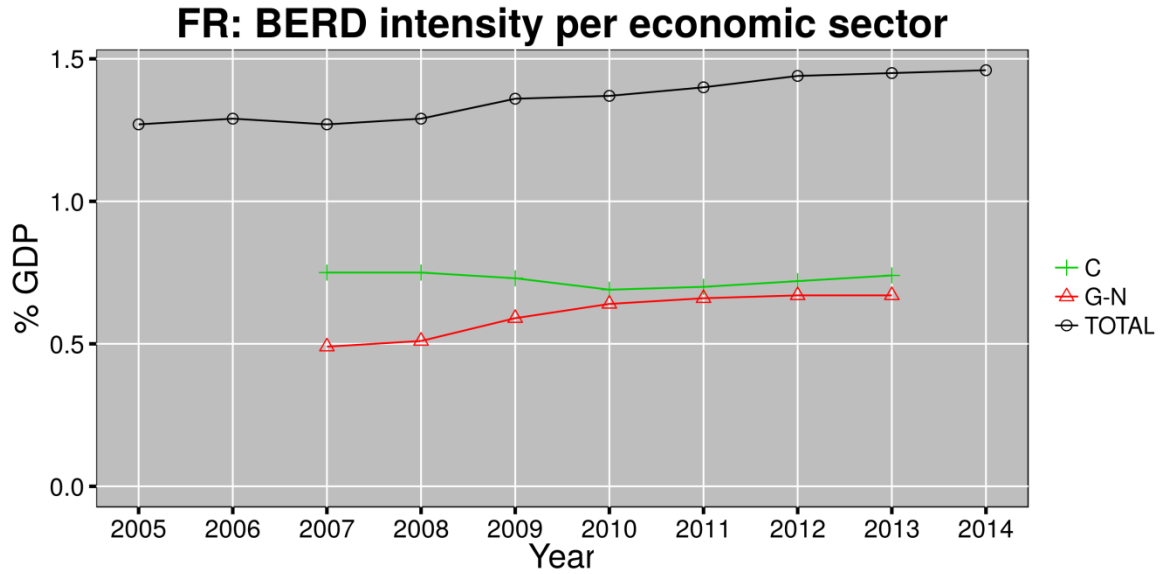
Business R&D increased from 1.27% to 1.46% of GDP between 2005 and 2014. The increase took place after 2008 and the economic and financial crisis does not seem to have had a negative impact on overall business intensity as the total amount of private R&D investments increased from 1.29% to 1.46% between 2008 and 2014.

The explanation for this growth of BERD partially lies in the R&D tax incentives system. France offers research tax credit since 1983. In 2008 there was a major reform of the French R&D tax credit (the *Crédit Impôt-Recherche*, CIR). On the basis of a declaration of their R&D expenditures over the latest fiscal year, companies which are subject to taxes on companies benefits in France can ask for a tax reduction proportionate to the volume of those expenses. The tax credit covers up to 30% of R&D expenses. The foregone revenue due to R&D tax credit has passed from 1,802 MEUR in 2007 to 5,6 MEUR in 2013. As such, taking into account this indirect measure, the public share in the funding of R&D activities gets close to 50%, when it reaches 30% for other comparable European countries (Germany, UK).<sup>57</sup>.

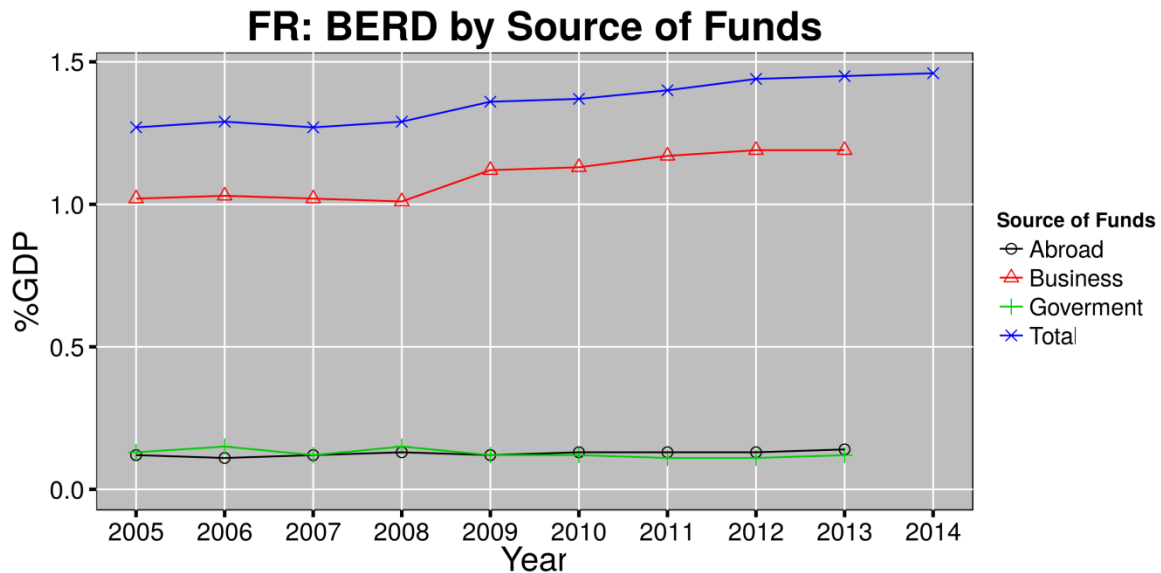
The biggest funder of business R&D is business itself (1.19% out of 1.45% of GDP) while the funding from abroad and government direct funding are almost negligible (0.12% and 0.14% respectively). Regarding government funding, the foregone revenue due to the tax breaks described above has however to be taken into account as it provides a strong incentive to private investment.

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<sup>57</sup> OECD Review of Innovation Policies 2014- France, <http://www.oecd.org/sti/inno/france-innovation-review-overall-assessment.pdf>



**Figure 11.** BERD intensity broken down by most important macro sectors (C= manufacture, G\_N=services).



**Figure 12.** BERD by source of funds

### 3.6.2 The development in business R&D intensity by sector

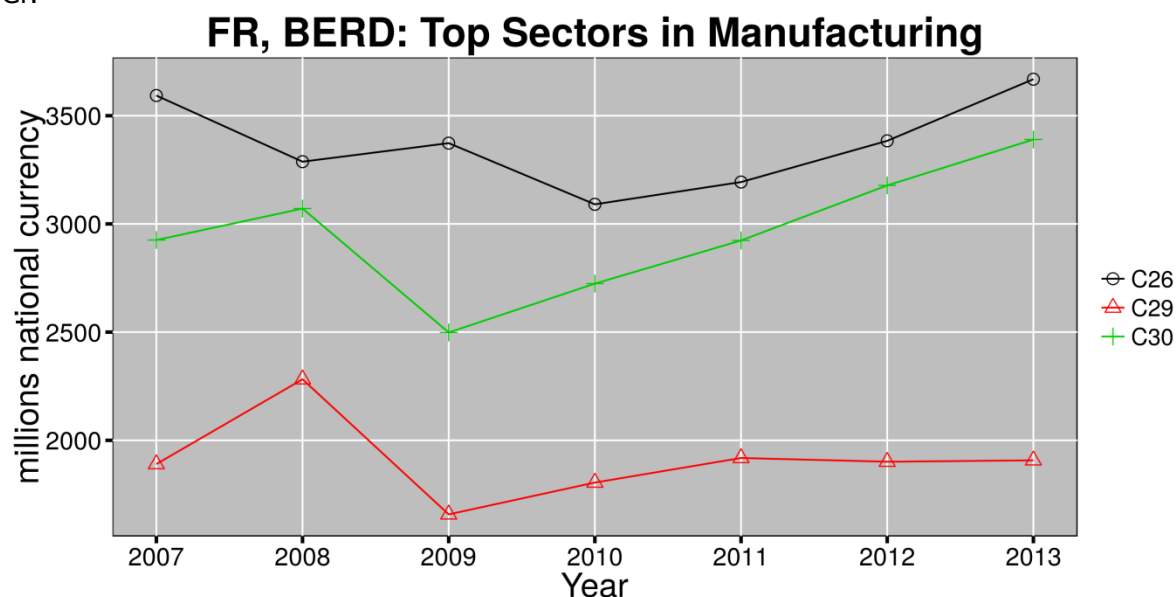
With a R&D intensity passing from 0.75% GDP in 2007 to 0.74% GDP in 2013, manufacturing has remained relatively stable over the last decade. It performed a bit more than half of French business R&D in 2013. Differently, services have since 2007 constantly increased their R&D intensity from 0.49% GDP to 0.67%.

Within manufacturing, the computer, electronic and optical equipment sector is the most important research performer accounting for about €3700 million of BERD expenditure in 2013 and has constantly been increasing since 2010 (€3100 million). According to the 2015 European Industrial R&D Scoreboard, in this sector, the largest French based R&D

performers are Alcatel-Lucent (ranked 17<sup>th</sup>), Schneider (41<sup>st</sup>), Orange (52<sup>nd</sup>), Ubisoft Entertainment (68<sup>th</sup>)<sup>58</sup> and Dassault Systemes (73<sup>rd</sup>).

Aerospace and defence on the one hand and Automobile on the other are the other main performers of R&D in manufacturing, accounting for about €8300 million in 2014 and in constant increase since 2009. During this period, the R&D expenditure in this sector rose by 26%. According to the 2015 European Industrial R&D Scoreboard, the main French companies in these sectors are Peugeot (16<sup>th</sup>), Renault (20<sup>th</sup>), Valeo (47<sup>th</sup>) and Michelin (54<sup>th</sup>), and Safran (29<sup>th</sup>), Thales (65<sup>th</sup>), Dassault Aviation(66<sup>th</sup>) and Zodiac Aerospace (97).

Cf.



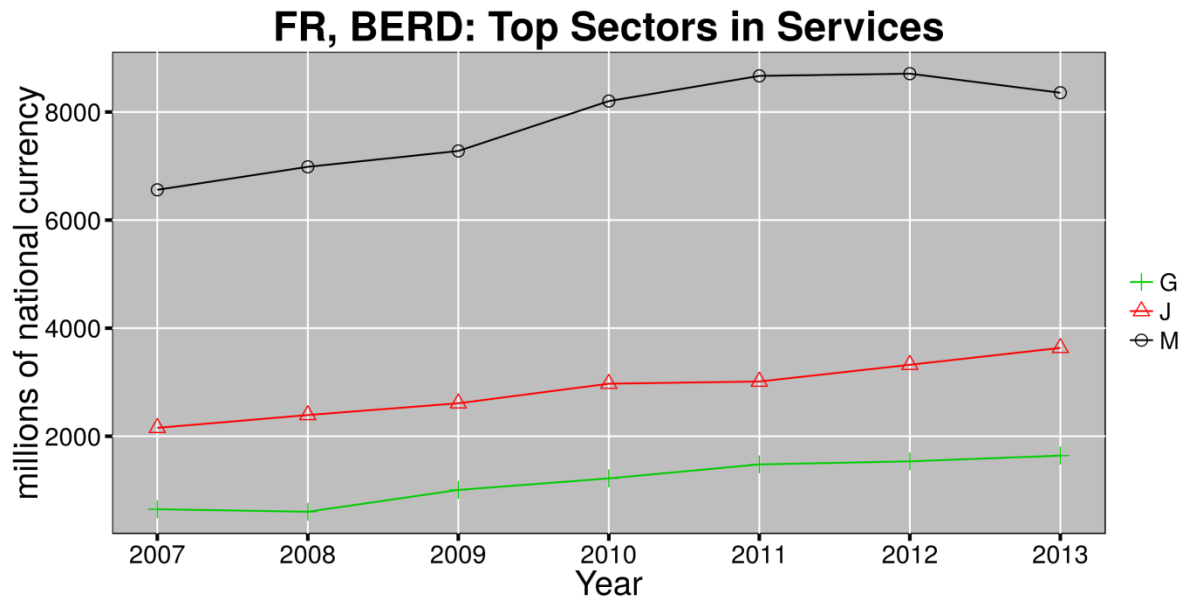
**Figure 13.** top sectors in manufacturing (C26=manufacture of computer, electronic and optical products; C29=Manufacture of motor vehicles, trailers and semi-trailers; C30=Manufacture of other transport equipment).

As far as the services are concerned, we notice an upward trend from 2007, in spite of the economic crisis. This can be attributed to the growth of professional, scientific and technical activities that passed from a BERD expenditure of €6500 million in 2007 to €8350 million in 2013. A decrease is however observable between 2012 (€8700 million) and 2013.

The two sectors of (1) information and communication and (2) wholesale and retail trade; repair of motor vehicles and motorcycles have also been constantly increasing over the observed period. Their respective BERD expenditures evolved from €2150 million to €3600 million and from €648 million to €1600 million.

<sup>58</sup> <http://iri.jrc.ec.europa.eu/scoreboard14.html>

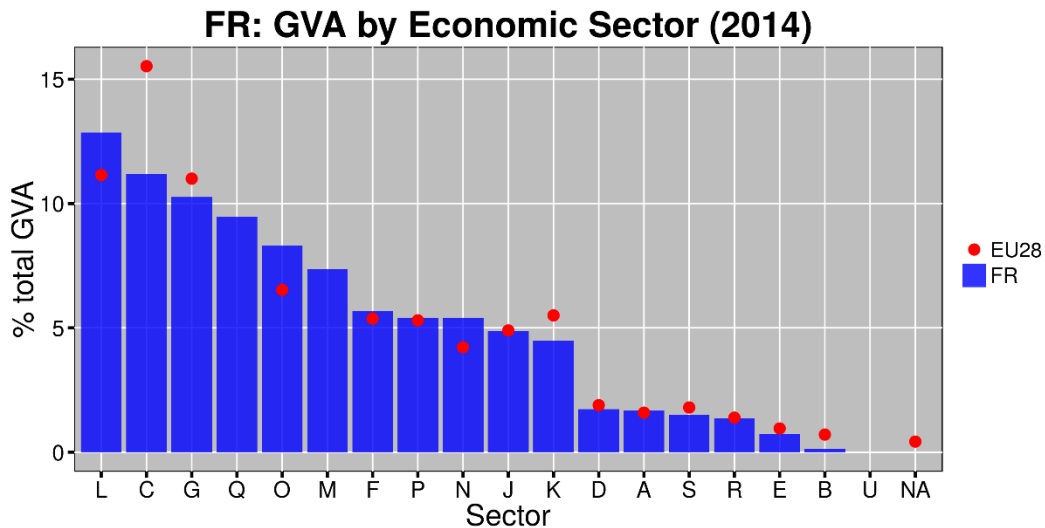




**Figure 14.** top service sectors (J=information and communication, G=wholesale and retail trade; repair of motor vehicles and motorcycles, M=professional, scientific and technical activities).

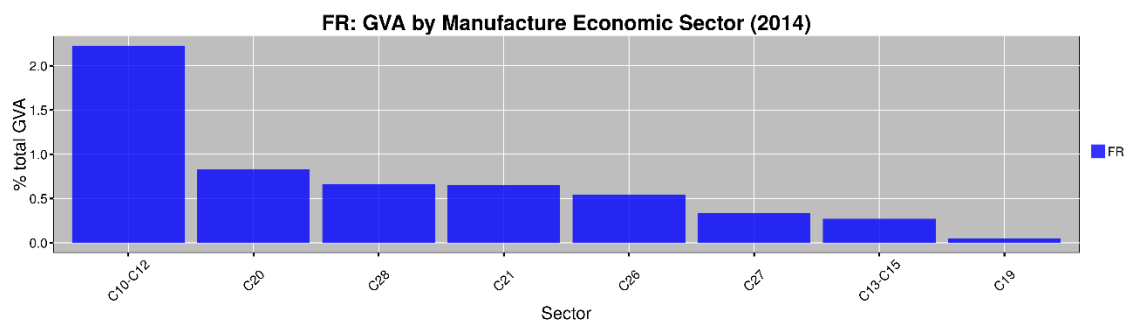
### 3.6.3 The development in business R&D intensity and value added

The real estate activity is the biggest contributor to Gross Value Added in France, with a total value (13.2% of GVA) superior to the EU28 average (11.1%). A top service sector in terms of BERD, namely the "whole sale of retail trade; repair of motor vehicles and motorcycles" also appears as one of the most important sectors in terms of GVA (11.2%). Its share is equal to the EU average. Manufacture stands as the third economic sector (10% GVA) but is far below the EU average (15.2%). Both Public administration and defence; compulsory social security (9.2%; EU average 7.5%) and Professional, scientific and technical activities (7.8%; EU average: 6.5%) are above the EU average.



**Figure 15.** economic sectors as percentage of the total GVA.

Top 6 sectors in decreasing order: 1) Real estate activities, 2) Wholesale and retail trade; repair of motor vehicles and motorcycles; 3) Manufacture; 4) Human health and social work activities; 5) Public administration and defence; compulsory social security, 6) Professional, scientific and technical activities.

