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RIO Country Report 2017

The R&I Observatory country report 2017 provides a brief analysis of the R&I system covering the economic context, main actors, funding trends & human resources, policies to address R&I challenges, and R&I in national and regional smart specialisation strategies. Data is from Eurostat, unless otherwise referenced and is correct as at January 2018. Data used from other international sources is also correct to that date. The report provides a state-of-play and analysis of the national level R&I system and its challenges, to support the European Semester.

Executive Summary

Key findings

At €48.6 billion, research and development (R&D) investments in France represented 2.22% of gross domestic product (GDP) in 2015. The stable increase over time is mainly driven by increasing R&D expenditure in manufacturing industry. The government aims to support R&D through tax incentives, synergies between research centres, enterprises and teaching institutions, and efficient transfer of the results of publicly performed R&D to private companies.

In 2017, the French economy was recovering, with its highest growth rate since 2011 (+1.6%), mainly led by household and company investments. The trade deficit, including that with continental European partners, remains stable and the unemployment rate is continuing to fall (9.7%). Inflation rate remains low (1.2%) and the French central State deficit decreased from January 2017, reaching €67.8 billion at the end of December. France public administrations' global deficit will remain under 3% maximum of GDP[1].

The main challenge for the French government is to reduce a too high unemployment rate and to get the economy moving again through the introduction of concerted and effective reforms focusing on modernising, simplifying and supporting the economy.

Challenges for R&I policy-making in France

Simplification of Innovation policies: In recent years, the French government has made significant efforts to improve the coordination of innovation policy. These efforts mainly consist in concentrating competences in some key operators and giving incentives to improve the coordination between these central players and other institutions (local or national) to ensure that they have a role in this field. Assessment of these policies is still partial, probably because the new orientations were implemented less than two years ago.

Fostering R&D and innovation in SMEs: Despite continuous efforts to improve their involvement in R&I systems and their participation in regional or national programmes, small and medium-sized enterprises (SMEs) remain the weakest links of the R&I cycle. The French government put two major programmes in place ("SME innovation savings plan" – Compte PME innovation, or CPI – and "Fonds d'innovation de rupture") to facilitate investments made by these companies. These supply-side policies have not yet been formally assessed, but the preliminary information available tends to suggest that they have not reached their objective.

A more efficient funding system for higher education and research: The French research and innovation system has undergone profound reforms since 2013 to develop more consistent systems, reinforce public and private partnerships, and optimise the use of human and financial resources. These mainly consist in the creation of the third round of the Investments for the Future Programme ("Programme d'investissement d'avenir", or PIA3) Excellence Initiatives, which aim to improve cooperative behaviour in R&D-related areas but represent a small part of the budgetary endowments. This policy lacks empirical evidence and assessment is still incomplete, mainly because of some disagreements among experts about the proper method to be used.

Promote R&I evaluation: Policy evaluation is a continuous challenge in France. A dedicated organism, the National Commission for the Evaluation of Innovation Policies (CNEPI), has been created to assess R&D and Innovation policies and identify their economic impact. The first empirical evaluation was published last year.

[1] Ministère de l'Action et des comptes publics, communiqué de presse du 16 janvier 2018: https://minefi.hosting.augure.com/Augure_Minefi/r/ContenuEnLigne/Download?id=DD7F9A41-CA39-4C47-BDC0-0DFC848B8113&filename=153.pdf

Main R&I developments in 2017

- Formation of the Ministry for Higher Education, Research and Innovation (MESRI)
- Creation of university graduate schools
- Call for funding for disruptive innovation
- Ministry of Defence (DOD) funding for growth in high-tech SMEs
- Joint laboratories between research organisations and SMEs or intermediate-sized enterprises (ETIs) (LabCom)
- extension of R&D tax credit.

Focus on R&I in national and regional smart specialisation strategies

The national smart specialisation strategy covers the general principles defined at European level. This strategy concentrates the financial resources devoted to research, innovation and economic development on priorities and key industries determined in line with major regional characteristics. The General Commissariat for Territorial Equality "commissariat général à l'égalité des territoires" (CGET) – an agency attached to the Prime Minister's Office responsible for government coordination to ensure balanced regional development – is responsible for monitoring the Smart Specialisation Strategy (S3). The recent S3 exercise has had a variety of results: some regions (here named as until end of 2015) chose to specialise in very few technologies (Alsace, for example), whereas others (Auvergne-Rhône-Alpes and Brittany) opted for a more general approach. However, all regions specialise in certain sectoral activities (e.g. health, energy). It is still too early to provide evidence of the impact of the French national and regional smart specialisation strategies on economic activity. Assessment of the effects of S3, mainly at the local level, are often hindered by a lack of quantitative data.

Foreword

This report offers an analysis of the R&I system in France in 2017, including relevant policies and funding, with a particular focus on topics of critical importance for EU policies. The report identifies the main challenges for the French R&I system and assesses the policy responses implemented. It was prepared according to a set of guidelines for collecting and analysing a range of materials, including policy documents, statistics, evaluation reports and online publications. The quantitative data are, 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 December 2017.

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Contents

1 Economic context for research and innovation

The French economy is recovering, with its highest growth rate since 2011 (+1.6% in 2017 after +1.1% in 2016 and +0.9% in 2015.), mainly led by household and company investments and, to a lesser degree, by household consumption. More dynamic world trade, including that with continental European partners, is limiting the trade deficit, while the unemployment rate continued to fall in 2017 and is expected to reach 9.4% (INSEE, 2017a) from 10.1% in 2016 (Eurostat). The French public deficit should however remain at around 3.0% maximum of GDP in 2017 (Cour des Comptes, 2017; Ministry of public action and budgets, 16 January 2018[2]) in comparison with an EU average of 1.4% in 2017 (EC, 2017a).

1.1 Structure of the economy

The French market sector specialises overwhelmingly in service industries, which accounted for 79% of GDP in 2016. Manufacturing accounted for 11% of GDP in 2016. Knowledge-intensive services (KIS) accounted for 41% of total value added compared with the EU-28 average of 18% in 2016. The turnover and value added of firms in high-tech manufacturing industries (€20 billion) remains the largest in Europe after Germany (€60 billion) (Eurostat, 2017). The French manufacturing industry specialises in transport equipment – including automotive, aerospace and aircraft equipment – and pharmaceuticals, but also in less technology-intensive industries, such as ground transport of goods, food industries and luxury products. In Europe, France is the third largest exporter of high-tech products to the rest of the world, after Germany and the Netherlands[3].

The number of new enterprises as a percentage of total active enterprises is 9% in France, where firms are created especially in the service industries (Eurostat, 2016a). In 2014, the observed entrepreneurial rate was higher than in Germany (7%) but lower than in the UK (14%). Between 2010 and 2016, opportunity became a more important driver of entrepreneurship than unemployment (EC, 2017b)[4].

In 2016, 44% of 25- to 34-year-olds reached tertiary education studies (23% of average for OECD countries in 2016, in OECD, 2017b). However, 17% of young French graduates have worse numeric skills than in other OECD countries. Numeric skill deficiencies are lower among young people than among those over 45 years old (OECD, 2017a).

1.2 Business environment

The French economy is relatively highly positioned in the "Doing business 2017" ranking (World Bank, 2017), where France was ranked 29th out of 190. However, France ranked 15th among EU-28 countries in 2016 compared with 13th in 2015 (World Bank, 2017). Despite broad agreement on the need for simplification, the regulatory and uncertainty burden for companies remains high (Beylat and Tambourin, 2013). Threshold effects in particular tend to limit the development of start-ups and micro firms, while a high corporate tax rate (applied to a narrow tax base; Heyer, 2015) and a complex tax system also hamper business activities (Garicano et al., 2013; Koske et al., 2015; World Bank, 2017).

The French financial system provides up-to-date and competitive solutions, including for start-ups and small and medium-sized enterprises (SMEs) (Observatoire du Financement des Entreprises, 2015; Bernard et al., 2015, appendix 2). Private venture capital (early and later stage) is dynamic in France, which became a leader in Europe across all investment stages (EVCA, 2017).

Furthermore, start-ups and SMEs are benefiting from recent initiatives that grant tax

[2] Ministère de l'Action et des comptes publics, communiqué de presse du 16 janvier 2018: https://minefi.hosting.augure.com/Augure_Minefi/r/ContenuEnLigne/Download?id=DD7F9A41-CA39-4C47-BDC0-0DFC848B8113&filename=153.pdf

[3] http://ec.europa.eu/eurostat/statistics-explained/index.php/High-tech_statistics_-_economic_data#Economic_statistics_on_high-tech_sectors (accessed on 2nd April 2018)

[4] EC (2017) European Innovation Scoreboard 2017, June, Brussels. https://ec.europa.eu/info/sites/info/files/2017-european-semester-country-report-france-fr.pdf (accessed on 2nd April 2018)

rebates on labour costs and investments, offer better access to finance, access to public procurement and simplify some administrative procedures (EC, 2016a).

