Secrétariat d'État à l'Enseignement Supérieur et à la Recherche

Ministère de l'Économie, de l'Industrie et du Numérique

Reforms in the French Industrial Ecosystem

Rapport à

Monsieur le Secrétaire d'Etat à l'Enseignement Supérieur et à la Recherche
Monsieur le Ministre de l'Economie, de l'Industrie et du Numérique

Etabli par

Suzanne Berger
Raphael Dorman and Helen Starbuck Professor
Department of Political Science
Massachusetts Institute of Technology

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Table of contents

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Cover letter

January 31, 2016

Monsieur le Ministre de l'Economie, de l'Industrie, et du Numérique

Monsieur le Secrétaire d'Etat à l'Enseignement supérieur et à la Recherche,

Please find enclosed a report that responds to the lettre de mission sent to me on 2 December 2015. The lettre de mission stated that the Government was determined to accelerate the transfer of knowledge from research into products and services in the market, to strengthen the role of universities in that process, and to simplify and rationalize the instruments of government support. The letter requested my views of existing institutions and processes and my recommendations with respect to the objectives of the Government. The letter asked that I consult on these issues with M. Jacques Aschenbroich, Administrateur et Directeur général, Valeo. We met several times and M. Aschenbroich expressed his agreement with the analysis and recommendations presented in the Executive Summary that was submitted to the two Ministers on 20 January 2016. The mission also requested that I meet with M. Jean Pisani-Ferry, commissaire général de France Stratégie, which on 30 septembre 2015 was chargé d'organiser à la demande du Commissariat Géneral à l'Investissement, l'examen à mi-parcours du Programme d'investissements d'avenir. I have met on several occasions with M. Pisani-Ferry and his colleagues and with M. Philippe Maystadt, head of the commission of experts established to carry out this evaluation.

In the course of the five weeks I spent in France for this inquiry, I interviewed 110 business, government, and academic actors with significant roles in the innovation system. Throughout the inquiry I benefitted greatly from the wisdom, experience, and unstinting assistance of Gilles Rabin, Conseiller auprès du Secrétaire d'Etat Thierry Mandon, en charge de l'innovation et de la politique spatiale; Thomas Lombès, Chef du Département des politiques d'innovation par le transfert de technologie (SITTAR C2), Direction Générale de la Recherche de l'Innovation (DGRI), Laure Ménétrier, Chef du Bureau de la recherche-développement partenariale/Direction générale des Entreprises; et et Frédérique Sachwald, Adjointe au chef du Service de la recherche et de l'innovation, DGRI. Special thanks go to Benjamin Gentils, whose intellectual and administrative contributions to the project went far beyond any that could be expected of a stagiaire. On most of the interviews, I was accompanied by Thomas Lombès, Laure Ménétrier, Gilles Rabin, and Benjamin Gentils; and our discussions played an essential role in my understanding of these complex issues. These persons have, however, no responsibility for any of the opinions or recommendations presented in the report.

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The institutions that successive Governments have created over the past fifteen years to intermediate between academic research and industry are currently the object of multiple and extended evaluations. The specificity of my brief mission (October 2015-January 2015) was to bring the perspective of a foreign expert to bear on the French system of innovation. I am an American social scientist and professor at the Massachusetts Institute of Technology who has conducted research on globalization, innovation, and production. My views of the French system of innovation inevitably reflect this experience. With all the limitations inherent in this bias as well as in the brevity of my solo investigation, I hope, nevertheless, that this report may be of use in your deliberations.

Sincerely,

Suzanne Berger

When the minister Gladstone asked Faraday what his research on electricity could be good for, the nineteen century physicist replied "*One day, sir, you may tax it*".
Cited by Serge Haroche, at Nobel Prize Banquet, 10 Décembre 2012.

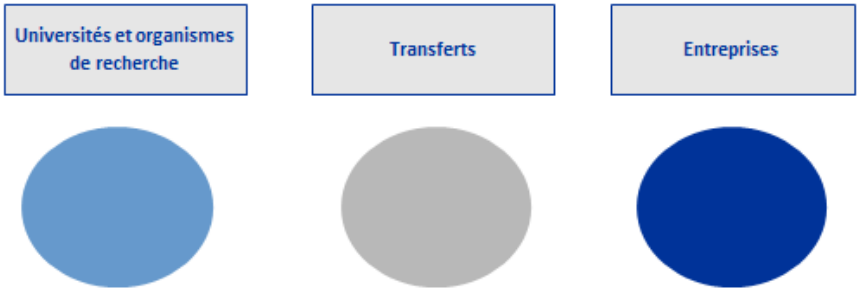
Alain Juppé and Michel Rocard in *Investir pour l'avenir* (2009), start with a question that has long troubled the French: "Pourquoi sommes-nous si bons dans la recherche et si faibles dans sa valorisation?" Three years later, the Gallois report, *Pacte pour la compétitivité de l'industrie française* returned to this question and identified missing links between research and industry among the first of the handicaps constraining French competitiveness. A number of international comparative studies support the view that French competitive performance suffers from its system of innovation. France ranks sixth or seventh in the world for its research (as measured by scientific publications and citations) but between sixteenth and twentieth for its innovation.[1] In the European Commission's "Innovation Union Scoreboard, France figures as an "innovation follower" not a leader. [2]

Why this is the case and what should be done to fix it remain controversial and unsettled matters. To explain why France has brilliant scientists and engineers and great discoveries but remains slow and inefficient in producing new goods and services in the market, these reports and much folk wisdom implicitly blame the universities and research centers. Academic researchers are described as interested only in publications. The institutions that employ them are seen as failing to provide incentives for scientists to address the needs of the economy and as incompetent when they do, finally, under pressure, attempt to commercialize academic discoveries. [3] As one official in a large urban chamber of commerce put it: "L'université est un monde clos qui ne s'ouvre pas sur son environnement car elle n'en a pas besoin." Even more bitterly, one high tech PME CEO told us: "Dès qu'on parle collaboration, on sort le contrat. Les chercheurs sont payés pour chercher et on paye des impôts pour qu'ils trouvent." Beyond that, why not just pay them on an hourly basis, he wondered.

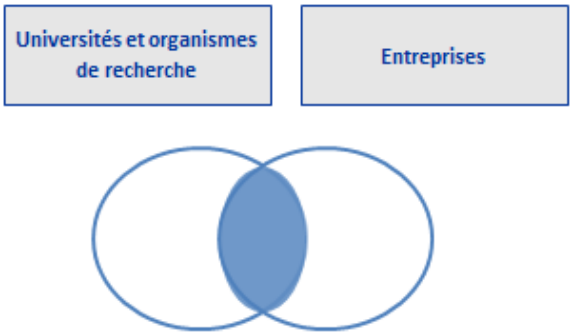
The key questions of the mission (lettre de mission de 2 décembre 2015 du Ministre de l'Economie, de l'Industrie, et du Numérique et du Secrétaire d'Etat à l'Enseignement supérieur et à la Recherche) with respect to these issues can be simply stated. How does academic education and research translate into a dynamic economy producing new goods and services in the market, new enterprises, and new good jobs? Do the new French institutions created over the past decade in fact perform the functions for economic growth that universities and research centers perform in other countries? Does the evidence of the early years suggest that these new institutions can serve as the missing links enabling new research to flow rapidly into the economy? Even if these new agencies are the right ones, is the system now too overcrowded and complex to work efficiently? How might this system be simplified and made more responsive to the challenges of competition in world markets and strengthening of societal well-being in France?

The innovation reform agenda of both Conservative and Socialist governments of the past fifteen years has basically been one designed to remedy what are perceived as the failures of the academic research community to build connections to industry that would transform the new knowledge of the laboratories into new products and services in the market. Reform efforts have mainly focused on creating new institutions to transfer technology. Many new agencies have been added; very few have been eliminated. The SATTs, the IRTs, the ITEs, the pôles de compétitivité, France Brevets, Instituts Carnot, Chaires industrielles, CEA Tech, and other agencies that figure on the elaborate *cartographie* of the French system of innovation are institutions built to fill gaps between public research and industry—gaps that academic institutions have supposedly proved incompetent to bridge. Each reform has superimposed new institutions on top of old ones. As one French scholar summarized this history: "un ministre, un colloque, une loi."[4] The system has been described in an authoritative account in *Quinze ans de politiques d'innovation en France* (2016) by the Commission nationale d'évaluation des politiques d'innovation.

If we imagine academic research, transfer, and firms as three distinct entities, then institutional reforms relating to innovation have mainly focused on building up "transfer."



To anticipate the conclusions I have reached, I will suggest that reform ought instead to focus on creating a broader and more dynamic interface between institutions of academic research and enterprises. This would require major new efforts and funding in universities.



1. Ground Clearing : Two misunderstandings

a. What Universities Can (and Cannot) Do for the Economy

Before considering whether the new institutions of the French innovation system are workable substitutes for supposedly deficient capabilities of French universities and research centers, it is first useful to establish what those foreign universities that are considered to be successful ones actually do that contributes to innovation and economic growth in their societies. Macro-economic growth theory from Robert Solow's pioneering work onwards identifies and quantifies the critical role of innovation in growth, but there are few reliable empirical studies that track the passage of inventions from the laboratory on through to market and that show exactly which products of academic institutions contribute to growth, how they do so, and at which points along the trajectory from lab to market they do so. Yet this is obviously a critical matter. If, for example, policymakers are concerned with employment, they need to know where along the trajectory of enterprise growth new jobs are most likely to be created. Recent research has demonstrated that while start-ups create many new jobs, most of these jobs disappear rather rapidly over the next five years along with the start-up. It's in young (but not the youngest) growing companies that we find the highest rates of durable job creation. The implications for policy would, therefore, be to focus public support on companies further along the growth path, when the company would have reached around $50-$100 million in revenues.[5] In sum, policymakers need to ground expectations about how innovation contributes to growth and employment in empirical research. What we have learned thus far in investigating "best case" success stories provides a useful reference point. We are still far, however, from the kinds of understanding that systematic inquiry and research on these questions could provide.

Two recent reports from universities are typical of efforts to demonstrate how and how much economic impact derives from academic research. A 2015 study of the economic impact of the twenty-one League of European Research Universities (including Pierre and Marie Curie University, Université Paris-Sud, and University of Strasbourg) attempts to quantify seven dimensions of technology transfer: licensing, consultancy, contract and partnership, start-ups and spin-outs, science parks, training, and volunteerism. The LERU report calculates an output of 21.9 billion euros in Gross Value Added.[6]

An MIT December 2015 report focuses on the role of MIT graduates in the economy.[7] Alumni surveys found that 22 percent of all graduates had worked in early-stage ventures. MIT alumni were among the founders of some 30,000 currently active companies employing 4.6 million people, generating revenues of $1.9 trillion, equal to the GDP of the world's tenth-largest economy in 2014. The report attributes the entrepreneurial performance of the alumni to the multiple and diverse educational opportunities and resources provided for undergraduate and graduate students as well as for faculty for interaction with industry through hands-on experience in internships in domestic and foreign laboratories and companies, entrepreneurship classes and labs, mentoring programs for students and faculty with ideas for start-ups, and easy access to a

strong technology licensing office and industrial liaison offices. Stanford University has produced a similar study based on surveys of Stanford alumni. Each of these reports makes rather heroic assumptions about how much of the outcomes in each case are due, specifically and uniquely, to the universities' contributions. But even if one discounts for institutional boosterism, still the impact appears to be big.