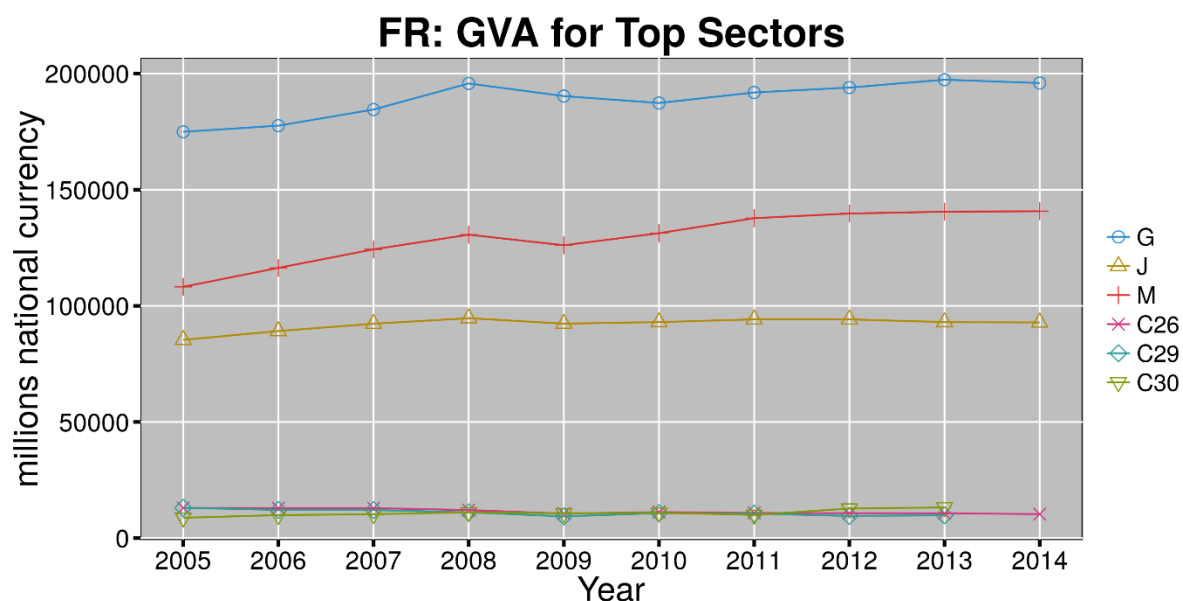


**Figure 16.** GVA in manufacturing.

Top 6 manufacturing sectors: 1) Manufacture of food products; beverages and tobacco products, 2) Manufacture of fabricated metal products, except machinery and equipment; 3) Repair and installation of machinery and equipment; 4) Manufacture of chemicals and chemical products; 5) Manufacture of machinery and equipment n.e.c.; 6) Manufacture of rubber and plastic products .

Consistently with the data exposed in Figure 16, the breakdown of the share of GVA in manufacturing activities shows that all sectors are below the EU average. The highest sector is Manufacture of food products; beverages and tobacco products (1.9% of GVA; EU average: 2.0%). The next two ones are "Manufacture of fabricated metal products, except machinery and equipment" (1%) and "Repair and installation of machinery and equipment" (1%).

According to the Small Business Act 2015 (DG GROW, EC<sup>59</sup>), SMEs account for 99.8 % of businesses in France, which is in line with the rest of the EU. They provide about two thirds of total employment and account for nearly 58 % of total value added. The French economy has been developing at a relatively modest rate over recent years. The number of new business registrations stagnated in 2014 and early 2015. The number of SMEs is set to grow at around 0.4 % until 2016. SME employment is also expected to remain close to current levels. Nevertheless, the outlook for SME value added is more optimistic: from 2014 to 2016, it is expected to grow by nearly 5 %, which is almost double the projection for large enterprises.



**Figure 17.** Value added for the leading sectors in Figures 13 and 14.

<sup>59</sup> [http://ec.europa.eu/growth/smes/business-friendly-environment/performance-review/index\\_en.htm](http://ec.europa.eu/growth/smes/business-friendly-environment/performance-review/index_en.htm)

### 3.7 Assessment

Considered through budgetary lenses, the current balance between project and institutional funding of R&I has very much evolved over the last few years, in favour of the former; notably as a result of the on-going implementation of the Investments for the Future 1 (PIA 1, started in 2010) and 2 (PIA 2, started in 2014). This disruptive form of national investment in R&I has triggered a wave of project-based public funding. From 2010 until today, slightly more than 2 000 projects were selected and funded within PIA. To illustrate the point, during the first two quarters of 2015, 9 'structuring projects for competitiveness' were selected and funded by Bpifrance (€81m); 35 projects were funded within the context of the Worldwide Innovation Contest for €51m (Bpifrance); the X6 project (helicopter of future helicopter), to be carried by ONERA for €330m; the 'Nano 2017' programme for €98m; 56 projects were selected as part of the "Vehicle of the Future" action. These obviously did not intend to finance institutions. Nonetheless, a number of these public financial supports are meant to last 10 years. Also, the huge amounts invested are often earmarked to one of the beneficiaries. Sometimes the beneficiaries are new organisations created for this very purpose.

Finally, whereas the public financier's aims were to gain flexibility and a renewed ability to choose, this form of public project funding tends to institutionalise funding: the beneficiaries are supported for a ten-year period; a period during which they will be richer, a period where they will have to invest in new equipment, a period during which they will adopt new habits. The goal of the organisation –especially if they were created to encapsulate the PIA funding- will be to do anything to benefit from a renewed funding afterwards. One may then wonder whether there is indeed a difference with regular institutionalised funding. On the other hand, more impacts are expected to develop. Firstly, there are amplified leveraging effects which get along with critical masses. The total amount of central government public money committed so far within the context of PIA 1 and 2, i.e. of €28.4b, have generated matching contract funds for about €29.7b, €19b originating in the private sector (i.e.67%). Secondly, better targeted investments, on specific societal challenges - on specific sites and on specific S&T domains - are foreseen to trigger stronger spill-over effects. Evaluations of parts of PIA (Investments for the future programme) are expected in 2016 and 2017. So far, no independent assessment of the impacts of the PIA type of project funding are published.

## 4. Quality of science base and priorities of the European Research Area

### 4.1 Quality of the science base

According to the latest available comparable data (cf. table below), the performance of France in terms of the main research outputs, namely publications, is middling.

**Table 12.** – French publications indicators compared with EU averages

Indicator	Value (Year)	EU average (Year)
Number of publications per thousand of active population	2.32 (2013)	2.42 (2013)
Share of international co-publications	59.7% (2013)	59.6% (2013)
Number of international publications per thousand of population	51 288 (2013)	9 378 (2013)
Percentage of publications in the top 10% most cited publications (full)	13.16 (2010)	12.25 (2010)
Share of public-private co-publications	3.1% (2011-2013)	3.3% (2011-2013)

**Source:** JRC IPTS RIO elaboration on Scopus data collected by Sciencematrix in a study for the European Commission DG RTD (Campbell, 2013). The share of public-private co-publications is derived from the Scival platform and is also based on Scopus data<sup>60</sup>. The data on public-private co-publications is not fully compatible with the data included in the IUS, due to differences in the methodology and the publication database adopted.

Although France is slightly below the EU average for number of publications per thousand of active population (2.32 vs. 2.42) and for the share of public-private publication (3.1% vs. 3.3%), other indicators are correct. France's researchers publish 5.5 times more than the European researchers' average per thousand of population (51 288 vs 9378); but France is only ranked third in Europe, below the UK (#1 at 73 325) and Germany (#2 at 67 173). French scientific publications are slightly more cited than the average: they account for 13.16% of the publications in the top 10% most cited publications (EU average is 12.25%). The share of international co-publication is 1 point of percentage above the EU average at 59.7%.

In most of the ten largest publishing sub-disciplines of material and life sciences, between 2008 and 2013, France's share has decreased: minus 15% on average. While the relative shares in 'Maths' and 'Astronomy and Astrophysics' still stand above 5% (5.6% precisely) despite a 10% decrease over the latest five years, the two-year impact index is poor (below 1) and decreasing.

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<sup>60</sup> Scival © 2016 Elsevier B.V. All rights reserved. SciVal ® is a registered trademark of Reed Elsevier Properties S.A., used under license.

**Table 13** –France’s world share and 2-year impact - 2013 - Most published sub-disciplines of sciences<sup>61</sup>

Sub-disciplines	WORLD SHARE (%)	2-YEAR IMPACT	
		Index	Change between 2008 and 2013 (%)
Maths	5.6	0.97	- 10
Astronomy, astrophysics	5.6	0.98	0
Geosciences	4.8	1.19	- 5
Immunology, virology and microbiology	4.8	1.05	- 10
General physics	4.6	1.25	- 11
Pulmonology, cardiology	4.3	1.07	- 8
Development biology, reproduction	4.2	0.98	- 6
Cancer	4.1	1.06	- 9
Nuclear and particles physics	4	1.16	- 9
Nuclear, mineral and organic chemistry	3.8	1.12	- 22
<b>All scientific disciplines</b>	<b>3.5</b>	<b>1.12</b>	<b>- 15</b>

**Source** : : Thomson Reuters; statistical treatments from HCERES' OST ; Extracts from "L'état de l'Enseignement supérieur et de la Recherche en France n°8 - juin 2015,

Choosing the most visible life and material sciences disciplines- those with the highest impacts - brings rather good news (see next Table); there, unlike in the general trend, significant progress has been made over the latest five years.

**Table 14** - France’s world share and 2-year impact - 2013 - Sub-disciplines of sciences with the highest impacts

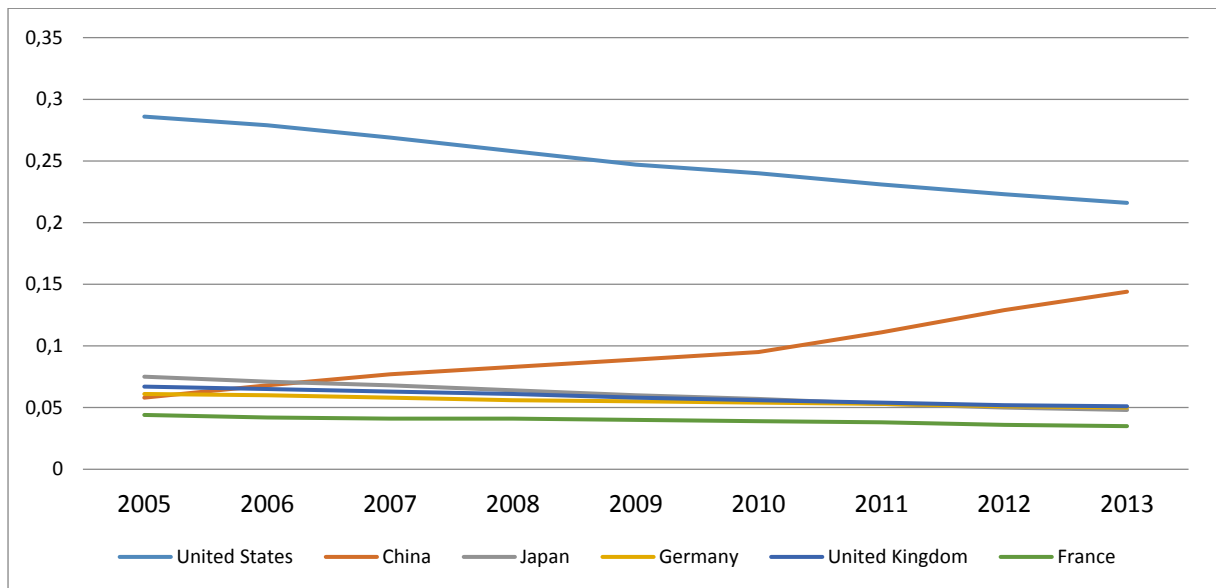
Sub-disciplines	WORLD SHARE (%)	2-YEAR IMPACT	
		Index	Change from 2008 to 2013 (%)
Agriculture, plant biology	2,9	1,66	+ 11
Mining and civil engineering	2,3	1,6	+ 16
Agrofood	2,4	1,44	+ 16
Ecology, marine biology	3,1	1,37	+ 11
General Physics	4,6	1,25	+ 9
General Chemistry	2,9	1,23	- 3
Materials, polymers	2,8	1,22	+ 10
Geosciences	4,8	1,19	+ 3
Stic: Artificial Intelligence	3,2	1,18	+ 12
Particle physics and nuclear	4	1,16	+ 8
<b>All scientific disciplines</b>	<b>3,5</b>	<b>1,12</b>	<b>+ 9</b>

**Source** : : Thomson Reuters ; statistical treatments from HCERES' OST ; Extracts from "L'état de l'Enseignement supérieur et de la Recherche en France n°8 - juin 2015

<sup>61</sup> A country's world share of publications is the ratio between the number of publications in the country and the number of publications produced during the same year in the world. A country's index of impact at 2 years is the ratio between its world share of citations and its world share of publications.

France's researchers publications are 66% higher than the world two-year impact index in 'plant biology and agriculture sciences', 60% higher in 'mining and civil and engineering', 44% higher in agro-food research and, still 25% higher in general physics. 'Artificial intelligence' also is a domain where France publication performance can be singled out.

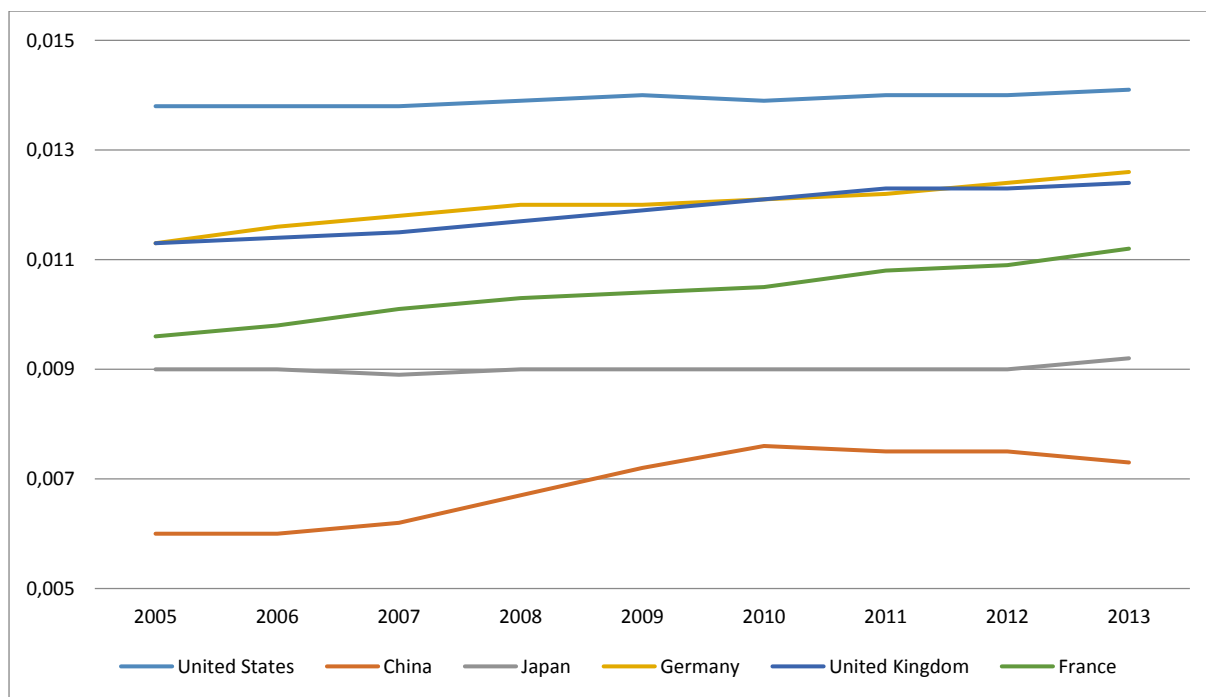
The overall quality of the French science base, as measured by the share of publications and by a short-term impact index in key scientific disciplines turns out to be average. The world share has been declining over the last 20 years, just like many comparable countries due the rise of new science countries, China in particular (see Figure 19). Hence, a purely mechanical effect.



**Figure 18.** Scientific publications by the top six producing countries - World share of publications - all subject areas combined - change from 2005 to 2013

**Source :** Thomson Reuters; statistical treatments from HCERES' OST ; Extracts from "L'état de l'Enseignement supérieur et de la Recherche en France n°8 - juin 2015"

At the same time, the relative impact index of France has slightly augmented over the period from 2005 to 2013. This differs from China's evolution, where more publications meant a progressive lowering of the impacts (see figure 19).



**Figure 19.** Scientific publications by the top six producing countries – two-year impact index - all subject areas combined - change from 2005 to 2013

**Source :** Thomson Reuters; statistical treatments from HCERES' OST ; Extracts from "L'état de l'Enseignement supérieur et de la Recherche en France n°8 - juin 2015"

Even if the impact on the most published disciplines of science remain 12% above the global's, the trend can be deemed worrying for some: -15% from 2008 to 2013.

An additional effort would certainly be fruitful in the most visible sub-disciplines of life and material sciences, where research output quality is quite above average, such as 'Vegetal biology & agriculture', 'Agrofood' and 'Artificial Intelligence'. These are both high performance fields for French research and scientific fields likely to be key in the future.

## 4.2 Optimal transnational co-operation and competition

### 4.2.1 Joint programming, research agendas and calls

The new National Research Strategy is part of "France Europe 2020", France's strategic agenda for research, technology transfer and innovation. It relies on a multi-annual programming revised every five years under the coordination of the Minister for Research. The priorities are to be adopted after a consultation including the scientific and academic community, social and economic partners and the regions. The Strategy must be "coherent with that developed in the framework of the European Union". And indeed, given the nature and magnitude of the challenges ahead of us, no Member State can efficiently develop solutions alone. Thus, the whole set of European research instruments aimed to favour the coordination of national efforts such as ERA-NET and ERA-NET PLUS, initiatives developed thanks to Article 185 of the TFEU, as well as public-private partnerships (Joint Technology Initiatives) are vital for the EU and for France. Joining forces helps providing common answers to common problems through critical mass and better use of resources.

In order to implement joint research agendas on major challenges, France actively takes part in all 10 Joint Programming Initiatives (JPIs) launched since 2008. Its representatives are: Chair of Joint Programme – Neurodegenerative Disease Research (JPND), Chair of JPI Water, and Vice-Chair of JPI Climate as well as historical coordinators of JP Agriculture, Food Security and Climate Change (FACCE), the three-year anniversary of which was held in Paris in October 2013. French participants are partners in all the initiatives, including in Living longer and better (MYBL) as of 11 April 2014.

