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PhD thesis in Political Science and Sociology

Road to (k)Nowhere

**Policy instrument selection in complex Governance arrangements:
The case of Research and Innovation policy in France and Italy**

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Abstract

Research and innovation (R&I) are increasingly understood as essential assets in national, and supranational, strategies for economic, social, industrial and technological development. Public engagement in these activities dates back to the pre-WWII period. Nowadays, its relevance has been revitalised as a powerful strategy to respond to major social, economic and environmental challenges (e.g. Grand Challenges). On the other hand, also the private sector has gained greater prominence within the field of scientific, engineering and technological activities employed for economic development (Arnold, Boekholt, 2003). Starting from these evolutions, the present research investigates the politics of policy instrument selection in the R&I sector. This study sheds light on the political dynamics that can explain how (and why) public actors decided to intervene (or not) in governing the field of scientific and technological innovation. Through a comparative analysis between France and Italy, the research investigates how the interplay between institutional characteristics, different policy styles and interest intermediation patterns influence actors' interactions, their preferences for various instrument mixes and ultimately the evolution of national R&I policy mixes. By adopting policy instruments as a proxy for analysing actors' preferences, it has been possible to understand different patterns of interaction taking place between governing, and non-governing, actors along the policy design process. In order to disentangle these dynamics a multi-method approach based on the triangulation of different sources (semi-structured interviews, document analysis and national statistics) has been adopted. Then, through a methodological approach to qualitative data analysis inspired by within and cross-case analysis (Miles, Huberman, 1994), thematic (Boyatzis, 1998) and content analysis (Schreier, 2012), national policy instrument selection process have been investigated. The comparative analysis ultimately shows that when we focus only on how governments have used their power to steer target population towards their intended behaviours (e.g. the inducement embedded in instrument action) our two cases share many similarities in their aggregate R&I policy mix features. But if we look at the characteristics of how different instruments exercise social control (e.g. instrument shapes) and the relationship between policy makers and target population (e.g. delivery structure) our results display a greater variety. These differences reflect the alternative approaches the two countries have undertaken to interact with target population, as well as in the political entrepreneurship and organizational capacity of national R&I performers.

Acronyms and Abbreviations

ADEME: *Agence de l'environnement et de la maitrise de l'énergie* (Environment and Energy management Agency)

AERES: *Agence d'évaluation de la recherche et de l'enseignement supérieur* (National Agency for the Evaluation of the University and Research System).

AII: *Agence de l'innovation industrielle* (Industrial Innovation Agency)

ANR: *Agence nationale de la recherche* (National Research Agency)

ANVAR: *Agence nationale de valorisation de la recherche* (National Agency for the Promotion of Research

ANVUR: *Agenzia Nazionale di Valutazione del Sistema Universitario* (National Agency for the Evaluation of the University and Research Systems)

ARI: *Aide* au *Recrutement pour l'Innovation* (Support to Recruitment for Innovation**)**

ATOUT: Technology diffusion within SME

BCRD: *Budget* Civil de *Recherche* et Développement (Civil Budget for Research and Technological Development)

BDPME: *Banque du Développement des Petites et Moyennes Entreprises* (Development bank for SMEs)

BPI France: *Banque Publique d'Investissement* (Public Investment bank)

CSRT: C*onseil* supérieur *de la recherche* et *de* la *technologie* (Higher Council for Research and Technology)

CDC: *Caisse des Dépôts et Consignations* (Deposits and Consignments Fund)

CDI: *Contrat de Développement Innovation* (Innovation Development Contract)

CDP: *Cassa Depositi e Prestiti* (Deposits and Consignments Fund)

CEA: *Commissariat à l'énergie atomique* (Commissariat for Atomic Energy)

CEPR: *Comitato di esperti politiche di ricercar* (Committee of Experts for Research Policies)

CGI: *Commissariat Général à l'investissement* (Commissariat-General for Investments)

CIFRE: *Convention industrielle de formation pour la recherche* (Industrial Convention for Training Through Research)

CIPE: *Comitato interministeriale per la programmazione economica* (Interministerial committee of economic planning)

CIR: *Crédit Impôt Recherche* (Tax credit for research expenses)

CIRST: *Comité Interministériel de la Recherche Scientifique et technologique* (Interdepartmental committee for scientific and technical research)

CIVR: *Comitato di indirizzo per la valutazione della ricerca* (Steering Committee for the Evaluation of Research)

CNES: *Centre national d'études spatiales* (National Centre for Space Studies)

CNR: Consiglio Nazionale della ricercar (National Research Council)

CNRS: *Centre national de la recherche scientifique* (French National Centre for Scientific Research)

CNRT: *Centres Nationaux de Recherche Technologique* (National Technology Research Centres)

CNVSU: *Comitato nazionale per la Valutazione del Sistema Universitario* (Committee for the Evaluation of the University System)

COMUE: *Communautés d'universités et établissements* (Communities of Universities and Institutions)

COROTECH: *Soutien au recrutement de techniciens sur des projets innovants* (Support for the recruitment of technicians on innovative projects)

CPCI: *Commission permanente de consultation avec l'industrie* (Permanent Commission for Consultation with Industry)

CRITT: *Centre régional pour l'innovation et le transfert de technologie* (Regional centre for Innovation and Technology Transfer)

CRT: *Centres de ressources technologiques* (Technological Resources Centres)

CRUI: *Conferenza dei rettori delle università italiane* (Conference of rectors of Italian universities)

CSRT: Conseil supérieur de la recherche et de la technologie (Higher Council for Research and technology)

D.L.: *Decreto Legge* (Decree law)

D.LGS.: *Decreto Legislativo* (Legislative Decree)

DATAR: *Délégation interministérielle à l'aménagement du territoire et à l'attractivité régionale* (Interministerial Delegation of Land Planning and Regional Attractiveness)

DGRST: *Délégation générale à la recherche scientifique et technique* (General Delegation for scientific and technical research)

DM: *Decreto ministeriale* (Ministerial decree)

DPEF: *Documento Programmatico di Economia e Finanza* (Economic and Financial Planning Document)

DRIRE: *Direction régionale de l'industrie, de la recherche et de l'environnement* (Regional Division for Industry, Research and Environment)

DRRT: *Délégation régionale à la recherche et à la technologie* (Regional Research and Technology Delegation)

DRT: *Diplôme de recherche technologique* (Technological Research Diploma)

ENI: *Ente Nazionale Idrocarburi* (National Hydrocarbons Agency)

EPIC: *Établissement public à caractère industriel et commercial* (Industrial and trade related public institution)

EPST: *Établissement public à caractère scientifique et technologique* (Scientific and technological public institution)

EQUIPEX: *Équipements pour infrastructures de recherche / technologiques* (equipment for research/technological infrastructures)

ERAP: *Entreprise de recherche et activités pétrolières* (enterprises for oil research and activities)

FAR: *Fondo Ricerca Applicata* (Fund for applied research)

FAS: *Fondo per aree sottoutilizzate* (Found for Underutilized Areas)

FCPI: *Fonds commun pour l'innovation* (Mutual fund for innovation)

FCS: *Fonds pour la compétitivité et le développement* (Competitive and Development Fund)

FFO: *Fondo Finanziamento Ordinario* (Ordinary financing fund)

FIRB: *Fondo per investimenti in ricerca di base* (Fund for Basic Research Investments)

FISR: *Fondo Speciale Ricerca Applicata* (Special applied research fund)

FIT: *Fondo per l'innovazione tecnologica* (Fund for technological innovation)

FNS: *Fond national de la recherche* (National fund for research)

FOE: *Fondo Ordinario enti di ricerca* (Ordinary Fund for the Funding of Research Institutions and Bodies)

FRI (Revolving Fund to sustain enterprises investments)

FRT: *Fond de la recherche technologique* (National fund for technology)

FSI: *Fond Stratégique d'Investissement* (Strategic Investment Fund)

FSRA: *Fondo di rotazione per il sostegno agli investimenti delle aziende* (Revolving Fund to sustain enterprises investments)

FIT: *Fondo innovazione tecnological* (Technological Innovation fund)

HCST: *Haut conseil pour la science et la technologie* (High Council for Science and Technology)

IEED: *Institute excellence sur les energies décarbonées* (Excellence Institute on Low Carbon Energy)

IHU: *Instituts hospitaliers et universitaires* (Hospital- University Institutes)

IIP: *Progetti di innovazione industriale* (Industrial Innovation Projects)

IIT: *Istituto italiano di tecnologia* (Italian Institute of Technology)

INFN: *Istituto nazionale fisica nucleare* (Institute for Nuclear Physics)

INRA: *Institut national de la recherche agronomique* (National Institute of Agronomic Research)

INRIA: *Institut national de recherche en informatique et en automatique* (National Institute for Research in Computer Science and Automation)

INSERM: *Institut national de la santé et de la recherche médicale* (National Institute of Health and Medical Research)

IPI: *Istituto per la promozione industriale* (Institute for industrial promotion)

IRI: *Istituto per la Ricostruzione Industriale* (Institute for Industrial Reconstruction)

IRT: *Instituts de recherche technologique* (Technological Research Institutes)

ISI: *Aide au projet d'innovation stratégique industrielle* (Support to innovative industrial strategic project)

JEI: *Jeune Entreprises Innovantes* (Young Innovative Companies)

LABEX: *Laboratoires d'Excellence* (Laboratories of Excellence)

LOLF: *Loi organique relative aux lois de finances* (Organic Law on Finance Acts)

LRU: *Loi Relative aux Libertés et Responsabilités des Universités* (Law on the Freedom and Responsibilities of Universities)

MEDEF: *Mouvement des entreprises de France* (Movement of companies from France)

MEF: *Ministero dell'economia* (Minister of Economy)

MESR: *Ministère de l'Enseignement supérieur, de la Recherche* (Ministry of Higher Education, Research)

MINEFI: *Ministère de l'Économie et des Finance* (Ministry of the Economy and Finance)

MIRES: *Mission interministérielle Recherche et Enseignement supérieur* (Interministerial mission for Research and Higher Education)

MISE: *Ministero dello sviluppo economico* (Minister of economic development)

MIT: *Ministero dell'innovazione tecnologica* (Minister of Innovation and technology)

MIUR: *Ministero dell'istruzione università e ricerca* (Minister of higher education and research)

OMC: Open Method of Coordination

PFT: *Plateformes technologiques* (Technology Platforms)

PIA: *Investissement pour l'avenir* (Investment for the future plan)

PICO: *Piano per l'Innovazione, la Crescita e l'Occupazione* (Innovation, Growth and Employment Plan)

PMII: *Programmes mobilisateurs pour l'innovation industrielle* (Mobilizing programs for industrial innovation)

PNR: *Programma nazionale di ricerca* (National research program)

PON: *Programma operativo nazionale* (National operational program)

POR: *Programma operative regionale* (National operational program)

PPA: *Prêt Participatif d'Amorçage* (Participatory Priming Loan)

PRES: *Pôles de recherche et d'enseignement supérieur* (Research and Higher Education Clusters)

PRIN: *Progetti di rilevante interesse nazionale* (Projects of relevant national interest)

RDT: *Réseau de développement technologique* (Technological Development Network)

RRIT: *Reseaux de Recherche et d'Innovation Technologique* (Technological Research and Innovation Network)

RTRA: *Réseaux thématiques de recherche avancée* (Thematic Advanced Research Networks)

SAAT: *Société d'accélération du transfert technologique* (Technological Transfer Acceleration companies)

SAIC: *Services d' activies industrielles et commerciales* (Commercial and industrial business services)

SGR: *Società gestione risparmi* (asset management company)

SLR: *Sauvons la recherche* (Let's save the research)

SNRI: *Stratégie Nationale de Recherche et d'Innovation* (National strategy for Research and Innovation)

SUIP: *Société Unipersonnelle d'Investissement Providentiel* (Unipersonal Risk Investment Company)

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1 Chapter 1: Introduction

National economies are moving towards new technological paradigms, where Information and communications technology (ICT), green tech and other computational technologies are increasingly acquiring a prominent place in policy making agenda. The diffusion of innovative technologies is transforming not only the way our societies function but also the way public administrations internally works and their relationship with external actors, (how they deliver policies and interact with different stakeholders) (Pencheva et al., 2018). This is the reason why knowledge production, and the capacity to trigger technological changes, have increasingly become a relevant asset characterising countries' economic development strategy (Nascia and Pianta, 2018).

Nowadays, innovation has somehow become a buzzword for many policy documents in different fields. This might be related with the fact that the concept of innovation is evolving, moving from a means to achieve broad range of policy goals, towards a policy goal for a broad range of policy sectors (Flanagan et al., 2011). In reality, Research and Innovation (R&I) are much more than that, exactly because these activities are potentially related with all the tasks of governments, just think about the different research centres attached to various functional ministers (e.g. agriculture, health, environment), and this could give you a hint about its multiple applications (OECD, 2014).

Over the last decades, despite contrasting interpretations on the drivers of economic development, a widespread agreement that innovation and knowledge represent important components of economic growth, especially in the long term, has emerged and consolidated. Their contribution to growth can be found in the enrichment resulting from technological progress embodied in physical capital (investments in more advanced machinery or computers); in the results coming from investments in intangible capitals (software, design, data, firm-specific skills); and in supplements linked to the increased efficiency in the use of labour and capital (OECD, 2015a, p. 17)[1].

At a different pace, national authorities have started to understand how contemporary economies cannot be able to compete globally if they do not start to invest in infrastructures,

[1] Some of the policy fields in which OECD (2015) registered an accelerated technological progress are the following: climate change mitigation, ageing, health, food security, information and communication management.

knowledge base, subsidies and programmes for retaining and upgrading their labour force in order to support their national competitiveness. Therefore, Research and Innovation can be interpreted as a special investment in long-term intangible assets that will (likely) generate profits in the future. This is different from regular investments, such as capital expenditures, because of its longer time horizon and higher risk (Bhattacharya et al., 2017, p. 2).

Indeed, when one is examining the development of a national system of innovation, she is reading a country's economic, social and political history through the particular prism of the conditions surrounding the use of technology in capitalist production and the choices made by the ruling class (or dominant élites), regarding the production and application of scientific and technological knowledge (Chesnais, 1993, p. 194).

In parallel with the technological evolution of contemporary societies, and the increasing complexities of the challenges these are facing, the scope of R&I policies has broadened beyond its traditional mission (Meissner and Kergroach, 2019). Policy makers are coping with questions related to how can R&I become a means to address persistent challenges our societies are facing and how can they translate knowledge advancements into tangible benefits for their citizens?

In modern times, state promotion for research and specific technologies has a long tradition, dating back to the pre-Wold War II period, when pubic research investments were mainly oriented towards agriculture (plant breeding, plant protection), health (vaccines), mining (geology, engineering) or navigation, transport and communication (shipbuilding, aeronautics, and telecommunications) (Nauwelaers and Wintjes, 2008). As further developed in the following chapters of this research, the tradition of state promotion for research and new technologies has been carried on through different eras, reflecting heterogeneous political and economic objectives. In the present day, the relevance of public involvement in the development of research and new technologies has been revitalised, as a potential strategy to respond to major societal, economic and environmental challenges (Grand Challenges). On the other hand, also the private sector has gained greater prominence within the field of scientific, engineering and technological activities used in the economy (Arnold and Boekholt, 2003). Consequently, we would expect that the power balance among the actors who possess the necessary assets to trigger innovation might have changed and, more broadly, the governance of R&I systems together with that.

This is closely related with the fact that economic growth has not only a rate but also a direction, and thus, it can actually undertake multiple, and alternative, paths (Kattel and Mazzucato, 2018, p. 787). Therefore, the actors who possess the necessary resources and capabilities to helm the ship toward a specific direction, can play a pivotal role in influencing the design of national R&I strategies.

Our research aims exactly at understanding how the interaction between the differently motivated actors involved in the governance of R&I, including knowledge producers and developers, public and private actors, together with decision-makers, influence the design of national R&I policies. By adopting an actor perspective, we will investigate the way stakeholders designed their strategies for action, and the extent to which this ultimately affected the evolution and the characteristics of national R&I policy mixes.

More specifically, we aim at understanding how the actors populating the governance of the sector have differently translated R&I questions into smaller scale issues, and their related political payoffs. Therefore, the role that alternative political ideas had in shaping policy-makers attitudes for selecting specific instrument characteristics; the way interactions between actors took place within the bounds of different institutional organisation structures and the morphologies of interest intermediation between decision-makers and policy recipients.

The innovative contribution of our research is closely related with the adoption of an actor perspective for the analysis, which allows to acquire an effective, and deeper, understanding of the political dynamics characterising the choices and the design of different policy instruments. Furthermore, our research aims at understanding these dynamics, and their consequences for policy making, focusing on a policy domain embracing multiple established sectors of policy intervention. Indeed, we will investigate how actors' shape the characteristics of different R&I instrument blends, and how this process take place in a sector where policy makers face issues that cannot be neatly categorised into clearly defined policy responsibilities (e.g. "wicked problems" (Mazzucato, 2013; Rittel and Webber, 1973)).

Therefore, by focusing on R&I instruments, as the operational dimension of governance arrangements (Capano et al., 2019), we will open the decision-making black box of R&I policies with the aim of understanding the different causal pathways shaping instrument mix characteristics. Following the Lasswell's definition of politics as "*the process of who gets what, when and how*", we will decipher the extent to which actors' choices and interactions

matter in policy instrument selection process and how alternative choices over different policy strategies influenced the evolution of national R&I policy mix.