The digital infrastructure in France is well developed and improving. France performs particularly well in terms of e-government and open data (EC, 2016c). The use of digital technologies by companies is below average and private use is similar to other EU countries. However, online transactions (banking, shopping) are widely used (DESI, 2017). French productivity is high compared with other EU countries. Productivity gains are still led by the manufacturing industry rather than services (INSEE, 2017b). Despite innovation, France has not managed to reduce its traditional competitiveness problems (EC, 2017b). Although the financial structure of French firms has improved, the number of exporting firms is still low, especially among SMEs, for which poor progress in productivity and a lack of specialisation in high-tech manufacturing goods undermine the competitiveness of the French economy (ECB, 2017). 7% of French exports go to the UK, and the rise of the euro against sterling is damaging French price competitiveness. Lower import prices from the UK (3.8% of French imports in 2016) reduce this negative effect. The proportion of French exports in world trade stabilised in 2016 (INSEE, 2017b). Gains in exports are led by the aircraft and aerospace industry alongside pharmaceutical, cosmetic, food and luxury industries (Trésor Public, 2017). The recovery in 2016-2017 of the automotive industry and tourism is also contributing to the upturn.

2 Main research and innovation actors

At €48.6 billion, R&D investments in France represented 2.22% of GDP in 2015[5]. The stable increase over time is mainly driven by increasing R&D expenditure in manufacturing industry.

2.1 Private sector

The structure of the research and innovation (R&I) system evolved in favour of private companies that became the dominant actors in French R&D efforts. Corporate company R&D expenditure increased from 1.29% to 1.45% of GDP between 2008 and 2015. While this proportion is lower than in some leading countries, many French firms are involved in R&D activities: in 2014, 65% of French businesses conducted R&D, which is on a par with similar countries such as the UK (64%) and Germany (67.5%) (MESRI, 2017a). Business expenditure on R&D (BERD) stood at €31.7 billion in 2015, or 161,769 full-time equivalent researchers in 2014, which represents about 65% and 60% of French R&D respectively. In terms of innovation outputs, 40.9% of French firms introduced product or process innovation in 2012-2014, whereas the EU-28 average is 36.8% (EC, 2017f). Thus, France is a strong innovator in Europe but is not one of the leaders (EC, 2017c).

Since 2010, French innovative performance has been improving in relative terms. This is due to both improving domestic performance and the relative decline of the three European leaders (Germany, Finland and Denmark). In particular, SMEs improved their position regarding product and process innovation, which had been identified as a main weaknesses in 2010. The proportion of SMEs introducing product or process innovations reached 35.5% in 2015 against 30.6% in 2011-2012. This upward trend contrasts with the falling trend observed in the EU-28 (35.1% to 30.9%) (EC, 2017c, and e). The notable improvement between 2012 and 2014 is due to SMEs innovating in manufacturing or in information and telecommunication services. A larger proportion of these firms now exports to Europe and worldwide (INSEE, 2017c).

After a fall between 2009 and 2013, the proportion of Patent Cooperation Treaty patent filings reached 3.3% in 2015. Still, France is lagging behind the USA, the UK and Germany, with fewer patents filed per enterprise. Young French firms accounted for a relatively high percentage of patents filed in 2013 (9%) (OECD, 2015a) but young patenting firms scaled by GDP are around the OECD average (OECD, 2016a). In a service sector economy, the importance of non-technological innovations, such as organisational and marketing innovations (15% of firms, as in the UK)[6], might explain the lag. This point is in line with the relative importance of trademarks over patents in France (EC, 2017c).

Finally, French business R&D is concentrated in three main regions. Industrial researchers are mainly located in Ile de France (41%), which hosts the largest population of inventors in Europe. Combined with those in the Auvergne-Rhône-Alpes and Occitanie regions, these researchers make up two thirds of the total French researcher population (MENESR, 2017a). The regional innovation scoreboard identifies the same regional leaders (EC, 2017d)[7]. 40% of technological innovators in France are concentrated in Ile de France and Auvergne-Rhône-Alpes. Technological innovation is less frequent in Normandy and in the Grand Est region (INSEE, 2017c).

2.2 Public R&D organisations

Public research is carried out by dedicated public research organisations (PROs) (accounting for 54% of the €16.8 billion non-business R&D expenditure in 2014), higher education institutions (HEIs) (40%), the private non-profit sector (5%) and government departments and other state institutions (1%) (MESRI, 2017a).

HEIs and PROs, including non-profit associations, conduct 35% of French R&D and employ 38% of national researchers (full-time equivalent). HEIs comprise about 70 universities and

[5] OECD (2017) MSTI data, OECD, Paris. http://stats.oecd.org/Index.aspx?DataSetCode=MSTI_PUB

[6] Eurostat (2017) CIS2014 data: http://ec.europa.eu/eurostat/web/science-technology-innovation/data/database

[7] European Commission (2017d) Regional Innovation Scoreboard 2017 http://ec.europa.eu/growth/industry/innovation/facts-figures/regional_en

223 "Grandes Ecoles"[8]. In 2014, HEIs employed around 73,000 researchers, and PROs around 28,000 researchers. French PROs are relatively large: the National Centre for Scientific Research (CNRS) (169 European Patent Office (EPO) patent applications in 2016; €3.3 billion in 2017); the Atomic Energy Commission (CEA) with a budget of €2.6 billion in 2016 (for civilian R&D) and 592 EPO patent applications in 2016; the National Institute for Health and Medical Research (INSERM) with a €0.98 billion budget in 2017 and 292 EPO patent applications in 2016; the National Institute for Agricultural Research (INRA, €0.85 billion in 2016).
However, between 2013 and 2014, the importance of public research in gross domestic expenditure on R&D decreased both in PROs (e.g. CNRS –0.9%) and in HEIs (–0.1%). Only R&D expenditure in the not-for-profit sector grew faster than GDP (+5.3%) (MESRI, 2017a). Also, the research landscape is undergoing reorganisation, leading, among other things, to mergers between universities (e.g. universities in Lille). Additional integration between universities and Grandes Ecoles and between HEIs and PROs are expected through the selection and funding of initiatives such as IDEX or I-Site. Other organisational experimentation, not exceeding ten years, should also now be allowed[9]. A novelty in 2017 was the sponsoring by the High Commission for Investments of an additional arrangement named "**university graduate schools**" (Ecoles Universitaires de Recherche)[10]. The global envelope for these structures is estimated at €300 million over ten years.

2.3 Policy makers

Different governmental entities are involved in R&I policy making: the main ones are the **Ministry for Higher Education, Research and Innovation** (MESRI), the Ministry of the Armed Forces, the Ministry for Solidarity and Health, the Ministry for the Ecological and Inclusive Transition and the Ministry of Ecological and Solidarity Transition, whereas the Ministry of Economy and Finances is also involved in fiscal aspects of R&D policies. In addition, to government ministries, the **High Commission for Investment** (CGI), placed under the Prime Minister's authority and in change of the Investments for the Future Programme (PIA), set up in 2010. Regions tend also to play a growing role in this field (See Cnepi, 2016a).
The coordination among actors is first achieved through the inter-ministerial R&D budget or MIRES[11] (Mission Interministérielle Recherche et Enseignement Supérieur, the Inter-

[8] As of June 2017 http://www.cge.asso.fr/
[9] See Premier Ministre (2017) Experiences are now eased with the draft bill dealing with simplifications In Projet de loi Pour un État au service d'une société de confiance (see Article 28), November 2017.
[10] http://www.agence-nationale-recherche.fr/informations/actualites/detail/3eme-programme-dinvestissement-davenir-ouverture-des-deux-premiers-appels-a-projets/ and ANR(2017a).
[11] MIRES: Each year, the French State budget is structured by "Missions" budget programmes, one of them being cross-governmental and dedicated to Higher Education and Research: "Mission Interministérielle Recherche et Enseignement Supérieur" (MIRES), with a total amount for Year 2018 over 27 billion euros. The MIRES comprises 9 different Budget programmes: 8 of them are focused on scientific and technological research and higher education activities, in various ministerial and thematic fields, the 9th being dedicated to students life (housing and food, social grants, health, inclusive actions, etc.). Some of the 8 budget programmes focused on scientific and technological research and higher education activities finance both: a) institutional funding for Public research institutions (PRI) and Higher education institutions (HEI) of the considered field; b) competitive funding for research projects; c) tax incentives as the R&D Tax Credit (CIR).
The Directorate General for Research and Innovation (DGRI) is responsible for 2 programmes: Programme n°172: Multidisciplinary Scientific and Technological Research; Programme n°193: Space Research, given to the French Space Agency (CNES).
Programme n°172 funds both PRIs such as CNRS and other national PRIs (institutional block funding); the National Research Agency - ANR (competitive funding) and tax incentives as the R&D Tax Credit (Crédit d'impôt recherche CIR).
Programme n°190 "Research in the fields of sustainable energy, development and mobility", is under the authority of the minister of ecological transition and solidarity. The Directorate General for

ministerial budget mission for higher education and research). However, neither the Ministry for Solidarity and Health nor the CGI are integrated within the MIRES. The transformation in December 2017, of the CGI into SGI and a renewed participation of the MESRI on R&D and innovation decisions of SGI are aimed to achieve a better coordination in the French R&I system.