To ensure optimal participation of French research organisations, the Thematic Alliances (thematic research coordination bodies) were requested to represent France in the JPIs' governing bodies (of which the National Research Agency –ANR– is part). Mirror groups have been set up to favour French stakeholders' involvement in JPIs.

The National Research Agency has notably been established to improve the influence of the French scientific research community by developing transnational collaborations with European and international partners (non-EU). To this end, competitive and transnational projects are supported through two cooperation schemes:

- Bi- or multi-lateral collaborations joint calls, through which the text of a joint appeal is negotiated and a common international evaluation committee is established. This applies both to European calls, and to other bi- and multi-lateral calls (e.g. ANR- DFG, Belmont Forum, Open research area and Open research area plus).
- Regular national programmes with transnational collaborations, through which agencies agree on common methods of assessment and funding; the ANR is forging bi-lateral and multi-lateral strategic partnerships with foreign counterparts and finance transnational collaborative projects built in areas of common interest.

From its creation in 2006 1,040 transnational projects have been funded by the ANR totalling over €330m. In 2014-2015, the ANR opened 41 international collaboration call for projects (including both specific international calls and international collaborations as part of generic calls); specific international calls added up to 28. They form a cohort of 124 projects, consistent with the ANR's societal challenges approach, for an overall ANR funding share of €32m.



**Table 15.** ANR 2014 multilateral co-funded projects

<b>Calls for projects</b>	<b>Topic</b>	<b>Eligible full proposals incl. French partners (count)</b>	<b>Selected projects (count)</b>	<b>ANR share of funding (€m)</b>
FACCE-ERA-NET +	Smart agriculture and climate change	20	7	1,42
JPI Climate	Societal change and climate change	5	3	0,58
Belmont Forum	Biodiversity - ecosystemic services	6	3	0,26
Belmont Forum	Arctic obs. - research on sustainability	7	3	0,57
ERA-NET: M-ERA-NET	Materials modelling and engineering	25	4	1,41
ERA-NET:ERA-MIN	Strategic metal supply security	1	1	0,33
ANR-JST	Molecular technologies for new ICT, health and energy materials	37	4	0,93
ERA-NET: Infect-ERA	Infectious bacteria-related diseases	23	6	1,3
ERA-NET: RARE 2	Rare diseases	26	9	2,22
ERA-NET: Neuron 2	Central nervous system diseases	25	8	1,65
ERA-NET: EuroNanoMed II	Nanomedecine	16	4	1,56
ERA-NET: ERASynBio	Synthetic biology	20	3	0,95
JNPD	Neurodegenerative diseases (cohorts)	11	1	0,05
JNPD	Neurodegenerative diseases (signaling pathways)	22	8	1,89
JPI AMR	Antibacterial resistance	15	4	0,98
ERA-NET: SUSFOOD	Food systems sustainability	6	2	0,52
ERA-NET: BIODIVERSA with JPI FACCE	Biodiversity and agriculture	31	6	1,7
ERA-NET: ANIHWA	Animal health and well-being	24	8	1,24
ERA-NET: COFASP	Contaminants in marine food networks	2	1	0,43
Belmont Forum with JPI FACCE	Food security	4	2	0,68
JPI HDHL	Biomarkers of Nutrition and Health	10	2	0,84
ERA-NET: CHIST-ERA	ICT and sciences	56	6	1,7
Franco-American ANR/NSF/NIH	Computational Neurosciences	31	5	1,61
ERA-NET + NORFACE	The welfare state futures	7	0	0
ORA with Germany, Netherlands, UK, China	Green economy and understanding pop. Changes	16	6	1,17
ANR-BMBF	Critical infrastructures security	22	3	2,91
ANR-DFG	Human and Social Sciences	77	15	3
	<b>TOTAL</b>	<b>545</b>	<b>124</b>	<b>31,9</b>

**Source:** Excerpts from ANR Annual Report 2014 (August 2015).

Multi-lateral projects represent 50% of the ANR submitted transnational proposals, 45% of the co-funded proposals and 45% of the funding allocated to transnational projects.

#### 4.2.2 RI roadmaps and ESFRI

In February 2013, France published its second national strategy for research infrastructures, which integrates current and future international commitments, including within Europe. France also participated in the update of the European Strategy on Research Infrastructures in the context of ESFRI and Horizon 2020. At organisational level, a centralised system of budgetary control on the operation and construction of facilities of national interest has been set up. A new governance system has been established, in which the chairmen of the Thematic Alliances, the CEA and CNRS participate under the guidance of the Ministry for Higher Education and Research. A high-level steering committee of very large research infrastructures decides on the national strategy for research infrastructures; it is responsible for multi-annual programming and participation in international organisations. It may seek scientific advice from the High Council for very Large Research Infrastructures.

The latest published update of the European Strategy Forum on Research Infrastructures (ESFRI) dates back to May 2011, adding six new pan-European infrastructure projects (for a total of 48 facilities). The fourth update of the ESFRI roadmap was launched in Trieste on 25 and 26 September 2014, and published in March 2016. The [national agenda](#) is aligned with the European (roadmap). France supports the following projects in the new ESFRI roadmap:

1. **Social and cultural innovation**, (1) E-RIHS (European Research Infrastructure for Heritage Science), coordinated by Italy, and (2) GGP (Generations and Gender Programme), coordinated by the Netherlands
2. **Health & Food**, (1) EU-IBISBA (Industrial Biotechnology Innovation and Synthetic Biology Accelerator), coordinated by France (Inra), and (2) EMPHASIS (European Infrastructure for multi-scale Plant Phenomics and Simulation for food security in a changing climate), coordinated by Germany.
3. **Environmental sciences**, ACTRIS (Aerosols, Clouds and Trace gases Research Infrastructure), coordinated by Finland.
4. **Analytical facilities**, ESRF UP PII (The II phase of the ESRF Upgrade Programme), France.

At the national level, the French roadmap for research infrastructure, outlined in the National Strategy 2012-2020, is reviewed regularly. The second review started in July 2014 and is due to be published in March 2016. Synchronised with the National Research Strategy, it is carried out in close connection with the current revision of the European Roadmap for Research Infrastructures ESFRI. As a consequence of this synchronisation, programmed in France-Europe 2020, a number of French infrastructures become European hubs.

French government investments in large research infrastructures are programmed over a ten-year period, up till 2024. They are consolidated by science domain.

With research infrastructures expenditures of roughly €0.8b per year (not including nuclear and space facilities), France ranks second in Europe, after Germany.

### 4.3 International cooperation with third countries

The French system of Science, technology and innovation (STI) is characterised by a strong international orientation. In terms of personnel, 17% of its researchers and 46% of its PhD students originate from a foreign country.<sup>62</sup> In terms of international copublications, all subject areas combined, France arrives in first place among the top 10 producing countries, with 50.5% involving at least one researcher from a foreign country.<sup>63</sup> In terms of structures, France operates a world-wide network of science attachés working within the Embassies' Services for cooperation and culture. This network works in synergy with the structures implemented by the Research Performing Organisations (RPOs) themselves, many of which operate representation bureaus and/or joint labs in third countries. The *Centre national de la Recherche Scientifique* (CNRS), the *Institut de recherche pour le développement* (IRD), the network of *Instituts Pasteur* and the *Institut national pour la santé et la recherche médicale* (INSERM) are examples of French institutions with a very high level of international involvement.

Within the Ministry for Primary, Secondary and Higher Education and Research (MENESR), the Division for European and Cooperation in Higher Education, Innovation and Research (MEIRIES), in connection with the Ministry of Foreign Affairs and International development (MAEDI), is responsible for developing the international dimensions of both the National Strategy for Research (SNR) and the National strategy for Higher Education (STRANES). In coordination with the International Transversal Concertation Group (GCTI), which gathers representatives from all of France's STI stakeholders, MEIRIES shall propose a comprehensive Strategy for international cooperation in Research, Innovation and Higher Education (SIRIES) in 2017.

On a bilateral level, joint S&T committees are implemented to discuss and design common priorities with a range of third countries, including all BRIC-M and the main producers in STI among high-income countries. Beyond the funding schemes of the Aside from collaborative research projects implemented by calls for proposals of the *Agence nationale de la Recherche* (ANR), mobility schemes are also funded on the basis of the joint agreement with third countries, often as a partnership between MENESR and MAEDI, as is the case for the *Partenariats Hubert Curien*.

On the EU level, France takes advantage of the general openness of Horizon 2020 to strengthen its ties with key partners in terms of STI: France is the first partner country of Mexico, the 2<sup>nd</sup> partner of Russia, the 3<sup>rd</sup> partner of China, the 4<sup>th</sup> partner of India and the 5<sup>th</sup> partner country of Brazil within the Framework programme. France is also among the few countries that implemented dedicated support for cooperation with third countries as part of their network of national contact points.<sup>64</sup>

At a multilateral level, France actively participates in the Strategic Forum for International Cooperation in Science and Technology (SFIC), the vice-chairmanship of which was held by France from November 2013 to December 2014; France currently chairs the China core group. Other SFIC geographical initiatives deal with Brazil, USA and Russia. The main SFIC cross-cutting actions over the 2015-2016 period concern the design of specific ERA international cooperation indicators, fostering a greater cohesion between Member States' and the EC's strategies and developing an overview of EU and Member States structures, programmes and funding mechanisms in regard with third countries.

France is also heavily involved in the public-public partnerships featuring third countries, which have been developed as part of the 7<sup>th</sup> Framework Programme (ERA-NET) and Horizon 2020 (ERA-NET Cofund). Beyond that, France has initiated and/or is taken part in all initiatives that have been created on an intergovernmental level as Joint

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<sup>62</sup> Source : Campus France, 2015

<sup>63</sup> Source : Etat de l'enseignement supérieur et de la recherche, 2015.

<sup>64</sup> <http://www.horizon2020.gouv.fr/pid29776/cooperation-internationale.html>

programming initiatives (JPI). In addition to 11 multinational funding schemes specifically dealing with third countries co-funded by ANR (see Table 15 “ANR 2014 multilateral co-funded projects”, in 4.2.1.), a number on-going international cooperation actions with third countries are also being carried out.

## 4.4 An open labour market for researchers

### 4.4.1 Introduction

France is an extremely opened country for young researchers since more than 40% of doctoral students in France are foreign citizens; France ranks second in the EU, after the United Kingdom, as far as PhD students from abroad are concerned. In 2012 foreign researchers accounted for about 10% and 15% of the public research institutions workforce. Since this rate is higher among new recruits, where it stands at between 15% and 30%, openness shall increase in the coming years<sup>65</sup>. This favourable evolution has not been hampered, as will be illustrated below, by the persistence of a regulated market for researchers.

### 4.4.2 Open, transparent and merit-based recruitment of researchers

The key legal provision which addresses recruitment and careers of researchers in France is the [1984 Decree \(HE institutions\)](#)<sup>66</sup>, modified at least nine times since then, and the 1983 Decree (Research performing organisation)<sup>67</sup>. Researchers are public civil servants, working according to a permanent position within the public sector. Public sector rules apply. Hence, little is based upon individual merit and career advancement results mainly from seniority<sup>68</sup>. On the other hand, openness and transparency prevail when it comes to recruitment<sup>69</sup>.

Permanent researchers' positions at CNRS for instance require post-doctoral experience in a research centre abroad; recruitment competitions are then open to excellent researchers from any national origin. Similar international experience is a clear advantage on the CV to apply to a university position (as a “maître de conference”, i.e. assistant professor) or to other French public research institution (as a “chargé(e) de recherche” or as a “directeur/directrice de recherche”). It should nonetheless be noted that university tenures may be more easily accessed with a French PhD. It is indeed required that the candidate is “qualified” by the National University Committee (Conseil national des universités). This national body, composed of both full professors and assistant professors of all the 80 disciplines, evaluates all candidates willing to apply to university tenures. Obtaining “the qualification” is a pre-requisite to access to local recruitment competitions. In a similar way, irrespective of one's experience and excellence in research, to become thesis supervisor requires obtaining the accreditation to supervise research (HDR, “habilitation à diriger des recherches”), based on a peer review process. These mechanisms do not facilitate researchers' mobility to French positions.

Researchers from outside the EU can benefit from “scientific visas” and “residence permits for scientists”. These specific procedures are simplified to facilitate scientists' access to researchers' positions within the French research system. Since the entry into force of the Law of 16 June 2011 on immigration, scientists have access to the “long stay visa” as an equivalent to “residence permit”. With long stay visas, administrative procedures are thus facilitated if their stay does not exceed one year.

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<sup>65</sup> Data used for this paragraph come from: [L'état de l'emploi scientifique en France –Rapport 2014](#), MENESR, July 2015

<sup>66</sup> “[Décret n°84-431 du 6 juin 1984 fixant les dispositions statutaires communes applicables aux enseignants-chercheurs et portant statut particulier du corps des professeurs des universités et du corps des maîtres de conférences](#)”

<sup>67</sup> [Décret n°83-1260 du 30 décembre 1983 fixant les dispositions statutaires communes aux corps de fonctionnaires des établissements publics scientifiques et technologiques.](#) | [Legifrance](#)

<sup>68</sup> Articles 36 to 40 in 1984 Decree and Articles 32 and 53 in 1983 Decree.

<sup>69</sup> Notably Article 22 in 1984 Decree and Articles 13 and 36 in 1983 Decree.

Recently, the Law of 7 March 2016 created a multiannual card called "passeport talent", for researchers and doctoral candidates. This 4-year visa is proposed to scientists from their first year in France<sup>70</sup>

The code for entry, residence and asylum of foreigners (CESEDA) was amended following the adoption of the Law of 22 July 2013 on higher education and research. The student or foreign researcher can now obtain a temporary residence permit for a period of 12 months (formerly 6 months), after having successfully completed a training course leading to a degree equivalent to a Master. This allows him/her to complete his/her training by professional experience, without limitation to a single job or a single employer.

Discussing the levels of inward versus outward flow of researchers in the French case is difficult. But it seems so for most countries. So starts the dedicated part of the specific official report on 'employment in science' in France. Indeed, the latest issue (2015) of [l'Etat de l'emploi scientifique](#) states: "The study of international mobility is difficult for two reasons. The first one is the lack of available statistics, which are poorly comparable: criteria used are never homogenous (methods, inputs, outputs, migrants' categories, length of stay, mobility type, etc.). A global database is nowhere to be found. Second, the very use of the term "researcher" is not homogenous either so that it conceals heterogeneity of professional situations." (p.130). A difficulty that is confirmed by checking the RIO website under the heading "[Human Resources in Science and Technology](#)" (or the OECD databases). As a consequence of these difficulties, the report does not display any useable figures for France. According to a [paper](#) cited in the report, "the main migration factors are quality of life, importance of research funding, career prospects and quality of research teams or of the host institution. For expatriate researchers personal and family reasons come first.

In the same reference document, the situation of scientific labour market in terms of temporary vs permanent contracts is dealt with. Again, one has to start with caution. In public higher education institutions non-tenured staff covers a variety of situations and functions. People may be recruited for training or for research (including research training by doing research, such as in CIFRE). It may also be research support. Recruitments can be casual or for periods limited to 10 months or for longer periods corresponding to a research project. Two categories of institutions may be usefully singled out. In the case of HEIs such as CNRS or Inserm, as of end 2013, there were 12,000 temporary (or contract) staff (excluding those who are preparing a PhD). That is a 8% increase as compared to 2008. That represents one-fifth of this type of institutions' global researchers' staff. At universities, the non-permanent staff amounted to about 19,700, a 14% decrease since 2008. They represented on-fourth of the total researchers and teachers' staff in higher education, against 27% in 2008. Unlike in other HEIs, this population is mostly made of PhD students, associate teachers and visiting professors.

#### **4.4.3 Access to and portability of grants**

As part of the ANR 2014 action plan, a new mobility scheme may usefully be described here. Labelled "Visiting top scholars", the ANR wishes to attract top researchers from abroad, providing them with excellent hosting conditions. ANR proposes a 3 to 4-year funding dedicated to top foreign scientists of any nationality; funded fellows shall settle in France for the duration of the funding and conduct a research project in a French research institution. The first call for proposals has led to the selection of 28 researchers, who were granted with a total of €14m. 190 proposals were submitted, 68% of which coming from European research institutions.

As far as ANR fellowships are concerned, portability is not an option: the agency shall support researchers to carry out research in France, and not elsewhere. Researchers living in another EU country may answer an ANR call for proposals but the selected

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<sup>70</sup> [LOI n° 2016-274 du 7 mars 2016 relative au droit des étrangers en France | Legifrance.](#)

project must lead in France. Access to cross-border grants ANR fellowships are open to non-residents, as are those of all French research organisations.

#### 4.4.4 Doctoral training

Most of the 284 doctoral schools responsible for the 62,7340 doctoral students in France in 2013-2014<sup>71</sup> develop close links with all potential recruiters of PhDs, including companies that are employers of researchers, and provide high quality training and learning services to their young talents. Universities (and their components and groupings) are autonomous in developing doctoral training as long as they comply with the 2009 Decree<sup>72</sup>. The Decree notably provides the minimum doctoral student's wage and stipulates that access to appropriate training must be guaranteed. This legal document is generally complemented with a "charter", specific to each doctoral school, which details reciprocal rights and duties.

Thanks also to the evaluations of doctoral schools carried out by the High Council for Evaluation of Research and Higher Education (HCERES, which replaced AERES), PhD programmes are becoming professional education and training institutions.