The strongest positive conclusion to be drawn from such studies—as from the work of University of Cambridge researchers Alan Hughes and Michael Kitson in the U.K. --- is that what matters is the breadth, depth, and continuity of interactions across a broad front between industry and academic researchers from multiple disciplines. It is sustained exchange across a wide interface that translates into economic impact. [8] University efforts at "valorization," "maturation," and commercialization of research are only one part and likely not the most important node along this interface. The measure of success of those universities that are in closest and most productive relationship to the strong regional economies around them—University of Cambridge, Stanford University and Silicon Valley, MIT, Harvard and the Kendall Square biotech industry— is not the income they derive from technology transfers. In fact, even leading American universities derive relatively little income from their licensing of the results of fundamental research.

About 90% of all research conducted at American private and public universities is funded with federal money. The Bayh-Dole act (1979) gives universities the ownership of patents from federally-funded research on their campuses and allows them to grant exclusive licenses on it. To take one familiar case: the MIT Technology Licensing Office (TLO) has 40 employees, including patent lawyers, intellectual property experts, business development specialists, and scientists and engineers with business experience. It is regarded as one of the most productive in the U.S. and turns out about 600 new invention disclosures a year, about 300 new patents, about 15-30 new companies a year and manages over 650 active licenses. But the amount of income that flows to the university after distributions to the labs and inventors is not a major factor in the university's annual budget, and the revenues fluctuate significantly from year to year. Consider one snapshot of this activity at MIT in 2014. In that year, over 50% of royalty income came from Digital TV patents. When those rights began to expire the following year, royalty income fell. In 2015 after covering expenses and after distributions to inventors, centers, and departments, only $13.2 million went into MIT General Fund. Harvard University has earned less than $13 million gross a year on licensing intellectual property in recent times. [9] As Lita Nelsen, director of the MIT Technology Licensing Office explained: "The university cannot expect that financial returns will ever be a major source of income---unless they get lucky." [10] Getting lucky means finding a blockbuster. Examples of such "blockbusters" are Northwestern University's anti-seizure drug Lyrica which has earned a billion dollars; University of Wisconsin's Warfarin (Coumadin), and University of Florida's sports drink "Gatorade."

Why then do universities devote significant time and effort to obtaining and protecting patents? Nelsen explained that one of the university's basic commitments to society is to transmit knowledge that contributes to the economy and to the public good. "We protect intellectual property -— mostly through patents---so as to provide a good

'dowry' to incentivize entrepreneurs to start companies. Then, we emphasize 'getting the deal done fairly' rather than 'getting the best deal.' It's for 'impact, not income': It's not about the money. Sure, we like it when our ships come in, but the primary focus is getting the deal done so that the technology gets developed." [11]

The Association of University Technology Managers' 2012 survey of 194 leading universities and research hospitals found that these universities had issued 5145 patents, 6372 licenses, and 705 new start-ups. The total licensing revenues these universities had received that year was $2.6 billion. The research base that generated these returns was $63.7 billion—so licensing revenue was equal to only 4.1% of research expenditures and after distributions to the academic inventors only about 3%. Fifty percent of the licensing revenue went to only twelve of the academic institutions, and for each of those twelve, more than 80 percent of their royalties came from one jackpot, i.e., one lucky technology transfer. Only 16% of university licensing offices are self-financing. [12] This is a fact to be kept in mind when considering that the rules establishing the new transfer agencies in France, for example, the Sociétés d'accélération de transfert de technologies [SATT], require that they be self-financing after ten years.

Despite the contrary evidence from U.S. and U.K. experience, many of those involved in innovation policymaking in France over the years continue to believe that a significant or even the most significant measures of a university's impact in the economy are the revenues it derives from the licensing of patents and the speed to profitability over shorter time intervals (10 years) than any foreign evidence validates as plausible. These beliefs, whether explicitly stated or implicitly held, have played a major role in the design of the new institutions (SATTs, IRT/ITEs, Instituts Carnot, France Brevets) that are supposed to substitute for the universities' deficient effort. Several persons consulted in the course of the mission explained how these beliefs gained new credence from a single French blockbuster: Taxotère. Taxotère and Navelbine, chemotherapy agents used primarily in metastatic breast cancer, were developed in the laboratory of Pierre Potier at the Institut de chimie des substances naturelles in Gif-sur-Yvette in the 1980s. By 2004 they were responsible for 1.7 billion euros of chiffre d'affaires of Aventis-Synthélabo (now Sanofi Aventis) and for about 90% of Centre national de la recherche scientifique (CNRS) patent revenues. The lesson of Taxotère was understood as meaning that there was vast neglected treasure in the laboratories that could be commercialized—if only the researchers were to seize the opportunity,as Pierre Potier had done, after battling and winning out against many bureaucratic obstacles. The reality is, however, that as American technology licensing results suggest, blockbusters are rare strokes of luck.

Equally, foreign experience suggests that outside of software and social media products and services, the path from discovery to profit making is still a very long one. There is much attention in the U.S. today both in government and in universities to speeding up the rate of advance from discovery in a university laboratory through stages of demonstration, prototyping, pilot production, and scale-up to commercialization. Advanced manufacturing technologies like 3D printing, open innovation, new funding mechanisms like crowd-sourcing all show promise for accelerating the scale-up process. But these are still in the realm of hopes for the future. Recent research suggests that

outside the information technology and social media sectors, it's still rare to find even the most promising new products reaching profitability within ten years. [13]

Even within large corporations, where resources are ample and pressures to bring new products on line rapidly are intense, scale-up of significant innovations from in-house discovery to market is a lengthy process. Consider, for example, two examples among many of innovation within U.S. multinational R & D. Michael Idelchik, General Electric vice president for advanced technologies at GE Global Research, in Niskayuna, New York, the oldest central corporate R&D laboratory in the United States, described bringing a new alloy into production for turbine blades. The process involved multiple exchanges between scientists and engineers and manufacturing specialists. The new alloy was patented in 1989. The first test of the engine could not be conducted until 1993; and only in 2009 did the new turbine enter into service. DuPont used technology from a U.S. national laboratory to initiate its work on cellulosic ethanol and then in 2003 received $20 million funding from the Department of Energy's Integrated Corn Biorefinery project. By 2010 DuPont, along with a Tennessee start-up, was able to open a demonstration-scale plant in Tennessee. It took until December 2012 before DuPont could break ground for a commercial-scale plant in Iowa. [14] The time from lab to market is likely even longer when research starts in an academic laboratory, then moves out into a start-up for development and then eventually grows via an IPO or via corporate acquisition or possibly, as with the California "unicorns," develops as a private company backed by venture capitalists. Even in a "liberal" economy like the United States, with powerful financial market pressures for short-term payback and quarterly profits, bringing innovation to market takes patience and long-term commitment.

The key lesson that emerges from this rapid survey of foreign "best practice" in academic research and industry is that building a dense set of connections along the interface between researchers and industry is what matters most. The essential exchanges are those between human beings: students excited about entrepreneurship graduating from universities and going to work in startups and companies, engineering students sent on internships to a German or Chinese or French company for several months, researchers from industry standing around a coffee machine in a lab talking with their university counterparts, scientists from research centers spending a few years in government policymaking positions, a university patent expert counseling the chemist with a great new idea on batteries, the chemist serving as a consultant to the startup that was initiated with a license from her discovery, the university industrial liaison officer walking a company's R&D director on an introductory round to visit labs. Licensing and maturation of research are valuable for the economy when woven into this web of productive connections —even if often they are only moderately remunerative for the individual university.

b. A Fraunhofer à la française?

A second critical misunderstanding of foreign experience has to do with German industry. [15] The remarkable record of Germany's Mittelstand companies in high value-added production, exports, and employment has focused attention on the public and

parapublic institutions that support these firms. The best known of them in France are the Fraunhofer Institutes. Almost every transfer agency in France presents itself as a "Fraunhofer à la française" in the making. But research on Germany shows that the Fraunhofers are only one part of an ecosystem that is very rich in public and private resources that companies can combine with their own capabilities. Indeed in 2011, as a fraction of total contract research spending, the Fraunhofer received a smaller proportion of the whole than even the Instituts Carnot. Les Fraunhofer avaient réalisé un montant de 570M€ de recherche contractuelle sur un total de 4Mds€ de recherche contractuelle en Allemagne. En comparaison, la même année les instituts Carnot avaient réalisé un montant de 450M€ de recherche contractuelle sur un total de 900M€ pour la France. [16]

French and German industrial ecosystems are very different. By ecosystem I mean the regional base of resources and relationships outside any given company that the company can draw on to develop its business and bring new products and services to market. [17] In the German industrial ecosystem firms find local and regional bankers with deep industry knowledge, a vocational education system that produces highly-qualified workers, trade associations, technical universities, industrial collective research consortia, industrial research centers, technical advisory committees. One survey of a sample of 744 industrial collective research projects in Germany found 293 different organizations involved in just those programs. [18] The government supports innovation through these institutions via specific technology programs that receive both industry and public funds. The *Projektraeger* ("project-bearer") system allows the government to determine program priorities and then to hand off the selection of grantees to independent research organizations with expert reviewers on their staff. The sums that the government provides may not be very large and typically range between about 20 percent to fifty percent of the development costs. Germany has no R&D credit, yet private industry picks up about 85 percent of the costs of the industrial collective research networks program. [19] The Fraunhofers play an important role in this ecosystem. But the system does not rest on them alone. Without far-reaching changes and enrichment in the French ecosystem, neither the Instituts Carnot nor the IRT/ITE nor PRTT CEA-Tech are likely to be able to achieve comparable results.