R&I budgets are based on a number of strategic objectives recently compiled in a National Research Strategy (SNR, 2015) and are implemented through hundreds of "operators" including non-profit organizations. Among them, the **National Research Agency (ANR)** was created in 2005 to fund academic and industrial research projects on a competitive basis and through public-public and public-private partnerships. The **Agency for Environment and Energy Management (ADEME)** was created in 1991 to support and fund environmental and energy research. ADEME's missions comprise promoting, supervising, coordinating, facilitating and carrying out activities aimed at protecting the environment and improving energy savings. In addition to these research funding agencies, **Bpifrance**, the public investment bank (which replaced OSEO as of December 2012), provides funding for business R&D and innovation projects, especially SMEs, alongside the Caisse des Dépôts et Consignations (CDC).

The coordination between policy makers, operators and executors also operates through five "Alliances"[12]. The Office parlementaire d'évaluation des choix scientifiques et technologiques (OPECST) and the Research Council advise the government. OPECST[13] is also responsible for assessing R&I policies at parliamentary level. The task is also the responsibility of two specialised bodies: the High Council for Evaluation of Research and Higher Education (HCERES)[14] evaluates public research and the General Commission for Strategy and Economic Foresight (CNEPI)[15] evaluates innovation policies.

At the strategic level, policy makers also use the country-specific recommendations and reports prepared on demand by different experts and commissions (e.g. Beylat and Tambourin, 2017; OFCE, 2017; Blachier, 2017). Figure 1 represents the relationships between the different entities.

Enterprises (DGE), Ministry of Economy, is responsible for Programme n°192 "Research and higher education in economic and industrial matters".

The Directorate General for military equipment procurement (DGA, Ministry of Army) is responsible for Programme n°191 "Dual Research (civil and military)". Ministries of Culture and Agriculture and food are each one responsible for another MIRES budget programme.

[12] AVIESAN on life and health, ANCRE on energy, ALLISTENE on digital, ALLENVI on environment and ATHENA on humanities and social science fields.

[13] http://www2.assemblee-nationale.fr/14/les-delegations-comite-et-office-parlementaire/office-parlementaire-d-evaluation-des-choix-scientifiques-et-technologiques

[14] www.hceres.fr

[15] "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.

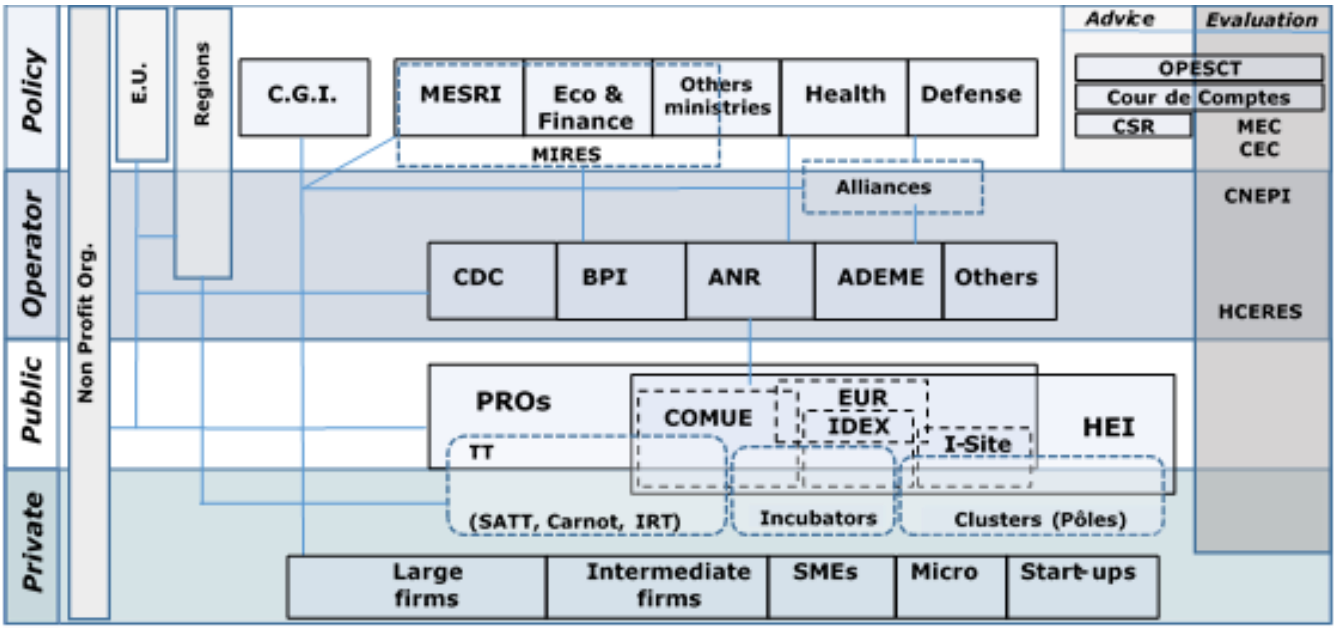


Figure 1. The French R&I system at the end of 2017: a simplified view

- Dashed lines indicate collaborative entities.
- Note: For simplicity, the blue links between entities can be one way or two way; they are used to link building blocks and not specific entities. Links overlap each other. For example, ANRT in Non-Profit organization is an operator and is linked to MESRI through the block of ministries but may be not related to the SGI. The SGI is related to the CDC or ANR and overlap the link between ANRT and MESRI.

3 R&I policies, funding trends and human resources

Figure 2. Main R&I policy developments in 2017

Formation of the Ministry for Higher Education, Research and Innovation (MESRI)	The previous ministry of Education, Higher Education and Research was split in two different bodies in June 2017: - The Ministry of (primary and secondary) Education - The Ministry of Higher Education, Research and Innovation (French acronym: MESRI). .
Creation of the university graduate schools	The objective of the "university graduate schools" programme is to support the creation of French graduate schools, mainly capitalising on the experience of doctoral schools[16]. This new stage accompanies a second wave of the call for "new university programs"[17].
Fund for disruptive innovation	A €10 billion fund to finance disruptive innovation projects by SMEs, announced by the Minister of Economy, July 2017.
Ministry of Defence funding for growth in high-tech SMEs	A fund for equity participation in SMEs with defence technologies (€50 million) announced by the Ministry of Defence, August 2017.
LabCom	The objective of the programme is to encourage academic research actors to create new structured partnerships through the creation of joint laboratories between one SME or one intermediate-sized enterprise and a research organisation laboratory[18].
Maintain of the R&D tax credit scheme	The French R&D tax credit is maintained and will be ring-fenced. Announced by the Ministry of Finance, August 2017.

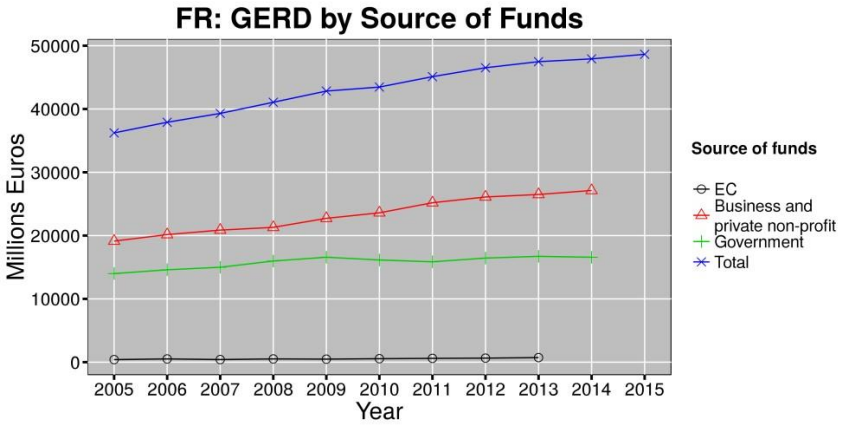
[16] See ANR (2017a).
[17] See ANR (2017b).
[18] See ANR(2017c).