CIFRE (Conventions industrielles de formation par la recherche / Industrial Research Training Conventions) is a national-level scheme which addresses directly the innovative doctoral training principle. CIFRE aims at contributing to the competitiveness and innovation of French business. It encourages exchanges between public research laboratories and socioeconomic environments and contributes to helping doctors find employment in companies of all sizes. CIFREs have already succeeded in bringing together over 6,000 companies and 4,000 academic research laboratories, involving 12,000 PhDs.

Through CIFRE, PhD trainees are recruited on either a permanent or a 3-year contract, with a minimum gross annual salary of €23,484. They study for their PhD while carrying out research work within the company and academic laboratory.

#### 4.4.5 Gender equality and gender mainstreaming in research

A few basic facts about gender equality in research in France may be usefully reminded:

- From 2000 until 2011 (latest available data<sup>73</sup>), the share of women in the total number of researchers has been declining to reach 25.6%. This proportion is slightly above that of Germany, but far below that of Portugal (above 40%), and below that of Poland, Spain, UK, Sweden, Italy and the Netherlands.
- In 2012, one public researcher out of three is a woman; one in five in private businesses. The ratios between men and women in research vary according to scientific research domains<sup>74</sup>. As in higher education, there are more women in medicine and agronomy than in aerospace and digital technologies. At INSERM, Institut Pasteur and INRA, women are as often part of research teams as men. At ONERA (aerospace) and INRIA (ITs), women represent respectively 16% and 20% of the researchers. A similar situation is observable in companies. In the Pharmaceutical and Chemical sectors, women account to 57% and 47% of researchers, respectively. On the other hand, women are poorly represented in the 'aircraft and spacecraft' (16%), the 'automobile' (13%) and "Manufacture of

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<sup>71</sup> Cf. [http://publication.enseignementsup-recherche.gouv.fr/eedr/8EN/EESR8EN\\_R\\_38-phds\\_and\\_phd\\_graduates.php](http://publication.enseignementsup-recherche.gouv.fr/eedr/8EN/EESR8EN_R_38-phds_and_phd_graduates.php)

<sup>72</sup> Cf. [Décret n° 2009-464 du 23 avril 2009 relatif aux doctorants contractuels des établissements publics d'enseignement supérieur ou de recherche](#) ; as stressed above (cf. 2.2.), a new version of the decree is about to be published as of the first quarter of 2016, subsequent to a large public consultation carried out by the MENESR, which has taken place in the beginning of 2015.

<sup>73</sup> [L'état de l'emploi scientifique en France –Rapport 2014](#), MENESR, July 2015, is the source for the following developments.

<sup>74</sup> Cf. [http://publication.enseignementsup-recherche.gouv.fr/eedr/8/EESR8\\_R\\_36-la\\_parity\\_dans\\_la\\_recherche.php#ILL\\_EESR8\\_R\\_36\\_04](http://publication.enseignementsup-recherche.gouv.fr/eedr/8/EESR8_R_36-la_parity_dans_la_recherche.php#ILL_EESR8_R_36_04)

machinery and equipment" (8%). In the past three branches, the share of women, however, is higher among researchers and support staff.

- Also, over the last five years, female researchers' presence in industry fell by 0.8%; a decline mainly explained by the growing weight - +50% over the same five-year period- of research in the service sectors (i.e. especially IT and science-related activities)
- The share of women accessing to high level scientific positions, such as President of University (10%) or Director of a HEI (12.8%) remains at a very low level and follows a decreasing trend: while in 2008 almost 20 % of universities were headed by women (which was a record), the figure is twice lower as a result of the 2012 elections.

On 28<sup>th</sup> January 2013, the Ministry for Education, Higher Education and Research signed the Charter for Equality between Women and Men in Higher Education, with the Ministry for Women's Rights<sup>75</sup>.

The Law of 22<sup>th</sup> July 2013 on Higher Education and research introduced the set up of "units" for Equality between Women and Men in HEIs; gender balance in all governing councils of these institutions; and sex-dissegregated data.

The [2015 MENESR road-map on gender equality](#) was published in May. Drawing from the 2015 "[L'état de l'emploi scientifique en France -Rapport 2014](#)", the road-map starts with taking stock of the measures taken as a consequence of the Law of the 22<sup>nd</sup> July 2013 and then turns to present the policies to be implemented in the field of higher education and research<sup>76</sup>. A new momentum is sought through a series of measures, the following three of which are given as illustrations (cf. *ibid.*, p. 51):

1. Sustaining the network of the persons responsible for reporting on gender equality in all the higher education and research institutions (linking with the Ministerial Committee for Equality).
2. Implementing the training on prevention and treatment of sexual harassment for all staff of higher education and research institutions.
3. Supporting the development and the dissemination of scientific research on gender in order to better target the actions and measures for achieving equality for all in the academic world and in society at large.

## **4.5 Optimal circulation and Open Access to scientific knowledge**

### **4.5.1 e-infrastructures and researchers' electronic identity**

At all levels, from Ministry to universities (and COMUE), from PRO level to public librarians of national schools, actions are being implemented in order to establish and disseminate among researchers a clear policy when it comes to researchers' electronic identity. As an example of this approach, one may consider taking a look at the [Guide des Usages du Numérique à destination des personnels de l'Université de Paris Diderot 2014-2015](#) (cf. p. 32-43).

[Huma-num](#) is a good example of a planned national-level measure related to research e infrastructures. It includes the development of digital research services, and addresses challenges such as personal data security, the scope of personal data use, and identity validation and tracking. It supports researchers' access to digital research services in other organisations (within the same country and in another country) by using their own user account, and membership to identity federation communities.

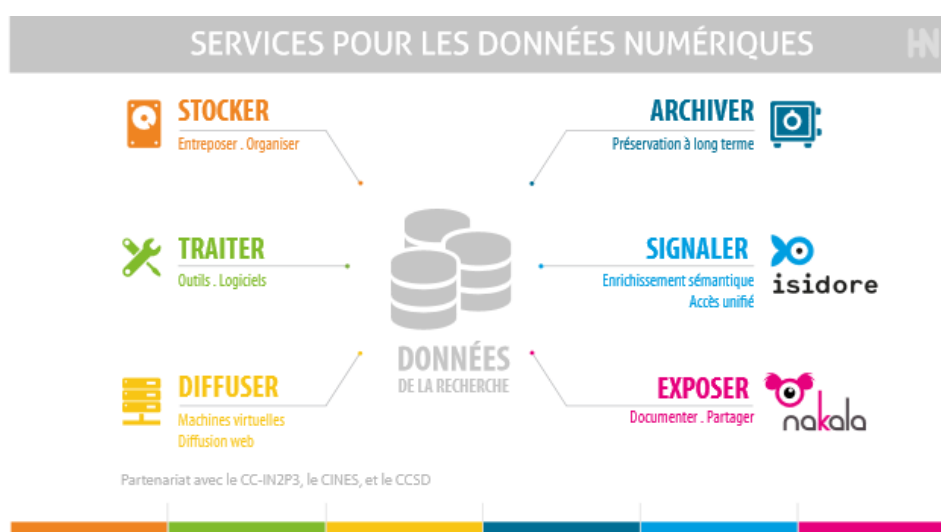
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<sup>75</sup> Cf Charter for Equality between Women in Men in Higher Education.

<sup>76</sup> It should be noted that the road-map also deals with "Human resources policies promoting gender equality in terms of equal opportunity", and with "the policies to be implemented in the field of formal education".

« [Huma-num](#) » is a Very Large Research Infrastructure (VLRI) aiming at facilitating the transformation towards digital research in the Social Sciences and Humanities (SSH); it is built upon a unique organization which consists of a mix of human (collective consultation) and technological systems (permanent digital services), based on a network of national and European level partners and operators. Hence, Huma-Num provides technological services that works throughout all the stages of the digital data life cycle: storage, processing, display, reporting, dissemination and preservation over the long term of digital SSH research data.

A detailed description of the e-services the platform provides to its members can be found in the activity report, cf. « [Rapport d'activité 2013-2015](#) », pp. 12-14.



**Figure 20.** Huma-Num e-services

**Source:** Huma-Num, *Rapport d'activité 2013-2015* », pp. 12 (in French). Six categories of e-services for SSH: "Stockage" - storage; "Traiter"- treatments; "Diffuser" – dissemination; "long term archiving"; Signaler (semantic content enrichment); "Exposer" – sharing.

#### 4.5.2 Open Access to publications and data<sup>77</sup>

In January 2013, the Minister for Higher Education and Research at the fifth "Days of Open Access" stated that "*scientific information is a public good that should be available for all*". The French Government wishes to develop green and gold accesses in a balanced and complementary way, while assisting the users that prefer gold access during the negotiation of licences with publishers.

The French system seeks a balance between open access models and other editorial models: in agreement with the Commission, France advocate a mix with the aim of implementing a policy that is both pragmatic and coherent, guided by the concern to reach solutions that are adapted and balanced with respect to the main problems that is the implementation of open access encounters.

France is rather active in the field of open access, with hundreds of French open access journals, tens of open disciplinary warehouses and institutional archives, and a handful of platforms.

<sup>77</sup> This section owes to the NCP who suggested to use excerpts from "Research Area Facts and Figures 2014: FRANCE", DG Research and Innovation, EC.



The October 2014 ScienceMetrix report, entitled "[Proportion of Open Access Peer-Reviewed Papers at the European and World Levels – 1996-2013](#)", positions France as one of the three member states:

- In which Green OA is more widely used, i.e. 14.0%, together with 16.3% in Portugal and 15.8% in Ireland,
- In which Gold OA journals are least used, i.e. 6.6%, together with United Kingdom (7.2%), and Belgium (7.4%).

The same study shows that, the overall 2008–2013 proportion of OA in France reaches 60.6% whereas the EU proportion is 58.8%. Recent noteworthy high-level initiatives aiming at encouraging OA include:

- the creation of the Secretariat-General for Government Modernisation (SGMAP) (Decree of 30 October 2012) under direct authority of the Prime Minister; it reports to the Minister of State, with responsibility for State Reform, including Etalab in charge of administrative open data. The Etalab Mission implements the policy of openness and sharing of public data ("Open Data"); Etalab is part of the General Secretariat for the modernization of public action. Its primary role is to facilitate the widest possible reuse of public institutions' information. This implies making it freely and easily accessible (cf. circular of the Prime Minister of 26 May 2011<sup>78</sup> and 13 September 2013 on the opening of public data<sup>79</sup>) the launch of the "OpenData France Association" in October 2013, an association which represents and supports local communities in a process of opening up their public data.
- France has implemented an action plan that re-stimulates and puts into coherency different national infrastructures :
  - o HAL, France pursues the optimisation of its HAL open archive platform (Online Hyper Articles Platform), which collects institutional archives. HAL is a national and disciplinary platform, interoperable with local and international thematic archives as PubMed Central or Arxiv. It receives nearly 3,000 documents per month and hosts more than 80 archive collections of scientific institutions. ANR-funded projects have to be integrated in the HAL open archive platform. A partnership *via* a Memorandum of Understanding was created between research institutions, universities and "Grandes Ecoles" for the joint development and management of HAL.
  - o **Thèses.fr**, a portal for consultation of theses (30 000 today), built upon databases of defended and on-going theses;
  - o **Open Edition**, national platform of books and journals in the platinum mode, that publishes more than 380 journals in social sciences and humanities, as well as research blogs;
  - o **Persée**, free access portal of retrospective collections in social sciences and humanities, today more than 140 and close to 3 million visits per month;
  - o **CINES**, perennial archive warehouse for all the platforms and, tomorrow, for research data.
- In addition, the project "Bibliothèque scientifique numérique" (Digital Scientific Library) has been launched in 2009 as a federal national infrastructure to federate stakeholders in higher education and research. Its aim is to structure the field of scientific and technical information on a national scale and to explore its different underlying challenges in ten fields of activities. A Steering Group representing all actors in the field of scientific and technical information was established to ensure coordination and issue recommendations. Two working groups are devoted to open access: publications and data.

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<sup>78</sup> <http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000024072788>;

<sup>79</sup> [http://www.modernisation.gouv.fr/sites/default/files/fichiers-attaches/circulaire\\_nde\\_5677-sg\\_du\\_17\\_septembre\\_2013.pdf](http://www.modernisation.gouv.fr/sites/default/files/fichiers-attaches/circulaire_nde_5677-sg_du_17_septembre_2013.pdf)

A recently published report from the French Academy of Sciences, entitled "[Les nouveaux enjeux de l'édition scientifique](#)" (i.e. emerging science publishing issues), acknowledges the importance of open access for the French research community, emphasising its economic dimension, and suggests a number of specific recommendations: "the procedures followed to allow dissemination of scientific publications [shall be reorganised along two complementary lines; 'Open Archives' and 'Institutional Open Access'. [These should be] financed by national agreements between public authorities and publishers, ensuring that academic standards for scientific quality are preserved." "Efforts should be deployed to enlarge the framework of this approach to at least the European level", the Academicians added.

To promote Open Science, France is proposing a law, fostering free circulation of publications and research data "Law for a Digital republic": Open Science can improve the access to research results, promote innovation and spread into civil society.

## 5. Framework conditions for R&I and Science-Business cooperation

### 5.1 General policy environment for business

As illustrated by the World Bank's 'Doing Business Index' latest issue (cf. Table below), France does not rank high in that matter. It is ranked 20<sup>th</sup> among comparable countries. France does relatively well according to three (3) out of the ten (10) opinion indexes collected: it ranks 6<sup>th</sup> for trading across borders, 7<sup>th</sup> in terms of enforcing contracts and 8<sup>th</sup> as regards the protection of minority investors. France ranks particularly low in terms of registering property (28) and ease of paying taxes (26).

**Table 16.** World Bank's 'Doing business index', 2015 – a selection of high-income OECD countries

Economy	Rank	Starting a Business	Dealing with Construction Permits	Getting Electricity	Registering Property	Getting Credit	Protecting Minority Investors	Paying Taxes	Trading Across Borders	Enforcing Contracts	Resolving Insolvency
New Zealand	1	1	4	14	1	1	1	9	19	6	22
United States	5	18	11	19	10	2	12	18	11	22	4
United Kingdom	6	17	5	22	22	5	2	5	10	20	12
Japan	19	27	19	9	23	22	17	30	14	16	2
France	20	14	20	18	28	22	8	26	6	7	19

**Source:** World Bank, Ease of doing business, 2015. Cf.

<http://www.doingbusiness.org/rankings> ; NB ; Ranking displayed for a selection of OECD high-income countries only.

As regards resolving insolvency, the World Bank survey confirms well known difficulties. Despite efforts, such as those made in the context of the "Loi de modernisation de l'économie"<sup>80</sup> (Economy Modernisation Law, 2008), much remains to be done on insolvency regulations to support the financial reorganisation of enterprises. However, at EU level, it should be noted that Regulation 2015/848 of the European Parliament and the Council of 20 May 2015<sup>81</sup> on insolvency proceedings that strengthens the efficiency of the management of cross-border insolvency proceedings has entered into force. It is applicable from 26 June 2017, with exceptions. This regulation applies to public collective proceedings, including interim proceedings, which are based on the laws relating to insolvency and during which, for the purposes of reorganization, a debt adjustment, reorganization or liquidation.

In France, the Law n° 2015-990 of 6 August 2015 "pour la croissance, l'activité et l'égalité des chances économiques/growth, activity and economic chances equality", the so-called Macron Law, does not contain the expected provisions concerning insolvency.

In the same line of reasoning, in spite of the Economy Modernisation Law which implied a vast harmonisation of practices, SMEs are still regularly confronted to customer payment delays (often beyond 60 days) and are ill equipped to cope.

<sup>80</sup> Cf. <http://legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000019283050&dateTexte=20150101>

<sup>81</sup> This Regulation recasts EC Regulation No 1346/2000 of 29 May 2000; it was published in the Official Journal of the European Union of 5 June 2015, so that it became effective on the twentieth day following that publication.

## 5.2 Young innovative companies and start-ups

Policy measures dedicated to favour SMEs and Young Innovative Companies' development fill up the whole continuum from support to start-up created out of researchers' inventions to specific innovation-oriented R&D tax credit (favouring demonstrators). The existence of policies and instruments such as innovation and knowledge clusters (competitiveness clusters / "pôles de compétitivité" for instance) and knowledge transfer platforms (Institutes of Technological Research, Institutes for Energy Transition, SATTs, Instituts Carnot, Labcoms) are to be stressed (cf. 5.7. Knowledge transfer and open innovation). These measures encourage cooperation and knowledge sharing so that a more favourable business environment for SMEs is in place. As far as the framework is concerned, the creation of an Ombudsman ("médiateur interentreprises") service dedicated to facilitating innovation relations between companies (SMEs and large in particular), seating with the "médiation interentreprises" service must be emphasised<sup>82</sup>.

Many financial products of Bpifrance are dedicated to innovation-driven SMEs. As put forth in Bpifrance's institutional brochure (p. 13): "*Bpifrance assists businesses of all sizes, primarily micro-businesses, SMEs, mid-caps. But we also assist big firms that are considered strategic in terms of national economy, the territories or employment*". There is a limited number of well-targeted, clearly differentiated, and easy to access support schemes to finance innovation (cf. 5.4. Access to finance). The funding support is tailored to the needs of SMEs, while bureaucracy kept to a minimum. Bpifrance is one of the two French banking intermediaries which are entitled to implement InnovFin (implemented by the European Investment Bank and the European Investment Fund<sup>83</sup>). InnovFin SME offers up to 50% loan guarantee to support risky SME innovative projects. €450 will be injected through this mean in innovative SMEs.

Because of its skills, the MENESR made the choice of a partnership with Bpifrance to drive i-LAB, the french national contest for the creation of companies of innovative technologies. Since its creation in 1999, more than 1 700 start-ups were rewarded and more than 70% are still alive, proving the efficiency of the detection of this help facility.