Our ultimate goal is to understand what is happening behind the scenes of R&I policy design process, the extent to which different actors can be able to influence this process and the role that target population can play as catalyser of these choices. Therefore, ultimately contributing to a deeper understanding of how governments design more ambitious policy mix aimed at solving the complex, and cross-sectorial in nature, social challenges our contemporary societies are facing.

1.1 The interesting case of Research and Innovation policies

Looking at the characteristics of Research and Innovation with a public policy perspective, we will illustrate the extent to which their instrument mix tend to hinge upon governing arrangements embracing multiple established areas of public policy, while attempting to foster a policy mix "encompassing common visions for the future" (Braun, 2008a; Flanagan et al., 2011). Indeed, in response to the increasing complexity of the problems our societies are facing the morphology of the policy making space is changing, and a growing number of cross-sectorial links have been created in order to enhance policy-making capacity to design more ambitious policy mixes. Such complexity is closely related with the fact that R&I policies tend to address broad challenges, that given the impossibility to be tackled as a whole, require to be translated into smaller scale issues (Edquist and Zabala-Iturriagagoitia, 2012).

These phenomena are not solely specific to R&I, but they rather represent generalised strategies which span across different "classical" sectors of policy responsibility (similar transformations are analysed in the field of climate policies (Van Asselt et al., 2015), migration policies (Scholten et al., 2017) and health care policies (Trein, 2017)). This is closely related with the fact that strategies for solving Grand Societal Challenges, like for example climate change, food security and other economic, societal and technological threats (WEF, 2020), cannot solely rely on the design capacity, and resources, of one unique policy area. A greater extent of collaboration needs to be found among formerly detached policy responsibilities in order to gather the necessary resources for designing more encompassing strategies.

These phenomena run in parallel with the increasing awareness emerging from policy instrument and governance literature regarding the reduced capacity that, in democratic

societies, political institutions have to act unilaterally (Bressers and O'Toole, 2005; Capano and Lippi, 2017; Majone, 1989; Ringeling, 2005; Woodside, 1986).

Therefore, we believe that Research and Innovation policies represent an emblematic "case of" (Ragin and Becker, 2009) complex governance arrangements in which policy makers are increasingly being asked to solve problems that cannot be neatly categorised into one policy sector, so-called wicked problems, (Mazzucato, 2013; Rittel and Webber, 1973); therefore, requiring greater cross-boundary synergies between interconnected policy areas and actors.

This complexity is also embedded in the paradox many national R&I policy-making processes are exposed to; namely, the more complex the issues they aim at solving, the more compartmentalised the policy-making process become (Kattel and Mazzucato, 2018). All of that is exacerbated by the fact that specific policy responsibilities (and sectors) are characterised by relatively stable groups of actors and institutions, associated interests, representation practices and perception of the problems; that further hinder opportunities for creating venues for collaborations (Candel and Biesbroek, 2016). Therefore, by focusing on actors, their interactions and stakes along the policy design process, we will be able to unravel the complexity characterising R&I decision-making processes; while exploring for the first time with an actor perspective how policy instrument are selected and blended.

1.2   Policy instrument have to be equipped for that

The combined effect of the evolution of state structures both internally (reorganization of administrative structures) and externally (relationship with citizens and the market); together with the increased complexity of problems policy makers are facing, also in the R&I sector (Chou et al., 2017), have consistently modified decision-making settings.

Crucial elements of public authority are shared with a multitude of non-governmental actors, that are often intimately involved in the management and implementation of public interventions. This is also the case for the research and innovation policies, where an increased number of instruments are implemented together with private or non-profit stakeholders (e.g. clusters, networks, pre-commercial procurements) (Edler et al., 2016, p. 8). Indeed, no single actor possesses sufficient resources to unilaterally influence policy change (Henry, 2011, p. 367) and governments are not anymore simply and unilaterally authoritative, but they are instead dependent upon the action and acquiescence, or support of others, which they do not directly control (Bressers and O'Toole, 2005; Goetz, 2008; Salamon, 2002a).

The governance of R&I becomes an highly complex arena for policy making, because the resources needed for instruments' activation are increasingly dependent upon the participation of different actors and the assets they can mobilize (Béland and Howlett, 2016; Capano and Lippi, 2017; Flanagan et al., 2011; Majone, 1976). Public choices have to be perceived as socially acceptable because, although instruments may be (in some theoretical or technical sense) substitutable, in practice they all differ in a number of ways, making their selection a highly (context-dependent) political matter (del Rio and Howlett, 2013; Edquist and Borrás, 2013; Howlett, 2005; Knudson, 2009).

Indeed, tools have heterogeneous substantive requirements of behaviours embedded in their action, as well as different mechanisms through which they can activate constraints, or opportunities, on recipients. It is precisely the possibility to identify "winners" and "losers" from their activation, and their capability to shift the power balance, that makes instrument choice a politically salient moment (Borrás and Edquist, 2019; del Rio and Howlett, 2013; Lascoumes and Le Gales, 2007; Linder and Peters, 1989; Salamon, 2002a). Therefore, the characteristics of policy instrument selected are dependent upon both decision-makers and target population behaviours and on the extent of conflict and agreement among these agents. That is why we cannot talk anymore of a paradigm in which one goal equals one instrument, where policy makers can freely select instruments from an already made toolbox (del Rio and Howlett, 2013; Edquist and Borrás, 2013; Howlett and Lejano, 2013; Knudson, 2009).

From a theoretical perspective, this research aims exactly at improving existing theories on policy instruments. Building upon the contribution of the existent scholarship, we propose a more accurate classification of R&I policy instruments, considering both the behavioural and political characteristics embedded in tools' action. Since instruments refer to the aspects of policy intended to motivate target population to comply with a policy, or utilize policy opportunities (Schneider and Ingram, 1993, p. 338); we believe that a focus on the relationship between decision makers and target population can help us to deepen our understanding of their selection. Because, ultimately, not only the types of instruments selected matter, but also their capacity to induce a specific behaviour while addressing the appropriate target (Candel and Biesbroek, 2016; EEA, 2005).

Therefore, if we want to understand the way in which different policy tools affect the reality where actors interact, an instrument analysis should be integrated with a deeper understanding of how social control is exercised (instrument shape) and of the type of governing arrangement

coming together with the selection of different instruments (delivery structure). By introducing a theoretical and analytical difference between instrument shapes and delivery components we aimed at overcoming the restricted focus on policy instruments limited to the analysis on the way governments use their legitimate power to shape public action (instrument families). Since exercising power means to obtain collaboration, that is obtaining behaviours in line with our expectations (Stoppino, 2001); an understanding of the relationship each tool establishes between policy makers and target population is needed.

Therefore, by introducing the analytical category of instrument shape, we are able to grasp the substantive characteristics of the inducement effectively administered to the target population through the selection of a specific tool. While, the delivery component, provides information on those actors who have the titularity, and the power, to steer instrument action along the managements process (Bouwma et al., 2017). Therefore, as demonstrated by the empirical results of our analysis, by adopting the R&I classification proposed in our research we aim at providing a greater understanding of the behavioural and political characteristics embedded in instrument action; while showing how both the choice, and the particular way instruments are crafted, reflect different types of interactions between decision-makers and policy recipients.

1.3   Policy instrument selection in complex governance contexts

Policy design can be defined as the political, and technical, process throughout which actors select and model policy instruments into different mixes (Howlett and Rayner, 2013), to achieve their interests. Researches on policy mixes have extensively focused on the "technical side" of this process; therefore, investigating the extent of coherence and contradictions embedded in its components (Howlett and Rayner, 2013; Rogge and Reichardt, 2016; Schmidt and Sewerin, 2018). These concepts underline different perceptions on alternative policy making strategies, which ultimately are thought to influence the ability to design an instrument mix compatible with a specific environment.

We believe that in order to understand the triggering reasons for instrument selection and policy mix evolutions, it is necessary to complement these approaches with a fine-grained investigation on the political side of this process. Indeed, what at first glance could be labelled as an "incoherent" policy mix evolution, it could actually be the result of an intentional and strategic political choice of actors.

In the everyday policy design practices, and specifically for the case of R&I policy, there could be some discrepancies between the intention, and the effective ability, to take on purposive instrumental policy designs according to these principles. Therefore, we do not want to take for granted the reflexive process by which policy makers take into account the principle of coherence and consistency in policy design practices. Policy instruments can alter power dynamics (Lascoumes and Le Gales, 2007; Salamon, 2002a), influence policy issue framing (Baumgartner and Jones, 1993) and ultimately produce different patterns of opportunity and constraints on a given target population (Schneider and Ingram, 1990). Moreover, tools are not stable over time, they have a high degree of interpretative flexibility, due the stratification of new instruments and changes in the rationale of policy-makers (Flanagan et al., 2011); they tend to come in a blend, so their actual state is influenced by the fact that they often come in a mix, and they layer upon an existing set of tools (Ringeling, 2005).

Consequently, it might be complicated the exercise of clearly identifying the goals and activities instruments were meant for at the moment of their design; to the extent that their action might be influenced by the context of pre-existing mixes, their overtime evolution and reinterpretation (Flanagan and Uyarra, 2010; Ringeling, 2005). That is to say that instrument decisions do not take place in a *tabula rasa* because there are contextual, and especially political and ideological constraints that shape the development of specific policy mix characteristics. Very few design processes begin *de novo* and when that was the case it reflected situations in which there was no previous history of policies in response to a perceived problem (Howlett and Mukherjee, 2014, p. 62). New instrument choices are constrained by existing policy mixes, and they have to find their place in-between the stratification of policy styles preceding their selection (Bressers and O'Toole, 2005; Edler et al., 2013; Flanagan et al., 2011; Howlett and Mukherjee, 2014).

Therefore, instrument selection, and the way they are implemented, is the result of a political process (e.g. following the formal/informal rules of the game North, 1990), which is dependent upon power dynamics, the institutional structure in which the decision takes place and on the preferences of the actors involved (Borrás and Edler, 2015; Capano and Lippi, 2017; Edler et al., 2016; Edler and Fagerberg, 2017; John, 2012; Laranja et al., 2008; Linder and Peters, 1989; Ringeling, 2005). This process requires some extent of adaptation according to the different needs of each specific national context and public administration capacity (Borrás and Edquist, 2019). That is the reason why policy instruments are said to be highly context

dependent (Edler et al., 2016), because the actors and the institutional context in which they operate become crucial in determining their effect (Flanagan et al., 2011).

Consequently, if we want to understand their assemblage into different packages, and the power relation they can trigger, a deeper understanding of the context in which instruments are selected, and will operate, is needed. This will be done through a reconstruction of the internal dynamics shaping their selection process together with an analysis of their operational characteristics following the analytical perspective provided by the focus on instrument shapes and devilry structure.

1.4 The formulation of R&I policy: what matters?

Policy making processes are said to be shaped by conflicts (and compromises) among involved interests, by the rule system inherited from the past, and by the formulation of different cognitive and normative framings (Palier and Surel, 2005) . Therefore, to fully understand the assembly of instrument mix and their evolution, it is necessary to investigate the political and contingent environment in which this process takes place, while integrating this information with a diachronic perspective on their evolution.

As argued by Rist (in Vedung et al., 1998), in order to understand these internal dynamics, we need to consider the political ideas of those actors involved in the selection, the power and the preferences of the target population, the political and administrative costs associated with different alternatives. Consequently, we developed a theoretical framework which intersects insights on the role of ideas (as the impact of dominant framing in a given political system); the opportunity structures provided by the institutional system (internal coordination and specialisation between bureaucrats) and the role target population (the strategies for interest intermediation) plays in policy design process.

This analytical perspective helped us to understand how ultimately, given the opportunities and constraints provided by different governance characteristics, actors interact for the selection of R&I policy instruments, and the extent to which this ultimately influenced the evolution of policy mixes. We are interested in explaining both the political process that stands behind policy instrument selection, as well as the extent to which alternative interactions between ideas, interests and institutions influenced the characteristics of instrument mixes. By breaking up this effect, it was possible to disentangle the political dynamics behind the selection and assemblage of different instrument mixes. More broadly, this helped us to

understand how, given the opportunities and constraints provided by different governance characteristics, actors interact for the selection of policy instruments, and the extent to which the way this is happening influences the resulting policy mixes.

Research and Innovation rarely represent a goal in itself, but rather a means to a achieve broader political goals; therefore, the way these objectives have been translated into innovation-intensity targets, represent a relevant political matter (Edquist and Borrás, 2013). Consequently, the selection of alternative designs for public policy interventions in R&I is the result of different political framings concerning both problems interpretation and the expected benefits from the application of a given set of policy instruments. Nonetheless, the existent literature displays a clear shortcoming regarding the relevance that political ideas can have in shaping the design of R&I policy strategies, many studies overlook its relationship with party politics and more generally with government ideology (Bergek et al., 2015; Bhattacharya et al., 2017; Wang et al., 2019). We know that different political contexts can influence the availability of financial resources for investments in R&D in various ways (Bergek et al., 2015), but it is still unclear how do different political preferences influence policy-makers attitudes in selecting specific R&I policy instrument characteristics. Therefore, with our analysis, we aimed at investigating this type of decisions, using as a proxy policy instrument characteristic; more broadly, we were interested in understanding how does the political orientation of different cabinets influence the formulation of national Research and Innovation policy strategies?

From an institutional organisation perspective, R&I policies, stand at the intersection of "classic policy sectors". The way in which policy responsibilities in this sector have been organized mirrors different national specificities reflecting their institutional systems, their framing of R&I issues and related policy strategies. Since ministerial organisation is not strictly determined by law, for the most part, these structures tell us how national governments have differently framed policy problems and the political priorities to be tackled (Peters, 1998). The literature recognizes the influence the variety of national institutions, and inter-institutional, networks play in shaping the ability of research and industrial actors to produce knowledge and innovation, as well as the set of problems related with policy areas characterised by the integration of different responsibilities, like the case of R&I (Braun, 2008a, 2008b; Chung, 2013; Edler & Kuhlmann, 2008; OECD, 2005; Griessen & Braun, 2008; Koch, 2008; Pelkonen … Waltari, 2008; Smits … Kuhlmann, 2010). However, an analysis on

the way actors play within the formal (and informal) rule system defined by the cross-sectorial nature of R&I national institutional structures is missing. Our contribution builds on these evidences and moves forwards the focus of analysis, in order to investigate how different morphologies of ministerial organisation patterns influence the ability of policy makers to design instrument mix able to consider multiple traditional subsectors of public action.

This will provide interesting insights on the interaction between functionally equivalent policy making institutions and, on the role, that specific ministries can play in the design of all-encompassing R&I policy mixes.

Ultimately, in policy making activities requiring technical competencies and skills that decision makers cannot provide by themselves, like in the case of knowledge or technological intensive activities, governing actors are likely to rely on the collaboration of external actors (Guston, 1996). This suggests how in R&I policy design it has increasingly become necessary to consider that governments are not anymore simply and unilaterally authoritative, but they are instead dependent upon the action, acquiescence or support of others, which they do not directly control (Bressers and O'toole, 1998; Goetz, 2008; Mazzucato, 2013; Nauwelaers and Wintjes, 2008; Salamon, 2002a). Consequently, despite the different preferences of decision makers and target groups, a minimum extent of agreement over the characteristics of public action should be found, because the latter have increasingly acquired the power to nullify, or alter, the operation of policy instruments (Dermont et al., 2017; Gross, 2007; Ingold et al., 2018; Kammermann and Ingold, 2019; Varone and Aebischer, 2001; Woodside, 1986).

This consensus will be grounded on the final characteristics of the instrument mix selected, since the extent of competence delegated to third party, reflects the room for manoeuvre they have in the application of public authority (Salamon, 2002a). On the one hand, this provides R&I performers with the power to shape the final instrument mix and to steer policy design process towards their expected benefits. While, on the other hand, part of this target population could miss the opportunity to see their interests represented, because of their incapacity to identify their shared needs and behave as a political constituency.

Therefore, the cross-sectorial nature of R&I policies implies that in addition to the internal ability of policy makers (e.g. coordination of ministerial responsibilities), we also have to consider their capacity to account for the characteristics of the (cross-sectorial) target population, which will bring with them different specific set of associated interests, problem perception and actors' configuration related with the specificity of the different sectorial

policies involved. Also, policy recipient matter, but since their heterogeneity in R&I sector we still know little about their strategic behaviours. For all these reasons, it becomes relevant to investigate the wat target groups relate to the policy process and the actors involved in these dynamics; therefore, how the internal policy making ability in R&I policy sector was challenged by the underlining necessity to integrate different policy responsibilities as well as a greater interaction with R&I target population.

Finally, we also aimed at providing a comprehensive overview of the instruments adopted in the R&I innovation sectors, while examining how different national policy mixes, have evolved over time. Since ultimately instruments represent the operational dimension of governance arrangements (Capano et al., 2019), by following their evolution, we have been able to shed light on both relationship between policy makers and target population and the internal dynamics shaping the evolution of national R&I governance arrangements.