3.1 Public allocation of R&D and R&D expenditure

The total gross domestic expenditure on R&D (GERD) in France was €48,643 million in 2015. It increased by 0.6% between 2013 and 2014 mainly thanks to BERD. Since 2009, GERD has remained around the 2015 value of 2.22% of GDP (MESRI, 2017a). Thus, the 2008-2009 crises did not greatly affect total GERD due to the increase in funding by the business and private non-profit sectors from 2008 onwards. Government-funded GERD as a percentage of GDP fell from 0.86% in 2009 to 0.77% in 2014. Direct government R&D funding remains higher than in other EU-28 countries, where on average funding stood at 0.66% of GDP in 2014.

Foreign funding is a marginal source (€3.731 billion, 2014) mainly from multinational enterprises (MNEs) such as Airbus; research institutions, such as the European Space Agency (ESA); or policy makers (e.g. EU). Foreign actors funded €2.9 billion of business R&D activities and €0.85 billion of government R&D activities in 2014. The European Commission contribution represents a small proportion of French GERD (3% in 2014) with respect to the public and private sectors (Figure 2).

Figure 3. Development of government funding of the total GERD.



Source: Eurostat, 2016.

3.1.1 Government funding of private sectors

At national level, industrial R&I policy is based on around 63 different direct or indirect government-run schemes, which amounted to approximately €8.5 billion in funding in 2015, supporting (1) industrial R&D (€6.0 billion, 2015), (2) tech-transfer (€0.226 billion, 2015), (3) R&D networking (€0.613 billion, 2015), (4) entrepreneurship (€0.305 billion, 2015) and (5) growth (€1.406 billion, 2015) (CNEPI, 2016a). Of these policy tools (CNEPI, 2016a), tax schemes amounted to €6.3 billion in 2015 (74.2%) direct policies amounted to €1.6 billion (19%), equity financing €0.38 billion (4.4%) and loans €0.20 billion (2.3%).

At national level, the direct contribution from the government to business R&D through MIRES or operators is stable but limited (€2.425 billion in 2014) and its share of funds has fallen since 2009. Large companies obtained around four fifths of the direct support in 2013.

Support for Industrial R&D mainly operates through a R&D tax credit scheme (the Crédit d'Impôt Recherche, CIR) giving companies a 30% tax reduction up to €100m R&D expenses (and 5% beyond) since 2008. This generous measure accounts for a shortfall in revenue that has risen from €1.802 billion in 2007 to €5.270 billion in 2015 and €5.420 billion in 2016. The CIR helped about 15,245 firms in 2013, of which 90% were micro firms and SMEs, receiving 31% of the credit paid out (MESRI, 2017a). Manufacturing and service industries received 61% and 37% of R&D tax credit in 2013 respectively. An

innovation tax credit (Credit Impôt Innovation, CII) was also introduced in 2013 to lower prototype and pilot plant costs by 20% for SMEs. It provided €0.0744 billion of tax credits to 3,445 SMEs in 2013, mainly firms with fewer than 50 employees (85%). Most (68%) of these firms were from the services industry.

The proportion of French firms receiving government assistance is the highest in Europe (see online Eurostat data for CIS2012[19]). The level of public assistance to private companies is also the highest (OECD, 2015a). Combining the direct public funding of R&D with indirect business R&D funding, France is the OECD country with the greatest public funding support: more than 45% of its GERD, while this figure is under 30% in Germany and Sweden.

3.1.2 Government funding of public sector

Budget allocations for public research come mainly from MIRES (€13.8 billion in 2014 and €12.8 billion in 2015). The government allocation is the main resource for HEI (73% in 2014) and PRO budgets (70%) (MESRI, 2017a). Additional public resources are available through competitive tendering (e.g. ANR, ADEME), which represented €2.63 billion in 2014 or 14% of public research budgets, similar to 2013. Falling national public research budgets (CESE, 2017) are compensated to some extent by "Investments for the future" (PIA) programmes (see CNEPI, 2016b). Other budgetary resources are available from the regions, where support for public R&D represented about 31% of the regions' R&I budget in 2012. Between 2012 and 2014, the regional funds for public research represented about €0.377 billion annually, of which 42% was used to support regional R&D projects, 26% spent on laboratory equipment and 32% on supporting researchers. R&D funding as a proportion of the total expenditure of a regional council is 2.9% on average, ranging from 1% in Corsica to 5.9% in Pays de Loire. Note that 50% of each region's R&D budget over the period was dedicated to property expenditure that benefited higher education (MESRI, 2017a).

3.2 Private R&D expenditure

BERD by enterprises with establishments in France amounted to €31.7 billion in 2015, compared with €31.1 billion in 2014. This represents a stable effort by companies, at 1.44% of GDP in 2015. When the industrial structure is not taken into account, the effort is much lower than in Germany, for example (2.06% of GDP in 2015) (EC, 2016b). When industrial structure is considered, the French BERD effort is one of the highest in the world (see OECD, 2015a).

With a level of R&D expenses equal to 0.75% GDP in 2007 and 0.74% GDP in 2013, manufacturing R&D has remained relatively stable over the last decade. It comprised more than half of French business R&D in 2014. As shown by figure 3, most R&D is conducted in computer, electronic and optical products (C26), aerospace and defence (C30) and the automotive industry (C29). R&D expenditure within the service sector has shown significant growth since 2009 (MESRI, 2017a) to reach 0.67% of GDP. Two sectors (1) information and communication technology (ICT)and (2) wholesale and retail trade; repair of motor vehicles and motorcycles, have been constantly increasing R&D over the observed period. Their respective BERD expenditures evolved from €2.150 billion to €3.600 billion and from €0.648 billion to €1.600 billion between 2007 and 2013. This can be attributed to the growth of professional, scientific and technical activities that rose from a BERD expenditure of €6.500 billion in 2007 to €8.350 billion in 2013.

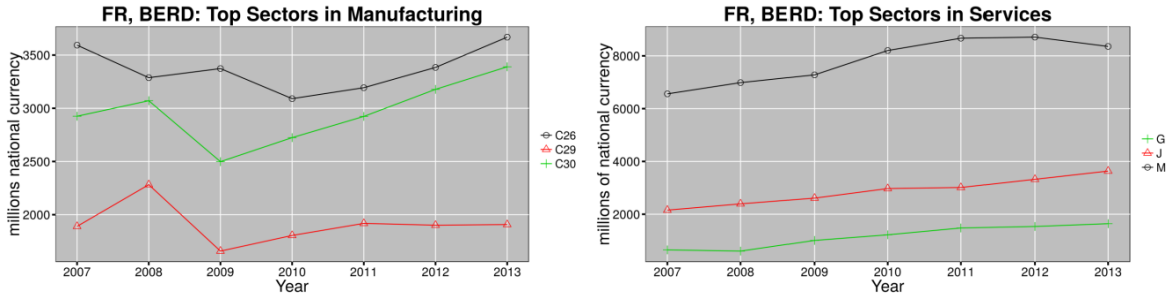
According to the 2016 European Industrial R&D Scoreboard (EC, 2017e), the main R&D players are in ICT – Alcatel-Lucent (ranked 18th), Schneider (46th), Orange (55th), Ubisoft Entertainment (65th) and Dassault Systèmes (70th) – in the automotive industry – Peugeot (19th), Renault (20th), Valeo (44th) and Michelin (56th) – in the aeronautical industry – Airbus (12th), Safran (34th), Thales (67th), Dassault Aviation (70th) and Zodiac Aerospace (94th) – and in the pharmaceutical industry –Sanofi (3rd), L'Oreal (51st) and Servier (53rd).

[19] http://ec.europa.eu/eurostat/cache/metadata/en/inn_cis8_esms.htm (accessed on 2nd April 2018)

Large companies contribute the majority of R&D expenditure (57%), medium-sized enterprises (entreprises de taille intermédiaire – ETI) account for one quarter, and SMEs, including micro-firms, represent 17%. The French BERD is thus skewed towards some very large MNEs concentrated in the aerospace, automotive and chemical-pharma industries; SMEs are dominant in knowledge-intensive business services (Bpifrance, 2016; MENESR, 2017a)[20].

The proportion of foreign firms in business R&D expenditure in France has been falling since 2009. It declined from 21% to 20% between 2013 and 2014. This trend shows that, despite its direct and indirect policies, France has not yet succeeded in becoming a destination country for foreign R&D firms.

Figure 4. Top sectors in manufacturing



Note: C26 = manufacture of computer, electronic and optical products; C29 = manufacture of motor vehicles, trailers and semi-trailers; C30 = manufacture of other transport equipment). Top service sectors are J = information and communication, G = wholesale and retail trade; repair of motor vehicles and motorcycles, M = professional, scientific and technical activities.