To add on all these mechanisms, the MENESR has supported the Young Innovative Enterprises (JEI) scheme since 2004, and will do so at least until 2016. So far, the JEI scheme benefited to about 3,000 companies, for an amount of social security exemptions of €108m (according to ACOSS 2014, [www.acoss.fr](http://www.acoss.fr)), for total R&D expenditures of €700m, mainly in the services.

## 5.3 Entrepreneurship skills and STEM policy

### 5.3.1 Many profound challenges to tackle...but no STEM policy

As odd as might seem, the recently published [National Strategy for Higher Education \(StraNES\)](#)<sup>84</sup> provides no analysis on the skills current and future content of the country's Human Resource base. The report does start with an introduction entitled 'Responding to a changing world: a challenge for higher education and research', in which it draws an unapologetic portrait of the French higher education system's strengths and weaknesses to take on the challenges to come. These include: "*elitism and a tendency to reproduce social inequalities (...); the prevailing impact of the initial degree, the lack of opportunity to make up for a failed year, and difficulty in changing tracks; fear of downward social mobility (...); uncoordinated strategies and a rigid administration; lack of recognition of the teaching profession and of innovative pedagogical initiatives; and an overall*

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<sup>82</sup> Officially launched on 13 March 2014, as a sequel to the "New deal for Innovation" (November 2013) plan; cf. [http://www.economie.gouv.fr/files/files/directions\\_services/mediation-interentreprises/COMMUNIQUE\\_DE\\_PRESSE\\_INNOVATION\\_DEF.pdf](http://www.economie.gouv.fr/files/files/directions_services/mediation-interentreprises/COMMUNIQUE_DE_PRESSE_INNOVATION_DEF.pdf)

<sup>83</sup> NB: The other bank is BPCE. Cf. [http://www.eif.org/what\\_we\\_do/guarantees/RSI/news/2013/bpifrance.htm](http://www.eif.org/what_we_do/guarantees/RSI/news/2013/bpifrance.htm)

<sup>84</sup> Cf. the English short version, available here: [http://cache.media.enseignementsup-recherche.gouv.fr/file/STRANES/24/2/Synthese\\_StraNES\\_V\\_def\\_anglais\\_462242.pdf](http://cache.media.enseignementsup-recherche.gouv.fr/file/STRANES/24/2/Synthese_StraNES_V_def_anglais_462242.pdf)

spending for higher education as a percentage of GDP (1.5%) slightly below the OECD average (1.6%), well below that of Northern European countries, and way behind that in the United States or Canada (2.7% and 2.8% respectively)" (cf. p. 3).

The 2015 version of the "[L'état de l'emploi scientifique en France](#)" provides forecasts of the evolution of the number of students in higher education between 2012 and 2022. Projections show that enrolment would increase by 8.5%, with 2 589 500 students enrolled in 2022 (i.e. +121,200 students as compared with 2012). All academic disciplines are likely to be affected with positive increases by 10% in Law, 8.7% in Science, 7.9% in health, 7.1% in literature and 2.3% in economics. Enrolment would also rise sharply in non-university engineering programmes (+ 8.7%) and in Grandes Ecoles de Commerce (+ 10.7%). This evolution mechanically follows the increase in the number of general baccalauréat. PhD student is the one and only category that would be impacted by a slow-down, by 5.5%<sup>85</sup>.

These insights may have led public authorities to conclude that no STEM policy is deemed necessary, and that other evolutions of the skills of the country HR based have priority.

### 5.3.2 Entrepreneurship skill

As of 2009, a number of initiatives were implemented under the auspices of the [MENESR to encourage the development of entrepreneurship within the students' population](#). In connection with public policy makers, the [Agence Pour la Création d'Entreprises](#) (business creation agency; APCE) collects them and disseminates widely all useful information to interested stakeholders. As an example of the schemes and measures implemented over the years<sup>86</sup>, the following paragraph focuses on the latest initiative, "the student-entrepreneur status".

Launched in September 2014, the 'student-entrepreneur status' was created to promote youth entrepreneurship. Access conditions are simple: young people should be aged under 28 (student status); they should hold a bachelor's degree (or equivalent); legal registration fees are then limited to 500 euros per year for the 2014-2017 period. The status can be obtained based upon an analysis of the actual quality of the entrepreneurial project, and upon the project leader qualities. The 'PEPITE - read "nugget" in English- committee' is responsible for examining applications to the Ministry for Education, Higher Education and Research. It is composed of representatives of PEPITE institutions, the head teacher of the student hosting school and of "PEPITE partners ". The PEPITE acronym stands for "Pôles Étudiants pour l'Innovation, le Transfert et l'Entrepreneuriat (Student Poles for Entrepreneurship, Transfer and Innovation). There are currently 29 of those PEPITE centres all over the country. With this status, the young student-entrepreneur has access to the following benefits:

- coaching delivered by a teacher and by an external referent from the PEPITE network,
- access to a PEPITE co-working space to favour young entrepreneurs' networking,
- possibility to sign a Contrat d'Appui d'Entreprise / Corporate Support Contract (CAPE) with an incubator or with PEPITE partner.

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<sup>85</sup> New projections, released in February 2016, can be found [here](#). They provide with projection until 2024. All estimates are confirmed by the new data and the trends are strengthened. The only exception to this is the evolution of the PhD diploma that would also grow (almost +5% when compared to 2014).

<sup>86</sup> To quote but a few of those initiatives, created over the years 2009 to 2010 and still in operation: the "national coordination of the mission on entrepreneurship"; "Entrepreneurship referrers in higher education institutions"; the 23 "interinstitutional student entrepreneurship poles"; the "Entrepreneurship skills repository"; the creation of "Junior Enterprises in universities"; The "[national competition of student entrepreneurship "Innovating together"](#)"

## 5.4 Access to finance

Improving access to finance for R&D and innovation is the purpose of Bpifrance, the public investment bank created by law of 31 December 2012. In July 2013, Bpifrance received a total capital of €21b. Bpifrance is by far the biggest venture capitalist in France: in 2013 for instance 95% of the national venture capitalist activity was supported by Bpifrance, for about €500m. In November, the market power of Bpifrance augmented with the launch of a new fund, "Large Venture", which aims to support innovative businesses in priority sectors of health, the digital and the environment, and for venture capital operations starting at €10m. To be more specific, Large Venture will mainly invest in innovative companies jointly with private partners, and may invest in listed and unlisted companies for long periods. The fund will complement existing direct equity funds such as "Innobio", "Digital Ambition" and "Environmental technologies", and will invest in funds of funds.

As described by Bpifrance, its most important support activities, basically financial products, are:

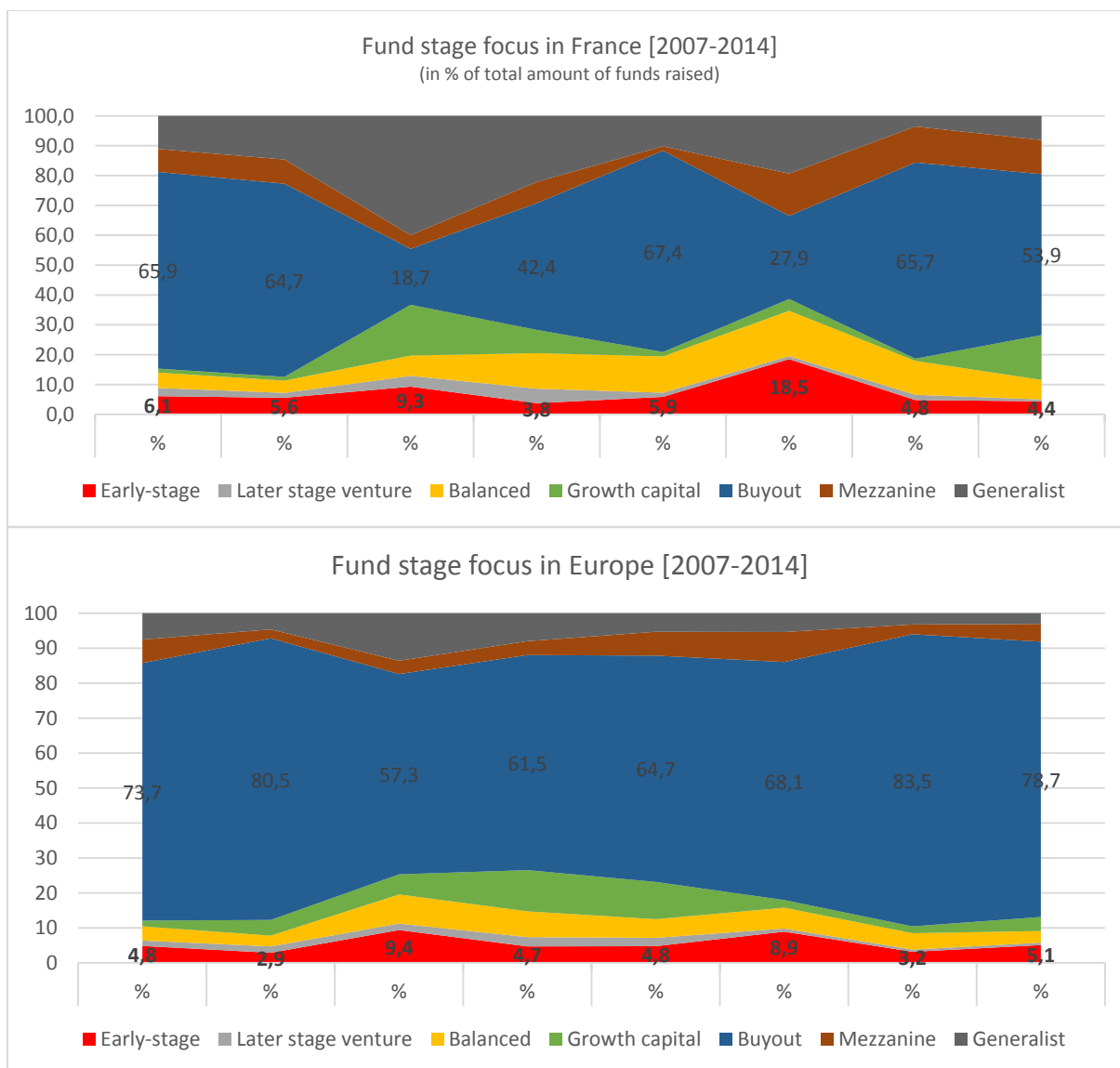
- **Equity investment.** It aims at bringing a minority investor in public capital to sustain small companies' business and boost its development.
- **Contract participatory development.** It aims at helping SMEs and ETIs to build their own funds for development projects.
- **Pre-financing of the R&D tax credit (CIR).** For innovative SMEs to have immediate cash to cover R&D expenses for current fiscal year, an interest rate being applied.
- **Pre-financing of CICE (Tax credit for competitiveness and employment).** Same system as with R&D tax credit, immediate cash-in.
- **Guaranteed cash loans.** This is the second measure of the National Pact for Growth, Competitiveness and Employment: Bpifrance provides guarantees to any bank that lends to medium term (2-7 years) to their SME clients to alleviate their short-term debt.
- **Innovation loan.** Aiming at helping SMEs finance their industrial and commercial development in France or abroad, even in the absence of collaterals.
- **Bpifrance export loan.**

Bpifrance is a major change: it is a unique centralised entry point to finance for innovative SMEs. It covers all their development needs, from "caprisk" to "capdev". As described in the bank documentation, there is a limited number of well-targeted, clearly differentiated, and easy to access support schemes. The funding support is tailored to meet SMEs needs. Selection criteria are straightforward. In March 2015 Bpifrance has presented its results for Y2014: Bpifrance supported 86,000 companies, a third of which were medium-sized, for a total funding of €12.5b dedicated to companies. Above €1b was allocated to financing innovation and slightly below €8b to loan guarantee.

EVCA data allow comparing the relative importance of early-stage funding in France with the rest of Europe<sup>87</sup>.

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<sup>87</sup> see <http://www.investeurope.eu/research/activity-data/annual-activity-statistics/>



**Figure 21.** Comparative weight of early-stage funding, France vs. Europe, 2007-2014

As the graphs above illustrate, it turns out that early-stage funding is overall slightly more developed in France than in Europe. A peak is observable in 2012, higher in France than in Europe in general, which is when Bpifrance was launched. In any instance, as an analysis of the type of investor would show, government agencies rule the game (with above 30% of all investments).

### 5.5 R&D related FDI

To start with, two key schemes, namely the French R&D tax credit (CIR) and the broad scope Competitiveness and employment tax credit (CICE) are meant to positively affect the FDI dynamics. Both measures have direct impacts on labour costs of the concerned populations, respectively researchers and employees with salaries below 2.5 times the minimum gross wage (i.e. €3,643.79 gross per month in 2015). These are typical framework conditions policy initiatives; international companies' decision-makers depend upon simple and highly visible indicators of attractiveness such as a reduced labour cost. As long as they can rely on the high quality skills they need and the market they intend to address. A crucial part of attractiveness policy is therefore to send positive signals that can reassure international players, irrespective of the fact that the company has already a R&D site in the country or not. Stability of the fiscal mechanisms in place is

one of those positive signals. This is why the current government has taken two initiatives aiming at attractiveness. Firstly, in 2014 the first Strategic Attractiveness Council<sup>88</sup> was held, chaired by President Hollande; and a second was held in June 2015. "Representatives of 22 major companies from 16 countries met with the Head of State, the Prime Minister and members of the government in the aim of "building sustainable dialog with CEOs and investors from around the world" (...); it serves to "highlight France's economic attractiveness." Secondly, on 1 January 2015, Ubifrance and the Invest in France Agency merged to become Business France<sup>89</sup>. The agency now gathers responsibilities for fostering export growth by French businesses (as in late Ubifrance) as well as for the promotion of international investment in France (as in late Invest in France). And it looks as though this strategy works, as the 15th edition of the Foreign Direct Investment (FDI) Confidence Index<sup>90</sup> emphasised; France has again moved up the ranking to reach rank 8<sup>th</sup> (from #12 in 2013).

According to the EY 2015 '[Baromètre 2015 de l'attractivité du site France](#)<sup>91</sup>', published on 27 May, France was the first location in Europe for industry implantations, with 231 investments (65 more than the previous year) in 2014. One may nonetheless notice that 20% of them were brand new ones, whereas 80% were extensions of already existing industrial locations. France has attracted 27 new R&D centres, so that it ranks third in Europe, after the UK (72 new centres) and Germany (47). 40% of the decision-makers surveyed stated the capacity for innovation and talents in France are the two main drivers of the country's appeal. However, these assets were not deemed sufficient to fix the strategic functions in France. For France to improve its attractiveness, the EY barometer suggests 4 policy actions to be taken (by order of importance): reducing labour costs, easing administrative and legal conditions, reducing business taxes and supporting R&I.

These recent data are confirmed by the '[Bilan 2014 des investissements étrangers en France](#)'; the latter account for more than 1,000 new implantations. According to this study, foreign investment projects in the R&D capabilities, engineering and design account for 9% of total investment (91 projects against 77 the year before). The subsidiaries of foreign companies in France account for 27% of R&D expenditure in France. New investment decisions in world's headquarters also increased, with 16 HQs in 2014.

## 5.6 Knowledge markets

A French patent box regime was introduced in 2000 (and amended in 2005 and 2010). Qualifying IP income and capital gains from qualifying IP are taxed at a reduced 15% rate of corporate tax, compared with the standard rate of 33.33%.

The R&D tax credit framework includes specific provisions with respect to patent-related expenses which are in many ways eligible expenses:

- the cost of applying to and maintaining patents and Proprietary Variety Certificate, the costs of defending patents and Proprietary Variety Certificate,
- the amortisation of acquired patents for research and Proprietary Variety Certificate,
- premiums and contributions or share of premiums and contributions in respect of the legal expenses insurance contracts for the management of expenditure incurred in litigation relating to a patent or a plant variety certificate whose company is holder are included in the limit of €60,000.

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<sup>88</sup> Cf. Strategic Attractiveness Council

<sup>89</sup> Cf. Business France

<sup>90</sup> FDI confidence Index 2015

<sup>91</sup> The 'barometer' is carried out as an opinion survey; 206 business leaders were surveyed in 25 countries and three languages from January 16 to 30 2015. The sample structure is representative of international investments.



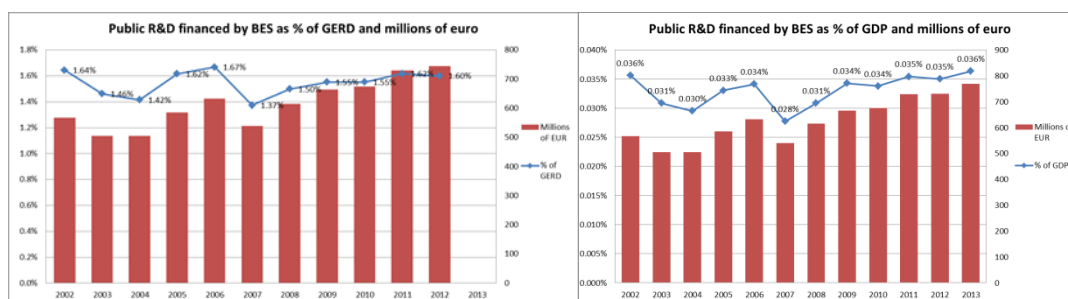
Secondly, INPI (Institut national de la propriété industrielle), the French patent office is entirely self-funded and actively participates in the development and implementation of public policies in the field of industrial property and anti-counterfeiting. INPI is in the decision loop regarding recent initiatives from the Commissariat général à l’investissement (CGI, the governing body responsible for the management of the Investments for the Future Programme) and from the Ministry for the Economy, Industry and Digital Affairs (MEIN). All over the country thanks to its regional offices, INPI has been very active in recent years in supporting, informing, educating and providing training to innovators. It has developed coaching solutions for SMEs to get their organisations IP-active so that they can fully benefit from their knowledge creation processes; the latter may then be re-designed. This goes as far as providing support for export initiatives, thanks to a large international network of country correspondents. On the international side, INPI adapts and builds industrial property rights, with a strong implication in European and global forums.