1.5 The cases

The research questions of this study relate to the debate on the politics of policy instrument selection, and on how these dynamics take place within complex governance arrangements characterised by "transversal" policy issues, like the case of Research and Innovation policies. In order to conduct our investigations, we adopted a comparative case study research design. Since, ultimately, we were interested in understanding both the role of different actors in shaping policy instrument selection process, as well as to explore the characteristics of policy mixes according to our new theorization; the choice was inspired by both exploratory and estimate case selection strategies (Gerring, 2016). Therefore, we selected France and Italy, on the basis of the variance they display in the theoretical factors of interests (exploratory) (Seawright and Gerring, 2008), and we adopted a longitudinal estimate strategy to investigate the effects of their diachronic evolution on the evolution of policy mix.

From the perspective of R&I policies, France and Italy are two apparently similar and binary systems nevertheless, within this similarity, there are also very different approaches characterizing national policy making dynamics. Therefore, even though the two countries share a stable centre-of-government R&I structure and a similarly sophisticated instrumentation; the Italian case suffers from an inherent fragmentation and duplication of instruments, that is matched with a scarcely effective monitoring and uncertainties related with the implementation process and availability of resources (Potì and Reale, 2011). If we interpret

layering as a way of designing institutions through which policy makers intervenes to affect related behaviours (Capano et al., 2019), we can differentiate the layering for equilibrium pursued in the French case and the attempt of layering for change characterising the Italian context. Indeed, in the former, the evolution of specific policy instruments (like the Research Tax Credit, the Incubator and Technology Transfer Organisations) suggests an underlying design logic aimed at chasing coherence through the stratification of multiple (often similar) instruments. Whereas, in the Italian case the systematic tendency to design one-off instruments, approved in the framework of broader national decrees, alludes to an attempt to trigger changes by exploiting the windows of opportunity provided by systematic national policy design practices, like the drafting of the yearly budgetary law.

When focusing only on the on the way governments use their legitimate power to shape public action (instrument families), the French and the Italian case share many similarities in their policy mix characteristics. But if we look at the aggregate characteristics of the different shapes (e.g. how social control is exercised) and delivery structures adopted (e.g. relationship between policy makers and target population) the results display a greater variety. These differences reflect the alternative approaches the two countries have undertaken to interact with target population, as well as the different extent of activism and organizational capacity national R&I performers played in the two cases.

1.6   Conclusions and structure of the thesis

Thus, the purpose of this thesis is to analyse the politics of policy instrument selection. We aim at investigating the dynamics shaping the policy formulation process, and the extent to which the interactions between differently motivated across within and increasingly complex decision-making environment can influence this process.

We will shed light on actors' stakes for alternative trajectories of change and how these have been shaped along the formulation process into different instrument mix characteristics.

Given the increasing complexity of the problems our societies are facing policy makers show reduced capacity to act unilaterally (as discussed in Chapter 2); moreover, they have to be able to design policy mix capable of embracing multiple traditional subsectors of public action, in order to address these issues in an all-encompassing manner. Consequently, this requires governance ability both internally (among ministers) and externally (interactions with policy recipients), in order to tackle these issues in an all-encompassing manner. That is ultimately

why we investigated the extent to which actors' choices and interactions matter in policy instrument selection process. Because we believe that a greater level of analytical accuracy is needed in order to understand the complementarity between policy-makers' decisions, as well as the role that target population can play as catalyser of public choices. In the same vein, we propose a new typology of R&I policy instrument classification, which is able to embrace both the behavioural and the political characteristics embedded in different tools. Since, ultimately, instruments refer to the aspect of policy intended to motivate target population to comply with a policy, or utilize policy opportunities (Schneider and Ingram, 1993, p. 338); we believe that the relationship between decision makers and target population needs to be taken into account in explanations concerning the underlining logics of instruments action. Because, ultimately, instruments display many differences not only regarding the concrete details according to which they are design, but also with respect to the context in which they are applied (Borrás and Edquist, 2019).

To answer all these questions, and to test the validity of the proposed instrument classification, the thesis has been structured as follow. In Chapter 2 we first discuss the conceptual boundaries of Research and Innovation policies as applied in our research. Then we will review the contributions of the existent literature to the study of policy instrument selection process in the Research and Innovation sector; ultimately, we will conclude by presenting the research question driving our investigation.

In Chapter 3 we will present our theoretical framework, together with the conceptualisation (and operationalisation) of policy instrument typologies and of the theoretical factors of interest we hypothesise shaping policy instrument selection. To conclude, we will define the path of investigation for the analysis of the two case studies, and put forward our predictions on the different causal pathways shaping instrument selection process.

Chapter 4 will present the methodological approach adopted for the analysis. We will discuss case selection strategies and present the constitutive characteristics of our sample; then, we will move on by describing the methods of data collection and analysis adopted for our investigation. To conclude, we are going to discuss the piloting process for European and regional issues, in order to provide further evidences in support of our analysis.

Chapter 5 and 6 are focused on the within case study analysis of France. In the former we will describe the chronological evolution of the R&I sector together with an accurate description of the instrument mix adopted and the governance arrangements characterising the sector.

While in the latter, we will analyse the characteristics of the case in the light of our theoretical framework, and we will test the validity of our predictions on the different causal pathways shaping instrument characteristics.

Similarly, Chapter 7 and 9, will mirror the same narrative but for the Italian case. Therefore, in the former we will present the historical evolution of the national R&I governance arrangements, together with the policy mix characteristics. While in the latter, we will present the results of the within case analysis in the light of our analytical framework.

To conclude, Chapter 9 will wrap up on the results of the within case study analysis (the four chapter above mentioned) and it will focus on the cross-case comparison of these data. Therefore, it will dig into the analysis of national policy mix evolution, testing the relevance of proposed policy instrument classification. Then, it will comparatively analyse the different causal pathways leading policy instrument selection in our two cases. Finally, the conclusion, policy implications and related issues for future studies are presented and discussed.

2 Chapter 2: The literature review

This research is addressed to a broad audience in the field of public policy studies, therefore an accurate conceptualisation of what we do mean by Research and Innovation sector is needed, so that readers who are not familiar with these concepts can easily grasp the boundaries of the phenomenon under investigation. Particularly, we are interested in understanding the dynamics shaping the characteristics of policy instrument selection taking place in this sector. Meaning, the way instruments are selected and blended into different mixes, with the ambition of creating policy mixes able to encompass the cross sectoral nature of R&I policy goals.

After a problematisation of the specific features of R&I policies, we will review the current literature analysing the fundamental characteristics of this policy sector. We will discuss the contributions of the existent scholarship in explaining how ideas influence the way R&I challenges have been translated into smaller scale issues; stressing the necessity for a more accurate analysis focusing on how do party politics preferences influence policy-makers attitudes for selecting specific policy instrument characteristics and the extent to which the legacy of previous strategies affect this process. We will shed light on how R&I policy strategies tend to hinge upon governing arrangements embracing multiple established areas of public policy; and underline the necessity to fill the a consistent gap in the literature with respect to an understanding of the extent to which this institutional structure influences the capacity of actors to foster an instrument mix bearing "encompassing common vision for the future" (Braun, 2008a; Flanagan et al., 2011). Moreover, we will discuss the present contributions investigating the system of interactions between the actors involved in both knowledge production and development sectors; hence, among the state, university, public research organisations and different business actors (Amable and Petit, 2001; Considine et al., 2009; Edler et al., 2016; Edquist, 2001a). We will show how a deeper understanding of the role, interests and strategies of these actors could contribute to a more accurate understanding of R&I policy making, and the shortcomings of the existent literature with respect to the relevance that target population have acquired on the way instrument are selected and blended into different mixes. On the same vein, we will move toward a more accurate discussion on policy instruments literature, in order to how the gaps we identified in the Research and

Innovation policy literatures, actually mirror some of the most relevant open questions in the study of how government select and design policy instruments.

2.1 Conceptualizing Research and Innovation policies

The field of innovation policy is a strongly multidisciplinary area. Different scholars from various fields have contributed to its development and establishment. The downside of this synergic process is the fact that the components of this field of research have been labelled in different ways, thereby producing heterogeneous definitions and analytical perspectives.

To disentangle the stratification of contributions and to make clarity on the characteristics of this policy sector it useful to begin with the conceptual exercise provided by Lundvall and Borras (in Fagerberg … Borrás, 2009). Before starting, it is necessary to bear in mind that "much of what is called innovation policy today may previously have gone under other labels such as industrial policy, science policy, research policy or technological policy" (Edler and Fagerberg, 2017, p. 5). Therefore, this represents one among the multiple definitions of innovation policy, but we believe it is a good starting point, to the extent that it sketches out the main dimensions characterising the policy sector.

The authors identify three broad concepts, science policy, technology policies and innovation policies, in the effort to understand the components of a system that in real world can consistently overlap. Science policy aims at allocating resources to science and regulating the internal and external structures of the actors involved in the research and knowledge production. Technology policy focuses on the creation of connections between universities and industries, with a more instrumental focus on economic/industrial objectives. Finally, innovation policies put emphasis on the role organisations and institutions have in coordinating the components of science and technology policy to produce innovative outputs and to create interactions and dialogue between the actors involved. Therefore, following the same line of thought, according to this perspective innovation policy can be defined as

> *"the system of public activities devoted to coordinate the results of science and technology policy with the characteristics of national economic and industrial systems, in order to support the generation and diffusion of new products, processes or services" (Lundvall, Borras, 2009* in Fagerberg … Borrás, 2009).

Within this system enterprises and private actors at large, represent one among the various stakeholders involved in the process, that can produce innovation autonomously or in

cooperation with public actors. For the sake of clarity, it is necessary to define what do we mean for innovation outputs. Here it is useful to rely on the definition provided by the Oslo manual[2], and applied by Eurostat, which identifies four types of innovations, namely: organizational innovation, market innovation, process innovation and product innovation[3]. Hence, if inventions can be defined as the first occurrence of an idea (and its first application), innovation represents the systematic development and exploitation of this idea into practice (Fagerberg et al., 2009a).

For the purpose of this research it is also necessary to consider the set of activities which often stand at the upstream of innovation processes, as defined by the Frascati Manual these are classified as follows: basic research; applied research and experimental development[4].

The relevance of the research component for understanding knowledge production-development process is related with the fact that knowledge advancements are often a necessary, although not sufficient in themselves, conditions for producing innovations. Since countries differ in their economic and industrial specialisations, they also tend to display different needs with respect to their demand of skills, knowledge and finance structure. Moreover, the interactions between policy makers, knowledge infrastructure and innovation performers are consistently shaped by these needs (Edler and Fagerberg, 2017). Therefore, we think that both knowledge production and knowledge exploitation systems need to be considered jointly, to the extent that they can mutually shape each other's needs and features, while moulding national R&I strategies. This is also in line with other arguments found in the current literature (Smits et al., 2010) concerning the necessity to keep a wider approach for investigating the origins and dynamics of innovation.

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[2] It is an OECD document which contains guidelines for the collection and use of data on innovation activities in industries.

[3] Organizational innovation, refers to the implementation of a new organizational model or business practice; market innovation concerns the introduction of a new marketing method involving changes in product design and product placement; process innovation is the implementation of a new method of production and finally, product innovation refers to the new improvements in technical specification, components and material for both goods and services (OECD/Eurostat, 2018, p. 45).

[4] Basic research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlining foundations of phenomena and observable facts, without any particular application or use in view. Applied research is an original investigation undertaken in order to acquire new knowledge; it is however, directed primarily towards a specific practical aim or objective. Experimental development is systematic a work, drawing on knowledge gained from research and practical experience and producing additional knowledge, which is aimed at producing new products or processes or at improving existing products or processes (Frascati Manual 2015, pp. 50–51).

Consequently, the governance of R&I defines a system of interactions between the actors involved in both the knowledge production and knowledge application sector; therefore, among the state, firms, university and public research organisations (Amable and Petit, 2001; Considine et al., 2009; Edler et al., 2016; Edquist, 2001a). In order to understand policy design process and the universe of actors, and interests, who gravitate around it, we believe a broader perspective is needed.

Following on that we delineate the operational boundaries of the policy sector under investigation according to what can be classified as *Research and Innovation Policies* (henceforth R&I).

Therefore, if research policies focus on the generation of new ideas and innovation policies on the activities related with exploitation of this idea into practice (Edler and Fagerberg, 2017); we identify Research and Innovation policies as:

> *the system of public actions aimed at supporting research and knowledge production, and their coordination with public interventions focused on the development and exploitation of this knowledge into practices for various political goals (e.g. economic growth, national competitiveness, employment, Grand Societal Challenges).*

This implies both systematic strategies designed to enhance the knowledge developments and their coordination with measures aimed at supporting the process of generation, diffusion and adoption of new products, services, processes and business models (Doern and Stoney, 2009). Inasmuch as innovation can be framed as "the process thorough which ideas can be exploited in practice" (Edler and Fagerberg, 2017, p. 16); we believe that in order to understand the process that shaped the design of national strategies it is necessary to account for both requests to support public research (Cantner and Pyka, 2001) as well as the necessity to support the demand, development and application of this knowledge in practice (Borrás and Edquist, 2019).

Our conceptualisation is also consistent with what has been defined as "the historical evolution of the science policy frame to a technology policy frame and to a broader innovation policy frame" (Ulnicane, 2016, p. 8)[5]. Its boundaries are intentionally kept broad, so as to embrace

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5 As for any conceptualisation process, also in this specific case, researchers are always engaged in a tension between generalisation and accuracy. Therefore, in order to deal with this issue, we believe that it is necessary to specify that the conceptualisation provided defines R&I policies in the context of Western European Democracies and from a purely public policy-oriented perspective.

the universe of actors gravitating in the sector, with the goal to understand their potential role in the policy design process and in the governance system at large.

Borrowing a conceptual framework from Tödtling and Trippl (Tödtling and Trippl, 2012, 2005) we can think of R&I policies as composed of two subsystems, one devoted to knowledge creation, centred around universities, PROs and private research. Another one, focused on knowledge exploitation based on firms (heterogeneous in size and sectors), universities spin-offs and public developmental agencies. R&I policies represent the system of public activities devoted to fuel knowledge production and application in these two (ideal type) systems and to enhance cooperation and synergies among the actors involved.

These interventions can be administered and designed by governments, including agencies and public institutions at different territorial levels (Edler et al., 2013). Therefore, private corporate policies or strategies for innovation are not included within this operational definition. Nevertheless, given the relevance of private actors as both knowledge producers and developers, we included these stakeholders in our analysis (Edler et al., 2016), with a focus oriented to the role they can play in policy making process and as recipients of different R&I policy mixes. We are aware of the advices made by Borras and Edquist (2019), regarding the tendency to adopt a "liner model of innovation" perspective when analysing Research and Innovation policy, and the related risks to overestimate the role of the research component at the expenses of the innovation one (putting too much attention on the Research and overlooking the Development side). Taking these warnings into consideration along our investigation, we believe that in order to understand policy design process we need to adopt a more encompassing view on this policy sector, exactly because we have to be able to understand also those actors' rationalities that do not follow the principle of a holistic innovation approach. To conclude, we are convinced that given the discrepancies between the willingness of actors, and their actual organizational capacities, to deal with R&I issues, by analysing these two components in combination it will be possible to enhance our analytical accuracy.

2.2   A public policy analytical perspective on the study of R&I policies

Looking at the characteristics of R&I policies with a public policy analytical lens, it emerges how these policies strategies tend to hinge upon governing arrangements embracing multiple established areas of public policy (defined as policy sector or policy subsystems) while

attempting to foster an instrument mix "encompassing common visions for the future" (Braun, 2008a; Flanagan et al., 2011). That is why R&I policies are thought to design multi-level, multi-actor and multi-issue governance systems (Chou et al., 2017), where each intervention needs to be joined up across a broad set of delivery areas, including tax, science, education, immigration, enterprises, foreign and direct investments and health policies.

This inherent complexity is closely related with the fact that R&I policies tend to address broad challenges, that given the impossibility to be tackled as a whole, require to be translated into smaller scale issues (Edquist and Zabala-Iturriagagoitia, 2012). Therefore, behind the process of issue framing, a parallel process takes place, shaping different organizational structures of policy-making, while defining what some of the current literature describes as boundary-spanning policy regimes (Jochim and May, 2010) or horizontally connected policy sectors (Trein, 2017). Basically, these governance structures define different extent of integration practices across "classical" policy sector responsibilities, in order to coordinate policy making between multiple areas and design holistic R&I interventions.

The literature in this field suggests that policy integration represents a political goal that must be obtained (Tosun and Lang, 2017, p. 560), it can be related with different framings of policy problems (Nilsson and Nilsson, 2005), or it can be the result of conscious organizational design based on strategic considerations (Christensen et al., 2014). An emblematic case of policy integration between policy sectors is provided by the research of Trein (2017), who investigated health care and public health sector integration. Here the author shows the extent to which the governance capacity to coordinate the actions of different policy sub-sectors is closely related with the institutional design adopted for integration (e.g. ministerial structure) and the collaborative attitudes of the stakeholders involved, what he calls actors' responsiveness. These phenomena are not solely specific to R&I, but they represent generalised strategies for tackling societal issues which span across different "classical" sectors of policy responsibility (e.g. climate policies (Van Asselt et al., 2015), migration policies (Scholten et al., 2017) and health care policies (Trein, 2017)).