2. The view from the actors in the French innovation system

Three Points of Consensus

The 2 December 2015 lettre de mission from Secrétaire d'Etat à l'Enseignement Supérieur et à la Recherche Thierry Mandon and Ministre de l'Economie, de l'Industrie, et du Numérique Emmanuel Macron stated the Government's objective in requesting an inquiry by a foreign expert on innovation and globalization : "Pour accélérer les transferts de connaissances à partir de la recherche publique et pour renforcer le rôle de l'Université au cœur de ce dispositif, le Gouvernement souhaite prendre des mesures de simplification et de rationalisation de l'ensemble du système de l'innovation." This was not a request for yet another assessment or evaluation. Indeed over the past three years there have already been very many quantitative and qualitative evaluations of the agencies created over the past decade to link academic research and the economy.[20] The point was to bring

an outsider's perspective on the French innovation system into the intense discussions taking place today in government and society about the evolution and future of these institutions. As an outsider who has studied innovation, production and globalization in the United States, I decided that the most useful contribution I could make to these debates was to meet and listen to people in academic research organizations, in the new transfer organizations, and in the business world and to try to understand their expectations, experiences, and judgment of the French innovation system and to consider that as against the benchmark of what I see as best practices in the United States. The observations that follow draw on 111 open-ended interviews carried out in five weeks over several visits in the period October 2015-January 2016. (See the list of persons consulted in Annex 2.) I am grateful to M. Jacques Aschenbroich, Directeur Général, Valeo, for advice and counsel on this project. As he reminded me, there is much to be learned from les Grandes Ecoles, both as models of education with hands-on experience for students along with classroom instruction and as sites of engagement in the interface between academic and industrial actors.

Where the actors agree

a. Crédits d'impôt recherche (CIR)

On a set of far-reaching institutional reforms, it is not surprising to find sharply differing views. All the more interesting, therefore, was it to learn that on a number of points most actors in the French innovation system are in agreement. Across the individuals who were interviewed over the course of this mission, opinions on the new institutions of the French system of innovation converged on three points. First, of all the changes in the system of innovation of the past fifteen years starting with the Allègre reform (1999), the one that receives the largest measure of enthusiasm from industrialists is the replacement of policies of direct state grants to companies for R&D projects corresponding to specific national programs by a policy of tax credits (crédits d'impôt recherche, CIR) as the principal channel of state support for R & D in private industry. [21] Tax breaks which amounted to 17 percent of state support for private sector R&D in 2000 now represent 60 percent of state support. This is equal to about two-thirds of state spending on innovation. This shift began at the end of the 1990s and accelerated in the mid-2000s.

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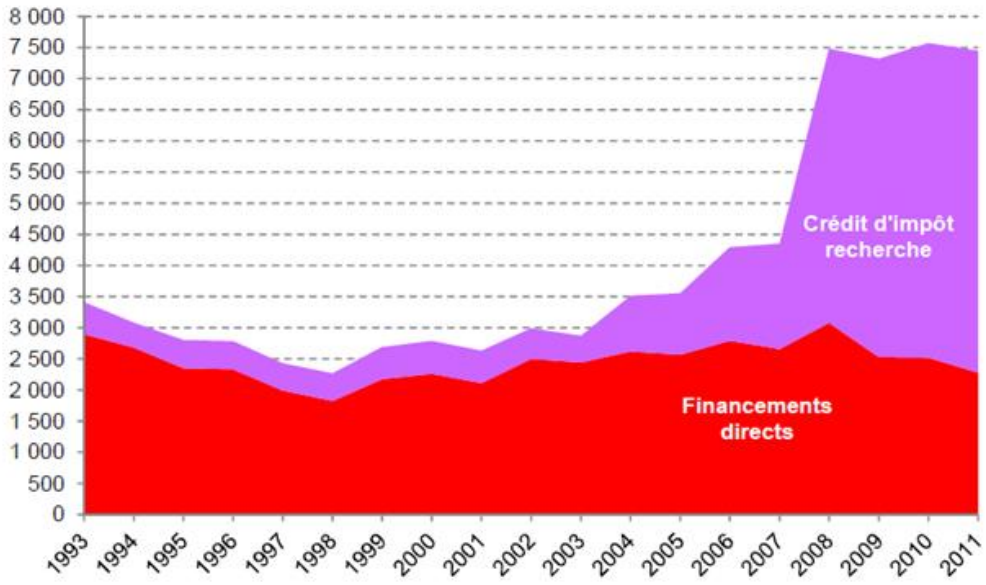
Financements publics à la R&D des entreprises en France, 1993-2011, M€ courants



Remarque : ce graphique ne tient pas compte du financement indirect que représente le dispositif Jeune entreprise innovante (allègements de charges d'environ 130 millions d'euros par an).

Sources : base GECIR, MESR-DGRI-C1 pour le CIR ; DGESIP/DGRI-SIES-C1 pour les financements directs

Extrait de : MENESR, 2014, Développement et impact du Crédit d'impôt recherche : 1983 – 2011, p.18

By 2011 the reduction in direct state funding of industrial R & D had been more than compensated for by expenditure via the CIR. The level of French government funding for private sector R & D (as a share of PIB) is now among the highest in the world. France spends 0.37 percent of PIB on tax breaks for private sector R&D ---second only to Korea. [22] Industrialists are positive about CIR because it lowers the cost of the salaries of their R & D staff. Surveys conducted in grands groupes by Association Nationale de la Recherche et de la Technologie (ANRT) in 2013 found that thanks to CIR, the cost of hiring a researcher in France was less than in Germany, Sweden, or Japan. [23]

The director of strategy at one multinational told us : « Le CIR est le dispositif gouvernemental le plus utile. Il est critique pour notre industrie (oligopolistique, cycle long), car nos décisions sont prises sur le très long terme et le temps d'attente entre les premières dépenses et les premières recettes est supérieur à 10 ans. Les financements internes sont par conséquent difficiles à obtenir. » The founder of an PME said: « Le CIR n'est pas un effet d'aubaine; il rentre dans le plan de financement de mon entreprise, dans les recettes possibles. » Others went even further and argued that without the CIR at current levels of funding, there would be a mass exodus of industrial R&D and of companies. The CEO of a major French-headquartered multinational told us bluntly that he still locates R & D in France because the Grandes Ecoles turn out excellent graduates, and the CIR cheapens the cost of hiring them. Without these two factors, he would see no

reason to keep R & D in France since a large proportion of his sales now are to customers outside France in Asia and the United States, and he could find perfectly good engineers in those markets. Indeed the export of French private industrial R&D is a concern. In contrast to the United States, in which the amount of R&D performed in country by U.S. headquartered and foreign firms grew by 34% between 2007 and 2015 and to Germany, in which R&D carried out domestically grew by 15% over the same period, in France private sector R&D carried out in-country declined by 21%. [24]

In a roundtable discussion the mission conducted with an association of PME CEOs, there was much criticism of the amounts of CIR funding that go to grands groupes. But when one of the MESR staff who happened to be sitting in on the meeting asked provocatively if the businessmen present in the room would support the government's giving all the CIR funds to PME and none to grands groupes, there was silence and then a unanimity of voices declaring that without the CIR, the grands groupes would move out of France and that they, the PME suppliers to grands groupes, would suffer. It is hard to know how to evaluate the claim that CIR is what keeps R&D and companies in France. In the United States, too, there are R&D tax credits, but far less generous ones than in France. When U.S. companies have moved abroad through so-called inversions, the issue has not been R&D tax credits. It has been the prospect of lowering their overall corporate tax rate—nominally higher in the U.S. than in other OCDE countries. In Germany there are no R&D tax credits, and yet German industry finds multiple advantages in the industrial ecosystem that induce them to remain in Germany. A more complete understanding of the factors that induce French multinationals to keep R&D in the country or to offshore it would require further investigation.

On the side of public researchers, the CIR also elicit a wide measure of support. Since 2004, the policies governing CIR have provided increasingly targeted incentives for those companies that outsource their research to public laboratories. Originally these incentives were calculated only on the increases in the volume of research that was conducted with public laboratories and were applied only up to fixed ceilings. These restrictions have now been relaxed; amounts have been doubled for work carried out in public laboratories; and further incentives have been added for work carried out with public research within Instituts Carnot. There has been a dramatic increase in the volume of research outsourced to public research institutions in France. [25] One of the most striking and positive features has been the increase in the number of small and medium-sized companies that are now externalizing some of their R & D to public research institutions. [26] This increase implies greater levels of interaction between academic research and firms from all sizes and sectors of French industry. This might augur well for future developments.

b. Complexity and uncertainty

While the persons interviewed in the course of this mission supported the shift in public policy from direct project support to indirect support via the CIRs, they were often unsure about how the system worked and about what exactly the rules were. In several of the interviews and presentations made to us, the interviewees' first move was to hand

over a diagram depicting their understanding of how the system worked. See in Annex 1 the *cartographies* prepared by MESR, by France Stratégie, by MEDEF, and by staff at Valéo and Moveo. The struggle to figure out what the relationships among institutions were, which were responsible for which functions, and where accountability resided was evident in the elaborate *cartographie*. Countless hours had obviously been spent in making these diagrams; and matching up the diagrams shows that everyone did not have the same picture. One of the senior industrialists told us: "les dispositifs français sont complexes, non pérennes, instables, difficiles à comprendre pour l'entreprise. Des dizaines de dispositifs s'interpénètrent et sont de plus en plus difficile à lire. Lorsque l'entreprise commence à comprendre, les règles changent. J'ai de moins en moins envie de rentrer car les règles évoluent trop vite."

Beyond their maps—on paper or in their minds--- of the architecture of the whole system of innovation, the interviews revealed many points on which our interviewees were uncertain. Would doubling of CIRs apply to work carried out with CEA Tech? Within IRTs[27] ? If a SATT has received a CIR to develop research, could a PME who licenses the technology receive another CIR to develop it further? Our respondents were not sure of the answers, nor were always the various staff from the Ministries who were sitting in during the interviews. Even more confusing and negative were situations in which industrialists had discovered after agreeing to join an IRT that they were liable for expenditures that they had never envisaged. The cost of constructing buildings to house an IRT, an industrial interviewee told us, turned out to fall on the industrial members of the IRT when the region declined to pick up those costs. In at least one case, construction costs became the object of a kind of bidding war among IRTs for corporate members, with one of the IRTs offering participation without construction costs. As the executive of one of the companies whose participation was solicited by more than one IRT told us: " Dans le cas de l'IRT Toulouse et Bordeaux : pourquoi avoir un IRT sur deux villes (Toulouse, Bordeaux) si ce n'est pas à cause d'une concurrence entre elles. Cela a mené à une surenchère immobilière sans justification technique ou scientifique des avantages de l'un par rapport à l'autre. On ne savait plus à qui s'adresser ».

The role of the regions in supporting some of these activities has added yet another level of complexity. Some of our respondents saw the regional interventions as additional complications. One of the Nantes industrial leaders told us : « Les régions en France ont un poids de plus en plus fort sur l'économie. Pour des calculs politiques on pourrait préférer transférer une technologie à une startup locale plutôt qu'une ETI industrielle d'une autre région. Il manque une doctrine dans la chaine de valorisation. Si on veut la masse critique pour être crédible, il ne faut pas diviser ses forces. On a besoin d'une doctrine claire de l'Etat et d'une homogénéisation des dispositifs. Il ne faut pas treize Frances. Attention quand on confronte toutes les logiques individuelles (SATT/régionalisation/PME) on revient dans dix ans on aura créé zéro valeur." He concluded: We need to have a national solution, not regional solutions. A senior multinational executive described changes in the governance of the pôle de compétitivité in which his company participates as regional priorities and interests came to play a larger role. He described the dwindling participation of corporate leaders in meetings at the pôle. In early years, when the pôle's agenda was focused on technologies, the CEO

himself had attended meetings; then as the pôle shifted towards regional development priorities, it was only managers next down the hierarchy who turned up for meetings; then even lower-level managers; then no one.