Thirdly, recent changes in the French systems are guided by a new attention to creativity and intellectual property value. Most Investments for the Future Programmes (PIA) funded projects have effects in terms of IP creation, valuation and protection. This is so of France Brevets. Established in March 2010, this experimental sovereign patents fund would eventually benefit from €100m capital, half from Caisse des dépôts et consignations (CDC), half from the PIA. The Fund’s mission is to support private and public research to better leverage its patent portfolio on the international stage. So far, its investment priority area is ICTs. This domain would eventually be complemented with aeronautics and space, new energy, chemistry, materials, life and environment sciences.

## 5.7 Knowledge transfer and open innovation

### 5.7.1 Knowledge Transfer Indicators

#### BES-funded/publicly-performed R&D

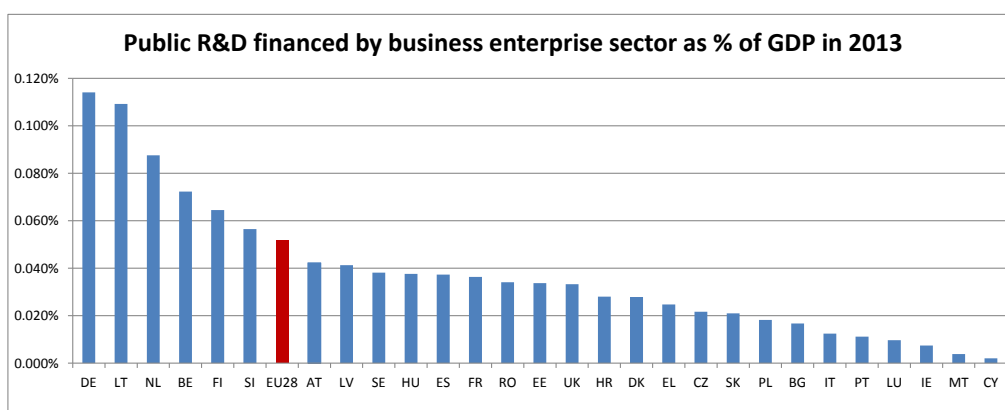
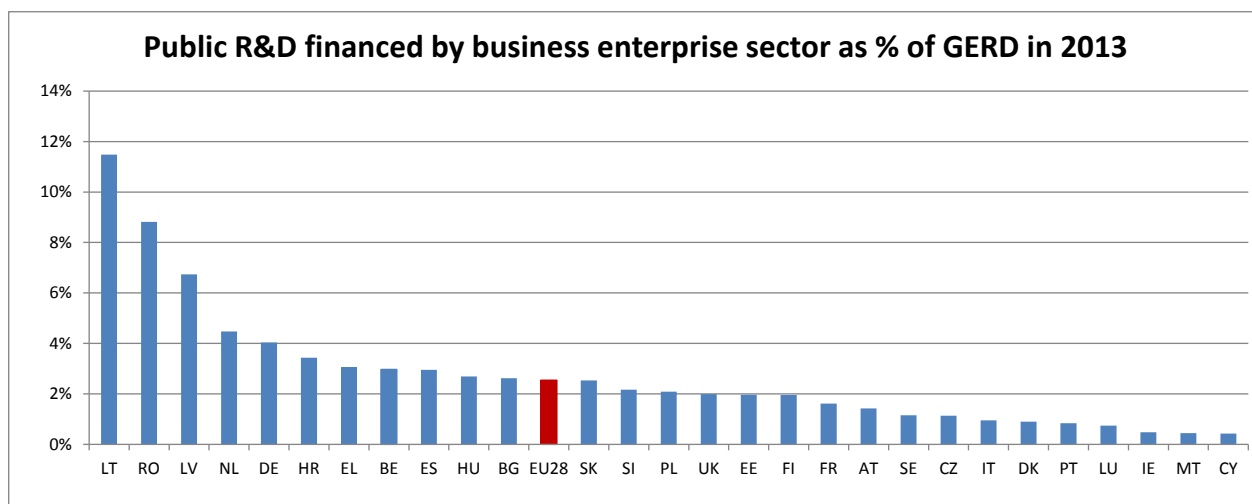


**Figure 22.** BES-funded public R&D in France as % of GERD (in €MLN) and % of GDP

The level of the French business enterprise (BES)-funded public R&D expenditure as a percentage of GERD decreased from 2002 to 2004, then increased till 2006, before decreasing in 2007. From this year on, it returned to a growing path until 2012, for which its level is superior to €700m.

The indicator expressed as a percentage of GDP followed a similar trend reaching a value of 0.036% GDP in 2013.

The increase public R&D financed by BES from 2007 has to be understood in relation with a major reform of the French R&D tax credit (,CIR) in 2008. Under the new regime, the tax credit covers up to 30% of all R&D expenses.



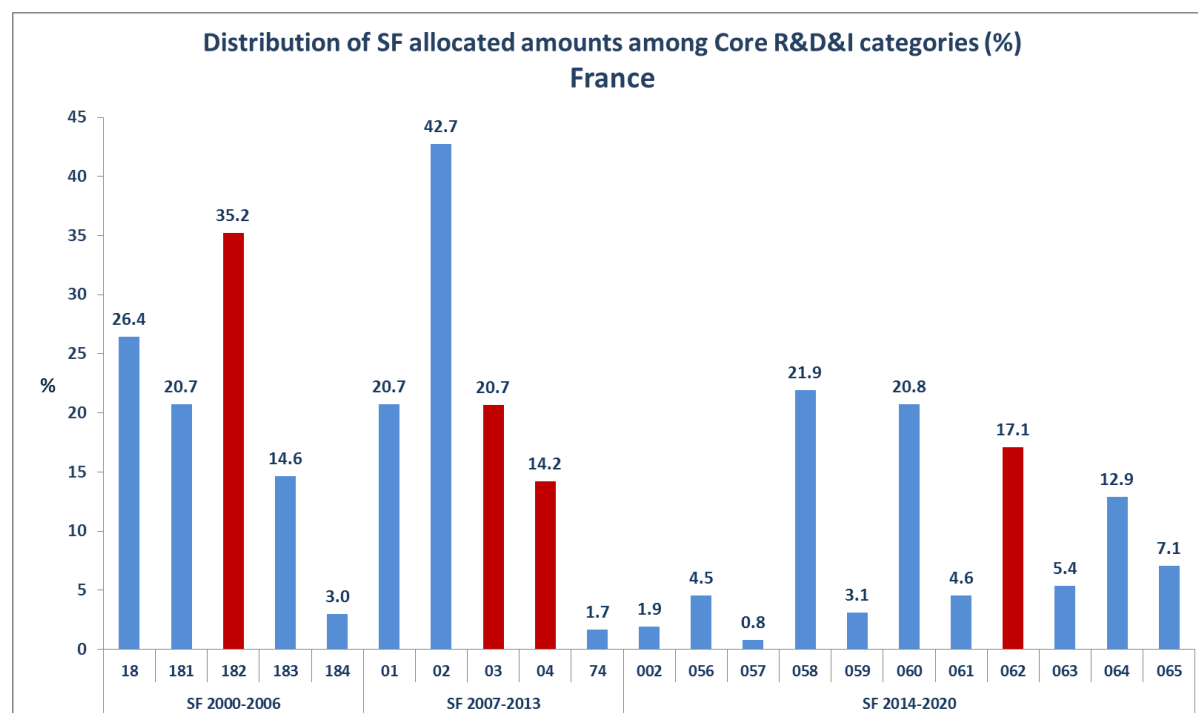
**Figure 23.** BES-funded public R&D as % of GERD and as % of GDP in 2013 in Member States<sup>92</sup>

The two charts in Figure 23 show the values of BES-funded public R&D in all EU-28 as percentages of GERD and GDP respectively.

France's levels are far below the one of the best performers and the EU-28 average for both indicators. It stands at 18<sup>th</sup> position regarding public R&D financed by business enterprise sector as percentage for GERD in 2013 (Germany: 5<sup>th</sup> position) and at the 12<sup>th</sup> position when the same indicator is expressed as percentage of GDP (Germany: 1<sup>st</sup> position).

<sup>92</sup> 2013 was chosen as the latest data series providing a full comparison within EU-28.

## Funding: structural funds devoted to knowledge transfer



**Figure 24.** Structural Funds for core R&D activities 2000-2006, 2007-2013 and 2014-2020<sup>93</sup>.

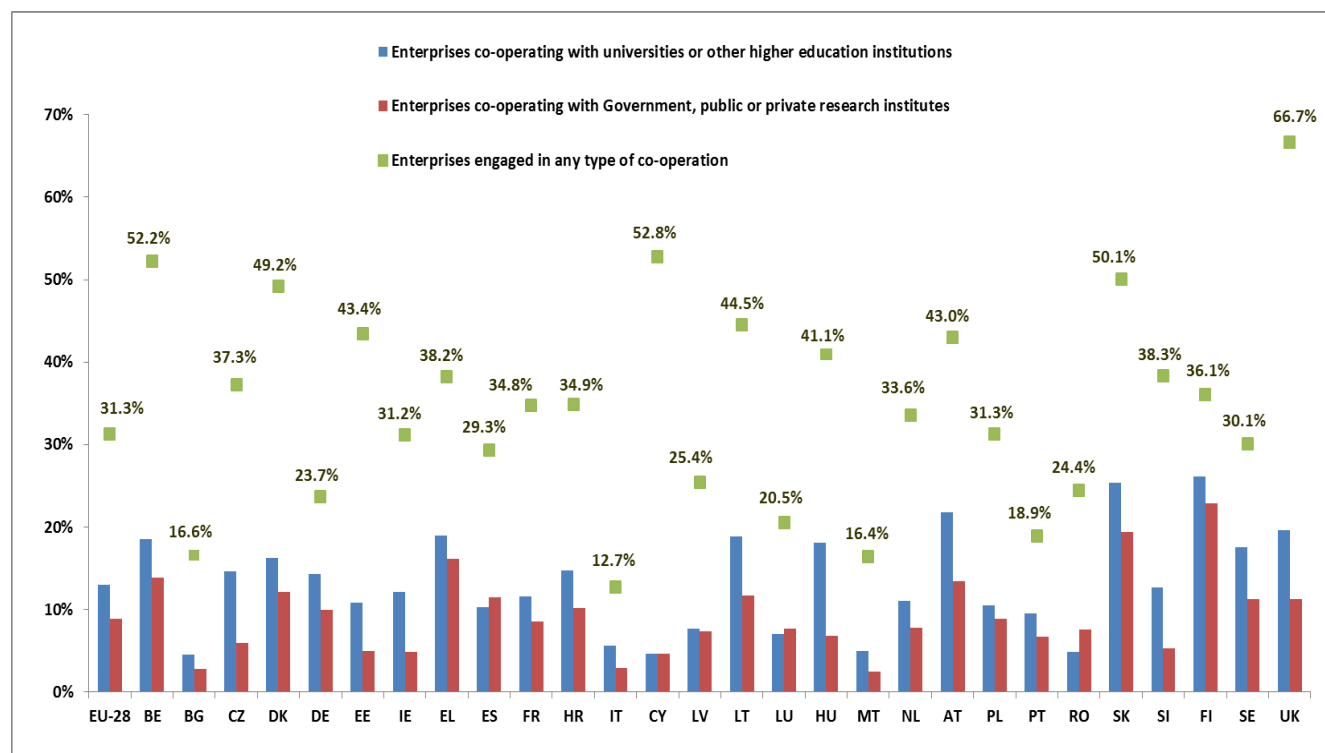
France has allocated 17.1% of its structural funds for core R&D activities to technology transfer and improvement of cooperation networks as well as assistance to R&D (compared to 35.2% for 2000-2006 and 34.9% in the previous programming period). It is slightly higher than the EU average of 15.7% (the EU average was 26.1% for 2000-2006 and 30.1% for 2007-2013). This high level of investment in public and private research infrastructure results from a number of policy orientations aiming to foster the development of public-private cooperation. Among these, in 2012, the Ministry of Higher Education and Research published "15 measures for a new transfer of public research dynamics, lever for growth and competitiveness". These measures have in turn been included in the Law on Higher Education and Research of July 2013 and taken into account in the elaboration of the national research strategy (2015).

<sup>93</sup> Figure 24 provides the Structural Funds allocated to France for each of the above R&D categories. The red bars show the categories used as proxies for KT. Please note that the figures refer to EU funds and they do not include the part co-funded by the Member State. The categories for 2000-2006 include: 18. Research, technological development and innovation (RTDI); 181. Research projects based in universities and research institutes; 182. Innovation and technology transfers, establishment of networks and partnerships between business and/or research institutes; 183. RTDI infrastructures; 184. Training for researchers.

The categories for 2007-2013 include: 01. R&TD activities in research centres; 02. R&TD infrastructure and centres of competence in specific technology; 03. Technology transfer and improvement of cooperation networks; 04. Assistance to R&TD particular in SMEs; 74. Developing human potential in the field of research and innovation.

The categories for 2014-2020 include: 002. Research and Innovation processes in large enterprises; 056. Investment in infrastructure, capacities and equipment in SMEs directly linked to Research and Innovation activities; 057. Investment in infrastructure, capacities and equipment in large companies directly linked to Research and Innovation activities; 058. Research and Innovation infrastructure (public); 059. Research and Innovation infrastructure (private, including science parks); 060. Research and Innovation activities in public research centres and centres of competence including networking; 061. Research and Innovation activities in private research centres including networking; 062. Technology transfer and university-enterprise cooperation primarily benefiting SMEs; 063. Cluster support and business networks primarily benefiting SMEs; 064. Research and Innovation processes in SMEs (including voucher schemes, process, design, service and social innovation); 065. Research and Innovation infrastructure, processes, technology transfer and cooperation of enterprises focusing on the low carbon economy and on resilience to climate change.

## Cooperation: share of innovative companies cooperating with academia



**Figure 25.** CIS survey 2012 – share of enterprises cooperating with academia

The share of French innovative companies involved in any type of cooperation is of 34.8%, slightly above the EU average (31.3%). About one third of them (11.6% of total sample of innovative companies) cooperates with universities and higher education institutions. Though lower, this level compares to that Germany (14.3%). Slightly less (8.5%) cooperates with government or public or private research institutes (compared to 9.9% in DE). In comparison to the UK, where two-third of enterprises engaged in any kind of cooperation, France still has room for improvement in terms of cooperation between enterprises and academia.

### Cooperation: Technology Transfer Offices (TTOs), incubators and technological parks

France has created a wide range of offices aimed to facilitate knowledge transfer between sectors:

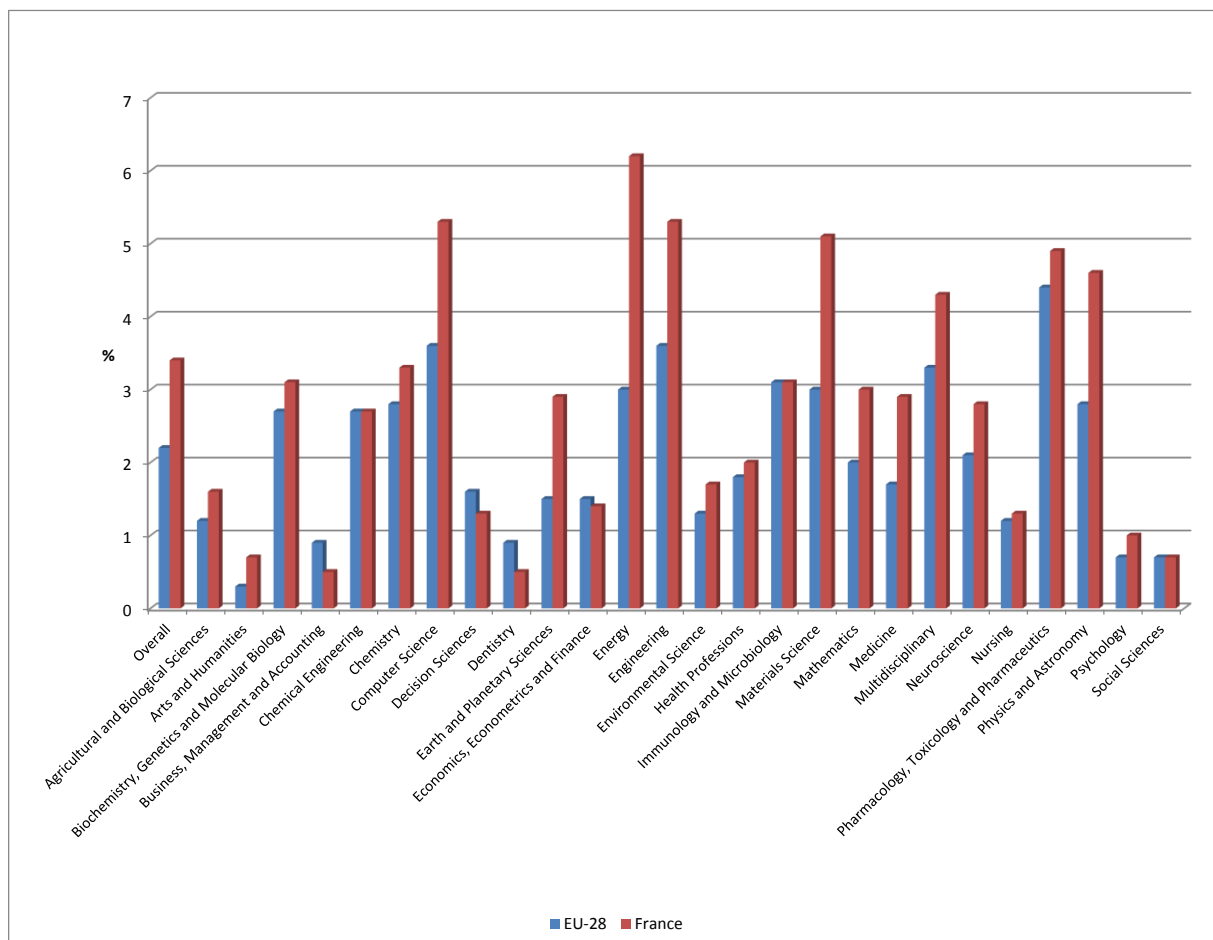
- SATT (Sociétés d'Accélération du Transfert de Technologies) - Societies for Accelerating Technology Transfer. There are 14 private companies with full public capital so far, geographically distributed nationwide, benefiting from 0.856 billion Euro over ten years. SATTs are mandated by public research institutions to take care of the value creation process from research results' intellectual property. One interim evaluation of the first five SATTs has been carried out; as it was deemed satisfactory enough, the planned budgetary outlays were granted to these 5 SATTs<sup>94</sup>. According to the budgetary documents<sup>95</sup>, the SATT declared the following progress indicators (as of May 2014):