The rationality behind our conceptualisation of R&I policies and the underlining goal of our research aim exactly at investigating how policy design processes take place in cross-sectorial governance arrangements, and the way the actors involved in this process influence the selection of instruments that could effectively design an ambitious policy mix for Research and Innovation. Indeed, policy integration challenges becomes particularly severe, when

complex societal issues are confronted with governance systems characterised by relatively stable actor configurations, associated interests, problem perceptions and interest beliefs (Candel and Biesbroek, 2016). Because policy sectors, as well as subsystems, are made of institutions, actors and specific interests regarding certain problems (Howlett and Cashore, 2009). And the current literature in this field, is mainly focused on how to achieve policy integration (or coordination) rather than on the effects that such a peculiar cross-sectional governance arrangement can have on policy design, and more generally on decision-making practices. Therefore, in order to investigate how policy instruments are selected, and blended into mixes, a deeper understanding of how actors play within the cross-sectorial nature of the R&I governance arrangements is needed. Together with a deeper understanding of the characteristics, and expected consequences of instrument mix actions. Consequently, the interpretative framework of our analysis will consider both the institutional capacity of policy makers to (attempt to) integrate ministers with complementary competences; as well as the role target population have in easing or hampering these practices. Since policy design is fundamentally an intellectual process of constituting a reality and then attempting to work with it (Linder and Peters, 1998, p. 45), which is linked to the general policy preferences in the sector (Cashore and Howlett, 2007), these dynamics should also be interpreted accounting for alternative framings influencing the politics of problem definition. All these issues are coherent with the increasing awareness emerging from policy instrument and governance literature (Bressers and O'Toole, 2005; Capano and Lippi, 2017; Majone, 1976; Ringeling, 2005; Woodside, 1986) regarding the reduced capacity that, in democratic societies, political institutions have to act unilaterally. Because, ultimately, it is all about (tying to) "establishing, promoting and supporting a specific type of relationship between governmental and non-governmental actors in the governing process" (Capano et al., 2015, p. 313).

Consequently, in order to understand policy design in complex governance regimes we will investigate how the integration between R&I policy responsibilities has been effectively pursued in our two cases and the way this affected their ability to coordinate public action internally (among ministers) and externally (interactions with policy recipients), and ultimately, the different policy instrument blends.

As extensively discussed in the following chapters, theory and practice do not always overlap; indeed, our two cases display different extent of successful policy making experiences in which they were able to design such a comprehensive strategy. Therefore, through a

reconstruction of the policy design process, of the rationalities of the actors involved, their ideas, interests and strategies for action, we will contribute to the scholarship of policy instruments, by providing a deeper understanding of how tool selection, and the interaction between differently motivated actors shaping their final characteristics, takes actually place in governance arrangement characterised by cross-sectorial policy issues. While supporting a more general understanding of the dynamics characterising the sectorial specificities of R&I policy design process. However, from a public policy perspective, the R&I sector represent an example among the broader variety of complex governance regimes characterised by the integration of different policy responsibilities. Therefore, we aim at providing theoretical and empirical contributions that could be easily generalised to the broader sphere of policy sectors characterised by policy integration issues.

2.3 Different rationalities for state intervention: the politics of R&I policies

In 1934 Schumpeter defined innovation as creative destruction, meaning a process able to shape new combinations of hitherto disconnected ideas, knowledge domains, technologies or markets (Smits et al., 2010). Since technological progress, and more broadly knowledge advancements, represent one of the factors supporting economic development, the interest of policy makers in knowledge-intensive activities is closely related with the positive spill-overs these can trigger (in terms of employment, human capital, national economic competitiveness) and the possibility to steer them, towards their interests.

Looking at the history of past policy design in the R&I sector (Edler et al., 2016; Gassler et al., 2008; Laranja et al., 2008; Mazzucato, 2013) it is possible to identify four different historical phases of R&I policies, mirroring different cognitive paradigms (political framings) according to which governments have differently translated their political purposes into innovation-intensity objectives. These rationalities, and the characteristics of the related policy mixes attached to them, are intimately linked with various perceptions of the duties and benefits that public actors can get out of this political process.

The first phase emerged in concomitance with the historical and political contingencies arising in the aftermath of the Second World War conflict (1940s- 1950s) and the upcoming, cold war period. Policy makers' goals, in what nowadays is called R&I, were focused on key military technologies, in order to support the production of public goods in areas where there was no private incentive to do so. Their primary goal was restricted to develop particular technological

capabilities (Foray et al., 2012), with a purely top-down, market fixing rationality (Kattel and Mazzucato, 2018; Laranja et al., 2008) . In this context, state intervention was perceived as a necessary condition in order to overcome market failures embedded within the public good characteristics of knowledge (distinguished by non-rivalry and non-excludability).

The following period was distinguished by the application of R&I goals for civilian industrial technologies, and it was contextual to the post-war industrial and economic development era. The dominant framing was mainly driven by a first mover advantage logic, and it was focused on the development of private industry with the ultimate goal of disseminating results to the wider public (Gassler et al., 2008). Innovation process was mainly interpreted as a linear mechanism starting from basic research, through applied research and development, until the market introduction of new products and technologies (OECD, 2005). Public actors had a prominent role in leading innovation process often from the input, through public research laboratories, either military or civilian, until the output, by supporting (or in some case owning) national industries.

The third phase characterised the 1980s and it was closely associated with the emergence of the National System of Innovation (NIS) approach (Freeman, 1987; Gassler et al., 2008; Lundvall, 1992; R. Nelson, 1993). The innovation process was seen in a broader perspective, as an interplay of systemic elements with institutional framework conditions, where the production of innovation was made up of constant interactions and learning among the constituents of this network (Edquist, 2001a). Public intervention was perceived as necessary in order to support coordination, enhance complementarities among the components of the system and to ease the cooperation between actors and organisations involved. The rationality for state intervention was guided by the perceptions of different systemic failures inherent to the network-based nature of the sector, such as infrastructural failures, capability failure, institutional and network failures (Chaminade and Edquist, 2006; Cimoli et al., 2009; Edquist, 2014, 2001a). Therefore, public intervention was sometimes required, but it couldn't completely displace the role of private actors, whose coordination and interaction were meant to fuel innovative processes.

The last period, which started around 2000s, saw the role of R&I policies as increasingly oriented to respond to major societal and economic challenges. This concept has been used since 2007, with the drafting of the Green Paper on the European Research Area, and it has been introduced into the policy discourse with the adoption of the Lisbon strategy (2000-

2010), that framed R&I as an important component for economic growth (Ulnicane, 2016). It represented a new mission-oriented approach with a pronounced orientation towards technologies and innovations relevant for coping with new societal developments, such as environmental and health problems, job creation, security and defence (Borrás, 2009; Gassler et al., 2008). It supported a wider policy making attention towards how research and innovation could become instrumental to tackle economic and social challenges nations face in contemporary global environments. This approach reflects an emphasis on new strategies adopting cross boundaries collaboration between multiple actors and policy sectors (Ulnicane, 2016), dealing with new interconnected and complex (wicked) problems (Head and Alford, 2013; Kattel and Mazzucato, 2018; Peters, 2017), requiring insights from many perspectives. The historical overview of ideational approaches behind R&I policy design shed light on the evolution of different governance modes, and related dominant policy framings this policy sector has experienced over the last decades. Since ideas are closely related with various cognitive paradigms, meaning how people make sense of the reality surrounding them, in turn these are also embedded within different interpretations of the problems at hand.

Different paradigms of priority setting (in R&I) did not substitute their predecessors but they rather tend to develop new features, which add up to the existing structures of priorities (Gassler et al., 2008). Consequently, the extent to which policy makers have adopted one or another rationality is related with how political preferences have been translated into research and innovation-intensity targets. Indeed, this process is the result of a specific political framing (Edquist and Borrás, 2013), which tend to be influenced by both individual values and perceptions, as well as by long-lasting assumptions about how the world should be.

Technological progress, and more broadly knowledge advancements, represent one of the factors necessary to sustain economic and social development, these can also (potentially) play a vital role in designing strategies to support poverty alleviation, rural development and sustainable economic growth (Taylor, 2016, p. 31). Therefore, the political context is said to (in)directly influence the availability of resources for investments in R&D, and to legitimizes different spaces in which firms can gain access to resources (Van de Ven and Garud, 1989). Consequently, R&I represent a highly risky and long-term intangible asset, mainly supported through public finance, which is expected to generate profit in the future (Bhattacharya et al., 2017). Because of its long-term benefits, or losses, this could eventually create, it is plausible to expect that different stakeholders would have different stakes with respect to the spill-overs

R&I policies can trigger in different policy areas. Meaning that the choices of alternative designs for public policy interventions in the sector should be influenced by alternative political framings concerning both problems interpretation and expected benefits.

Actually, as suggested by the literature, many studies on innovation overlook its relationship with party politics and more generally with government ideology (Bergek et al., 2015; Bhattacharya et al., 2017; Wang et al., 2019). There are some contributions concerning the influence of left/right wing party cleavages on the application of university tuition fees (Kauder and Potrafke, 2013), on the progress of technical innovation (measured through patents and trademarks) (Wang et al., 2019); on the influence that political uncertainty plays on economic incentives to innovate (Bhattacharya et al., 2017), and on the conditions affecting the innovative attitudes of different governments (Ma, 2017).

Nevertheless, the existent literature displays a clear shortcoming regarding the relevance that different political ideas can have in shaping the design of R&I policy strategies. We know that the political context can differently influence the availability of financial resources for investments in R&D (Bergek et al., 2015). But it is still unclear how do party politics preferences influence policy-makers attitudes for selecting specific R&I policy instrument characteristics. Therefore, our analysis aims exactly at investigating the content of R&I decisions, and the way different governments formulate their choices on alternative instrument mixes. At the same time, we are also aware that since policy design is "an intellectual process of constituting a reality and attempting to work with it" (Linder and Peters, 1998, p. 45) there might be some discrepancies between what actors want and what they can actually achieve. Indeed, both individual values and long-lasting assumptions about how the world should be, are key ideational components shaping the politics of problem definition (Béland, 2016). Consequently, alternative framings tend to cluster into long-term paradigms, acting as a lens that filter information and focuses attention on specific issues (Wilson, 2000). They carry out various sets of values, interpretations of the reality and images of target population influencing the characteristics of different governance settings (Capano and Lippi, 2017; Edler et al., 2016; Sanz-Mendez and Borrás, 2001). That is why, it is relevant to focus our attention on the extent to which different dominant R&I cognitive framings influence how innovation intensity problems are framed, and how strategies are differently assembled.

The combination between policy problem interpretation and the perceived appropriateness of a given instrument influences interest definition; this can fuel the creation of different political

constituencies (Daviter, 2007), as well as the tendency for some instruments to become institutionalised (Laranja et al., 2008) or supported by a specific group of actors (Voß and Simons, 2014).

Since alternative design of R&I instrument mix mirror different political priorities (by differently distributing cost and benefits to actors), by investigating how different governments formulated their choices on R&I instrument mix, and the influence that existent framings had on this process can ultimately help to shed light on the politics dynamics fuelling R&I policy making.

2.4 The institutional shapes of R&I policies

At the beginning of 2000s Borrás and Biegelbauer (Biegelbauer and Borrás, 2003) noticed a trend in national innovation policies directed towards their integration with other national policy fields. This was interpreted as a result of the combination between an increasing awareness concerning the systemic nature of innovation processes, an acquired relevance in the role of knowledge for economic development, and as a consequence of networking and bridging strategies of previous policies. From an institutional perspective this trend has been accompanied by an increasing blurring of competences between executive national departments, which consequently led to different patterns of institutional organizations among actors with complementary competences in the sector (Edler et al., 2016; Perry and May, 2007)6.

This phenomenon is associated with the characteristics of R&I policy discussed in previous paragraphs, namely the fact that traditionally these issues lie within the remit of different ministerial responsibilities, whose task division varies according to different national contexts (Edler et al., 2016; Edler and Fagerberg, 2017). From an institutional organisation perspective, R&I policies, like for example climate policies (Van Asselt et al., 2015), migration policies (Scholten et al., 2017) and health care policies (Trein, 2017), stand at the intersection of "classic policy sectors", mirroring different functional executive policy-making organisations (as further operationalised in the next chapter). The way in which R&I responsibilities have

6 This is also related with the increasing awareness regarding the systemic nature of innovation processes (see Lundvall (1992); Lazonick (1993); Elidias et al., (2005) Considine et al., (2011)), which highlights the relevance of different type of institutional and political relations existing between different *locus* of power with integrative decision-making competences in the sector.

been organized among ministries mirror different national specificities reflecting their institutional systems, the different framings of R&I issues and of related policy strategies (Tosun, 2018). Since ministerial organisation is not strictly determined by law, for the most part the organisation of institutional structures tell us how national governments have differently thought about policy problems and the political priorities to be tackled (Peters, 1998). Ultimately this is closely related with the fact that R&I policy strategies imply a policy mix "encompassing common visions for the future" (Braun, 2008a, p. 231; Flanagan et al., 2011), aimed at solving transversal policy issues (Jochim and May, 2010; Peters, 2005). Consequently, the system of ministerial organisation can take different shapes, according to how differently national governments have translated these issues into smaller scale, policy-related strategies.

In both the Italian and French case, these responsibilities are mainly coordinated externally, between the Minister of Research and Education and the Minister of Economic Development, with the open window for functional ministerial, or regional, activation [7]. These structures have been supplemented by the creation of platforms for interministerial dialogue (e.g. the CIPE in the Italian case), common budgeting procedures (e.g. the MIRES in the French case), or the involvement of public agencies (see the Finnish case in Pelknonen et al., 2008); in order to overcome the lack of hierarchical coordination and enhance collaboration among peers.

Differently, for example, in the British case, after the creation of the Department of Innovation Universities and Skills (2007), competences in the field of higher education, skills and innovation have been merged within a unique institution[8]. Such integration went even further in 2009 with the creation of the Department of Business Innovation and Skills, where also responsibilities related with trade, business regulation and support have been merged under the same structure. Then, this has been supplemented by the creation of specialised public sector organisations (Innovate UK), with the mission to support innovation (Edler and Fagerberg, 2017).

Despite the mixed results emerging from previous studies (Bäck et al., 2017; Martin and Vanberg, 2014), we are confident to assume that ministers detain a central role in the formulation of policy mixes within their areas of competences given their expertise, resources

[7] In these cases, Regions can also develop their own R&I initiatives on the basis of the concurrency principle.
[8] This Department took over some of the competences of the former Department of Education and Skills, and the Department of Trade and Industry.

and institutional power in policy making process. Even in the case of political systems relying on collective decision-making at the cabinet level, or presidentially-based systems, discussions on policy strategies often consider whether to accept, reject or amend, a particular policy proposal usually produced by the minister (or department) in charge of a specific policy issue (Laver, Michael; Shepsle, 1996).

The influence of ministerial structures on R&I policy mix characteristics is related with the fact that social choices are shaped, mediated and channelled by the structure of different institutional arrangements (John, 2012; Powell and DiMaggio, 1991). Indeed, as organizational research points out, and as confirmed by some of our interviewees (see case study analysis Chapter 6 and 8), different departmental identities affect actors' selective perceptions, by focusing their attentions on different phenomena; therefore, shaping different understandings of causal effectiveness (Scharpf, 1997, p. 40).

This influence becomes even more relevant if we consider that R&I policy issues design a complex governance regime, characterised by the integration of different policy competences, in which interventions often need to cut across multiple established areas of policy responsibility.

Therefore, given the complexity of R&I issues (Verhoest and Bouckaert, 2005) the traditional siloed approach characterising many public administrations (Christensen et al., 2014; Pencheva et al., 2018) as well as the classic departmentalized structure of formal policy making institutions (Pelkonen et al., 2008), some extent of coordination between the different *locus* of policy making power is needed. The literature recognizes the influence that the variety of national institutions, and inter-institutional networks, play in influencing the ability of research and industrial actors to produce knowledge and innovation, as well as of policy makers to invest and regulate (Braun, 2008b; Chung, 2013; Smits et al., 2010).

Koch (2008) provides an interesting example for the Danish case, showing how changes in ministerial organizations, and more generally in their internal dynamics of coordination, are related with shifts in the instruments characterizing dominant policy mix in the sector. Edler and Kuhlmann (2008), analysing the German case, stress the relevance that ministerial coordination practices plays in shaping a balanced R&I policy mix, within and across knowledge sectors, in terms of a coordinated blend of different policy measures. On the same vein, Griessen and Braun (2008), show how despite Switzerland can be grouped among the most successful countries in terms of knowledge production and technological innovation, it

faces consistent cross-sectoral policy coordination challenges within its institutional structures.

Consequently, in the current literature it is well established the set of problems related with policy areas characterised by the integration of different responsibilities, as well as the necessity to support ministerial coordination in order to enhance policy making practices (Braun, 2008b; OECD, 2005; Pelkonen et al., 2008). Our contribution builds on these evidences and attempts to move forwards the focus of analysis, in order to investigate how the different morphologies of formal (and informal) ministerial interactions at work have influenced the ability of policy makers to design instrument mix able to consider multiple traditional subsectors of public action.