But others strongly supported giving the region a larger role in the innovation system. At a meeting with MEDEF firms, one participant said flatly: "La France n'est pas un échelon territorial pertinent, la région oui." In discussion in Nantes with a group of entrepreneurs from mid-sized firms, one of them summarized the group's sentiment: « Un message à faire passer : un territoire est une organisation particulière. Suppression de certains mécanismes." For the Nantes entrepreneurs, complexity and rigidity were the problems. « Ce n'est pas les subventions et les aides qui manquent, ce sont les moyens de s'y repérer. Pour notre parcours, le GPS a été Atlanpole. Pour moi, la SATT ne sert à rien et je me pose la question de l'utilité des pôles. A Nantes, on a la chance d'avoir un guichet unique : Atlanpole. On a deux super outils : le CIR et la BPI qui gère tout, des subventions aux augmentations de capital. C'est important d'avoir un intermédiaire dans le territoire pour gérer l'innovation : un GPS, un facilitateur local. Dans le Pays de Loire on a Atlanpole ».

In many of the interviews the participants reminded us that complexity also derives from older elements of the innovation system, and particularly from the multiple *tutelles* in laboratories. The lab, the academic department, the CNRS, possibly INSERM or INRIA may all have a potential veto. Any time a company wants to pursue a partnership with a laboratory with three or four of these *tutelles*, it knows negotiations will be lengthy and likely conflictual. For many, one of the attractive features of the SATTs—often its only attractive feature for them—is the promise of a *guichet unique*. Given the number of research institutions who have been granted exemption from the requirement to commercialize IP through the SATT (e.g. Saclay, Grenoble) and as the number of those institutions who have refused or are just stalling grows, even that potential gain in simplification has disappeared.

c. Stability

A system that is too complex, too regional, too centralized, too open to capture by grands groupes, too focused on start-ups, too rigid, too frequently changed---these and many others contradictory criticisms flew around in the interviews. But on one point, almost all the persons consulted could agree: "ne changez rien, n'y touchez pas!". One rationale for this hostility to improving even the defects that the interviewee himself might have excoriated was the notion that the system was gradually evolving in a self-correcting direction and should be left to do so. As Professor Philippe Larédo, an expert on innovation and industry (Professor at Paris-Est and at University of Manchester) expressed it: " Le mille-feuille français est-il un problème? Si on ne change pas les objets tous les quatre ans, les objets de la nouvelle génération absorbent ceux de l'ancienne et petit à petit le système se simplifie." People pointed to great improvements in the openness of academics to collaborating with industry, too much greater interest among students in entrepreneurship, and other positive evolutions. The PME suppliers who criticized the fact that the grands groupes got the lion's share of the CIRs panicked at the

thought of a change in policy for fear that their own businesses might suffer. Many of those we talked with had in one way or another made their peace with the system and found ways to protect or enlarge their interests within it. One university president who regretted that the university had not been given the resources that the SATTs received to create a strong internal capability for licensing nonetheless warned against closing down the SATTS: "A vouloir trop simplifier en supprimant les SATT, nous serons mis en très grande difficulté, car les moyens ne seront pas redistribués aux universités."

3. Performance of the new institutions

There have been very many evaluations of the transfer agencies over the past three years. [27] The minimal conclusions that a reader of this voluminous literature might draw are, first, that there have been no stunning successes. A review of the current status of the fourteen SATTs that have been created since 2011 shows that seven of them have no income from transfers and that the revenues of the other seven range from 10 k euros to 893 k euros. The evaluation of the first four IRTs found slow starts, mixed results, and some glimmers of accelerating performance. The second general observation is that those institutions that are perceived to have worked the best are ones built on and with pre-existing institutions and networks. One example is the widely well-regarded Alsace SATT, Conectus, which is basically a re-baptized version of the old University of Strasbourg's licensing and industrial liaison office built by Alain Beretz, now University of Strasbourg president, who had hired Nicolas Carboni as director of the university's licensing bureau (SAIC) which was subsequently absorbed into the SATT. Another example is PRTT CEA-Tech in Grenoble, which has built an Institut Carnot, an IRT, and a SATT out of pre-existent relationships and networks. The third general conclusion from the evaluations is a more or less explicit acknowledgement that they have not yet achieved much because of slow starts and initial difficulties, but an expectation that now launched these agencies will perform as originally promised. All optimism about performance is projected onto some point in an indefinite future. [28]

Across the 111 persons interviewed, most of the comments focused on the SATTs and IRT/ITEs. The majority of opinions were harsh. Even those directly involved in the SATTs agreed that the explicit objective of profitability within ten years was a mistake. Virtually all those consulted realized that the only way it could be achieved would be with short-term strategies on patents and selling services that would basically undermine the long-term objectives of the institution. Aiming at short term profitability also incentivizes risk avoidance and short term gains and thus runs counter to the objective of investing in France's future.

Some of the university presidents regard the SATT which now has a monopoly on the commercialization of the university's intellectual property as a kind of "filiale" of the university. Outstanding among those with that perspective is the University of Strasbourg where, as previously noted, the SATT grew directly out of the university's previous efforts. Elsewhere responses were more muted. One of the presidents wondered if the SATTs would turn out to focus on selling services or would somehow lead to more fruitful ties with industry. But the most common sentiment within universities and the

research centers is of a kind of dispossession. As one person said: "La SATT déresponsabilise les universités. Le fruit de la recherche est confié à des financiers avec des objectifs financiers. C'est suicidaire." A top manager from one of France's largest multinationals: "Je ne vois pas la différence entre une SATT et les bureaux de valorisation du réseau Curie. Ils ont plein d'idées, plein d'argent, mais je n'en ai pas vu les bénéfices pour le moment."

Comments on the IRT were equally mixed. The most positive came from industrialists. One of the R&D directors from a large French multinational said that in the ITE in which he participates, there's a concentration of talent beyond anything they could muster in-house. Working in the IRT with its advanced equipment, another said, is like working sur échelle réelle et en temps réel. The CEO of a PME said IRTs are great for any project in which you are not sure who your customer will be. But watch out! He warned. If you know who your customers are for the new technology, better keep it in house. A more guardedly positive response came from those who saw the IRT as potentially productive, but felt that as a free-standing institution it would not be able to contribute fully to the ecosystem. These issues came up again in the course of reviews of the first wave of IRT (BCom, BioAster, Jules Verne, Nanoélec). Among the recommendations for remedying this was to experiment with partnering up an IRT with an academic research institution or with a pole de competitive. I have included this recommendation among mine at the end of this document.

Most comments on the IRT from the interviews were negative. Some centered around unfair competition: "du Colbertisme—on a créé à Lyon un IRT avec des fonds publics pour nous faire des concurrents". "C'est un mécanisme de concurrence déloyale," protested another. From universities and research centers, there were complaints about IRT's efforts to poach researchers from laboratories. When an excellent researcher leaves her academic laboratory to work at the IRT, what happens to her research group in the laboratory? The universities also claimed that the IRT diverts research collaborations from the universities since the companies get more funding by going to an IRT than to an academic setting. Reviews of the first four IRTs also underscored the difficulties of involving academic researchers in the IRT. In part this was due to administrative complications of moving from university to IRT. But there was also very little overlap between the scientific interests of the researchers and the IRT project. Finally, there was uncertainty about how participating in an IRT would be evaluated in a research career. Some of those we consulted saw no value coming out of the IRT/ITE: "Les IRT(…) sont un outil qui développe des projets sans intérêt avec du mauvais personnel."

Rather than tallying positive and negative appreciations of these institutions, perhaps it would be more constructive to match up institutions with public objectives and to recognize that these fall along different time lines. Today in a situation of high unemployment and very slow economic growth, public policymakers need to consider which institutions can make contributions with effects that would be felt in the short term, i.e., the next year or two. At the same time policymakers must invest in France's future, as the Juppé-Rocard report urges, with investments in institutions whose societal benefits may well not be realized for another decade or two.

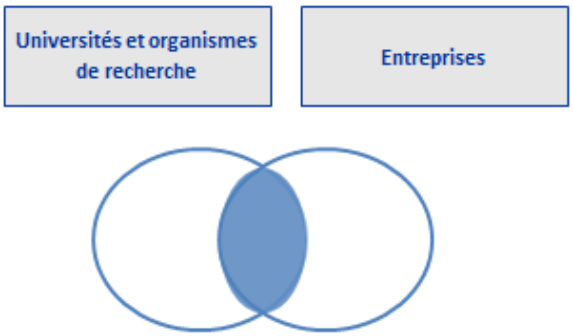
For the short-term contributions to the economy, the most valuable of the projects that were observed in the mission were those launched by the PRTT CEA Tech in Pays du Loire.[29] During a visit to the site (17 décembre 2015) we met individually with four industrialists currently working with the CEA Tech. At the start of CEA Tech's entry into the region in March 2013, CEA personnel identified a pool of companies for whom CEA generic technologies ("les briques") might have value. They telephoned 260 companies to offer their services. Seventy partenariats have already been signed and others are underway. The four industrialists recounted how favorably impressed they were that CEA Tech reached out to them. One said: "Imagine! The people who made the atom bomb want to help my company!" One of the PME who employs 160 people needed a new composite material for bringing a new product to market. They had already discussed this product with their longstanding customers, who were interested. In order to develop the product, they had tried to contact a nearby IRT and also a nearby university. Neither had responded. The industrialist described the rapid and positive response of the CEA Tech, its willingness to work too hard and near-term deadlines, and the meetings with CEA technicians at Saclay. The others had similar stories. What we saw in the meetings with the CEA staff and with the industrialists was the great capacity of the CEA Tech to identify enterprises who could use their technologies; its ability to understand the technical problem of the firm; and its ability to match up the firm's need and the generic technology ("la brique") at CEA Tech; and finally, to customize the technology to the firm's requirements. The CEA Tech seemed to be remarkably good at identifying firms they could work with, understanding their need, and coming in with a solution that was of acceptable cost on a short timetable of about a year to 18 months.

What was absent from these stories, however, was any indication that the firms were on a learning curve that would result in their developing new competences in the course of the work with CEA-Tech. They would acquire "briques" to allow them to bring new products and services to market. They claimed that that would make it possible to maintain jobs and perhaps even increase them. But no new learning was taking place that would allow the firm on its own in the future to develop new products. When asked "Vos équipes R&D, seront-elles capables de faire évoluer le processus? Y-a-t-il un apprentissage?" one responded: "C'est tellement différent de notre cœur de métier. Nous n'avons pas vocation à maîtriser la technologie (contrôle non destructif de soudure)." The others had similar responses.