<sup>94</sup>[http://www.performance-publique.budget.gouv.fr/sites/performance\\_publique/files/farandole/ressources/2016/pap/pdf/jaunes/jaune2016\\_investissements\\_avenir.pdf](http://www.performance-publique.budget.gouv.fr/sites/performance_publique/files/farandole/ressources/2016/pap/pdf/jaunes/jaune2016_investissements_avenir.pdf)

<sup>95</sup> [http://www.performance-publique.budget.gouv.fr/sites/performance\\_publique/files/farandole/ressources/2015/pap/pdf/jaunes/jaune2015\\_investissements\\_avenir.pdf](http://www.performance-publique.budget.gouv.fr/sites/performance_publique/files/farandole/ressources/2015/pap/pdf/jaunes/jaune2015_investissements_avenir.pdf)

- 358 people specialised in intellectual property, technology projects management, law, marketing and business development are employed;
- 2300 projects were detected and analysed;
- 48 million Euro were invested in "maturing projects";
- 86 licenses were signed.
- IRT (Instituts de Recherche Technologique) and ITE (Instituts pour la Transition Energétique) forms a continuum of technology research public-private platforms. There are 16 of those institutes and they have benefited from about €2b over the last ten years. Legally they are set-up as foundations.
  - Voted budget for IRTs are 471 million Euro of "consumable endowments" and 1.5 billion Euro of non-consumable endowment. As of 31<sup>st</sup> of July 2014, 166.2 million Euro were actually spent. One only of the 8 IRTs in operation has declared some progress or impact indicators.
  - Voted budget for ITEs are 221 million Euro of "consumable endowments" and 655 million Euro of non-consumable endowment. As of 31<sup>st</sup> of July, 40 million Euro were actually spent. There are 12 ITEs in operation, but no progress or impact indicators are available yet.
- Complementary initiatives are the 5 CEA-TECH platforms (a CEA initiative), the Carnot 3.0, and the National Research Agency's calls for proposal named "LabCom", aiming at the creation of 100 SME-public research joint labs.

### Cooperation: share of public-private co-publications



**Figure 26.** Co-publications by field 2003-2013 in France. Scopus database

Figure 26 shows the 2003-2013 average percentage of academia-industry co-publications by field in France compared to the European average. Scopus data also indicate that the percentage of co-publications has increased over the last ten years (2003-2013), passing from 2.6% to 3.4% of academia-business publications in 2013. In 2013, France produces 52.5 public-private co-publications per million of population, well above the 29 for the EU-28 (and 57.8 for DE, 67.5 for UK)<sup>96</sup>. The domains with highest percentage of co-publications are energy, engineering and computer science.

**Cooperation: patenting activity of public research organisations and universities together with licensing income**

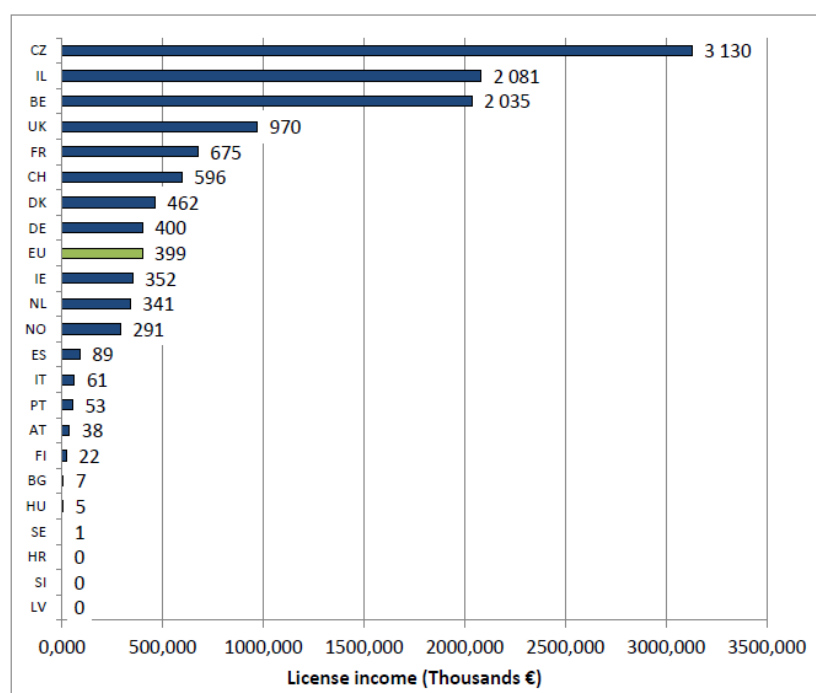
The Knowledge Transfer Study allows benchmarking the French performances with the other surveyed countries as well as with the EU average.

The number of patent grants per 1 000 research staff is in France of 18.7, well above the EU average (4.5), UK (4.4) and Germany (2.6).

On the other hand, France (4.3) is below the EU average (6.5), DE (5) and the UK (16.3) in terms of number of license agreements per 1000 research staff.

Similar results are obtained regarding the license income per 1000 research staff. France (675 000 Euro) is above the EU average (399 000) and Germany (400 000), but below UK (970 000).

*Exhibit 3-35: Thousands Euros of license income per 1,000 research staff by country, EKTIS 2011 and 2012 results combined*



Source: MERIT, European Knowledge Transfer Indicator Survey 2011 and 2012.

**Figure 27.** License income per 1 000 research staff by country. EKTIS 2011-2012 survey

<sup>96</sup> RIO elaboration based on Scopus data.

**Table 17.** Patent applications by PROs as indicators of KT

Rank	PROs	# of patent applications by
6	CEA (Commissariat à l'énergie atomique et aux énergies alternatives)	643
10	CNRS (Centre national de la recherche scientifique)	565
20	IFP Energies nouvelles	193
21	INSERM	165
32	Université Claude Bernard Lyon 1	58
33	Université Pierre et Marie Curie Paris 6	56
41	Université de Strasbourg	39
43	INRA (Institut national de la recherche agronomique)	37
50	CNES (Centre national d'études spatiales)	33
50	Université de Montpellier	33

Source: [Laurence Sekkat, Les palmarès de déposants de brevets, Statistiques INPI ; avril 2015](#)

### Cooperation Companies

Although no national comprehensive data is available on the number of spin-offs in France, several proxies provide information on private companies established by academics or linked to universities<sup>97</sup>:

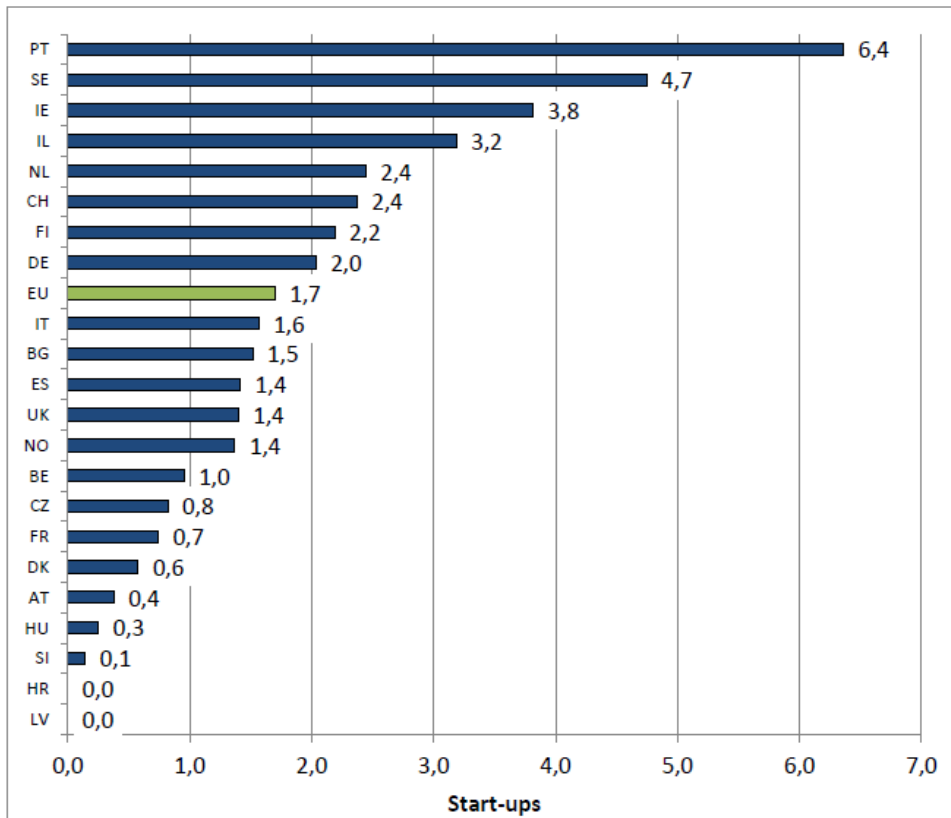
- 113 start-ups were created in the framework of SATT in the last four years (Societies for Accelerating Technology Transfer)
- around 65 start-ups par year are created since 2006 in the framework of the Carnot Institutes aimed at fostering public-private cooperation between research institutes and companies.
- more than 1730 start-ups were financially supported through i-LAB, a national award of the Ministry of Higher Education and Research for the creation of companies of innovative technologies
- around 2 800 start-ups were accompanied by public incubators (23 public incubators in France)

The European Knowledge Transfer Survey highlights that France has a very low number of start-ups per 1000 research staff (0.7) in comparison with the EU average (1.7).

<sup>97</sup> Draft RIO Country Report 2015.

National source: [http://www.performance-publique.budget.gouv.fr/sites/performance-publique/files/farandole/ressources/2015/pap/pdf/jaunes/jaune2015\\_investissements\\_avenir.pdf](http://www.performance-publique.budget.gouv.fr/sites/performance-publique/files/farandole/ressources/2015/pap/pdf/jaunes/jaune2015_investissements_avenir.pdf)

Exhibit 3-33: Number of start-ups per 1,000 research staff by country, EKTIS 2011 and 2012 results combined



Source: MERIT, European Knowledge Transfer Indicator Survey 2011 and 2012.

**Figure 28.** Number of start-ups per 1 000 of research staff per country. EKTIS 2011-2012 survey

### 5.7.2 Policy Measures

One of the current objectives of recent research and innovation policies in France is to better link public and corporate research to reach a higher competitiveness level. A specific focus is also placed on improving the support for the exploitation of research outcomes from a business perspective. The new Law on Higher Education and Research, promulgated on 22 July 2013, includes the formulation of a new national strategy for research, incorporated into France Europe 2020 strategic agenda for research, technology transfer and innovation.

The on-going reform modifies key components of the system's organisation and deals with open innovation, technology and knowledge transfers, as exemplified in the new book of the Code of Research<sup>98</sup>. The law notably stipulates that inventions resulting from publicly funded research should preferably be commercialised through SMEs and ETIs on European territory.

Noteworthy changes were implemented in the framework of the law, including: first, a single representative shall be given the responsibility for the management, operation and trading of patentable inventions made by State personnel and persons vested with public research mission, when the whole or part of the property is shared among several public research institutions<sup>99</sup>. Second, as mentioned above, the transfer of research

<sup>98</sup> <http://www.legifrance.com/affichCode.do?cidTexte=LEGITEX000006071190>

<sup>99</sup> Cf. Décret n° 2014-1518 du 16 décembre 2014 relatif au mode de désignation et aux missions du mandataire prévu à



results to the service of society is added to the mission of higher education and public research.

The mainstreaming of the knowledge transfer mission through the law stems from converging societal and political evolutions. Within a few months after the nomination of the Minister for Higher Education and Research, a founding policy document was issued: "[15 measures for a new transfer of public research dynamics, a lever for growth and competitiveness](#)". It was published in the form of a joint communication of the Ministry for Research and the Ministry for the Economy at the close of the Council of Ministers of 7 November 2012. It was then included in the France Europe 2020 strategic agenda (May 2013). In the meantime, the Beylat-Tambourin report was issued.

Knowledge transfer-oriented policies are listed in "France Europe 2020" strategic agenda (May 2013), and especially in Chapter 5 entitled "Promoting innovation and technology transfer" (pp. 56-61), which addresses the challenge of the "efficiency of technology and knowledge transfer to industry". In more detail, the Strategic Agenda specifies 6 main lines of action:

- Piloting, supporting and monitoring the stakeholders involved in knowledge transfer
- Dissemination of transfer and innovation culture within public research
- Improved management of intellectual property publicly funded research
- Strengthening transfer to SMEs
- Strengthening of transfer by the creating companies
- Research on transfer and entrepreneurship (via the creation of a think-tank)

The French government has also developed a large set of programmes aimed at strengthening the cooperation and facilitate knowledge transfer. In addition to the SATT and IRTs (introduced in section 5.7.1), key initiatives consist of:

#### (1) France-Europe 2020 strategic agenda.

Knowledge transfer-oriented policies are listed especially in Chapter 5 entitled "Promoting innovation and technology transfer" (pp. 56-61), which addresses the challenge of the "efficiency of technology and knowledge transfer to industry". The Strategic Agenda specifies 6 main lines of action:

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- Improved management of intellectual property publicly funded research
- Strengthening transfer to SMEs
- Strengthening of transfer by the creating companies
- Research on transfer and entrepreneurship (via the creation of a think-tank)

#### (2) The CIFRE program (Conventions industrielles de formation par la recherche)<sup>100</sup>

The purpose of CIFRE is to strengthen exchanges between public research laboratories and private companies, promote the employment of doctors in business and contribute to the innovation process of French companies. Since its creation in 1981, CIFRE agreements have allowed the defence of more than 20,000 theses. It has encompassed 7 500 companies and 4 000 research teams.

#### (3) The Technology Platforms<sup>101</sup>

The objective of Technology Platforms (created in 2000) is to support and institutionalise the 3rd mission of public education and training institutions, i.e. the promotion of innovation and technology transfer. The measure is geared both to education institutions

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l'article L. 533-1 du code de la recherche

<sup>100</sup> [http://www.anrt.asso.fr/fr/espace\\_cifre/accueil.jsp#\\_VC1W5xApx8E](http://www.anrt.asso.fr/fr/espace_cifre/accueil.jsp#_VC1W5xApx8E)

<sup>101</sup> <http://www.enseignementsup-recherche.gouv.fr/cid5777/les-structures-de-diffusion-de-technologies.html>

and SMEs and aims at making the two parties mutually aware and open to cooperation. Organised around SMEs needs, Technology Platforms are expected to reinforce the supply with education institutions of technological services to SMEs.

Technology Platforms have three main guidelines:

- to provide resources and competences of HEI, training institutions but also secondary technical education institutions (professional high schools) and lifelong learning professional training organisms, for the benefit of SMEs;
- to create a common space for training and technological services;
- to develop of a network gathering various technology

A PFT covers a medium sized city. According to its size each French region has 1 to 6 PFTs.

#### (4) The National Research Agency

This organisation created in 2005 provides funding for project-based research. Employing a method based on competitive peer reviews that complies with international standards, ANR provides the scientific community with instruments and conditions that promote creativity and openness, and stimulate new ideas and partnerships between the public and private sectors. In addition, the National Research Agency manages the "Investment for the Future Programs" (Programme des Investissements d'Avenir) created in 2010 to foster research investments.

#### (5) The Carnot Institutes<sup>102</sup>

The Label Carnot is part of the global "Pact for research" programme passed at the end of 2005. The Carnot Label measure is in line with the wish to develop better links and partnership between public and private research and business in France. It was designed in 2005 in the context of the competitiveness clusters policy.

The main challenge addressed is the use of basic research performed by public actors by enterprises and SMEs with the aim to develop innovations.

To be awarded the label (for 4 year duration), a Carnot Institute must:

- Clearly define its research strategy
- Have or create a sound internal organisation
- Keep downstream research in-house to enrich more applied research
- Be substantially engaged in contract research with socio-economic actors

Carnot Institutes encompass 15% of the French research staff and over 55% of the research financed to the French public laboratories by enterprises. They are defined by the following indicators:

- 13 000 permanent research staff;
- 8 000 PhD students;
- 2 200 million Euro of annual budget;
- 458 M€ million Euro from research in partnership with industry;
- Income linked to contracts with the private sector have increased up to 50% between 2010 and 2014 ;
- More than 5 000 research contracts concluded in 2008.