All the different ministerial organisation strategies require to strike a balance between coordination, in terms of designing an all-encompassing policy strategy, and specializations, related with the fine-grained calibration of policy mix to specific contexts. Therefore, the choice of different ministerial organization structures can have different trade-offs according to how differently actors do manage to integrate their policy making structures and interact with policy recipients. There is not best organizational strategy because divisions can persist in both external or internal institutional strategies, due to the different system of competence division among departments (Pelkonen et. Al., 2008), and related mechanisms of habituation and socialization within organizational structures (Binder et al., 2009; Merton, 1938). These patterns influence the way authority is exercised, meaning how ministers, and eventually agencies, organize their actions during the governing business.

Therefore, building on that, we want to understand how internal policy making ability in R&I policy sector was challenged by the underlining necessity to integrate different policy responsibilities; and the extent to which different policy mix choices addressed (un)balanced or (un)coordinated blend of instruments to their targets.

As reported in the literature, another emerging phenomenon in R&I policies is the tendency for knowledge and innovation components to invade the field of many traditional policy sectors (Nauwelaers and Wintjes, 2008), defining a situation very similar to the external coordination practices discussed above. For the sake of clarity, in this research we adopted a strictly institutional approach (Edler et al., 2016) to investigate national R&I policy-making process. Hence, we decided to focus on the typically sector-based division of labour between

different ministers, or public agencies, with direct competences in R&I sector9. The extent to which different functional ministries are involved in the policy design of national R&I strategy, is also dependent upon the type of strategies governments are determined to achieve. Hence, their participation in policy-making processes can only be assessed in the empirical analysis of the cases; when it will also be possible to understand whether different national governments have undertaken R&I policy strategies in a wider sense, therefore including specific objectives in other sectorial domains, such as environment or health; or whether they focused on stricter R&I-oriented goals (OECD, 2005). All these questions will go along with the empirical analysis of the two cases under investigation, and will pave the way to understand the role different institutional factors play in shaping R&I governance arrangements, and the extent to which different actors can interfere in this process.

2.5 The quest for systemic approaches: how interest intermediation takes place

In policy making activities requiring technical competencies and skills that public decision makers cannot provide by themselves, like in the case of knowledge or technological intensive activities (e.g. R&I policies), public actors are likely to rely on the collaboration of external actors. During this delegation of responsibilities, the agent should perform the task but with some consequential benefits accruing to the principal (governing actors) as well (Guston, 1996, p. 230).

In the case of science policy, but we can also expand it to R&I at large, the delegation process between political principals and R&I performers embeds a trade-off in the role of science and technology in societies, which has been consistently debated. Beginning, with Bush (1945) and Merton (1938), both pointed out the necessity to preserve the autonomy of science as a premise for its development and circulation among researchers, governments, industries or elsewhere. One empirical example of this principle is the German case, where scientific

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9 We focused our attention to the study of policy making organisations explicitly responsible for research and innovation (technology development) issues. Therefore, for the sake of this research we did not primarily focus on the measures in support of research and innovation designed and implemented by functional ministries and agencies (e.g. energy, health, or transport), serving the purpose of supporting innovation as means to achieve their ultimate policy goals (Edler et al., 2016). That is because in this research we are not interested in policy integration (Lafferty and Hovden, 2003), therefore in commitments aimed at minimizing contradictions between innovation and sectorial policies; but rather in formal policy processes aiming to get the various institutional and managerial system, which formulate policy, to work together (OECD 2003:9).

autonomy is constitutionally established, and the government has little possibility to influence basic funding for research councils (Van der Meulen, 1998a, p. 405).

In some instances, the creation of intermediary institutions between governors and R&I performers has represented a strategy to stabilize the interest of the actors involved and to (temporarily) temper the politics/science conflict. Such as in the Danish case, where the creation of different research councils with tasks related to the coordination of public research, the production of policy advice and, partly, the management of national funding allocation, represented a strategy to balance university autonomy (Koch, 2008). While in other cases, as demonstrated by the comparative case study of Braun (1993), this strategy has represented a sword with two edges. On the one hand it alleviated administrative burdens while intergrating access to information and cooperation with recipients; but on the other hand, it granted considerable power to R&I performers.

The tension for power is persistent in the Research and Innovation sector, to the extent that often the freedom of choices of the agents who carry out these activities is the underlining *moutus* that can feed new discoveries. Even though, as suggested in the literature (Mazzucato, 2013), there have been experiences in which the contribution of the State has been pivotal for the development of new societal, economic and technological breakthrough innovations. Another persistent debate, as also reported by some of our interviewees, regards the identification of those actors who have the legitimacy, and power, to determine national R&I investments decisions, and whether these choices should be driven by market needs *versus* scientific considerations. Indeed, as for any delegation process, also in this case, the information asymmetry between those who govern research (principals – governments-) and those who conduct research (agents – R&I performers-) is the central issue (Guston, 1996).

Van der Meulen (1998) theorised three main solutions in order to stabilize the relationship between these players: blind delegation to scientists, consensus building among the actors involved or competition for resources, whose priorities have been decided by the principal. Nevertheless, all these forms of stabilisation are closely dependent upon the dynamics characterising different systems, therefore on the preferences, the perceptions of preferences, the strategies of both actors, and how their relation institutionalise (p.412).

Borrowing and expression from Braun the issue of science-government relations, and its related autonomy, is an antinomy or a paradox, because equally rational but contradictory views exist and solutions are consequentially hard to come by (Braun, 2003, p. 309).

Indeed, if on the one hand the main problem of science policy concerns the support of research with governmental funds; on the other hand, policy makers should not undermine the vigour, initiative and independence of scientific institutions (Ben-David, 1991, p. 297). Therefore, some extent of preference alignment between the principal and the agent is needed, that is what Trein (2017) defines as actor responsiveness.

This is in line with some of the arguments extensively illustrated in the case of the environmental policy sector (Dermont et al., 2017; Gross, 2007; Ingold et al., 2018; Kammermann and Ingold, 2019; Varone and Aebischer, 2001); meaning also policy preferences of target population become important, to the extent that the lack of stakeholders' support, or legitimacy, for the behavioural change proposed by a new instrument can hamper cooperation and undercut successful implementation.

Indeed, when actors are cooperating to produce a public good, the major problem is how to distribute the revenues of the sale of the public good among all contributors. Since, this is not easy to be measured, there is a tendency of each actor to "free-ride"(Braun, 1993, pp. 137–138). So, establishing communication channels between the political system and the addressees of political action, directly or through an intermediary agency, can help to overcome possible moral hazard, while easing the activation of policy instruments.

The available solutions to this issue mainly rely on either the sharing of common goals, therefore by including some joint formulation practices between the principal and the agent (eventually also through the involvement of intermediary agencies) or through monitoring and evaluation of results. These two scenarios differ in terms of the extent of discretion left to the target population and on the characteristics of the resulting governance arrangement.

These dynamics suggest how it has increasingly become necessary to consider how governments are not anymore simply and unilaterally authoritative, but they are instead dependent upon the action, acquiescence or support of others, which they do not directly control (Bressers and O'toole, 1998; Goetz, 2008; Salamon, 2002b). In the case of R&I policy issues, policy makers have to design actions which require to be legitimated by highly different actors, from the research production, development and industrial sector. This provides R&I performers with the power to shape the final instrument mix characteristics and to steer policy design process towards their preferences. While, on the other hand, part of this heterogeneous target population can be cut off, because of their incapacity to identify their needs and behave as a proper political constituency.

Consequently, we believe that the current challenge to understand R&I policy making process, requires to disentangle the relationships existing between the actors involved in the broader governance of the sector, both on the R&I performers and the government side (as explained in the paragraph above). An understanding of how target population (R&I performers) relates to R&I policy process and different political actors is needed. This perspective will provide useful information on the different opportunity structures R&I performers face along the policy making process, as well as to reconstruct their rationality of action.

This path of investigation closely mirrors a phenomenon taking place in R&I policy making defined by the OECD (2005) as horizontalization. Meaning the belief that a unique authority could autonomously identify in a top-down manner national strategy in R&I seems to have disappeared; leaving space to a policy-making environment where both top-down and bottom-up forces are present, and where actors bargain over the selection and design of national strategies (Gassler et al., 2008; Kattel and Mazzucato, 2018). The interrelated nature of R&I policies maps out a system of production where actors become interdependent on the basis of the exchange of resources; R&I performers do benefit of public funding for their activities, but also policy makers benefit from the results of these activities. And that is because, investments from both public and private actors are required (Kattel and Mazzucato, 2018).

2.6   What about policy instruments in R&I policies?

As suggested by the literature on Research and Innovation, policy mix are meant to design "encompassing common visions for the future" (Braun, 2008a; Flanagan et al., 2011). Their selection is a political moment, it should be based (ideally) on tackling the problematics of the innovation system, while requiring some extent of adaptation according to the different needs of each specific national context and public administration capacity (Borrás and Edquist, 2019). Indeed, policy instruments are said to be highly context dependent (Edler et al., 2016), because the actors and the institutional context in which they operate become crucial in determining their effects (Flanagan et al., 2011).

The combination between the increased complexity of problems in the R&I sector (Chou et al., 2017), and the incapacity of contemporary governments to move unilaterally, neglecting the preferences and resources of other social actors (Bressers, 2005; Fraussen, 2014; Smits, 2010), suggests that analysing policy design as a mere technical process becomes too simplistic and reductive of real-world complexities. We cannot talk anymore of a paradigm in

which one goal equals one instrument, where policy makers can freely select instruments from an already made toolbox (del Rio and Howlett, 2013; Edquist and Borrás, 2013; Howlett and Lejano, 2013; Knudson, 2009). Consequently, policy design can be rather depicted as:

> *"a case of muddling through (Charles E. Lindblom, 1959) in which the choice is shaped by the characteristics of the instruments, the nature of the problem at hand, past experiences of governments in dealing with the same or similar problems, the subjective preferences of decision-makers and the likely reaction to the choice by affected social groups (Howlett and Ramesh, 1993, p. 13)".*

Therefore, it has become necessary to investigate policy selection process from a two-way perspective, where both policy-makers and recipients have the power to influence the likelihood that certain instruments' features will be selected. Since ultimately policy instrument represent an attempt to "get people do things they might not otherwise do" (Schneider and Ingram, 1993, p. 513), we have to understand which are the factors that can influence the way different inducement embedded in tools' action have been assembled. The following table (Table 2.1) summarizes different contributions to policy instrument selection literature, while classifying them according to the principal variables influencing this process, the role of target population and the main theoretical assumptions characterising each perspective.

	Key variables for selection process	Target population role	Assumptions
Wilson, Doern (1974)	Governments prefer to start by first adopting the least coercive instruments, while moving up the scale. (if necessary, toward higher coercive instruments).	Recalcitrance/social pressure by target groups drive toward higher coercive instruments.	All instruments are technically substitutable. In liberalist governments, as opposed to interventionists, we should find more efforts to maintain instruments at a low level of coercion.
Majone (1976)	It is dependent upon: the relative distribution of power, political constraints, skills of policy makers to exploit the degrees of freedom allowed by the system.	The multiplicity of players constantly attempts to modify the rules of the game and to create powerful oppositions to prevent their selection.	Regulators, regulated and other interest groups interact in a single decisional structure.
Trebilcock, Richard, Hartle, Dewees (1982)	The interaction between constraints on government and the extent to which an instrument can be substituted with another, help explaining their choice.	Decision-makers will select instruments that confer benefits on marginal voters and costs on infra-marginal. This will be done in a way that accentuates their visibility while minimizing their costs.	Full rationality of decision makers. Voters' ignorance about the influence of policy output.
Woodside (1986)	The lower the political power of the target population, the higher the likelihood of adopting highly coercive policy instrument. This probability decreases with the more powerful actors are.	The nature of the target group represents a source of differentiation in instruments' features. Because certain groups will be able to demand more respect and autonomy from state officials for their interests.	Both the choice and the way in which an instrument is structured will reflect the political power of the policy clientele.
Hood (1986)	Instrument choice is a function of the nature of state goals and resources, together with organizational capacity of target groups.	Different instruments vary in their effectiveness according to the nature of the social group they are intended to influence. The larger is the target group (and the better organised) the more likely is that governments will use passive instruments.	Capability of decision-makers to be united and overcome collective action problems.
Linders, Peters (1989)	Organizational culture of the agency: the context of the problem situation and decision-making subjective preferences for instruments' combinations understood as being socially acceptable.	The relevance of contextual factors and the social relevance (the nature of the clientele served by the organisation).	Some instruments are more apt then others according to the context. The attributes of any given instrument are thought to matter less than the prevailing conditions.
Schneider, Ingram (1993)	The allocation of benefits and burdens embedded in the action of different policy instruments varies to the extent of power (strong VS weak) and the type of social construction (positive VS Negative) of target population.	Social construction of target population10 influences the agenda and the selection of policy tools as well as the rationalities that legitimize policies. Because different target population receive different messages embedded in each policy.	Target populations are assumed to have empirically verifiable boundaries (because policies create those) and to exist within objective conditions even though those conditions are subject to multiple evaluations (p.335).

10 These are cultural characteristics or popular images of the persons or groups whose behaviour and well-being are affected by public policy (Schneider, Ingram, 1993:334).

Table 2. 1 Policy instrument selection literature

	Key variables for selection process	Target population role	Assumptions
Van der Doelen (1998)	By combining stimulative (low coercion) and repressive (high coercion) forms of control models, policy-makers enhance the feasibility and effectiveness of a policy (giving contribute to the legitimacy and the taking to the effectiveness).	Legitimacy: the degree to which a certain instrument is assessed as feasible by policy makers and evokes acceptance among citizens and organisations. Effectiveness: the degree to which the chosen policy instrument contributes to goals' attainment.	Policy instruments have two purposes: to legitimate a policy and to effectuate it.
Howlett (2000)	The selection varies according to the type of instrument. Substantive: it is dependent on state capacity and complexity of social actors' state wishes to influence. Procedural: it is dependent on the interplay between sectorial de-legitimation and level of systemic de-legitimation.	Their characteristics and the extent of trust and legitimacy they require influence the type of instrument selected.	Substantive instruments: are intended to directly affect the nature, types, quantities and distribution of the goods and services provided by the society. Procedural instruments: have the purpose to alter or manipulate the policy process (used to manipulate number/nature of actors arrayed in policy subsystems).
Mac Donald (2001)	The balance of power between regulators-regulated.	Target population attitudes influence the coerciveness associated with the political dynamics at governmental level and variations in the level of instruments' enforcement.	The two main actors of a network will always function as a focal point for a larger network.
Howlett, Ramesh (2003)	The nature of the government in question and social actors' behaviour government is wishing to influence.	The likely reaction to the choice of the instrument by target groups influence the selection process.	The choice is shaped by instruments' characteristics, the nature of the problem and governments' past experiences in dealing with the same/similar problems.
Bressers, O'Toole (1998–2005)	Network interconnectedness and cohesion11 influence the selection process.	Governments actions are not simply and unilaterally authoritative, they depend on the action and the acquiescence or support of others.	The course and outcomes of the process depend on inputs, but also on the characteristic of the actors involved (their motivations, information and relative power).
Capano, Lippi (2017)	Different patterns of selection on the basis of legitimacy (sense making) and instrumentality (search for effectiveness) required for their selection.	The instrument has to be accepted by some (the public, the specific target groups, experts or external actors) in terms of the values of that specific sector or the instruments' capacity to achieve certain goals.	Decision makers are rational beings trying to find good reasons for believing that a policy instrument is suitable and useful.

11 Interconnectedness refers both to the contacts in the relevant policy formation process (and the habits that have developed in this connection over time) and also the relationship between these actors outside the actual policy process at any particular time. Whereas, cohesion refers to the extent to which individuals, groups and organisations emphasize with each other's objective insofar as these are relevant in other policy field. This empathy generally stems from shared values and shared worldview (Bressers, O'Tolle, 1998 p.219).

The theoretical approaches displayed in Table 2.1, provide valuable suggestions regarding the contributions of both policy-makers and recipients to the process of policy instrument selection. Reading through the cells it clearly emerges how these theoretical statements are not in contrast, but they rather compensate, and sometimes overlap, with each other. Indeed, they all consider the relevance of policy-makers and target group relationships in both the choice and the design of different instruments. The resources needed to activate policy instruments are not all simply given by virtue of being governments, but they are rather dependent upon the participation of different actors and the assets they can mobilize (Béland and Howlett, 2016; Capano and Lippi, 2017; Flanagan et al., 2011; Majone, 1976).

This is connected with the specificities related to any given decision-making situations and the extent to which the presence of different interests can influence policy-making outputs (Capano and Lippi, 2017; Doern and Wilson, 1974; Linder and Peters, 1989; Macdonald, 2001; van der Doelen, 1998; Woodside, 1986). Therefore, in theory, policy-makers should make sense of the type of resources needed to undertake certain actions, the public ability to find shared solutions, target groups' resources and attitudes for collaboration.

Governments are part of a broader decision-making environment, where the selection of different instruments is somehow constrained by the nature of the context in which decision-making takes place. Public choices have to be perceived as socially acceptable, to the extent that these represent interventions aimed at solving collective problems of general interest. Indeed, decision-makers have to fulfil the democratic principle of political accountability (through parliament and other auxiliary channels), the preservation of public sectors values and the support of the institutional structure[12] (Considine and Afzal, 2010). Moreover, public officials are subject to their electoral mandate embedded in the functioning of representative democracies, as much as to the constraints of the institutional structures regulating policy making process and the political system at large.