There's a need for such short-term solutions. At the same time France must invest in institutions that over the long term will augment productivity and place France on the far frontier of technological advance.

RECOMMENDATIONS

The picture that emerges from the interviews is of a great diversity in the ways in which new institutions have evolved across different regions and across different industrial ecosystems. This diversity has been accidental not intentional. For the next phase of strengthening relations between research and the economy, public policies should deliberately conceive a program of experimentation. The experiments should focus above all on broadening and deepening the range of interactions along the interface between research and industry. These experiments should be evaluated at stated intervals with funding contingent on measurable achievement. Where examples of collaboration and strong networks exist today as, for example in les grandes écoles or in strong regional collaborations between research and industry, they may suggest yet further models for experimentation. The central idea is to acknowledge that the critical zone for improvement lies at the intersection of research and the economy and that no one model will work across all territories and sectors of the economy.



1. Identify 3-5 universities of excellence (Idex) willing to integrate into their governance structures a broad range of activities along the interface. These would include functions currently held by the SATT and would add and/or strengthen many others: eg., real welcome and a "GPS" for industrialists to the laboratories, simplification of the formalities for contrats de recherche; internships for students (comparable to those in the grandes écoles), CIFREs for masters candidates as well as doctoral candidates, physical space and equipment for student-initiated maker spaces, fab labs; classes on entrepreneurship, competitions for new technologies and start-ups, mentoring services for students and faculty with ideas for startups, plans for building strong relationships with alumni. Many of these already exist—but at levels of activity too low to be productive.

2. For universities and research centers: the objective of transfer is to diffuse the results of research into economy and society, not to reimburse the costs of research or of transfer

3. Today, the IRTs/ITEs stand apart from the public research institutions, with consequent difficulties in attracting researchers from these institutions and building

strong networks. Experiment with integrating 1-3 IRT/ITE into academic research centers funding by both companies and state.

4. Distinguish the relevant time horizons for each of the transfer agencies. PRTT CEA Tech has solutions that can serve companies within a one to two year timeframe. Research in university laboratories usually takes about 15 years to bring to market. The short term projects may be essential in today's economy for jobs and growth. The long term projects are essential for France's future.

5. In universities and research centers, bring researchers into contact with eventual customers for products and services—not only into contact with industrial R&D.

6. Simplification of the *cartographie* of today's innovation system: clarify rules about eligibility when private industry works with public research; eliminate redundant functions. Eg., should commercialization of brevets and licenses be held within SATTs or France Brevet? Clarify the mission of France Brevet.

7. Simplification: the grands organismes de recherche publique need to take the initiative on a plan for a single tutelle per laboratory.

8. Focus the transfer agencies on transfers to growing young firms as well as to startups. Recent research shows that durable job creation takes place in young firms not in startups.

9. Focus the transfer system on customers not on technologies.

[1]Source: Tableau de bord de l'Union de l'innovation, 2015. Presentation Alain Schmitt, DGE, 16 Novembre 2015. See also Coordination interministérielle du Transfert et de l'Innovation, L*'innovation en France. Indicateurs de positionnement international.* Edition 2015 (Novembre 2015).

[2]OECD Reviews of Innovation Policy: France. (2014)

[3]An analysis of the relations between academic research and the economy in France written twenty-five years ago remains the best guide to these questions. See the brilliant essay of Jean-Jacques Salomon in "La Capacité d'innovation," in Maurice Lévy-Leboyer et Jean-Claude Casanova, *Entre l'Etat et le marché. L'Economie française des années 1880 à nos jours, Paris,* Gallimard, 1991.

[4]Philippe Larédo, "La situation française: les exercices stratégiques actuels comme révélateurs des tendances longues et des transformations en cours," à paraître in *Futuris*.

[5]J. Haltwanger, R. Jarmin, and J. Miranda. "Who Creates Jobs? Small Versus Large Versus Young," *The Review of Economics and Statistics*, 95 (2): 347-361.

[6]BiGGAR Economics, *Economic Contribution of the LERU Universities: A Report to LERU*. August 2015.

[7]Edward B. Roberts, Fiona Murray, and J. Daniel Kim, Entrepreneurship and Innovation at MIT, MIT Innovation Initiative, December 2015. For Stanford University, see Charles Eesley and WilliamMiller, "Impact: Stanford University's Economic Impact via Innovation and Entrepreneurship." Stanford University: Stanford CA: 2012.

[8]Alan Hughes and Michael Kitson (2012) "Pathways to Impact and the Strategic Role of Universities: New Evidence on the Breadth and Depth of University Knowledge Exchange in the UK and the Factors Constraining its Development." *Cambridge Journal of Economics*, vol. 36, no. 3, pp. 723-750.

[9]Rebecca Robbins, "Money. Why isn't Harvard getting rich off its scientific research?" in STAT, http://www.statnews.com/2015/12/21

[10]Powerpoint presentation by Lita Nelsen, Director, MIT Technology Licensing Office, November 2015, ISTA, Nanjing.

[11]News.mit.edu/2014/3-questions-lita-nelsen-technology-licensing-office-1107.

[12]Walter Valdiva, *University Start-Ups: Critical for Improving Technology Transfer* (Washington, D.C.: Brookings Institution/Center for Technology Innovation at Brookings, 2013).

[13]See research on scale-up in Suzanne Berger, *Making in America: From Innovation to Market* (2013) MIT Press and Richard Locke and Rachel Welhausen, eds., *Production in*

the Innovation Economy (2014) MIT Press. Also: MIT Industrial Performance Center (2015) *Growing Innovative Companies to Scale: How Does Massachusetts Measure?* (2015).

[14]Examples drawn from *Making in America*.

[15]On comparisons between French, German, and English transfer institutions, see Bruno Rostand, "Transfert et valorisation dans le PIA. Quelques elements de comparaison." Rapport au Commissaire Général à l'Investissement. Juillet-Octobre 2015.

[16]Information kindly provided by Frédérique Sachwald.

[17]Suzanne Berger, *Making in America* (2013) p. 138.

[18]Michael Rothgang, Matthias Peistrup, and Bernhard Lageman, "Industrial Collective Research Networks in Germany: Structure, Firm Involvement and Use of Results," *Industry and Innovation* 18,no. 4 (2011).

[19]Berger (2013) p. 156.

[20] Commission nationale d'évaluation des politiques d'innovation (France Stratégie), *Quinze ans de politiques d'innovation (rapport préliminaire),* 2016 ; CGE, *Audit de la situation financière de l'IRT SYSTEMX*, 2014 ; IGAENR, *Évaluation de l'expérimentation des plateformes régionales de transfert technologique de CEA Tech*, pour le MENESR et le MEIN, 2015 ; IGAENR, *Évaluation des incubateurs publics*, pour le MENESR, 2014 ; IGAER, CGE, *Les relations entre les entreprises et la recherche publique : lever des obstacles à l'innovation en France*, 2015 ; IGF, CGEDD, CGE, *Revue de dépenses sur les aides à l'innovation*, 2015 ; Cour des comptes, *Le programme d'investissements d'avenir : une démarche exceptionnelle, des dérives à corriger*, 2015 ; Mission d'évaluation et de contrôle de la Commission des finances de l'économie générale et du contrôle budgétaire, *Conclusion des travaux de la Mission d'évaluation et de contrôle sur la gestion des programmes d'investissements d'avenir relevant de la mission Recherche et enseignement supérieur*, 2015 ; Commission Carnot 3, *Recommandations sur l'évolution des modalités de fonctionnement du dispositif Carnot*, pour le MESR et le MEIN, 2014 ; Rapport Beylat J.L., P. Tambourin, *L'innovation : un enjeu majeur pour la France*, 2013 ; ANR, Technopolis, 2012, *Enquête sur le devenir professionnel des docteurs ayant bénéficié du dispositif Cifre l'année 2000* ; ANR, Technopolis, 2014, *Évaluation de la SATT IDF Innov* ; ANR, Technopolis, 2014, *Évaluation de la SATT Lutech* ; ANR, Technopolis, 2014, *Évaluation de la SATT Toulouse Tech Transfert* ; ANR, Technopolis, 2014, *Évaluation de la SATT Sud-est* ; ANR, Technopolis, 2014, *Évaluation de la SATT Conectus* ; ANR, Technopolis, 2015, *Évaluation de la SATT Aquitaine Science Transfert* ; ANR, Technopolis, 2015, *Évaluation de la SATT AxLR* ; ANR, Technopolis, 2015, *Évaluation de la SATT Ouest Valorisation* ; ANR, Technopolis, 2015, *Évaluation de la SATT Nord* ; Erdyn, BearingPoint et Technopolis, 2012, *Étude portant sur l'évaluation des pôles de compétitivité* ; Kurt Salmon, *Évaluation du positionnement stratégique de France Brevets*,

2015 ; Bellégo, C. et Dortet-Bernadet, V., 2013, *La participation aux pôles de compétitivité, quelle incidence sur les dépenses de R&D et l'activité des PME et ETI ?* Document de travail de l'INSEE ; Bellégo, C. et Dortet-Bernadet, V., 2014, L'impact de la participation aux pôles de compétitivité sur les PME et ETI ? Économie et Statistique n°471, INSEE ; Bellégo, C., 2013, Les pôles de compétitivité et les projets financés par le FUI ont accru les dépenses de R&D, l'emploi et l'activité, sans effet d'aubaine, 4 pages DGCIS ; Fontagné, L.; Koenig, P.; Mayneris, F. et Poncet, S., 2012, Cluster policies and firm selection: Evidence from France, document de travail, Université de Louvain ; Hallépée, S. et Houlou Garcia A., 2012, Évaluation du dispositif JEI, direction générale de la compétitivité de l'industrie et des services ; Lhuillery, S. ; Marino, M. et Parrotta, P., 2013, Évaluation de l'impact des aides directes et indirectes à la R&D en France, rapport pour le MESR ; Masquin, B. et Huber, D., 2012, Le financement de l'innovation par Oséo, Trésor-Eco, Direction générale du Trésor ; MENESR, 2014, Développement et impact du crédit d'impôt recherche : 1983-2011, avril, 84p ; OCDE, 2014, Examen de l'OCDE des politiques d'innovation en France. ; OSEO et AFIC, 2012, Performance des entreprises innovantes investies par les FCPI.

[21]See the informative discussion of this evolution in MENESR, *Développement et impact du crédit d'impôt recherche, 1983-2011* (2014).

[22]CNEPI, Quinze ans de politique d'innovation, Rapport préliminaire, 15 janvier 2016, p. 54.

[23]Ibid., 49.