3.3 Supply of R&I human resources

6.2% of the active population are scientists and engineers, which is lower than the EU-28 average (7.4% in 2016). New graduates in science, maths, computing, engineering and manufacturing represent 0.29% of the population, which is one of the highest in the EU-28 and should help France to raise the profile of science, technology, engineering and mathematics (STEM) in the active population. The relative specialisation in STEM fields is also observed at doctoral level, where 27,000 students were enrolled in STEM PhDs in 2015-2016 (MENESR, 2016a). In 2014, 11,700 PhDs were awarded in French universities, 60% in science and technology. However, between 2006 and 2016 the number of first-year PhD candidates dropped by 13%. The fall in PhD candidates is limited in STEM fields, thanks to international students, who represented 41.1% of the total in 2015-2016, 63% of whom were African and Asian (MESRI, 2017a), and grants for "vocational" PhDs (Convention industrielle de formation par la recherche entreprise (CIFRE)), 60% of which were awarded in STEM fields in 2016 (ANRT, 2017). The recognition of a PhD degree is still low in both business and the French administration. French PhD graduates in STEM are more likely to be unemployed or in temporary positions than those with a Master's degree (MENESR, 2017b; Margolis and Miotti, 2017). Measures taken to improve this situation include tax incentives for hiring PhDs, a 2016 reform of doctoral schools to reinforce the professionalisation of PhD courses and improve employability (e.g. in 2015, http://www.mydocpro.org/fr).

In the last 30 years, the level of tertiary attainment has doubled for men and trebled for women. In total, 49% of women and 40% of men now graduate from tertiary education in France. Female graduates are still in the minority in engineering fields: their proportion rose from 23% in 2000 to 29% in 2014. Progress was also made at PhD level where there is a gender gap in science and engineering (40% of PhD graduates were female in 2014) (MESRI, 2017a). Despite the rise in the number of female graduates in France, female workers are under-represented in highly skilled jobs, both in higher education and in

[20] Eurostat R&D data: http://ec.europa.eu/eurostat/web/science-technology-innovation/data/database

business (25% in 2013). The gender gap is significant in French HEIs, where, in 2015, female researchers made up only 37% of employees (MESRI, 2017b), which remains, along with French PROs, among the lowest percentages in Europe (OECD, 2017b)[21]. Furthermore, only 24% of female professors are full professors (MESRI, 2017b). The gender gap is greater in some disciplines: in mathematics, physics and engineering, only 21% of academic staff (associate and full professors) in universities are female, compared with 47% and 54% in biological and medical sciences (MENESR, 2016b).
Historically, efforts have been made to create more opportunities and careers for female students and researchers, in either private or public research: specific awards[22], associations[23], gender commissions, gender parity in organisations' governance (the 2013 Fioraso law), and charters and laws on parity are found in France among PROs, HEIs, private stakeholders and assessment bodies. The efforts were stated as a priority for 2017 (see MENESR, 2017c).

Job mobility in science and technology in France was in line with the EU average in 2013, but has deteriorated since 2003 (EC, 2016d). Within France, mobility between public research bodies and firms is still limited, despite a flexible status allowing extended leave (Beylat and Tambourin, 2017). While France has consistently moved closer to the UK model, the geographic mobility between research units and public research bodies remains difficult.

France finds it difficult to prevent researchers moving to the USA, the UK, Germany, Canada or Switzerland. The brain drain is, however, less significant than that observed in Germany, the UK, Sweden or the Netherlands (OECD, 2015a). Nevertheless a strategy exists to reward incoming researchers and talents. For example, at the city or national level, specific chairs (Chairs of Excellency) are set up or temporary positions offered to scholars by PROs and HEIs. With fewer than 300 entrants in 2012 (García-Peñalosa and Wasmer, 2016), a new "passport for talents" visa was proposed in 2016[24], followed by a "France visa" starting in July 2017[25], introducing even more reliability, rapidity and flexibility for foreign, especially non-EU, innovators and researchers. Since 2013, several French public organisations have also worked closely with EURAXESS[26] to propose services that improve researchers' mobility. Recruitment procedures in French PROs became more open to foreign researchers. Access to positions in public HEIs is, however, still difficult, due to complex procedures available only in French[27] and the paucity of English information and files compared with other EU countries.

[21] OECD (2017b), MSTI data, OECD. Available at: http://stats.oecd.org/Index.aspx?DataSetCode=MSTI_PUB
[22] See http://www.enseignementsup-recherche.gouv.fr/pid24580/prix-irene-joliot-curie.html or http://www.fwis.fr/en/awards
[23] See http://www.femmesetsciences.fr/
[24] https://www.service-public.fr/particuliers/vosdroits/F16922
[25] https://www.interieur.gouv.fr/Actualites/Accueil-des-etrangers-en-France/Attirer-les-talents-et-les-competences
[26] See http://www.euraxess.fr/en
[27] See the HEI site with procedures explained in French for open associate professor and full professor positions: https://www.galaxie.enseignementsup-recherche.gouv.fr/ensup/cand_postes_GALAXIE.htm

4 Policies to address innovation challenges[28]

4.1 Challenge 1: Simplification of R&I policies

Description

France has a wide range of policies and operators to foster R&D and innovation. In 2015, 63 national policy initiatives were identified in France (CNEPI, 2016a). These instruments have fostered R&D investment but yielded mixed results so far: France has relatively low employment levels in knowledge-intensive activities (13th in the European Innovation Scoreboard 2017, in EC, 2017c), knowledge-intensive services export (10th) and SMEs introducing product or process innovations (10th), highlighting limitations in its innovation capacity. The mismatch between the number and cost of R&D tools and policies and their impact has raised questions about their relevance and efficiency (Beylat and Tambourin, 2013; OECD, 2014; Bitard and Zacharewicz, 2015; IGF-CGEDD-CGE, 2015; EC, 2015; Berger et al., 2016; EC, 2016d; EC, 2016e). A simpler, improved innovation policy is widely considered necessary (Beylat & Tambourin, 2013; CNEPI, 2016a; IGF-CGEDD-CGE, 2015; OECD, 2014; Berger et al., 2015; Bitard and Zacharewicz, 2015; Lhuillery and Zacharewicz, 2016; Beylat and Tambourin, 2017).

The fragmentation, overlap, and excessive complexity of R&I support measures are often criticised (e.g. CNEPI, 2016a; EU Council, 2015, 2014). Difficulties for users, either firms or researchers, have been identified in three areas: (1) an overabundance of responsible bodies in tech-transfer and knowledge-sharing policies (e.g. SATT, CVT, CRT, SRC, Carnots, CEA Tech, France Brevets, IRT, competitiveness clusters); (2) the proliferation of funds and funds of funds for start-up and growth policies (CDC and Bpifrance); and (3) in contractual research with the proliferation of calls and types of calls for R&I projects and of bodies launching these calls (ANR, ADEME, the EU, regions).

Policy response

In recent years, the French government has adopted a set of different strategies to simplify its R&I system and policy.

One of the main moves to improve the **coordination** of innovation policy since 2015 has been to concentrate competences in very few operators – ANR, Bpifrance, CDC and ADEME. These four institutions have become the main operators in the French R&I system (CNEPI, 2016a). In addition, the new Ministry of Higher Education is responsible for managing R&D and innovation areas that were previously managed by the CGI. In health, a centralised website for calls for tender for different bodies was also set up in 2016[29].

The **merger** of several bodies was also done as well as the merge of advisory councils: the merge between operators for example led to the creation of the public investment bank BPI France; the merge of the High Council for Science and Technology (HCST) and the High Council of Research and Technology (CSRT) led to the Strategic Research Council (SRC) in 2013.

To complement these measures, the **streamlining of** existing procedures and policy mechanisms is ongoing. 70 simplification measures, mainly based on digitalised procedures, were introduced in 2016[30]. These are mainly oriented toward HEIs and PROs. Firms should, however, derive some benefits from simplified calls for tenders and intellectual property rights management.

Finally, a fourth, radical simplification measure has **abolished** some innovation support schemes. The French Small Business Act (launched in 2008) targeting innovating SMEs

[28] Besides the innovation challenges, for the preparation of the next Semester Country Reports, examples of successful practices in Member States in 2017 are also of interest – examples may be offered in relevant sections of the report and/or discussed during the Brussels visit.

[29] http://www.aap-recherchesante.fr/

[30] http://www.enseignementsup-recherche.gouv.fr/pid34393/simplification-de-l-enseignement-superieur-et-de-la-recherche.html. The evaluation of these 2016 simplification measures has been planned in 2017: http://www.enseignementsup-recherche.gouv.fr/cid116248/evaluation-des-plans-de-simplification-de-l-enseignement-superieur-et-de-la-recherche.html

was repealed in 2013. Similarly, the "Gazelle" scheme for fast-growing SMEs and the Strategic Industrial Innovation Programme (ISI) were discontinued in 2014 and 2015 respectively. These assistance schemes were replaced by other policy tools and thus did not represent a net decrease in procedures.