That is to say that governments are not free in selecting the instruments they prefer indeed, *"only authoritarian states do not have to bother with these limitations"*(Ringeling, 2005, p. 199). Therefore, in addition to the interest of stakeholders involved in the process it is also necessary to consider the political and institutional constraints actors face along the policy design process (Bressers and O'toole, 1998; Capano and Lippi, 2017; Howlett, 2000; Linder and Peters, 1989; Majone, 1976).

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[12] This is intended as the formal rules and procedures regulating actors' interaction.

Consequently, instrument selection, and the way they are implemented, is the result of a political process (e.g. following the formal/informal rules of the games North, 1990) which is dependent upon power dynamics, the institutional structures in which decisions take place and on the preferences of the actor involved in the R&I sector[13](Borrás and Edler, 2015; Capano and Lippi, 2017; Edler et al., 2016; Edler and Fagerberg, 2017; John, 2012; Laranja et al., 2008; Linder and Peters, 1989; Ringeling, 2005).

Both the literature on policy instrument and the sectorial R&I policy studies contributions, suggest how the interplay between state preferences, the ability to internally agree upon a general policy making strategy and the willingness to cooperate between stakeholders, are among the most relevant factors shaping policy instrument choices. All of that proves that, in order to understand policy instrument selection process, it has become necessary to shift the focus of analysis towards the actors involved, their interplay and strategies for action. From this perspective we will be able to analyse the effective influence that actors play in the definition of different national R&I strategies, as well as to comprehend the underlining rationalities for governments-target groups interactions and ultimately the different causal pathways leading to policy mix crafting.

2.7   The main lines of investigation

The ultimate goal of our analysis is to understand how the interactions between differently motivated actors can influence the process of policy instrument selection in complex governance arrangements like the Research and Innovation sector. The literature on policy instruments has extensively focused on the "technical side" of policy design process, therefore investigating the extent of coherence and contradictions embedded in their components (Howlett and Rayner, 2013; Rogge and Reichardt, 2016; Schmidt and Sewerin, 2018). Scholarly contributions have focused on the different trade-offs associated with instrument selection and on the complementary approach needed for their blending into mixes;

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13 The new configurations of public and private role in policy making process don't have to be read as a complete hollowing out of the state; but they rather represent a transformation of previous model of power distributions and practices (Peters and Pierre, 1998). As argued by Goetz (2008), *"governance constitutes part of the reality of how modern states are run, but traditional institutions, process and means of governing associated with the concept of "government" still prevail at national and probably also at European level"* (:271). This means that, although with different features, the components of state legitimacy in governing are present also inside new governance arrangements characterising contemporary democracies (Considine and Afzal, 2010, p. 4; Héritier and Lehmkuhl, 2011).

introducing concepts like "complementary effects", " goodness of fit" and "degrees of freedom" (Howlett and Rayner, 2013).

However, in the everyday policy making practices, and specifically in the case of R&I policies, given its inherent cross-sectorial nature and its underlining goal of designing more ambitious policy mix able to encompass different areas of public action; there could be some discrepancies between the intention, and the effective ability, to take on purposive instrumental policy design according to these principles.

The combination between the increased complexity of problems in the R&I sector (Chou et al., 2017) and the incapacity of contemporary governments to move unilaterally, neglecting the preferences and resources of other social actors (Bressers and O'Toole, 2005; Fraussen, 2014; Smits et al., 2010), has designed a policy-making environment where the selection of different instruments is somehow constrained by the nature of the context in which decision-making takes place. Indeed, although instruments may be, in some theoretical or technical sense, substitutable, in practice they all differ in a number of ways, making their selection a highly political matter (del Rio and Howlett, 2013; Edquist and Borrás, 2013; Howlett, 2005; Howlett and Rayner, 2013; Knudson, 2009). Indeed, it is precisely the possibility to identify "winners" and "looser" from their activation and the opportunity to shift the power balance that makes their choice a politically salient moment (Borrás and Edquist, 2019; del Rio and Howlett, 2013; Lascoumes and Le Gales, 2007; Linder and Peters, 1989; Salamon, 2002a).

That is why, in order to understand the reasons for specific instrument selection and policy mix evolutions, it is necessary to complement these approaches with a fine-grained investigation of the political side of this process. What a first sight could be labelled as "incoherent" policy mix evolution, in reality, it could simply be the result of an intentional, and strategic, political choice of actors. Therefore, to fully understand the selection of R&I policy instruments, it is necessary to investigate the political ideas of those actors involved in the selection, the power and preferences of the target population, the political and administrative costs associated with different alternatives (Rist, 1998).

Similarly, also in the field of R&I policies, despite a growing scholarly interest, the policy mix concept has been more often used in a normative sense, with few evidences (Ghazinoory et al., 2019; Neicu et al., 2016) of how innovation policy mixes are blended, and even thinner evidences of how their interactions effectively work (Meissner and Kergroach, 2019).

Therefore, our research agenda easily meet at the crossroads of the open questions characterising the policy instrument and more generally, the policy design of R&I policies literature. Namely, both streams of research overlooked the relationship of R&I policy instrument selection process with party politics and more generally with how alternative ideas can shape the way political objectives are translated into innovation-intensity targets (Bergek et al., 2015; Bhattacharya et al., 2017; Wang et al., 2019). Also considerations regarding lock-in, or path dependent, effects that long-lasting assumptions, or paradigms, about how the world should be (Béland, 2016; Wilson, 2000) can have on the design of R&I policy strategies are missing.

In order to support a more general understanding on the political stakes related with alternative R&I policy mixes, and the role of the actors who bear these preferences, we will investigate: How do the political preference of different cabinet periods influence the formulation of national Research and Innovation policy strategies?

This analysis will support a more general understanding of the political stakes related with alternative R&I policy mix scenarios, and the diachronic evolution of their governance arrangements. We will explain how governmental instrument mix preferences have evolved against different cabinet periods and the feedback effects related with the accumulation of long-lasting institutional aims attached to different dominant R&I paradigms.

One of the most intriguing peculiarities of the R&I policy sectors, which also make it an interesting case of "complex governance arrangement", is the fact that these policies address issues of a cross-sectorial nature, in which policy makers are increasingly asked to solve problems that cannot be neatly categorised into one policy sector, so-called "wicked problems" (Kattel and Mazzucato, 2018; Rittel and Webber, 1973). Therefore, R&I policy design practices are confronted with the challenge of assembling more ambitious policy mixes, which should be able to embrace multiple traditional sectors of policy responsibility.

From an institutional perspective this trend has been accompanied by an increasing blurring of competences between national executive departments, which consequently led to various patterns of institutional organisations among ministries with complementary competences in the sectors involved (Edler et al., 2016; Perry and May, 2007).

The literature tells us that the influence of different ministerial structures on policy decisions is related with the fact that social choices are mediated and channelled by the structure of different institutional arrangements (John, 2012; Powell and DiMaggio, 1991). And the actors

playing within their rules tend to experience selective perception biases, since different departmental identities influence their attention and understanding of policy issues (Scharpf, 1997).

This complexity doesn't relate exclusively to the different values and perceptions of the actors involved, but also to their structure of interaction. Indeed, the different morphologies of ministerial organisations portray different framings of the political priorities to be tackled (Peters, 1998), which in turn shape the necessary coordination practices to be established among different institutions. Therefore, R&I decision making process are increasingly facing an internal paradox (Kattel and Mazzucato, 2018) meaning, the more complex the issues they aim at solving become, the more compartmentalised is their policy-making process.

Previous investigations have recognized the influence that the variety of R&I institutional arrangements have on the ability of research and industrial actors to produce innovation, as well as of policy makers to invest and regulate (Braun, 2008b; Chung, 2013; Kuhlmann et al., 2010). Other contributions have focused on the policy making trade-off of alternative ministerial organisation structures (Edler and Kuhlmann, 2008b; Koch, 2008) and the challenges these pose to R&I policy making (Griessen and Braun, 2008). Our contribution builds on these findings, and aims at deepening our understanding of the way actors interact within alternative institutional structure. Therefore, specifically, we investigate how different morphologies of formal (and informal) ministerial organisations influence the ability of policy makers to design more ambitious policy mix, able to involve multiple traditional sectors of public action. Alternative ministerial organisation strategies require to strike a balance between coordination, in terms of designing an all-encompassing policy strategy; and specialisation, related with the fine-grained calibration of policy mix to specific contexts. Therefore, our analytical focus will be directed towards understanding how did the internal policy making ability in R&I policy sector was challenged by the underlining necessity to integrate different policy responsibilities? And, to what extent did different policy mix choices addressed (un)balanced or (un)coordinated blend of instruments to their targets?

The interrelated nature of R&I policies issues maps out governance arrangements where actors become interdependent on the basis of the exchange of resources. Indeed, R&I performers do benefit of public funding for their activities, but also policy makers benefit from the results of the same activities. And this is because in this sector investments from both public and private actors are required (Kattel and Mazzucato, 2018)

Indeed, if on the one hand the main issue of R&I policy concerns the support of research with governmental funds; on the other hand, policy makers should not undermine the vigour, initiative and independence of scientific actors undertaking these tasks (Ben-David, 1991). All of that is also consistent with the findings in the literature (Dermont et al., 2017; Gross, 2007; Ingold et al., 2018; Kammermann and Ingold, 2019; Varone and Aebischer, 2001) concerning the extent to which the lack of stakeholders' support, or legitimacy, for the behavioural change proposed by new instruments can hamper cooperation, while undermining a successful implementation. Therefore, the tension for power between policy-makers and R&I performers is persistent in this sector, especially for what concerns the identification of those actors who will have the legitimacy, and power, to determine national R&I investments decisions, and whether those choices should be driven by market needs *versus* scientific considerations. However, despite an increasing attention on the relevance of target populations for R&I policy design, and on the different forms of stabilisations of this conflict, the current scholarship is still loosely focused on understanding the strategic behaviours that move the choices of R&I performers. Therefore, in order to fully comprehend, and assess, the role policy recipient plays in the selection of policy instruments it is relevant to investigate:

How do target groups relate to the policy process and the actors involved in these dynamics? And, to what extent do the different strategies of interest intermediation influence the characteristics of the instrument mix selected?

Consequently, we believe that current challenges to understand R&I policy making process, require to disentangle the relationship between the actors involved in the broader governance of the sector, both on the R&I performers and the government side. We have to understand the way different policy actors manage to find a seat, and play a role, in the process of policy instrument selection and the extent to which the internal ability of policy makers (e.g. coordination of ministerial/departmental responsibilities), and their capacity to account for the characteristics of their target population influenced their capacity to design the right inducement.

2.8 Conclusions

The ultimate goal of our research is to investigate what is happening behind the scenes of R&I policy design process. Therefore, the extent to which different actors, with their resources, interests and preferences do manage to influence this process and the role that R&I performers, the recipient of these policies, play as catalyser of these choices. This will ultimately shed light on the way governments design more ambitious policy mixes aimed at solving the complex, and cross-sectorial in nature, social challenges our contemporary societies are facing.

As discussed in previous paragraphs, the design of R&I policies is a complex political process, which involves different actors, their interest and rationalities within a broader policy environment shaped by the legacy of previous interventions. Therefore, in our analysis, we will first focus on the way the political preferences of different cabinets, as well as the legacy of former decision-making rounds, influence the formulation of national R&I policies. Then, given the inherent cross-sector nature of the issues these policies are tackling, we will investigate how the different shape of ministerial organisation structures influence the coordination between ministers involved in the sector and in turn, the way practices affect the capacity of the resulting policy mix to integrate different policy responsibilities.

The holistic nature of many R&I policy issues maps out governance arrangements where actors become interdependent on the basis of the exchange of resources. Indeed, R&I performers do benefit of public funding for their activities, but on the other hand, also policy makers benefit from the results of the same activities. Therefore, due to the persistent tension for power between policy-makers and R&I performers, in order to understand policy instrument selection, it becomes relevant to investigate how target groups relate to the policy process and the extent to which their strategic behaviours influence the characteristics of R&I policy mixes.

The governance of R&I policy represent an extremely complex arena for policy making, exactly because the resources needed for instrument activation are increasingly dependent upon the participation of different actors, and the assets they can mobilize (Béland and Howlett, 2016; Capano and Lippi, 2017; Flanagan et al., 2011; Majone, 1976). For the same reason, public choices have to be perceived as socially acceptable, because it is precisely the possibility to identify "winners" and "losers" from instruments' activation, and their capacity to shift the power balance, that makes their choice a politically salient moment (Borrás and Edquist, 2019; del Rio and Howlett, 2013; Lascoumes and Le Gales, 2007; Linder and Peters,

1989; Salamon, 2002a). Since, ultimately, policy tools refer to the aspect of policy intended to motivate target population to comply with a policy, or utilize policy opportunities (Schneider and Ingram, 1993, p. 338); it is the relationship between decision makers and target population which can help us to understand the underling logic of instrument action. That is why we believe it is necessary to stress the analytical and theoretical contribution that a differentiation of the dimensions characterising instrument action (e.g. instrument shape and delivery structure) can make in understanding how both the choice, and the particular way instruments are crafted, reflect different relationship between decision-makers and policy recipients. Because, not only the types of instrument selected matter, but also their capacity to induce a specific behaviour while addressing the appropriate target (Candel and Biesbroek, 2016; EEA, 2005).

This will contribute to a greater understanding of the behavioural and political characteristics embedded in instrument action; while showing how both the choice, and the particular way instruments are crafted, reflect different extent of interaction between decision-makers and policy recipients. We will interpret this relationship as a two-way bond, where both actors have a stake in finding a common terrain for agreement, which can be consequently substantiated in the characteristics of the instrument mix selected. Then, through a diachronic analysis of policy design processes, we will highlight the relevance of actors' interactions for instrument selection, of the resources and political risks related with their application. Then, by focusing on instrument characteristics, and the history of policy mixes, it will be possible to sharpen the analytical focus so as to reconstruct the political dynamics that can explain the long-term mosaic of national R&I strategies, the characteristics of the actors involved and their internal dynamics of interaction.

3   Chapter 3: The theoretical framework

Policy instrument selection and design, contrary to how it has been portrayed so far, it is not a rational, linear and purely technical exercise. It rather represents a *muddling through* (Charles E. Lindblom, 1959), an inherently political process involving different actors, interests and constraints (Linder and Peters, 1989; Salamon, 2002a).

In our research, we aim at exploring the political dynamics taking place behind the scenes of policy design processes; by investigating actors' stakes for alternative trajectories of change and how these have been shaped along the formulation process into different instrument mix characteristics.

The chapter is organised as follow; first, we briefly describe the theoretical framework that will guide our analysis, as well as the analytical perspective adopted for analysing policy mix characteristics. Then we will operationalise policy instruments and describe their constitutive components; and after the concepts of Ideas, Institutions and Interest according to their distinctive features. Finally, we will define the path of investigation for the analysis of the two case studies, and outline our expectations regarding the political dynamics characterising their policy design process and then put forward our predictions on the different causal pathways explaining the selection of different instrument characteristics.

3.1   Institutions, interest and ideas: the influence on actors' interactions and instrument mix characteristics

In order to understand the different causal pathways leading to policy mix crafting it is necessary to narrow the focus of analysis on how actors do manage to find a common strategy for action. The quest for coordination requires governance ability both internally (among ministers) and externally (interactions with policy recipients). In addition to the reduced capacity that political institutions have to act unilaterally (as extensively discussed in Chapter 2), policy makers are also facing the challenge to design R&I policy mix able embrace multiple traditional subsectors of public action, in order to address these issues in an all-encompassing manner.

Therefore, policy makers are part of a system where, due to the complexity of problems at stake, the morphology of different decision-making structures, and the relevance of target

population activation, they are often bounded to share their authority with a plurality of actors. The more power is dispersed, the more different actors tend to have a say in the decision-making process; and the more difficult it becomes to foster the consensus necessary to support change. Consequently, in order to shed light on the policy design process, it is also necessary to understand the way in which the relationship between R&I performers and policy makers shape policy instrument characteristics. Indeed, given the resource dependency tie between target population and policy makers (Schneider and Ingram, 1990), and more generally the cross-sectorial nature of R&I policy issue, alternative solutions need to be legitimated by multiple actors. This is the reason why it becomes necessary to dig into the dynamics of this process.

An in-depth investigation of these activities needs to consider, the political ideas of those actors involved in the selection, the power and the preferences of the target population, the political and administrative costs associated with different alternatives (Rist, 1998). As discussed in Chapter 2, policy instruments are said to be highly context dependent (Edler et al., 2016), because the actors and the institutional context in which they operate become crucial in determining their effect (Flanagan et al., 2011). Decisions regarding policy design are made in a nested context characterised by a complex regime of goals, related instruments and settings, in which new elements have to be adjusted within the existing framework (Cashore and Howlett, 2007). In order to understand the political essence of this process, we need to figure out the extent to which the context, actors and their practices of interaction influence these dynamics (Varone and Aebischer, 2001).