[24]Strategie&. "2015 Global Innovation 1000. Innovation's New World Order." www.strategyand.pwc.com/media/file/2015-Global-Innovation-1000-Fact-Pack.pdf.

[25]See *Développement et impact du crédit d'impôt recherche, 1983-201* 1 (2014), Graphique 8. Dépenses externalisées à des institutions publiques de recherche en France et dans l'Espace économique européen au CIR, en M euros, p. 35.

[26]Ibid., p. 36.

[27]Commission Nationale d'Evaluation des Politiques d'Innovation (France Stratégie), *Les politiques d'innovation depuis 2000 : Une cartographie (version de travail préliminaire)*, december 2015, pp. 1-41. Conseil général de l'économie, *Audit de la situation financière de l'IRT SYSTEMX*, 2014. Cour des comptes, *LE PROGRAMME D'INVESTISSEMENTS D'AVENIR, Une démarche exceptionnelle, des dérives à corriger*, 2015.Erdyn, Technopolis, BearingPoint, *Etude portant sur l'évaluation des pôles de compétitivité,* 2012 ; Kurt Salmon, *Évaluation du positionnement stratégique de France Brevets*, 2015. MENESR et MEIN, *Evaluation de l'expérimentation des plateformes régionales de transfert technologique de CEA Tech*. December 2015, pp. 1-51. MENESR, *Développement et impact du crédit d'impôt recherche: 1983-2011*, April 2014, pp. 1-85. OCDE, *Examen de l'OCDE des politiques d'innovation en France*, 2014, pp. 1-294. Technopolis, *Rapport de synthèse de l'évaluation des 5 Sociétés d'accélération du*

Transfert de Technologies de la vague A, 2015. Technopolis, Rapports individuel de l'évaluation des SATT, 2015.

[28]See for example the conclusions (pp. 35-6) of Bruno Rostand, "Transfert et valorisation dans le PIA. Quelques éléments de comparaison," Rapport au Commissaire Général à l'Investissement, Juillet-Octobre 2015.

[29] See the most recent evaluation of the PRTT CEA Tech: IGAENR, 2015, Evaluation de l'expérimentation des plateformes régionales de transfert technologique de CEA Tech, pour le MENESR et le MEIN

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ANNEXES

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RÉPUBLIQUE FRANÇAISE

ANNEXE 1 : Lettre de mission

Paris, le 02 décembre 2015

Chère Madame la Professeur Suzanne Berger,

Face à l'accélération des évolutions de notre monde et à la circulation de plus en plus ouverte et rapide des savoirs, des idées et des moyens, la capacité d'une nation à encourager sur son territoire l'émergence et la valorisation d'innovations, constitue un enjeu crucial pour l'avenir de son économie et de ses emplois.

L'innovation est l'une des clés de la compétitivité hors coût de notre industrie, qui lui permettra de se développer dans un contexte de concurrence internationale tout en préservant notre modèle social.

Le rapport rédigé par MM. Beylat et Tambourin en 2013 souligne la diversité des domaines qui concourent au processus d'innovation et identifie plusieurs axes d'amélioration du système français : développer la culture de l'innovation et de l'entrepreneuriat, accroître l'impact économique de la recherche par le transfert et accompagner la croissance des entreprises innovantes. Il insiste sur la nécessité de se doter d'une politique globale en faveur de l'innovation, qui accorde une place importante à l'évaluation de l'impact économique des mesures. L'organisation sous l'égide de France Stratégie de la Commission nationale d'évaluation des politiques d'innovation répond à cette exigence.

Au-delà de cette évaluation quantitative, il reste encore à réfléchir sur les mesures à prendre pour rendre plus cohérent et lisible l'ensemble des structures nouvelles que les Gouvernements successifs ont mis en œuvre depuis une dizaine d'années. Selon de nombreux acteurs économiques et des ratings internationaux, la diversité et la superposition des dispositifs et organismes mis en place en France pour stimuler et accompagner le transfert de technologie vers les entreprises, tant à l'échelle nationale que régionale, ont créé des complexités qui rendent moins productif et efficicent l'écosystème industriel français et pénalisent les laboratoires de recherche sans juste retour pour les innovations qui y ont vu le jour.

Pour accélérer les transferts de connaissances à partir de la recherche publique et pour renforcer le rôle de l'Université au cœur de ce dispositif, le Gouvernement souhaite prendre des mesures de simplification et de rationalisation de l'ensemble du système de l'innovation.

Compte tenu de votre connaissance des enjeux de l'innovation et de la mondialisation, de votre connaissance de différents systèmes nationaux mais aussi de votre capacité à apprécier les origines et particularismes du système français, nous souhaitons vous confier l'élaboration de propositions sur ces questions.

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Vos propositions pourront être appréciées sous plusieurs angles : articulation des niveaux d'intervention (national et territorial), cohérence entre approches transversale et sectorielle, couverture de l'ensemble de la chaîne de l'innovation. Votre rapport pourra porter à la fois sur des évolutions structurelles s'inscrivant dans la durée, sur l'éclairage de « bonnes pratiques d'innovation » dans le cadre d'écosystèmes industriels, et sur des axes de clarification ou de rationalisation des politiques publiques pouvant être mis en œuvre à plus court terme.

Vous pourrez vous appuyer sur les travaux récents décrivant notre système de recherche et d'innovation (rapports officiels, études d'évaluation, indicateurs…) et sur des interviews sur des territoires qui vous sembleront pertinents.

Monsieur Jacques Aschenbroich, administrateur et Directeur général de VALEO, apportera son expérience et sa connaissance du système d'innovation industrielle tout au long de la mission sous la forme de points d'étape réguliers avec Madame la Professeur Suzanne Berger. Vous formulerez conjointement des propositions.

Nos services vous apporteront leur concours pour vous donner accès aux données et analyses pertinentes. Ils pourront vous aider à identifier les acteurs et experts que vous souhaiterez rencontrer. Vous pourrez aussi envisager avec France Stratégie la meilleure façon d'interagir avec la Commission nationale d'évaluation des politiques d'innovation, dont le commissaire Jean Pisani-Ferry assure la présidence.

Nous souhaitons disposer de votre rapport pour janvier 2016.

Vous remerciant d'avoir accepté cette mission, nous vous prions d'agréer, chère Madame, l'expression de nos reconnaissantes salutations.

Emmanuel MACRON

Thierry MANDON

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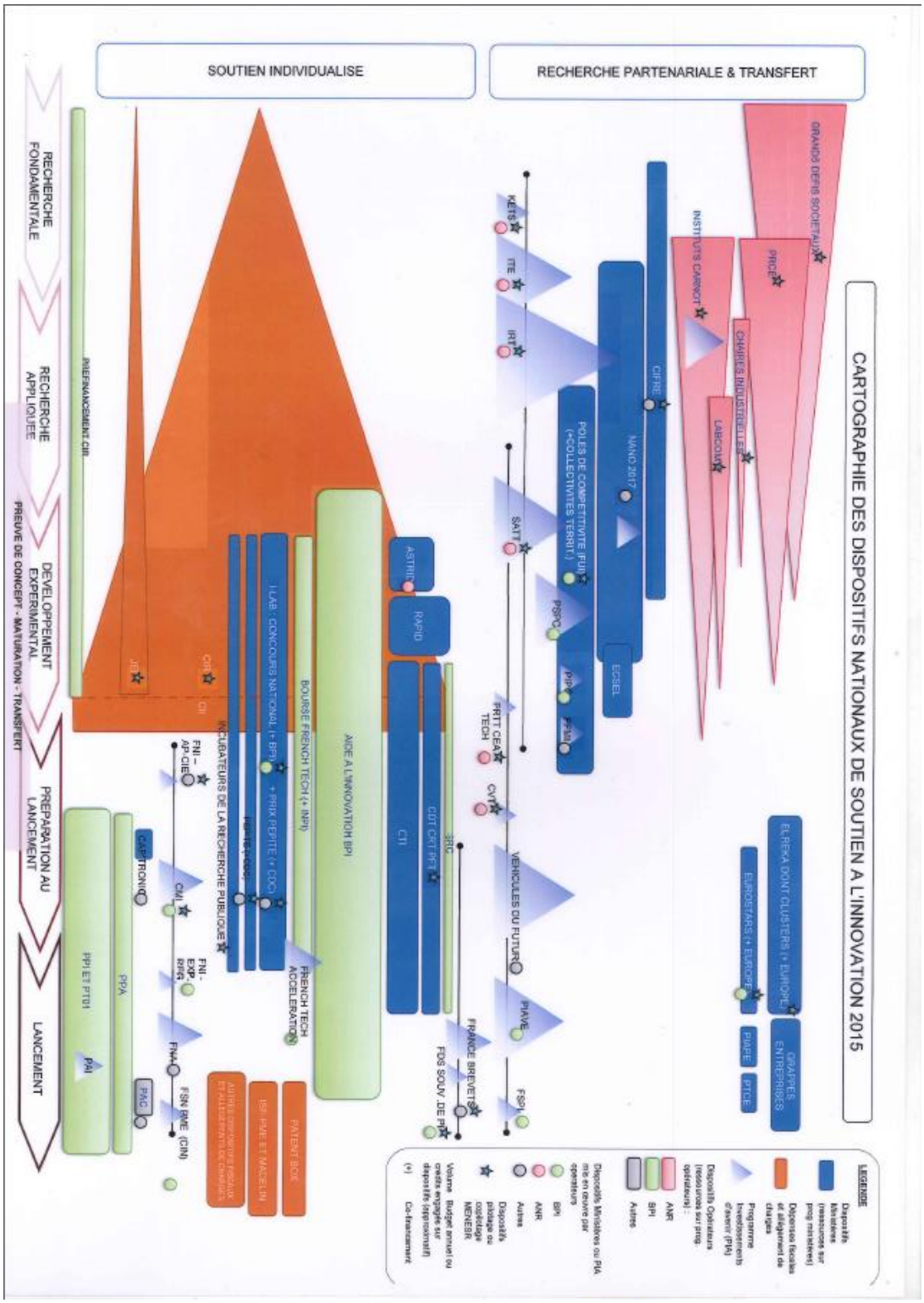
ANNEXE 2 : Cartographies des dispositifs de soutien à l'innovation