Policy assessment

While a number of policy initiatives have recently been taken to simplify the R&I policy system and support measures, the continuous implementation of new programmes (e.g. the new graduate schools and LabCom structures, the future €50 billion "major investment plan", the new fund for disruptive innovation and the increase in regional policies) is hampering this task.

4.2 Challenge 2: Fostering R&D and innovation in SMEs

Description

Incentivising R&D and innovation is a French government priority. Many of the tools implemented (CIR, National Investment Program and French Tech) demonstrate that SMEs are a priority, but they are still under-represented in R&D and innovation. SMEs are, overall, less innovative than larger companies, and their innovation is directed more towards marketing and organisation than towards product innovation (MENESR, 2016c). This issue is not new. Several past reports have pointed out the difficulties SMEs face in contributing to technological innovation (Oseo, 2006; Chabbal, 1997), despite the large number of diverse measures adopted. Looking at the extensive series of measures available, it appears that two ideas dominate. SME innovation is hampered by a lack of human resources and skills and by a shortage of financial resources. Most policy measures in this field are oriented towards the alleviation of these apparently crucial problems. On the whole, more than 30 years of incentive policies in favour of SMEs have not really significantly increased the contribution of these companies to technological innovation.

Policy response

Besides the traditional tax rebates (CIR) and subsidies, new policy measures have been adopted to increase and promote SME innovation. Two main programmes are designed to improve SME access to financial resources.

- The "SME innovation savings plan" (Compte PME innovation, or CPI), created in January 2017, introduces individual tax exemptions to incentivise business angels. It aims to encourage entrepreneurs who sell shares of their company to reinvest the capital gains in young SMEs or innovative companies.
- The new "Fonds d'innovation de rupture"[31] announced by the Minister of Economy in July 2017, clarifies the distinction between ability to innovate and commitment to projects related to technological innovation.

These schemes are supply-side policies based on the idea that investments in innovative activities are liquidity constrained due to capital market imperfections[32]. They leave unsolved the problem of the capabilities and skills that SMEs require to innovate. Indeed, to improve the position of SMEs in the national innovation system it is necessary to take account of the unique features of SMEs as well as giving them financial and tax incentives. Many academic papers (Guerzoni and Raiteri, 2015; Pierre and Fernandez, 2017) highlight the diversity of innovation capabilities in an SME context. They insist upon the roles of cooperation and networks as effective means to involve SMEs in innovation programmes. Policies supporting these joint projects must promote resource sharing to make SME integration in larger R&D and innovation projects possible (Carré and Levratto, 2013).

[31] The Ministry of economy is going to launch this €10 billion fund to promote radical and disruptive innovation in SMEs. A presentation is available at: http://www.caissedesdepotsdesterritoires.fr/cs/ContentServer?pagename=Territoires/Articles/Articles&cid=1250279542828

[32] Several research papers question the efficiency of this kind of policies (OECD, 2015c; Edler and Yeow, 2016) and consider the possibility to the support to build linkages (soft support) on both the supply-and demand-side.

Policies to improve the competitiveness of a production collective provide a mix of incentives encouraging new behaviour by partnerships of large and small businesses, and in particular public research institutions (i.e. competitiveness clusters, Fonds unique d'investissement). These policies aim to improve cooperative behaviour in R&D-related areas but represent a small part of the budgetary endowments.

Policy assessment

Whereas the assessment of competitiveness clusters has shown them to be drivers of innovation (Ben Hassine and Mathieu, 2017), there is no available evaluation of the new programmes. Only a few papers published in economic magazines (e.g. Feuerstein, 2017) provide feedback on the CPI. They generally consider the CPI a major failure. This tool is much too constraining to attract businesses angels. Above all, the investor must be a member of the executive committee to benefit from the tax rebate, which is rarely the case for business angels, who are the main target of this scheme. Another criticism is that social taxes are applicable to earnings, which reduces the incentive to reinvest them. It is too early to assess the impact of the "Fonds d'innovation de rupture". In August 2017, the Agence des Participations de l'Etat, the French government shareholding agency, sold its shares in Engie, the French energy company, to fund the Fonds d'innovation. So far, no investments have been made.

4.3 Challenge 3: A more efficient funding system for higher education and research

Description

The French public research funding system has long been considered to be a very specific case, which did not easily fit into international classifications (Senker, 2000). Many studies suggest updating this system, underlining the limited amount of public money dedicated to project funding, channelled through agencies, and promoting excellence policies and increased project funding rather than institutional funding (Thèves et al., 2007).

Since 2010, the ANR has been the main operator in charge of the *Programme d'Investissements d'avenir (PIA)* in the field of higher education and research. ANR selects and monitors projects, funded by PIA rounds. From 2009, its non-targeted endowment gradually decreased and this fall accelerated from 2013[33], when the Government decided to reduce its budget in favour of subsidies to public research organisations. The budget constraints did not applied to the PIA. On the contrary, calls for projects have proliferated recently. Their objective is to concentrate resources in frontrunners that demonstrate their potential to become major international players in education and research. As part of the third Investments Program (Finance Act of 29 December 2016), the ANR is the operator on several actions within two axes: "Supporting the progress of education and research "and" valuing research".

Policy response

The French R&I system has undergone profound reforms to develop more consistent systems, reinforce public and private partnerships, and optimise the use of human and financial resources. The changes introduced in the organisation and the financing of the research system aim to increase the performance, visibility and international influence of French research. They mainly consist of increasing the sums devoted to research projects that demonstrate international excellence criteria and an emphasis on reporting and evaluation.

[33] ANR granted credits of €716.6m million in 2012 and €510.7m in 2015. This amount increased from 2016 and the efforts should be intensified in 2017. Source : Projet de loi de finances pour 2017 : Recherche et enseignement supérieur, available on line : http://www.senat.fr/rap/l16-140-325/l16-140-32514.html

Two bodies (ANR and HCERES) have played an important role in restructuring policymaking and resource allocation. The National Research Agency was designed to fund project-based basic and applied research in all fields of science. The ANR is at the core of the French research system. Its mission is to finance research projects demonstrating excellence. The agency works essentially through calls for proposals. In addition, *HCERES* contribute to orientate policies through the results of the assessments which can influence the annual allocations to research organisations.
In addition to projects grants provided by ANR on a competitive calls process, an Excellence Initiative named *Programme d'Investissements d'avenir* (PIA, for Investment for the Future Programme) was launched in 2010. Even if the PIA was not set up with an specific objective of reforming the French R&I system, the selection process adopted, based upon projects-funding through competitive calls, contributed to the evolution of R&I funding in France. By 2017, its first three rounds (PIA 1, PIA 2 and PIA 3) had already dispensed approximately €30bn on Higher Education Research. Based on competitive calls assessed by high-level international panels, the PIA programme targets research, innovation, and higher education. It grants labels of "excellence" (IdEx, EquipEx, LabEx, etc.) and allocates relevant funding (approximately €1bn for an average IdEx project, and from €5-25m for a LabEx or EquipEx). This selective policy has been strengthened in 2017:

- the creation of nine science/innovation/territories/economy initiatives (I-SITE) consisting of university groupings
- a call for a project to create "Ecoles universitaires de recherche" consisting of the grouping of Master's and doctoral schools
- partnership contracts initiated by the CNRS with selected universities (Bordeaux, Aix-Marseille, Pierre et Marie Curie).

These new instruments present a common feature: the amount of funds provided is subject to the grouping of research institutions to build bigger research clusters that will be able to compete with the best-ranked institutions in the Shanghai ranking. They increase the concentration of financial resources in bigger institutions.

Policy assessment
Researchers have highlighted the lack of empirical evidence (Bernella and Bouba-Olga, 2014) regarding the French R&I system and therefore the difficulty to reform it. Some facts and figures confirm this thesis. Indeed, arithmetically, the measures adopted have not radically changed research project and research institute budgets. They have not significantly improved France's position in international research rankings. Indeed, the resources devoted to research projects are often too scarce and the increasing number of non-tenured and part-time researchers tends to reduce the efficiency of research organisations. Some scholars emphasise the risks associated with resource concentration, which tend to redistribute power between disciplines and institutions by transferring assessment to academic-based independent bodies (Musselin, 2017).
Assessment is incomplete, especially since policy reforms are still ongoing, and changes are expected (Paradeise, 2017). In addition, the assessment methods are being debated. The assessment independent authority (AERES, then HCERES) has adjusted its own indicators many times. Nonetheless, the context of budgetary constraint seems to justify the generalisation of a performance culture.

4.4 Challenge 4: Promote R&I evaluation

Description
As presented in previous challenges, France has implemented many policy measures to promote research and innovation. While the expansion of these policy schemes has been accompanied by multiple monitoring mechanisms to ensure their legal compliance, the alignment of their achievements with their original objectives and their general consistency, impact evaluations, comparison of policy schemes, counterfactual analysis, and

benchmarking remain marginal[34]. This prevalence of audit mechanisms over impact assessment has led the European Commission (2015, 2016d), the Council (2014) and French experts (e.g. Lauvergeon, 2013; Beylat and Tambourin, 2013) to express repeated concerns about the need to assess the complete portfolio of R&I policy instruments. A sound impact assessment of R&I policy schemes would allow future policy developments to be based on evidence of the effects of previous R&I instruments.