Indeed, by analysing different political preferences of governments (e.g. ideas), we can understand various patterns of preferences for the content of the policy mix; so, how governments have differently formulated their R&I decisions. While, by looking at the interaction between different ministerial organisation structures (e.g. institutions), the patterns and the content of intermediation practices with target population (e.g. interests), we aim at illustrating the political process that leads to the selection of different instrument typologies. Since the effectiveness of tools varies according to different context-specific characteristics, also their perceived utility and attractiveness is dependent upon that. Therefore, it becomes necessary to specify these circumstances in order to understand policy design process and how different policy mixes have been assembled (Howlett, 2005; Salamon, 2002a)

In Figure 3.1 is depicted the analytical process we will employ to disentangle the dynamics, actors and processes embedded in policy design activities, which are ultimately meant to influence policy mix features.
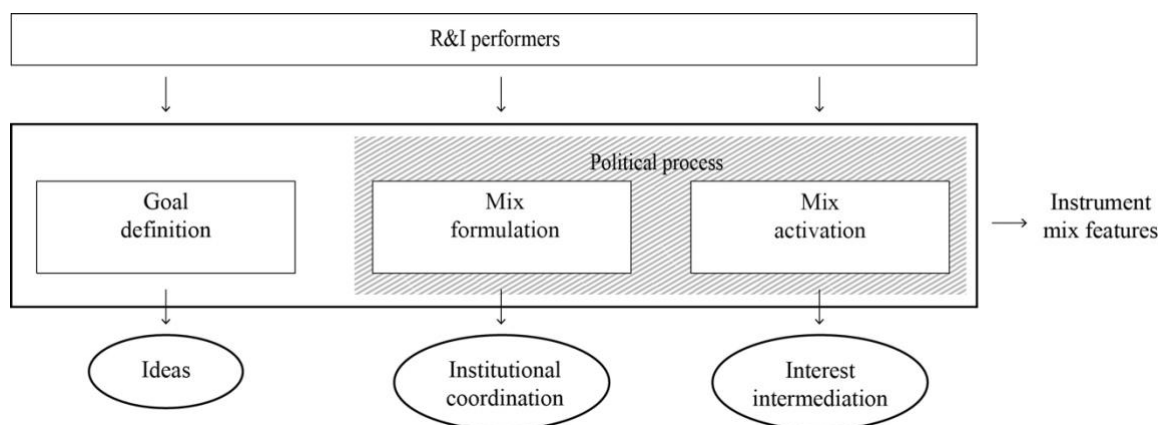
Figure 3. 1 Theoretical framework

Ideas are said to represent a proxy for a more general understating of the political stakes related with alternative R&I policy mix scenarios, and programmatic beliefs about its content. The ideational fractures activated by different R&I framings will help to shed light on the political payoffs alternative policy design will likely put in place and the distribution of attitudes among different governments. While the combination of actors' interaction both in terms of internal policy making ability (e.g. coordination between ministers/departments with R&I competences) and external ability to interact with target population, can help us to understand instrument calibration and the final characteristics of the mix adopted.

To translate these theoretical insights into the R&I policy sector it is first necessary to understand which are the political trade-offs attached to the scenarios different policy mix will likely put in place. Therefore, the political freedom decision-makers have in supporting the adoption of different instruments and the cleavages attached to alternative mixes. This will help us to understand the content of different national policy mix, and their likely evolution.

Secondly, we have to understand how internal and external cooperation between actors take place, influencing the shape and delivery structure characterising the final policy mix. This reflects the various patterns of ministerial specialisation, and related coordination practices, as well as the characteristics of different R&I performers, their power and ability to influence the policy decision.

From this perspective we will be able to analyse the effective influence actors play in the definition of national R&I strategies, as well as to comprehend the underlining rationalities for governments-target groups interactions and ultimately the different causal pathways leading to policy mix crafting. Therefore, we are interested in both explaining the political process that stand behind policy instrument selection, as well as the extent to which alternative interactions between ideas, interests and institutions influence the characteristics of the instrument mixes. By breaking up this effect, it will be possible to disentangle the political dynamics behind the selection and assemblage of different instrument mixes. More broadly, this will help us to understand how, given the opportunities and constraints provided by different governance characteristics, actors interact for the selection of policy instruments, and the extent to which the way this is happening influences resulting policy mixes.

3.2 The perspective on instrument mix evolution

Given the complex nature of policy design processes, many contributions in this field of studies have investigated the extent to which instruments interact with each other, and how, ultimately, this can shape public actions. Therefore, introducing concepts such as policy consistency (e.g. the capacity of instruments to reinforce each other's), and policy coherence (e.g. the capacity of policy goals to achieve synergies and positive connection between instrument actions) (Rogge and Reichardt, 2016; Schmidt and Sewerin, 2018). In the same vein Howlett and Rayner (2013) theorised different trade-offs associated with instrument selection. They talk about a complementary effect, so the extent to which instruments should avoid to invoke contradictory responses from target population, a context-dependent degree of freedom in the availability of choices and the necessity of a specific goodness of fit related with the adequacy of any policy mix alteration. These concepts underline different perceptions on policy making strategies, which are ultimately thought to influence the ability to design an instrument mix compatible with a specific environment.

Nevertheless, we have to bear in mind that the selection of policy design components reflects political and social values, national trends and ideas about "good" policies (Schneider and Sidney, 2009). Therefore, theoretically, when policy design components are modified, policy makers should account for the political and technical synergies among its constituents, in order to leverage the possibilities for change provided by the design structures into force.

We believe that in the everyday policy design practices, and specifically for the case of R&I policy mix, there could be some discrepancies between the intention, and the effective ability, to take on purposive instrumental policy designs according to these principles. Therefore, we do not want to take for granted the reflexive process by which policy makers take into account the principle of coherence and consistency in policy design practices.

Indeed, instruments are not stable over time, they display a high degree of interpretative flexibility, due the stratification of new instruments and changes in the rationale of policy-makers (Flanagan et al., 2011). They tend to come in a blend, consequently their actual state is influenced by the fact that they often come in a mix, and they layer upon layers of existing set of tools (Ringeling, 2005). Consequently, it might be quite complicated the exercise of clearly differentiating the goals and activities instruments were meant for at the moment of their design; to the extent that their action can be influenced by the context of pre-existing mixes, their overtime evolution and reinterpretation (Flanagan and Uyarra, 2010; Ringeling, 2005).

That is to say that instrument decisions do not take place in a *tabula rasa* because there are contextual, political and ideological constraints that shape the development of specific policy mix characteristics. Very few design processes begin *de novo* and when that was the case it reflected situations in which there were no previous history of policies in response to a perceived problem (Howlett and Mukherjee, 2014, p. 62). Therefore, new instruments are constrained by the existing policy mixes, and they have to find their place in-between the stratification of policy styles preceding their selection (Bressers and O'Toole, 2005; Edler et al., 2013; Flanagan et al., 2011; Howlett and Mukherjee, 2014).

Consequently, we cannot isolate the additionality effect of one instrument package over the existent blend, given their likelihood of overtime interactions and instability. Also, because, as demonstrated by Capano and colleagues (2019), the mix of instrumental shapes created by specific mix, makes a difference regardless of the "quantity" of the shapes included.

Therefore, since policy tools refer to the aspect of policy intended to motivate target population to comply with a policy, or utilize policy opportunities (Schneider and Ingram, 1993, p. 338); we believe that the behavioural relationship they establish between decision makers and target population can effectively help us to understand their logic of their action.

Analysing instrument mixes from the perspective of the behavioural changes required to the target population, can help us to explain more accurately their selection process (and related actors' stakes) as well as their stratified influence on the dynamics of R&I sector.

Indeed, tools have heterogeneous substantive requirements of behaviours embedded in their action, as well as different mechanisms through which they activate different constraints, or opportunities, on recipients. Therefore, since ultimately instruments represent the operational dimension of governance arrangements (Capano et al., 2019), by following the evolution of these characteristics, we will be able shed light on the internal dynamics shaping the design of national R&I strategies. This broader perspective over the evolution of the governance arrangements can help us to understand whether, and how, governments have been able to learn from previous experiences, and the extent to which feedback effects had a positive or negative influence on their decisions.

3.3 Conceptualisation and operationalisation of the dependent variable: policy instruments and mixes

Policy instruments represent different techniques of governance by means of which policy makers can connect their ideas and preferences with the formulation of different strategies in the effort to achieve their goals. They tend to be combined in specific mixes, in response to the complexity of problems they are aimed to solve (Edquist and Borrás, 2013) and to the historical stratification of public actions (Howlett and Rayner, 2013).

Consequently, policy mix represent a complex portfolio of instruments, which combines newly selected tools, with instruments already into force, in the effort to fulfil various, and in some cases even conflicting, goal (Bressers and O'Toole, 2005; Howlett and del Rio, 2015; Howlett and Rayner, 2007; Martin, 2016). Whereas, policy design can be defined as the political, and technical, process throughout which actors select and model policy instruments into different mixes (Howlett, Rayner, 2013), to achieve their goals and fulfil their interests.

The basic unit of thinking for investigating decision-making processes are policy instruments; by analysing their constitutive features, it is possible to understand the strategies and the goals embedded in public action. Their interaction within mixes is something which takes place over time (Edler et al., 2016), that is why a diachronic perspective of analysis is adopted. As suggested by the current scholarship (Edquist and Borrás, 2013; Rogge and Reichardt, 2016), we believe that some conceptual clarity needs to be provided before digging into the

components of policy instrument analysis. Therefore, when we refer to policy design, we mean the formulation process that stand behind the creation of different package of instruments; the policy mix concept encompasses the overtime process by which instruments emerge and interacts, while instrument mix refer to a temporally defined set of tools and their different configurations. To use a metaphor, when we refer to policy mix, we imply a longitudinal perspective of analysis, while with the term instrument mix we adopt a cross-sectional view, and we allude to the temporally defined features of a specific instrument blend.

3.4   Different categories for different purposes

In the policy instrument literature, we find various conceptualizations for governing tools, reflecting different theoretical approaches to the study of their origins and consequences. Therefore, identifying a common and shared definition for this concept is a rather difficult business, because *"there is a lack of coherence in the literature on public policy instrument regarding their definitions"* (de Bruijn and Hufen, 1998, p. 13). Indeed, as correctly stated by Hood (2007), alternative classifications represent *"ways of doing different kinds of analysis, rather than different ways of doing the same kind of analysis"* (p.141).

Despite the explanatory power embedded in various policy instrument theorizations, an overview of the different conceptualisations is helpful to understand the various analytical perspectives developed by the existent scholarship so far.

According to Vedung (1998), policy instruments represent "*a set of techniques by which governmental authorities wield their power, while attempting to ensure support and affect social changes*" (p.3). They represent ends in themselves, to the extent that instruments are the content of the political debate because they have the capacity to influence policy making process. According to Lascoume and Le Galés (2007) instruments are institutions, because they influence the way in which actors behave, driving forwards representations of problems, by organizing specific social relations between the state and those they are addressed to. On the same line of thoughts, Salamon (2002) claims that "*tools significantly structure decision-making networks, by defining actors that are centrally involved in a particular type of program and the formal rules they will play*" (p.64).

Differently, other streams of literature focus on the role of policy instruments as techniques and devices governments use to implement policies and achieve their goals (Howlett et al., 2009; Schneider and Ingram, 1990); as means through which governments attempt to shape

the life of its constituents (Hood, 1986) and make use of legitimate coercion (Doern and Phidd, 1983).

The various instrument conceptualizations mirror a likewise definition of theoretical frameworks to classify and identify the patterns for their applications; there is no best classification, but rather different categories for different research purposes. Following on that, it is necessary to highlight the heterogeneous meanings that have been conferred to these concepts, in order to understand the theories that stand behind their definition and classification. The following Table (3.1) summarizes the most relevant developments in policy instrument literature. The "classification" entry refers to the variables differentiating their features, while "instruments components" entry identifies various operationalization efforts of these concepts.

	Phidd, Doern (1983)	Hood (2007; 1986)	Schneider Ingram (1990)	Vedung (1998)	Howlett (2000)	Salamon (2002; 2012)	Lascoume, Le Galès (2007)
Meaning of policy instruments	Means for the management and manipulation of legitimate coercion.	Means through which governments attempt to shape the life of its constituents. They are about social control.	Techniques addressing the problem that people are not taking actions needed to ameliorate social, economic or political problems.	Set of techniques by which governmental authorities wield their power attempting to ensure support and affect social change. They are ends in themselves because they represent the content of the political debate.	Techniques and devices governments use to implement policies and achieve their goals.	Identifiable methods though which collective action is structured to address a public problem. They define the actors centrally involved in particular type of programs and the formal rule they will play.	Devices that are both technical and social, that organise specific social relations between the state and those it is addressed to, according to the representations and meanings it carries.
Classification	Based on the extent of coercion adopted for instrument action.	NATO Model resources, at governmental level simply by virtue of being governments (1983:4). Nodality, authority, treasure, organisation[14].	Different assumptions about how policy relevant behaviour can be fostered by the target population by providing: legitimation of authority; tangible payoffs (positive or negative); resources to enable individuals to make decisions; alternative values and beliefs (persuasion)	Inspiration from Etzioni (1974) on the basis of different type of relationship between governors and governed.	NATO model inspired by Hood (1983).	Because of the multidimensionality of policy instruments no single classification is possible, and these schemes will differ depending on which facet is used as the basis[15].	Have classified five major typologies of tools relying partly on the NATO model, improving and supplementing it by adding the type of political relations they create once in force and the legitimacy required to be applied.
Tool dimensions	Visibility, historical context, politicians prefer less coercive instruments.	Defective instruments (used to gather information) Effectives (used to modify behaviours).	Different responses to the lack of action be target population: authority tools, incentive tools, Capacity tools, Symbolic and Hortatory tools, Learning tools.	Action content: what the target population should do. Authoritative force: degree of power needed to obtain compliance.	What they do: substantive (modify distribution of goods and services) where do they operate: procedural (indirectly influence policy outcomes through the manipulation system of rules.	Type of good delivery; delivery vehicle, the set of organisations designate to the provision of the service and a system of rules.	Related to their effect: the type of political relations organised by instruments and the type of legitimacy that such relations presuppose

Table 3. 1 Policy instrument classifications

14 Nodality: the capacity of government to operate as a node in information networks; authority denotes government's assets or fungible resources; organisation denotes its capacity for direct action.

15 The author provides a range of dimensions according to which it is possible to compare different set of tools, namely: coerciveness (the degree of authoritative power instruments rely on), directness (the degree of involvement if the authorizing and financing actor in the precision of the service), automaticity (the extent to which instruments make use of existing administrative structures) and visibility (the extent to which resources devoted to a toll are visible in the governing budget). He believes that it is the only way through which it is possible to clarify the full matrix of choice policy makers face and the trade-offs between them (Salamon, 2012).

The classification adopted in this analysis build upon, and attempt to improve, the tripartition of Vedung (1998). The selection of this classification is consistent with the framework of analysis adopted indeed, it doesn't conceive the state as unitary actor, opening new venues for interpretation considering a shift towards a governance paradigm and the participation of different actors to the policy-making process. Moreover, it differentiates instruments on the basis of the type of connections established between governors and governed. Indeed, Vedung (1998) considers the relevance of the type of political relationships needed for tools' activation, overcoming the strictly resource-based approach of previous categories (Hood, 1986; Hood and Magretts, 2007; Howlett, 2000). Instruments are not selected from a toolkit, but they are rather dependent upon the context in which they are applied. This can require different extent of political and technical legitimacy from their target populations as well as different, and sometimes multiple, governing resources. Moreover, thanks to its analytical simplicity, this classification remains the most accepted in the literature and it is extensively applied in practical contexts (Salamon, 2002a)

This double-way relationship between those who exercise the legitimate power for the general interest, and the recipients of the measures, embodies the move toward a governance setting. Because, the resources needed for governing are not only localised at the governmental level, *"simply by virtue of being governments"* (Hood, 1986, p. 4), but these are rather dependent upon the action and acquiescence or support of others, which cannot always be directly controlled (Bressers et al., 1998).

3.5 Climbing down the ladder: from theoretical categories to operational devices

The multidimensionality inherent in policy tools complicates the task of describing and sorting them. Nevertheless, we have to bear in mind that the most appropriate tool dimensions useful for classification depend upon which outcomes are of particular interest to us (Salamon, 2002, p. 1644) leaving enough room for interpretation.

The operationalization of tool dimensions adopted in this research originates from the classification theorized by Vedung (1998). This choice is driven by the desire to focus not only on the influence the institutional structure plays on policy design activities, but also account for the role of actors involved in the process. Since we believe that the type of instrument selected is dependent upon the participation of different private, public or non-for-profits organisations, their preferences and the assets they can mobilize. Therefore, the dynamics embedded in the functioning of different instruments require to simultaneously account for different phenomena meaning, the dominance of a given policy style (Salamon, 2002), the political components embedded in the unfolding of

instrument actions (Vedung, 1998) as well as the power affected interest might have in this process (Woodside, 1986)[16].

Following on that we can operationalise policy instruments as made up of two components:

- Authority component: it represents the degree to which governments use their authority in order to induce specific behaviour on target population (Capano et al., 2019). Since public policy almost always attempts to get people do things that they might not otherwise do; or it enable people to do things that they might not have done otherwise (Schneider and Ingram, 1990, p. 513).