Carte 1 : Secrétariat d'Etat à l'Enseignement Supérieur et à la Recherche



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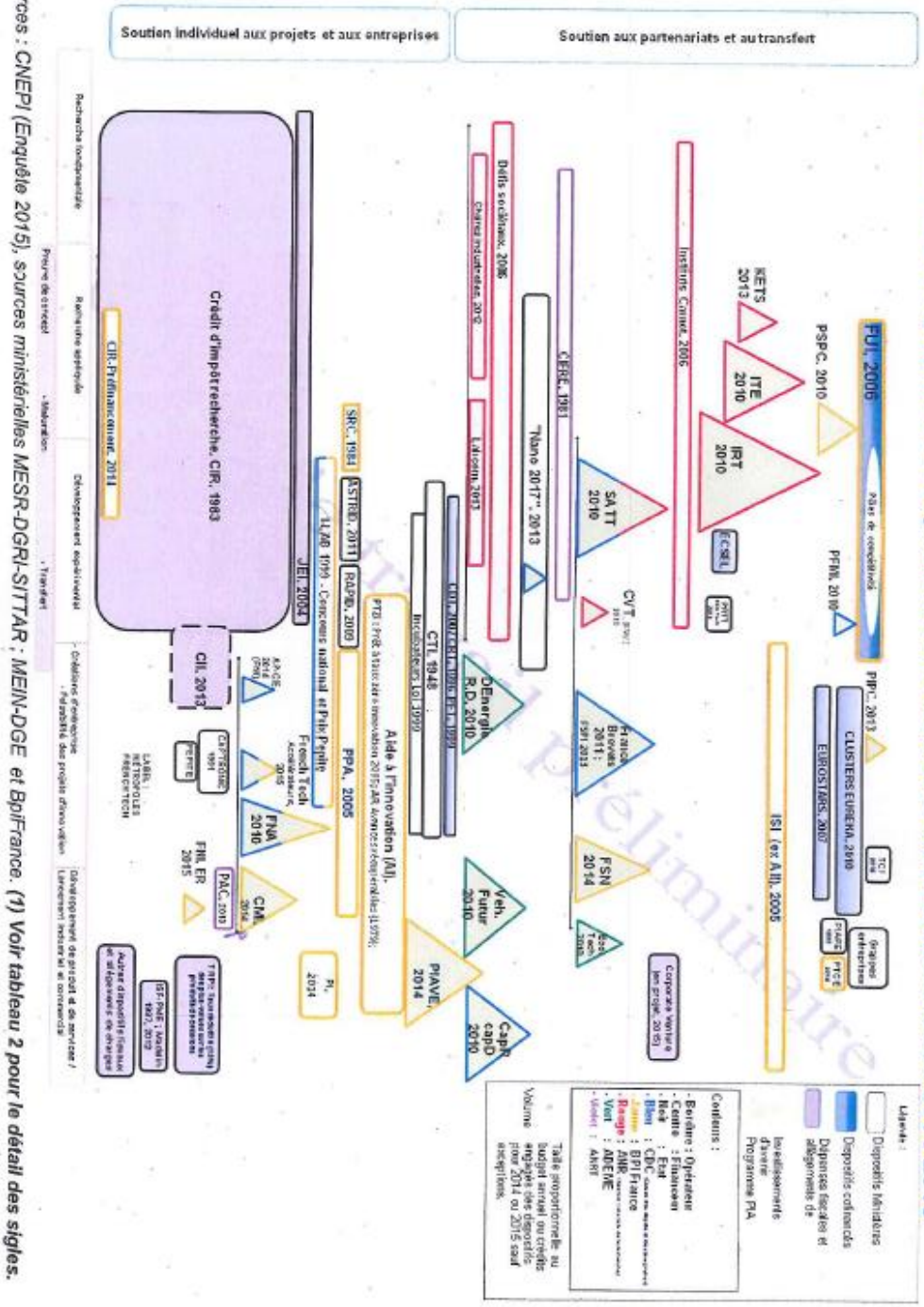
Carte 2 : France Stratégie



Sources : CNEPI (Enquête 2015), sources ministérielles MESR-DGRI-SITTAR ; MEIN-DGE et BpiFrance. (1) Voir tableau 2 pour le détail des sigles.

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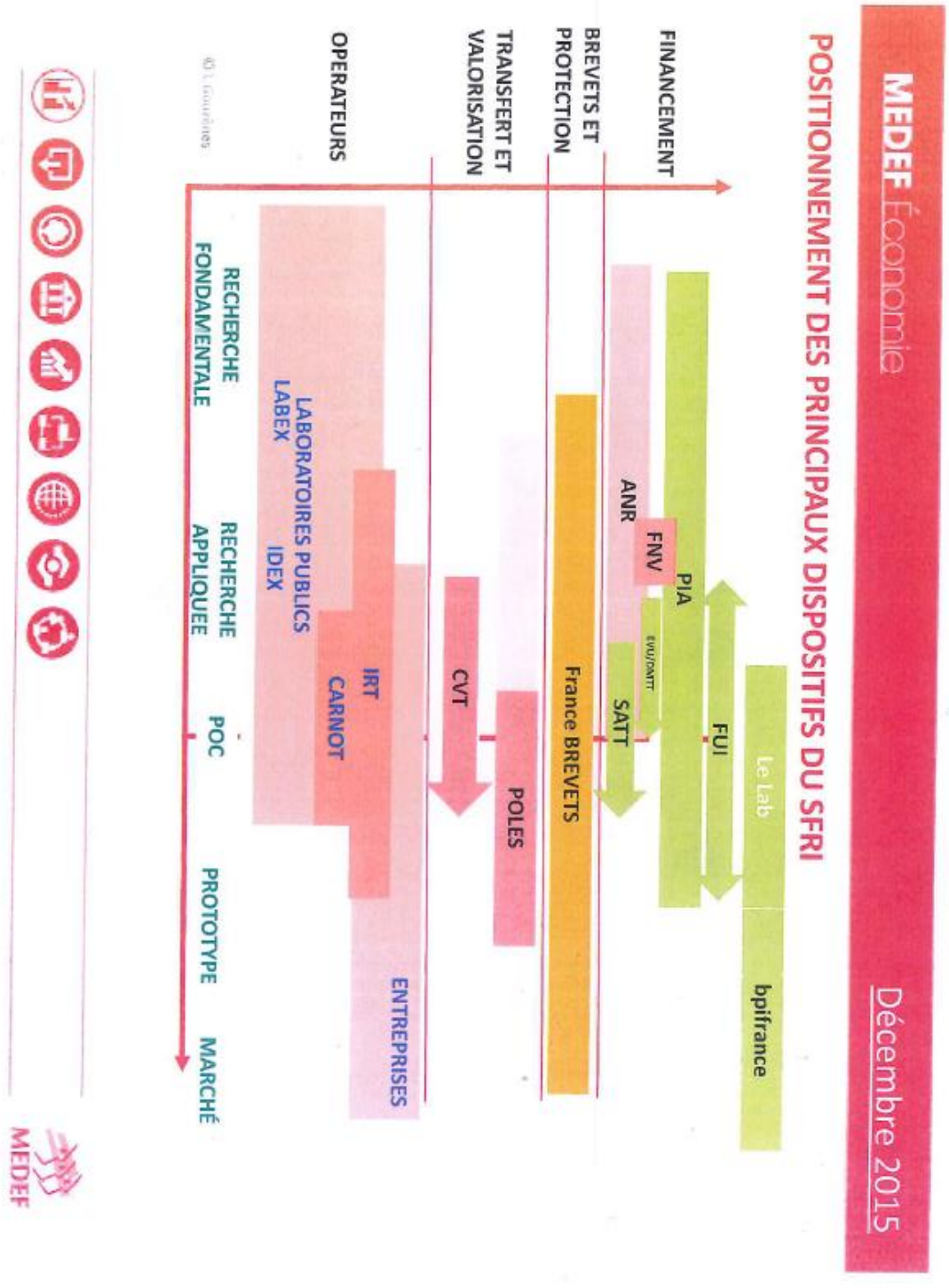
Carte 3 : Medef



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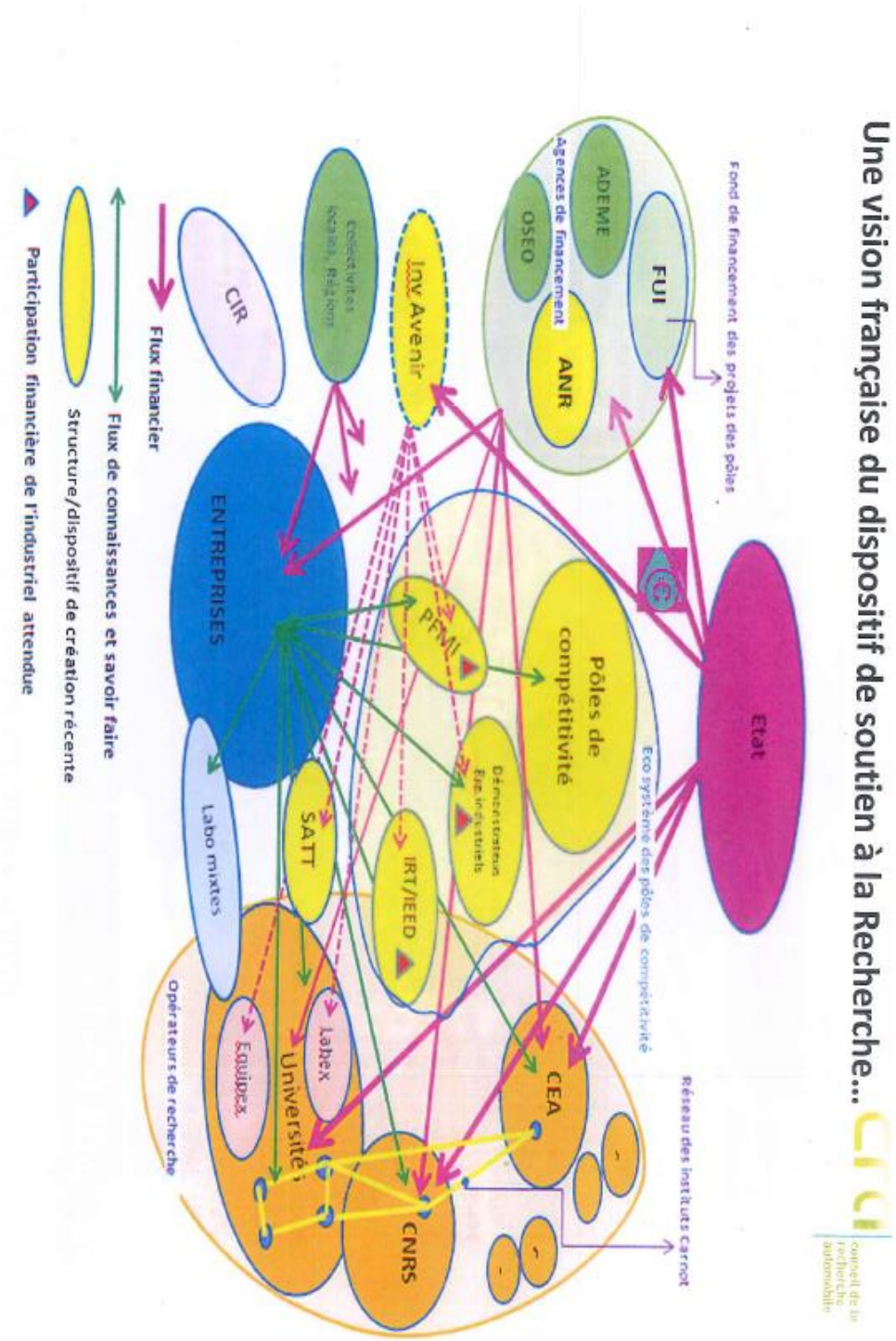
Carte 4 : Conseil de la recherche automobile