Policy response

The creation of several evaluating organisations in recent years highlights the desire to tackle the issue at both research and innovation level. HCERES was founded in 2013, replacing the previous Evaluation Agency for Research and Higher Education, known as AERES,, to assess research and higher education institutions, PROs, research units, higher education programmes and degrees. Regarding innovation, the National Commission for the Evaluation of Innovation Policies (CNEPI) was set up in 2014, as planned in the "New Deal for Innovation" roadmap released one year previously.[35] The main purpose of the CNEPI is to assess innovation policies and identify their economic impact; to analyse their consistency, taking into account the other innovation support measures; to suggest new ways of increasing innovation policy efficiency; and to promote good practice at national and regional level. It has already published two important reports – one on the R&I system (e.g. CNEPI, 2016a) and one on the PIA initiative (CNEPI, 2016b).

Policy assessment

In a context of simplification and downsizing of assistance schemes, impact evaluations are required both ex ante and ex post to select and develop the best tools. In this respect, simplification without a sound assessment of innovation policies could be worse than a slow and cogent transformation. The creation of CNEPI and HCERES aims to link policy making to analysis, and is thus a first step in the development of an evaluation culture.

5 Focus on R&I in national and regional smart specialisation strategies

5.1 New policy developments

There is in France no National Smart Specialisation Strategy. The French specialisation policy is rather a continuous process, regularly adapted to take account institutional changes. These include:

- the development of national specialisation strategies such as France-Europe 2020 (2013), Innovation 2030 (2013), "New Industrial France" (2013), ANR (2015)
- the new institutional framework resulting from the enforcement of recent laws (ESR law 2013, MAPTAM law, 2014 and NOTRe in 2015) which reinforce the leadership and competences of regional authorities.

The national smart specialisation strategy covers the general principles defined at European level. This strategy concentrates the financial resources devoted to research, innovation and economic development on priorities and key industries determined in line with major regional characteristics.

The "commissariat général à l'égalité des territoires" (CGET) – an agency attached to the Prime Minister's Office responsible for government coordination to ensure balanced regional development – is responsible for monitoring S3. It has underlined the complementarity between the different national priorities and the regional smart specialisation processes. The report "Synthesis of research & innovation strategies for smart specialisation of French

[34] A noteworthy recent exception is the IGF-CGEDD-CGE report (2015) in which the economic impacts of different innovation policy expenditures are compared. See also Bozio and Romanello (2017).

[35] http://proxy-pubminefi.diffusion.finances.gouv.fr/pub/document/18/16212.pdf

regions" (2015) highlights the importance of entrepreneurial discovery, of developing complementary products and services, of openness to other regions, and of a long-term evaluation system.

The French regions' innovation strategies represent a good starting point for designing smart specialisation strategies. Regions are the appropriate governance level due to their experience in managing complex local strategies between state, the region ("Contrats de plans Etat-Région" or CPER), cities or local public operators (HEI, PROs, communauté d'universités et établissements (COMUE) or IDEX mainly). The governance structures and mechanisms are designed to discuss and agree on R&I priorities and generate two main regional documents: the SRESRI (Schéma Régional de l'Enseignement Supérieur de la Recherche et de l'Innovation) and the SREDEII (Schéma régional de développement économique, de l'innovation et de l'internationalisation).

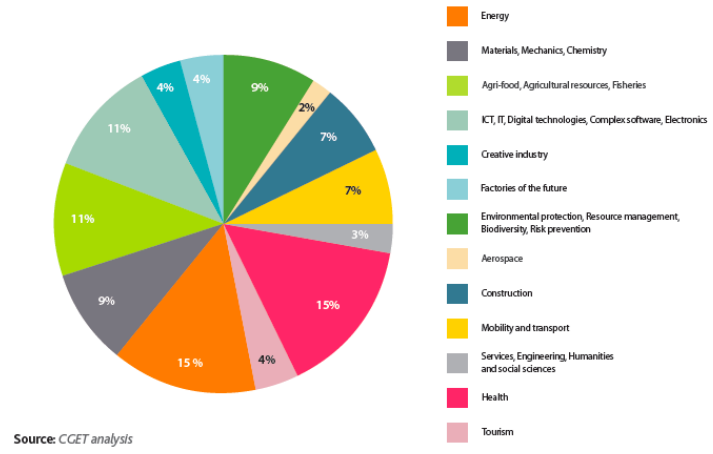
The regional research and innovation strategies of smart specialisation (RIS3s) are defined by the regions in very different socio-economic contexts. These specific characteristics determine each region's ability to adopt a smart specialisation approach as well as the way they appropriate this concept. They also shape the application of the smart specialisation concept.

Universities play a role in this process, as shown by the "politiques de site"[36] implemented at regional level. The "strategies de site" are defined in accordance with European policies. They aim to encourage scientific partnership and cross-fertilisation between universities, research institutions and other innovation operators in a given area.

The recent S3 exercise has had a variety of results: some regions chose to specialise in very few technologies (Alsace, for example), whereas others (Auvergne-Rhône-Alpes and Brittany) opted for a more general approach. However, all regions specialise in certain sectoral activities (e.g. health, energy). A number of themes emerge from the French regions' RIS3 in terms of national innovation (see Figure 4)

- Health covers at least one smart specialisation area in every region, apart from Corsica, Mayotte and Franche-Comté. In some regions (Alsace, Aquitaine and Midi-Pyrénées), health is a component of several smart specialisation areas.
- Energy is a key field in a great majority of regions (except Auvergne, Burgundy and Martinique).
- Agri-food, agricultural resources and fisheries are priorities for 20 regions.
- ICT, digital technologies, complex software and electronics are smart specialisation fields for 17 regions. In some regions, this market covers several smart specialisation areas (e.g. Aquitaine, Auvergne, Brittany, Ile-de-France and Franche-Comté).
- 16 regions are positioned in the materials, mechanics and chemistry sectors.

Figure 5. Breakdown of the smart specialisation areas of the French Regions' RIS3



Source: CGET (2015) p. 42.

[36] https://esr-wikis.adc.education.fr/ca2co/index.php/1.4_D%C3%A9finir_les_politiques_de_site

Some regions use the 15% of structural funds to fund external actors. The Hauts-de-France region has launched three programmes ("TRI", the third industrial, agricultural and maritime revolution; "Euro-hub" to connect transport systems and networks; and "Welcome EU" to develop cyber-security R&D programmes and innovation, fin-techs, education techniques and judicial and back-office services). No quantitative information has been published yet. The Ile-de-France region has also used structural funds for a programme named "Actions d'accompagnement individuelles et collectives en faveur des PME/PMI de la Spécialisation Intelligente et son schéma régional (SRI-SI)." No summary or quantitative information is available on the actual use of European funds by the regions to launch RIS3 programmes.

Three regions are already strongly committed to a cross-border strategy: Grand-Est (Alsace and Lorraine), Bourgogne-Franche Comté, and Nouvelle Aquitaine (Pays Basque). The cross-border region of the Upper Rhine provides a good example of the implementation of a joint concept for smart specialisation. Apart from parts of Switzerland and South Palatinate, the Upper Rhine region comprises Alsace and Baden – the western part of Baden-Württemberg. Several instruments have been developed to coordinate efforts across the formally delineated support systems of both regions. Examples include a cross-border biotechnology cluster (Biovalley), a university network (Eucor), joint political initiatives (RMT/TMO), and cross-border local (Eurodisctrict) and regional (Pamina) institutions. These efforts aim not only to manage but also to leverage and use complex policy frameworks and actor constellations in a given framework – preceded by discourse, exploration, negotiation and, ultimately, joint decision-making. The regional smart specialisation strategy added little to existing dynamics, as the two administrative processes were very weakly linked in practice (Muller et al., 2017). Pays Basque is another good example of the implementation of the S3 strategy in an area already committed to joint programmes.

5.2 Progress on implementation

Even though RIS3 is designed as a global framework for research and innovation funds, the relative weight of European Structural and Investment funds might impact on the actual influence of RIS3 on R&I ecosystems. Moreover, the roles and responsibilities of RIS3 vary significantly from one region to another (Polverari, 2016).
Analysis of these strategies shows that, in most cases, the definition of the policy mix, roadmap and action plan is under way (CGET, 2015). The implementation of the RIS3 strategies must specify the link between the territorial analysis and the proposed action plan by clarifying the territory's challenges and ambitions with regard to innovation. In some regions, the process is more advanced. Action plans differ according to the maturity of the smart specialisation areas. Many fields are covered, even if energy and health and, to a lesser extent, agri-food, ICT and the environment are, by far, the most common.