#### (6) The LabCom program<sup>103</sup>

In March 2013, the French National Research Agency (ANR) issued a call for projects, known as "LabCom", to promote the creation of joint laboratories bringing together

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<sup>102</sup><http://www.instituts-carnot.eu/>

<sup>103</sup><http://www.agence-nationale-recherche.fr/fileadmin/aap/2014/aap-labcom-2014.pdf>

public research laboratories and SMEs and mid-caps. The aim of this new programme is to encourage and support partnerships with businesses. To become a "LabCom", the laboratory must sign a contract setting out how it operates. In particular, this must include:

- Joint governance
- A research and innovation roadmap
- Working resources allowing joint implementation of the roadmap
- A strategy to ensure that the company generates added value from partnership work.

The purpose is to create 100 laboratories over 3 year.

(7) The PEPITE Programme (Pôles Étudiants pour l'Innovation, le Transfert et l'Entrepreneuriat)

Launched in September 2014, the 'student-entrepreneur status' was created to promote youth entrepreneurship. Access conditions are simple: young people should be aged under 28 (student status). They should hold a bachelor's degree (or equivalent). Legal registration fees are limited to 500 euros per year for the 2014-2017 period. The status can be obtained after an analysis of the quality of the entrepreneurial project, and upon the project leader qualities. The 'PEPITE committee' is responsible for examining applications to the Ministry of Higher Education and Research. It is composed of representatives of PEPITE institutions, the head teacher of the student hosting school and of "PEPITE partners ". There are currently 29 of those PEPITE centres all over the country. With this status, the young student-entrepreneur have access to the following benefits:

- Supervision by a teacher and by an external referent from the PEPITE network,
- access to a PEPITE co-working space to favour young entrepreneurs' networking.

Science-industry links have long been identified as one of the systemic problems of the French research and innovation system. National and international assessments have highlighted the fragmentation of the French R&D policy and a relative lack of consistency of knowledge transfer mechanisms.

To improve this tendency, France has recently implemented a series of legal and strategic documents such a Law on Research and Higher Education (2013) and a strategic agenda for research, technology transfer and innovation (France-Europe 2020). These two documents provide a general framework for research and policy developments and define an action line for the French R&D policy till 2020. In particular, the transfer of research results to society is characterised as a core mission of the higher education and research system.

In parallel to the development of a legal and organizational framework, France has implemented a series of policy measures aimed at facilitating the transfer of knowledge from academia to business. Among them, the creation of the National Agency for Research (2005), aimed to provide funding to research projects and institutions, is of utmost importance. Other initiatives, such as the creation of SATT (Societies for Accelerating Technology Transfer), IRT (Technological Research Institutes), the LabCom program or the Carnot Institutes have been designed to transform the French knowledge transfer landscape and foster synergies between public and private sectors. The institutional initiatives illustrate the relatively high and still increasing rate of enterprises involved in any kind of cooperation (34.8%).

Finally, although evaluations of the R&D institutions, programmes and policies have long been identified as a weak point of the French framework, recent developments indicate a significant evolution in this field. A National Commission for the evaluation of innovation policies has been created in 2014 and should allow future independent assessments of R&D stakeholders.

## **5.8 Regulation and innovation**

Although the question of the impacts of regulations and laws on innovation was debated, both in 2012 and in [2014](#)<sup>104</sup>, within the Parliamentary Office for the Evaluation of Scientific and Technological Choices (OPECST), there is no such thing as a systematic impact assessment of new laws on innovation and competitiveness as is the case at EU level. There are some ex ante evaluations of future regulations and laws mainly when they pose ethical problems.

## **5.9 Assessment of the framework conditions for business R&I**

In light of the facts compiled and exposed in previous sections (from 5.1. to 5.8.), framework conditions can be said to become consistent and likely to be conducive to business investment in research and innovation. In particular, supply and demand-side policies and instruments tend to co-evolve through joint formulation and coordinated implementation. Inter-ministerial decision-making is making progress. One may talk about some mainstreaming of research and innovation policies so that businesses are positively affected. Systemic evaluations remain much too scarce though and too often confined to generic questions relating to 'big principles'. Government and policy bodies, even when they were build independent, tend to be cautious when it comes to being evaluated.

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<sup>104</sup> Cf. Rapport de l'OPECST n. 133 (2014-2015), « Le principe d'innovation » - Compte rendu de l'audition publique du 5 juin 2014 et de la présentation des conclusions les 4 et 26 novembre 2014, 27 novembre 2014.

## 6. Conclusions

### Meeting structural challenges

A number of structural challenges have been identified in the French system. The table below lists a selected number of actions and assesses appropriateness, efficiency and effectiveness of the actions. Since the changes aimed at are systemic, only convergent efforts over a rather long period of time can succeed.

**Table 18.** Structural challenges and potential policy answers

Challenges	Policy measures/actions addressing the challenge <sup>105</sup>	Assessment in terms of appropriateness, efficiency and effectiveness
<b>1. A culture of innovation.</b>	<p>Levers to <b>trigger cultural changes to improve a country innovation's abilities</b>, including collective actions, such as:</p> <ul style="list-style-type: none"> <li>. The development of associations dedicated to entrepreneurs "rebound", such as those gathered under the umbrella of the web portal "portail du rebond des entrepreneurs", <a href="http://portaildurebond.com">portaildurebond.com</a></li> <li>. Organisation of conferences, supported by public policy and HEI such as: "bouncing entrepreneurs", 13 January 2014, supported by the Ministry for the Economy, Industry and Digital sector.</li> </ul>	<p>High level of appropriateness</p> <p>Both effectiveness and efficiency will be hard to assess (incl. regarding simple questions like: who, when and how much)</p>
<b>2. Closer connections between the education system and the business and industrial world.</b>	<ul style="list-style-type: none"> <li>. Cf. first two recommendations of "Innovation, a major challenge for France" (November 2012):</li> <li>1. Revise teaching methods in primary and secondary education to develop innovative initiatives.</li> <li>2. Establish a large-scale program for entrepreneurship learning in higher education.</li> </ul>	<p>High level of appropriateness</p> <p>Much remains to be done before any evaluation of the effectiveness and efficiency</p>
<b>3. Better science-industry links: efficiency of technology and knowledge transfers to industry.</b>	<p><b>Implementing open innovation</b> measures:</p> <ul style="list-style-type: none"> <li>. "15 measures for a new transfer of public research dynamics, lever for growth and competitiveness" (November 2012; and in the chapter of the France Europe 2020 strategic agenda, May 2013).</li> <li>. IRT (Instituts de recherche technologique, with their thematic variant "Instituts pour la transition énergétique", ITE), public-private technological research labs (IRT+ITE~20).</li> <li>. SATT (Sociétés d'accélération du transfert de technologies), national coverage to commercialise research results to companies (SATT~10).</li> <li>. CEA-Tech, network of 5 local units, aiming at bringing the best key enabling technology from CEA research centres (LETI, LIST, LITEN) to SMEs in five regions.</li> </ul>	<p>High level of appropriateness.</p> <p>According to the High Commission for Investments, apparently rather good effectiveness; too early to assess efficiency</p> <p>In any instance: lack of transparency (cf. Challenge #4)</p>

<sup>105</sup> All kind of changes are included, not necessarily implying financial investments.

<p><b>4. Use of evaluation of research and innovation policy.</b></p>	<p><b>Implementing consistent, independent and cross-ministerial evaluations and monitoring of innovation and research policies:</b> a whole new evaluation scheme including:</p> <ul style="list-style-type: none"> <li>. The “Evaluation of Innovation Policies Committee” implemented under the auspices of France Stratégie (as of June 2014) whose mission is to assess the French innovation policies as a whole and in its parts, both on the basis of available reports and overseeing new studies; all reports will be made public.</li> <li>. The new High Council of the Evaluation of Research (established 1 November 2013).</li> <li>. Strategic Research Council (installed on 19 December 2013).</li> <li>. Growing number of published R&amp;I evaluations (notably by the Court of Auditors benefit from a large public attention).</li> </ul>	<p>High level of appropriateness.</p> <p>Both effectiveness and efficiency are globally improving; too early as regards this new initiative</p>
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**Source:** Synthesis based upon the author’s opinion.

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## Abbreviations

ADEME Agence de l'environnement et de la maîtrise de l'énergie / Agency for Environment and Energy Management

AERES Agence d'évaluation de la recherche et de l'enseignement supérieur / Evaluation Agency for Research and Higher Education (former name of the HCERES)

ANR Agence nationale de la recherche / National Research Agency

AREVA Public industrial conglomerate specialised in energy, especially nuclear power

ASRC Association des structures de recherche sous contrats / Contract Research Organisations Association

BERD Business Expenditures for Research and Development

BERD Business Expenditures for Research and Development

CEA Commissariat à l'énergie atomique et aux énergies alternatives / Alternative Energies and Atomic Energy Commission

CERN European Organisation for Nuclear Research

CGI Commissariat général à l'investissement / High Commission for Investments

CGSP Commissariat général à la stratégie et à la prospective / General Commission for Strategy and Economic Foresight (former name of France Strategy)

CICE Crédit d'impôt pour la compétitivité et l'emploi / Tax credit for competitiveness and employment

CIFRE Conventions industrielles de formation par la recherche / Industrial Research Training Conventions

CINES Centre informatique national de l'enseignement supérieur / National IT Centre for Higher Education

CIR Crédit d'impôt recherche / R&D tax credit

CNRS Centre national de la recherche scientifique / National Centre for Scientific Research

CNU Conseil national des universités / National University Committee

COMUE Communautés d'universités et d'établissements / Universities and research institutions clusters

COST European Cooperation in Science and Technology

CPER Contrat de projet Etat-Région / State-Region Projects Contract

CSR Conseil stratégique de la recherche / Strategic Research Council

DATAR Délégation interministérielle à l'aménagement du territoire et à l'attractivité régionale / Interministerial Delegation for Territorial Development and Regional Attractiveness (now part of the Commissariat général à l'égalité des territoires - CGET)

DG Directorate General (of the European Commission)

DGRI Direction générale de la recherche et de l'innovation (MENESR) / Directorate-General for Research and Innovation (MENESR)

EC European Commission

ECB European Central Bank

EIB European Investment Bank

ENA Ecole nationale d'administration

EPO European Patent Office  
EQUIPEX Excellence Equipments  
ERA European Research Area  
ERA-NET European Research Area Network  
ERDF European Regional Development Fund  
ERP Fund European Recovery Programme Fund  
ESA European Space Agency  
ESF European Social Fund  
ESFRI European Strategy Forum on Research Infrastructures  
ESIF European Structural and Investment Fund  
ETI Entreprise de taille intermédiaire / Mid-tier enterprise  
ETP European Technology Platform  
EU European Union  
EU-28 European Union including 28 Member States  
FDI Foreign Direct Investments  
FhG Fraunhofer-Gesellschaft (Fraunhofer Society)  
FP Framework Programme  
FP / FP7 European Framework Programme for Research and Technology Development / 7th  
FP7 7th Framework Programme  
FUI Fonds unique interministériel / Single Interministerial Fund (dedicated to competitiveness clusters)  
FUN France Université Numérique / France Digital University  
GBAORD Government Budget Appropriations or Outlays for R&D  
GDP Gross Domestic Product  
GERD Gross Domestic Expenditure on R&D  
HCERES Haut Conseil de l'évaluation de la recherche et de l'enseignement supérieur / High Council for Evaluation of Research and Higher Education  
HDR Habilitation à diriger des recherches / Accreditation to supervise research  
HEI Higher education institutions  
HERD Higher Education Expenditure on R&D  
HES Higher Education Sector  
HRST Human Resources in Science and Technology  
ICT Information and communication technologies  
IDEX Initiative d'excellence / Excellence Initiative  
IGF Inspection générale des finances / Inspectorate-General of Finances  
IHU Instituts hospitalo-universitaires / University Hospital Institute  
INED Institut national des études démographiques / National Institute for Demographic Studies  
Innovation

INRA Institut national de la recherche agronomique / National Institute for Agricultural Research

INSERM Institut national de la santé et de la recherche médicale / National Institute for Medical Research and Health

IP Intellectual Property

IPR Intellectual Property Rights

IRSTEA Institut national de recherche en sciences et technologies pour l'environnement et l'agriculture / National Research Institute for Environment and Agricultural Sciences and Technologies

IRT Institut de recherche technologique / Technology Research Institute

ITE Institut pour la transition énergétique / Energy Transition Institute

IU Innovation Union

IUS Innovation Union Scoreboard

JEI Jeune entreprise innovante / Young Innovative Enterprise

JPI Joint Programming Initiative

JTI Joint Technology Initiative

KET Key Enabling Technologies

KT Knowledge Transfer

LABEX Laboratoire d'excellence / Excellence Laboratory

MEDDE Ministère de l'Écologie, du Développement durable et de l'Énergie / Ministry for Ecology, Sustainable

MEIN Ministère de l'Économie, de l'Industrie et du Numérique / Ministry for the Economy, Industry and the Digital Sector

MENESR Ministère de l'Éducation, de l'Enseignement Supérieur et de la recherche / Ministry of Education, Higher Education and Research

MIRES Mission interministérielle recherche et enseignement supérieur / Interministerial Mission on Research and Higher Education

MRP Ministère du Redressement productif / Ministry for Economic Regeneration (former name of the Ministry for the Economy, Industry and the Digital Sector)

NRP National Reform Programme

OECD Organisation for Economic Co-operation and Development / OECD

PIA Programme d'investissements d'avenir / Investments for the Future Programme

PRES Pôle de recherche et d'enseignement supérieur / Research and higher education cluster

PRO Public Research Organisation

R&D Research and Development

R&D&I Research and Development and Innovation

R&I Research and Innovation

RDI Research Development and Innovation

RENATER Réseau national de télécommunications pour la technologie, l'enseignement et la recherche / Telecom Network for Technology, Education and Research

RI Research Infrastructures  
RIS Regional Innovation System  
RIS3 Regional and/or National Research and Innovation Strategies on Smart Specialisation  
S&E Science and Engineering  
S&T Science and Technology  
SATT Sociétés d'accélération du transfert de technologies / Technology Transfer Accelerating Companies  
SF Structural Funds  
SME Small and Medium Sized Enterprise  
SNR Stratégie nationale de recherche / National Research Strategy  
SRESR Regional Research and Higher Education Scheme  
SRI Stratégie régionale d'innovation / Regional Innovation Strategy  
SRR Schéma régional de recherche / Regional Research Layout  
SSH Social Sciences and Humanities  
SWOT Strengths, Weaknesses, Opportunities, Threats  
TFEU Treaty on the Functioning of the European Union  
VC Venture Capital

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## **Annex 1 – List of the main research performers**

ALCATEL-LUCENT (#54, EU R&D SCOREBOARD 2015)

BRGM - Bureau de recherches géologiques et minières

CEA - Commissariat à l'énergie atomique et aux énergies alternatives

CIRAD - Centre de coopération internationale en recherche agronomique pour le développement

CNES - Centre national d'études spatiales

CNRS - Centre national de la recherche scientifique

ELECTRICITE DE FRANCE (#154, EU R&D SCOREBOARD 2015)

Génopole

IFP Energies nouvelles

IFREMER - Institut français de recherche pour l'exploitation de la mer

IFSTTAR - Institut français des sciences et technologies des transports, de l'aménagement et des réseaux

INED - Institut national d'études démographiques

INRA - Institut national de la recherche agronomique

INRIA - Institut national de recherche en informatique et en automatique

INSERM - Institut national de la santé et de la recherche médicale

Institut Pasteur

IRD - Institut de recherche pour le développement

IRSTEA - Institut national de recherche en sciences et technologies pour l'environnement et l'agriculture

L'OREAL (#157, EU R&D SCOREBOARD 2015)

MICHELIN (#176, EU R&D SCOREBOARD 2015)

ONERA - Office National d'Etudes et Recherches Aérospatiales

ORANGE (#162, EU R&D SCOREBOARD 2015)

PEUGEOT (#53, EU R&D SCOREBOARD 2015)

RENAULT (#63, EU R&D SCOREBOARD 2015)

SAFRAN (#90, EU R&D SCOREBOARD 2015)

SANOFI (#19, EU R&D SCOREBOARD 2015)

SCHNEIDER (#134, EU R&D SCOREBOARD 2015)

SERVIER (#146, EU R&D SCOREBOARD 2015)

TOTAL (#87, EU R&D SCOREBOARD 2015)

Université de Strasbourg (Unistra)

Université Paris-Sud

Université Pierre et Marie Curie (UPMC)

VALEO (#151, EU R&D SCOREBOARD 2015)



## Annex 2 – List of the main funding programmes

**The Mission Interministérielle Recherche et Enseignement Supérieur (MIREs ; Interministerial Mission on Research and Higher Education)** is the main funding programme in France.

For Y2015, as given in the Finance Bill, Research funding amounted to about **€10b**:

- €7.76b of payment appropriations allocated to research funded by the Ministry of Education, Higher Education and Research (MENESR). Those notably included:

- a €580m endowment allocated to the **National Research Agency**;
- €5.8b of payment appropriations allocated to **public research institutions** (including for the Very Large Research Infrastructures);

- €2.33b of payment appropriations allocated to research funded by other Ministries than MENESR.

In addition, the **R&D tax credit**, which is fiscal measure connected to one the specific sub-programmes of MIREs, was planned to amount to **€5.3b for Y2015**.

On the top of that, for Y2015, the **Investments for the Future Programme** was planned to release **€1.5b** on research sub-programmes. These include: the "Excellence Thematic Projects", the Poles of Excellence' (e.g. IDEX, Saclay, Instituts Carnot, SATT, IRT), and the 'Future of Atomic Energy' (e.g. ITE).

### **Annex 3 – Evaluations, consultations, foresight exercises**

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Stimulating innovation  
Supporting legislation*

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