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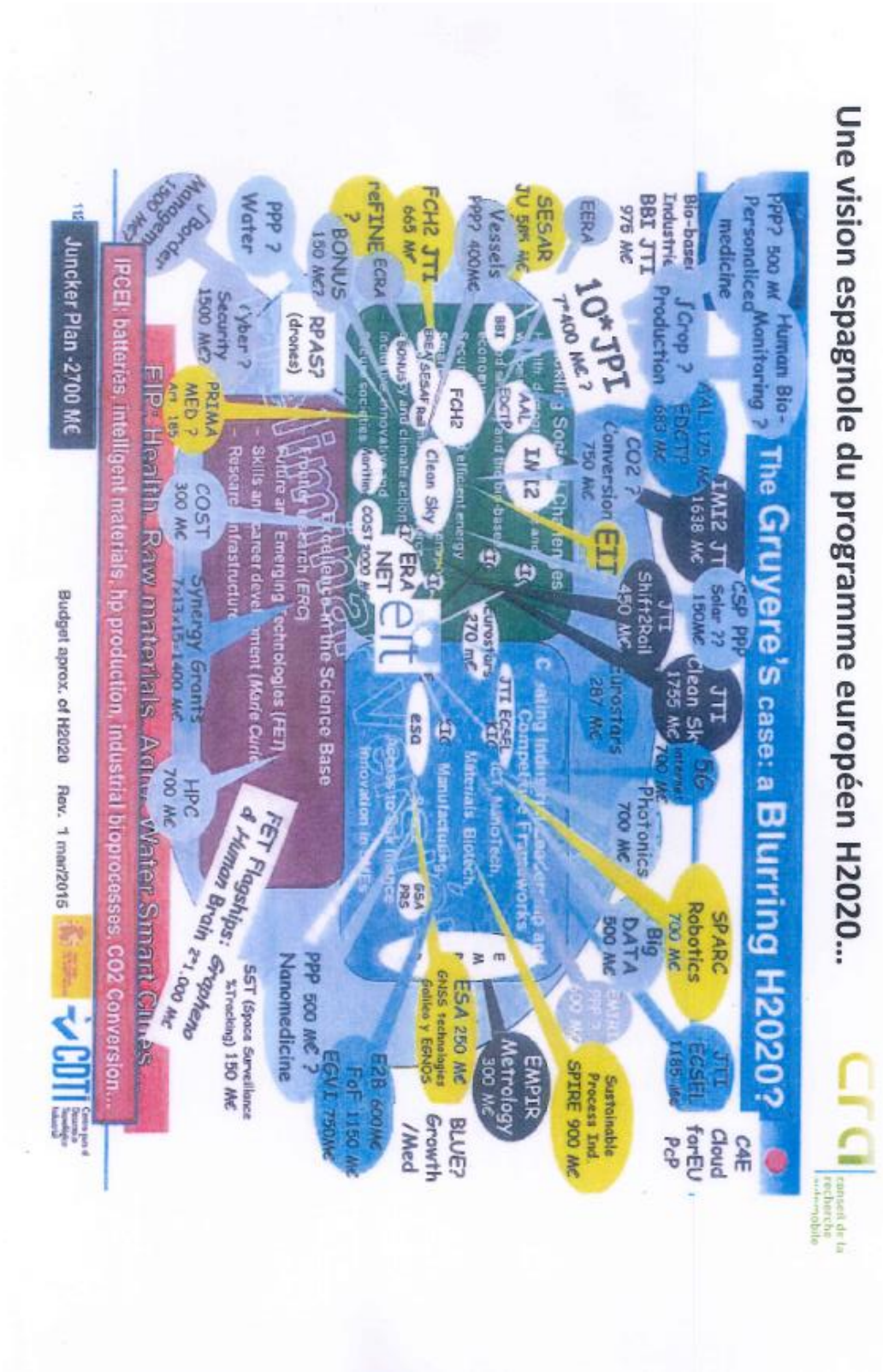
Carte 5: Conseil de la recherche automobile



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ANNEXE 3 : Liste des personnes consultées

Ministère de l'Education Nationale, de l'Enseignement Supérieur et de la Recherche
Cabinet de Thierry Mandon
GRAVIERE - TROADEC Isabelle
HUOT Gérard
MONTHUBERT Bertrand
STRASSEL Christophe

Direction Générale de la Recherche et de l'Innovation
GENET Roger
JAMET François
LOMBES Thomas
SACHWALD Frédérique
VALLA Pierre

Ministère de l'Economie, de l'Industrie et du Numérique
Cabinet d'Emmanuel Macron
LIRZIN Franck
PRUNIER Guillaume

Direction Générale des Entreprises
MENETRIER Laure
SCHMITT Alain

Académiques
ALLESSANDRINI Bertrand – Ecole Centrale Nantes
BERETZ Alain – Université de Strasbourg
CASTOLDI Nicolas – CNRS
CHAMBAZ Jean – Université Pierre et Marie Curie
COHEN Elie – CNRS
DAVID Clarisse – CNRS
FUCHS Alain – CNRS
HOUILLER François – INRA
LABOUX Olivier – Université de Nantes
LAREDO Philippe – IFRIS, Université de Manchester
LEVY Yves – INSERM
LEVY Patrick – Université Joseph Fourier
MARTIN Jean Louis – Supoptique
MUSSELIN Christine – Sciences Po Paris
PARADEISE Catherine – IFRIS
POITOU Arnaud – Ecole Centrale Nantes
SOUBEYRAN Romain – Ecole des Mines

BPI
REINHART Laure

CEA
BONNETIER Susana – CEA Tech
FIONI Gabriele – CEA
GUESNE Matthieu – CEA Tech
GEGOUT Christophe – CEA Investissement Amorçage Technologique
VERWAERDE Daniel – CEA
SEMERIA Marie –Noëlle – CEA Leti, Association Instituts Carnot
SIEBERT Stéphane – CEA Tech
THERME Jean – CEA Tech

CGI
GIRARD Claude
SCHWEITZER Louis

Entreprises
ALADJIDI Grégoire – Safran
ALLARD Odile – Fluoptics
ASCHENBROICH Jacques – Valeo
AUFRERE Jacques – Faurecia
De BANTEL Hugues – Cosmo
BEDIN Frédéric – Groupe Hopscotch
BEN YOUSSEF Walid – Compagnie européenne d'intelligence stratégique
BONNIFET Fabrice – Bouygues
BOUQUOT Geoffrey – Valeo
de BUCHET Amaury – UlyssCo
CAZAUBIEL Murielle – Biofortis
CHEPPE Patrick – Europe Technologie
CITROEN Philippe – Compagnie européenne d'intelligence stratégique
COLLET Patrick – Tronico
COLOMBANI Pascal – Valeo
DALBIES Eric – Safran
DEVAUCHELLE Guillaume – Valeo
DORSCHNER Sylvain – Innoeco
FAOUCHER Erwan – Valeo
FRANTZ Jérôme – Frantz Electrolyse
GOUZENES Laurent – Pacte Novation / Medef
GRIMAUX Franck – Valneva
JACQUIN Erwan – Hydrocean
JOBERT Timothée – ISKN
JENNY Christophe – SMTC
KLEIN Stéphane – STX
KOTT Laurent – IT Translation
LANDRAIN Thomas – La Paillasse
LECANTE Christophe – TKM, Comité Richelieu
LETERTRE Fabrice – Exagan

LIGNON Gérald – Airbus
de LUMLEY Thierry – Cosmo
MARION François – Valeo
MINSTER Jean –François – Total
ORANCE Nicolas – Daher
POULARD Fabien – Dictanova
RAINFRAY Lionel – Groupe Arthur
RODIER Frédéric – Mitis
ROIRAND Vincent – Mazedia
ROULAND Jérôme – Vaillant Group
SANCHEZ Fréderic – Fives
SOUPARIS Hugues – Sury's
SPORTISSE Bruno – Thuasne
SUEUR Thierry – Air Liquide
TIBI Philippe – Pergamon Campus
VERON François – Newfund
VUILLAUME François – Bosch

Institutionnels
BITARD Pierre – ANRT
BREVARD Christian – Académie des technologies
HUNAULT Jean-Louis – Syndicat de l'Industrie du Médicament Vétérinaire
MILLET Nicolas – CCI Lyon
RANDET Denis – ANRT

France Stratégie
HARFI Mohammed
LALLEMENT Rémi
MAYSTADT Philippe – Comité PIA
PISANI FERRY Jean

MEDEF :
FONTAINE Boris
de LAVERNEE Gérard
LEPINAY Agnès
ROUAULT Bruno
SCHMITT Patrick

Structures de soutien à l'innovation
AGOSTINO-ETCHETTO Florence – Lyon Biopôle
ARCHINARD Philippe – IRT Bioaster, Lyon Biopole
BALDUCCHI Jean François – Atlanpole
BENAMOU Norbert – SATT Nord, Association des SATT
BEYLAT Jean –Luc – pôle Systematic, association des pôles de compétitivité
CARBONI Nicolas – Conectus
CASAMATTA Gilbert – IRT Saint –Exupéry, Association des IRT

CASSEREAU Stéphane – IRT Jules Verne, Association des IRT
CHARLET Marc – Pôle Mov'eo, Filière Automobile & Mobilité (PFA)
CHUSSEAU Maylis – SATT Aquitaine, Association des SATT
MANACH Laurent – EMC2
MARCATTE Vincent – IRT Bcom, association des IRT
MORET Marc – Loiretech
POYETON Eric – Filière auto & mobilité (PFA)

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ANNEXE 5 : Glossary

ANRT : l'Association nationale de la recherche et de la technologie

BPI : Banque Publique d'Investissement

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

CGI : Commissariat Général à l'Investissement

CIFRE : Convention industrielle de formation par la recherche

CIR : crédit d'impôt recherche

DGRI : Direction générale pour la recherche et l'innovation

IRT : Institut de recherche technologique

ITE : Institut pour la transition énergétique

MIT : Massachusetts Institute of Technology

OCDE : Organisation de coopération et de développement économiques

PME : Petites et moyennes entreprises. Dans l'acception la plus générale en France, entreprise dont l'effectif est inférieur à 250 salariés.

PRTT : Plateforme régionale de transfert technologique

R&D : Recherche et développement

SATT : Société d'accélération du transfert de technologies

TLO : Technology Licensing Office