Monitoring mechanisms and the feedback loop
The same regional differences appear in the assessment and evaluation process even if, in most cases, a lot remains to be done. Assessment of the regional effect of the smart specialisation approach was mentioned as an improvement during the preceding phase of implementation of this policy. The principle is quite clear: regions should implement a system for continuous monitoring and assessment of the strategy to adapt its implementation. The CGET report (2015) points out that "Most French regions are in the process of implementing a monitoring and assessment system" (p. 30), which means that the majority still rely on previous systems, which lack robustness. Only a minority of regions has defined and implemented a genuine monitoring and assessment system:

- The assessment put in place in the Aquitaine region (Lefebvre, 2017, p. 22) aims to renew the smart specialisation areas. A preliminary assessment to identify its specialisation areas is ongoing. The results will renew the specialisation themes and

adjust funding. The second stage of the assessment measures the effects of funding on the theme and its impact on the markets. The results are not yet available.

- The Picardy region has planned an ex ante evaluation of its envisaged RIS3 to identify existing resources, the expected impact of the RIS3, the strategic and operational objectives, and the indicators to be deployed to enable regular monitoring of the strategy (CGET, 2015, p.31)

However, most indicators highlighted are implementation or performance indicators. Impact assessment remains a difficult topic to deal with, and is rarely addressed.

- Another key issue is the strengthening of links between regional ecosystems, made possible by their respective smart specialisation priority areas. At a national level, the design of the RIS3 has been the opportunity to make the regional ecosystems more visible, and to facilitate exchanges between regions on this research and innovation field. As a consequence, regions have to pay attention to the integration of their respective research and innovation support policies. Some regions like Nord-Pas-de-Calais and Franche-Comté are primarily involved in cross-border cooperation.

Partnerships between regions resulting from the involvement in a partnership strategy are often based upon competitiveness and other clusters, and structures created thanks to the investment programme for the future (Labex, Equipex, IRT, etc.), or in collaboration with innovation ecosystem stakeholders (laboratories, transfer centres, universities, businesses, etc.). Still, according to CGET (2015), this type of cooperation can result in institutional cooperation, specific projects (notably European projects, the joint filing of patents, etc.) or cooperation based on common equipment (partnerships between or within Equipex, for example).

Evidence of impact

It is still too early to provide evidence of the impact of the French Smart Specialisation Strategies on the regional innovation and economic ecosystems.Assessment of their effects, mainly at the local level, is often made difficult by the lack of quantitative data. For example, the Aquitaine region has announced that the smart specialisation area renewal procedures are decided via constant monitoring of the themes, an assessment of the effect of the funding selected, and the permanent co-existence between the selected themes and the new proposed themes. At the moment, no results are available.

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Abbreviations

List all abbreviations, including full names in both English and the national language.

ADEME	Agency for Environment and Energy Management/Agence pour l'Environnement et la Maîtrise de l'Énergie
ANR	National Research Agency/Agence Nationale de Recherche
CEA	Alternative Energies and Atomic Energy Commission/Commissariat à l'énergie atomique et aux énergies alternatives
BERD	Business expenditure on research and development
Bpifrance	Public Investment Bank/Banque Publique d'Investissement
Carnots	
CDC	Deposits and consignments fund/Caisse des Dépôts et Consignations
CGET	General Commisariat for Territorial Equality/Commissariat général a l'égalité des territoires
CGI	High Commission for Investments/Commissariat Général à l'Investissement
CIFRE	Scholarship for PhD students conducting their research in collaboration with an industrial firm/Conventions Industrielles de Formation par la Recherche
CII	Innovation tax credit/crédit impôt innovation
CIR	Research tax credit/crédit impôt recherche
CIS	Community Innovation Survey
CNEPI	National Commission for the Evaluation of Innovation Policies/Commission National d'Évaluation des Politiques d'Innovation
CNRS	National Centre for Scientific Research/Centre National de la Recherche Scientifique
CPI	SME innovation savings plan/Compte PME innovation
CRT	
CVT	
DESI	Digital Economy and Society Index
EC	European Commission
EPO	European Patent Office
ETI	Intermediate-sized enterprise
EU-28	European Union including 28 Member States
EURAXESS	Professional research information and support initiative
FDI	Foreign direct investment
France Brevets	
GDP	Gross domestic product
GERD	Gross domestic expenditure on research and development
Grandes Ecoles	
HCERES	French Evaluation Agency for Research and Higher Education/Haut Conseil de l'Évaluation de la Recherche et de l'Enseignement Supérieur
HCST	High Council for Science and Technology/Haut Conseil pour la Science et la Technologie
HEI	Higher education institutions (public and private)
ICT	Information and communication technologies

IDEX	Excellence initiative/initiative d'excellence
INRA	National Institute for Agricultural Research/Institut National de la Recherche Agronomique
INSERM	National Institute for Health and Medical Research/Institut National de la Santé et de la Recherche Médicale
IRT	
I-Site	Science/innovation/territories/economy initiatives
LabCom	Joint public and SME research laboratories
MENESR	Ministry for Education, Higher Education and Research (Until May 2017)
MESRI	Ministry for Higher Education, Research and Innovation (from May 2017)
MIRES	Inter-ministerial mission on research and higher education
MNE	Multinational enterprise
OECD	Organisation for Economic Cooperation and Development
OPECST	Parliamentary Office for the Evaluation of Scientific and Technological Options/Office parlementaire d'évaluation des choix scientifiques et technologiques
PIA (1, 2 or 3)	Investments for the future/Programme d'Investissements d'Avenir
PPI	Public procurement for innovation
PRO	Public research organisation
R&D	research and development
R&DTC	R&D tax credit (CIR)
R&I	Research and innovation
RIS3	Research and Innovation Strategy of Smart Specialisation
SATT	Technology transfer companies
SME	Small and medium-sized enterprise
SRC or CSR	Strategic Research Council
STEM	Science, technology, engineering and mathematics
ISI	Strategic Industrial Innovation Program / Programme « Innovation Stratégique Industrielle »,

Factsheet

	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
GDP per capita (euro per capita)	30000	30800	31500	31800	32100	32400	33000	33300	
Value added of services as share of the total value added (% of total)	78.49	78.62	78.33	78.49	78.53	78.62	78.6	78.81	
Value added of manufacturing as share of the total value added (%)	11.51	11.25	11.37	11.33	11.35	11.31	11.53	11.38	
Employment in manufacturing as share of total employment (%)	10.77	10.28	10.1	10.01	9.89	9.8	9.67	9.51	
Employment in services as share of total employment (%)	78.28	78.91	79.19	79.35	79.49	79.69	80.04	80.37	
Share of Foreign controlled enterprises in the total nb of enterprises (%)	0.76	0.71	0.79	0.69	0.84	0.71			
Labour productivity (Index, 2010=100)	98.6	100	100.8	101.1	102.4	103.3	104.1	105.1	
New doctorate graduates (ISCED 6) per 1000 population aged 25-34					1.25	1.22	1.21		
Summary Innovation Index (rank)	11	11	11	11	11	11	11	11	
Innovative enterprises as a share of total number of enterprises (CIS data) (%)				53.4		56.4			
Innovation output indicator (Rank, Intra-EU Comparison)			7	7	8	7			
Turnover from innovation as % of total turnover (Eurostat)		11.3		13.5					
Country position in Doing Business (Ease of doing business index WB)(1=most business-friendly regulations)						27	27	29	29
Ease of getting credit (WB GII) (Rank)						65	69	72	
Venture capital investment as % of GDP (seed, start-up and later stage)	0.048	0.042	0.035	0.032	0.037	0.035	0.034		
EC Digital Economy & Society Index (DESI) (Rank)						15	16	16	16
E-Government Development Index Rank		10		6		4		10	
Online availability of public services – Percentage of individuals having interactions with public authorities via Internet (last 12 months)	47	57	57	61	60	64	63	66	
GERD (as % of GDP)	2.21	2.18	2.19	2.23	2.24	2.23	2.22		
GBAORD (as % of GDP)	0.9	0.82	0.82	0.73	0.71	0.69	0.65	0.63	
R&D funded by GOV (% of GDP)	0.86	0.81	0.77	0.79	0.79	0.77			
BERD (% of GDP)	1.36	1.37	1.4	1.44	1.45	1.45	1.44		
Research excellence composite indicator (Rank)	11	10	10	10	10	10			
Percentage of scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country		10.67	10.85	10.97	11.22	11.06			
Public-private co-publications per million population	37.31	39.87	42.95	42.1	41.13	41.29	32.2		
World Share of PCT applications	4.54	4.34	4.06	4.05	3.87	3.81	4.28		
Global Innovation Index				20	22	21	18	15	

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