- Instrument shape component: it provides information on the characteristics of the inducement effectively administered to target population. Therefore, it provides information regarding the substantive requirements of behaviours embedded in instruments action, which can vary on the basis of the degree of coercion they apply on target population to obtain compliance and deliver expected outcomes.

- Delivery component: it represents different types of governing arrangements that accompany each instrument, therefore its activation process. Because, in addition to social control, every instrument embeds a particular way of exercising it, therefore influencing instrument action by privileging some actors and interests over others (Kassim and Le Galès, 2010; Lascoumes and Le Gales, 2007). This is closely related with the governance system in which decisions are taken and activated, that is dependent upon the acquiescence or support from others.

3.5.1 Authority component

It represents the common defining feature embedded in any policy instrument and it consists of the degree to which governments use their legitimate power in order to steer target population towards their intended behaviour. It can vary on the basis of the type of inducement applied for shaping target group conduct, and it remains intimately linked to the exercise of public authority.

The classification of policy instruments theorized by Vedung (1998), represent a solid point of departure to fully understand the degree of power embedded in public action. In order to have an accurate overview of its heterogeneity, it is useful to order instrument types on a continuum, from the most (regulative[17]) to the least (information) authoritative inducement their embed in their action (Figure 3.2).

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16 These factors characterise the multidimensionality (Salamon, 2002) embedded in policy instruments.

17 This conceptualization deviated from the standard English usage of the regulation concepts according to which the exercise of authority is backed by negative sanctions (or the threats of thereof). Regulations are often associated with threats of negative sanction, but this is not always the case. Moreover, this definition is also in contrast with interpretations equating regulation with all forms of governmental interventions. Here regulation is intended as one of the varieties of tools that government have at their disposal to exert power (Vedung, 1998 p. 30-31).
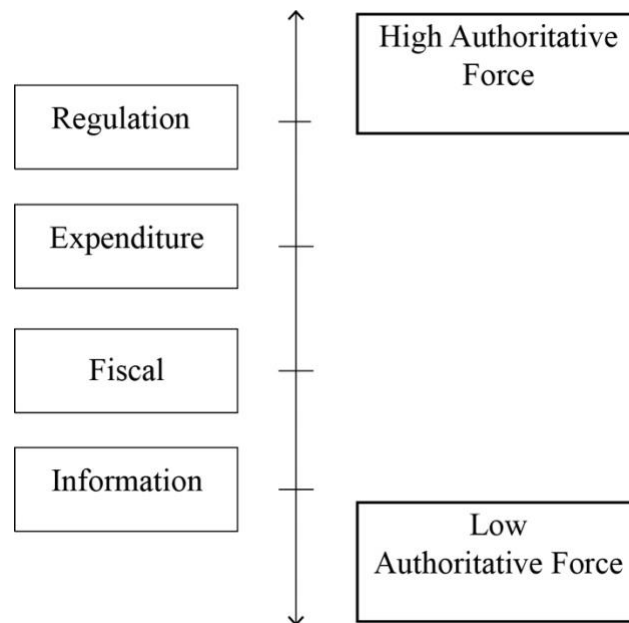
Figure 3. 2 Instrument Families

Regulatory instruments represent formal limitations of certain types of activities backed up by formulated rules and directives (Vedung, 1998, p. 31). They require (or forbid) some behaviours to target population under the threat of penalties identified by the rules embedded within them[18].

Then, at a medium level, we find expenditure instruments, which ask requirements or behaviours in exchange for subsidies (money, time, services or material benefits) they make available. Following on the lower authoritative scale we find fiscal measures, which do neither forbid nor require a given action, but they simply make costlier/easier to pursue certain behaviours. They do so by affecting the cost of alternative courses of action open to recipients.

An important addition to the classification of Vedung (1998), is the separation between expenditure and fiscal measures (which are clustered inside economic instruments by the former). This exercise is intended to fully grasp the heterogeneity of behavioural constraints these instruments will put in place. Indeed, the relationship of power between decision-makers and target population will be different in the case of expenditure-oriented economic tools (where government provides funds to certain actors/activities for a given purpose), compared to taxation-oriented economic tools (where

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18 Since our interpretation of institutions relates to the explicit norms and rules constraining individual actors' choices and influencing their behaviour, meaning the set of shared codes and beliefs influencing the rule of the game (North, 1990; Jhon, 2012; Peters, 2013). The creation of public agency, represent a highly coercive instrument. Indeed, such a change drives to the modification of the institutional structure and of the system of power relations among the actors involved in a given sector.

government rewards or charges certain behaviours of the target population). Therefore, economic and taxation instruments can be thought of having a different political economy (Woodside, 1983) [19]. These typologies vary on the basis of the underlying inducement involved in the governing effort, so on the extent to which policy makers can steer target populations towards the intended behaviour. Finally, the least authoritative set of instruments are information instruments, which rely on the voluntary cooperation of recipients. Indeed, they influence target groups conduct through moral suasion, by filling the information gap between actual and potential new behaviours. This variety of instruments clearly set out different typologies of authoritative relationships between decision-makers and recipients of public action.

3.5.2 Instrument shapes

Each family of tools displays a high degree of heterogeneity regarding the way in which their basic inducement is moulded to obtain compliance from the target population; because policy instruments containing similar inducement principles can be applied in different ways (Vedung, 1998). Therefore, even if instruments can be grouped into families according to the degree to which governments use their power, each of them displays a high level of variation in their action content, meaning in the different extent of constraints they can enforce (Woodside, 1986).

Consequently, tools have heterogeneous substantive requirements of behaviours embedded in their action, varying on the basis of the degree of coercion they apply on target population to obtain compliance and deliver expected results. This is what Salamon (2002) defined as instrument shapes; which *"should be the basic analytical units to adopt when assessing how policies are made, and which governance arrangement actually works in terms of policy performance"* (Capano et al., 2019, p. 5). Because, in addition to social control, any tool embeds a particular way of exercising it, influencing how target population will behave, by privileging some actors and interest over others (Kassim and Le Galès, 2010; Lascoumes and Le Gales, 2007). An example of the different design features embedded in policy instrument shape is the case of loans and grants. Indeed, both shapes fall under the family of expenditure instruments, therefore both instruments are used to encourage specific activities through the provision of funds, but they differ regarding the degree of coercion applied on

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[19] These two types of instruments create different typologies of preferences and incentives on the behavioural decisions of recipients: *"I'll give you money to do this (expenditure)"; "If you do (don't do) this I'll give you money (taxation)"*. Subsidy involves money that comes to recipients from the government in the form, for instance, a grant (a transaction that involves government ownership and control over the money priori to receipt of the grant); whereas fiscal instrument involves money that the government has not taken from the recipient, which suggests that the recipient has been, and remains, the owners of those funds. A second difference is their visibility. While expenditures will be funded through taxpayers' contribution, the tax expenditure involves foregone revenue. The importance of the visibility is related with the fact that the exercise of power entails winners and losers, and thus conflict. Therefore, the extent to which the action is easily associated with the government can become an important variable in government decision-making (Woodside, 1983:175).

target population. Due to the expectation of repayment, and possibly the fulfilment of some conditions attached to it, loans are more coercive than grants, which basically identify a goal (or a behaviour) and simply provide funds for it. This suggests us how policy instruments can be disaggregated into relatively small units, and scored according to the behavioural dimension of interest for the analysis (Schneider and Ingram, 1990, p. 522) underlining how any tool is actually a "package" of different elements characterizing the various aspects of public action.

The Figure 3.3 below represents a classification of the most employed instruments in the research and innovation sector according to different policy instrument families. This list is the result of the analysis of secondary sources[20] and it will likely be modified overtime, because the variety of policy instruments available to decision makers is limited only by their imagination (Howlett, 2009, p. 114). Nevertheless, it represents a satisfactory overview of the different instrument shapes of governing action in the Research and Innovation sector.

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[20] (Izsak et al., 2015, 2013; Veugelers, 2015).

Regulation	Intellectual Property Right regulation Agency for evaluation HE + research Funding agency Investment fund Financial market creation Administrative simplification regulation Labelling Coordination committee Advisory committee Contract Technology transfer organisation + Research institute, Technology transfer organisation
Expenditure	Public procurement Loans Cash advance Equity participation Economic guarantee Targeted funding Competitive funding
Fiscal	Tax reimbursement Tax reduction Tax exemption
Information	Public Private Partnership Consulting service Information campaigns

Figure 3. 3 Instrument shapes (by authoritative dimension)

Each instrument type is organised along a continuum from the most to the least authoritative family, while the within-shape description is listed by decreasing coercive order, meaning according to the extent to which target population is free to choose alternative behaviours. An analytical perspective able to consider the combination of different shapes into different instrument mix can provide a more accurate assessment on the extent to which the variety of behavioural changes required to target population has been differently coordinated.

3.5.3 The delivery component of policy instruments

This dimension focuses on instrument activation process, reflecting the mechanisms through which tools trigger different constraints/opportunities on recipients (Salamon, 2002a). It provides information on the different types of governing arrangements which come together with each instrument.

Policy design process doesn't really end with the enactment of policy decisions, but it rather continues along the structure of political relations that instruments unfold in the post-enactment process (Lascoumes and Le Gales, 2007). This is closely related with the fact that establishing an instrument involves a great number of different tasks, and each can attract the interest of various actors and connect various specific practices (Simons and Voß, 2018, p. 21).

Consequently, the extent of automaticity embedded in instruments activation provides insights on those actors who have the power to steer their action along the management process; describing the parties involved in a particular tool management (Bouwma et al., 2017).

Low automatic instruments are accompanied in their enactment by the involvement of an administrative or organizational structure (e.g. bureaucracy, public agency, local-regional actors) to unfold their effects, therefore adding an intermediary actor between decision maker and recipients. An example of an instrument with low degree of automaticity is an expenditure instrument, like competitive funding for research, through which governments earmark resources for the development of basic research programs (e.g. ministerial funding for research). In order to become effective, the instrument requires the creation of a system of actors, or organisations, which draft the call for funding, collect the requests and analyse them, grant the money to the winner and undergo the management (and eventually) evaluation procedures. Consequently, by adopting this type of delivery structure, the responsibility for providing the service is shared among multiple public organizational entities.

Whereas, automatic instruments rely on already existent organizational structures, like the market, the fiscal system or the private credit system. This type of delivery structure requires a different extent of resource investments, since it makes use of already existing structures. An emblematic example of this system are tax deductions for investments in R&D provided to enterprises. In this case, the recipient can automatically benefit of the measure by deducting tax expenses related with innovative investments (e.g. advanced machinery, new skills), directly from their balance sheet.

The main difference regarding these two delivery structures stand in their visibility and on the political burden attached to their effects. Low automatic instruments tend to be highly visible because of the bureaucratic machine they put in place for their enactment, consequently they are highly exposed to credit-claim and blame avoidance political mechanisms. Differently, automatic structures are less visible, inasmuch as the effective enactment of the tool is mainly evident just to the recipient and the grantor. Therefore, their effects tend to be less evident to the general audience.

A "certain overlap exists, between the automaticity dimension and the directness dimension of tools. However, not all automatic tools are indirect and not all indirect tools are automatic" (Salamon, 2002, p. 1663). This similarity is due to the fact that both dimensions focus on the mechanisms through

which policy instruments unfold their effects (post-enactment phase). Anyhow, the dimension of automaticity provides a fine-grained contribution of various policy style preferences attached to instrument activation, on the role of actors engaged in procedures that succeed policy instrument formulation, and their power to steer their enactment.

Figure 3.4 provides a classification of different delivery structures for instrument activation, on a continuum from low to high automaticity.
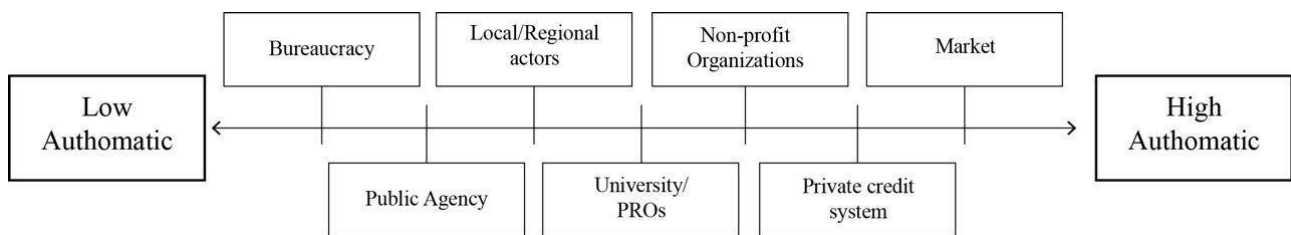
Figure 3. 4 Delivery component

At a low degree of automaticity, we find delivery structures relying on the involvement of public management resources, existing bureaucracies must be appointed to new tasks, new organisations must be created or agreement with decentralised administrative structures have to be set in place.

Mixed type of delivery systems relies on the cooperation with Research and Innovation performers like universities, public research organisations, enterprises, venture capitalists or foundations. Finally, instrument with highly automatic delivery system make use of existing management structures, like the private credit system (e.g. banks) the fiscal system or the market. In these cases, instruments unfold their action by exploiting the consolidated system of relations already into force, requiring a reduced amount of public management resources.

The degree of automaticity is not an exclusive component of policy instrument delivery; indeed, it is rather highly context dependent. That is because the same instrument can be more or less automatic according to the way in which it has been activated. For example, an economic instrument like loans can be either directly provided by governments (low automatic) or by private lenders like banks (high automatic).

Therefore, instruments differ on the basis of the amount of public resources that are necessary for their management, comparing structures of control based on already existent self-operating systems, to command-and-control techniques which have to be undertaken by public agencies or executive bureaucracies (Salamon, 2002). Their different activation mechanisms, together with the coercive nature of various shapes, influence the extent of discretion left to the target population in the management of tools activation, shaping various actors' interactions that can activate different

processes of change (Mahoney and Thelen, 2010). Thus, one might hypothesize that just as the choice of different policy instruments will reflect the political clientele of the policy, also the way in which they are structured and assembled may reflect similar considerations (Woodside, 1986).

3.6 Conceptualisation and operationalisation of the independent variables

Governing actors have become part of a system where, due to the complexity of problems at stake, they are often bounded to share their authority with a plurality of agents to cope with new policy problems. Therefore, in order to disentangle the characteristics of actor interactions for instrument selection, it has become necessary to understand how the interplay between different institutional characteristics, political framings and interest intermediation structures shape policy making processes. These features are relevant to the extent that they influence the different characteristics of the national governance of R&I, which ultimately affect the available strategies governing actors have at their disposal in order to steer the sectors towards their preferred goals.

The following paragraphs, builds on the literature review of Chapter 2, and bring the theoretically relevant concepts for explaining policy instrument selection at the level of empirical analysis.

3.7 Ideas: the role of different Research and Innovation paradigms

Innovation rarely represents a goal in itself, but rather a means to achieve broader political goals like economic growth and competitiveness, increasing employment, environmental protection and strategies to tackle social and health challenges (e.g. Grand societal challenges). Consequently, R&I objectives become one of the instrumental paths through which national governments attempt to reach these wider purposes, by means of meso-level innovation goals. How these objectives have to be translated into innovation-intensity targets, and the way in which these interventions should be balanced represent a relevant political matter (Edquist and Borrás, 2013). Therefore, policy design is a political process exactly because instruments embed different framings concerning individual perceptions on a given problem, and possible strategies to tackle it.

As emerging from the historical overview of R&I policy rationalities (See Chapter 3), the logic behind the design of public action in R&I has been driven by a multiple array of motivations. Starting from the highly top-down market fixing logic of the WWII period, passing through the first mover industrial advantage strategy of the post-war phase, to the systemic perspective of the National Innovation System and finally to the instrumentality of R&I for tackling grand societal challenges.

These rationalities reflect how policy makers attempt to make-sense of the reality and elaborate different policy strategies, on the basis of their perceptions of the problems at stake and their political framings on how to handle the interpretation of policy issues.

On the one hand change is said to come along with, and being supported by actors, their power in promoting new framings and the resources they can mobilise (Bouwma et al., 2016; Streeck and Thelen, 2005). Indeed, the capacity of some governance arrangements to last over a long period of time, has been explained as the outcomes of different coalitions of actors able to gather enough resources to keep the status quo intact (Mahoney and Thelen, 2010).

On the other hand, the room for manoeuvre actors have to design new policy interventions is consistently influenced the by the existent set instrument mixes (and related political dynamics), which can constraint, or ease, the likelihood of different scenarios for change. This is closely related with the fact that "the character of instrumental beliefs of previous policy instrument selection will constraints the likelihood and the direction of political change" (Hall, 2010, p. 208). Consequently, policy instrument selection, and more broadly, the policy-making process, can be thought as being linked to the nature of the general governance context and long-term policy styles embedded in a given sector. Because previous interpretations of policy problems (framings) influence the following decision-making rounds according to either a dominant set of beliefs or the supremacy of a set of policy instruments perceived as the best technical or political strategy.

Indeed, at the individual and organizational level, policy makers work within a set of pre-established abstract aims and implementation preferences linked with the dominant governance mode and long-term policy preferences in the sector (Cashore and Howlett, 2007). Therefore, new policy initiatives have to deal with, and are bound to be affected by, long-term legacies emerging from earlier rounds of decision-making activities, and the system of power distribution resulting from their consolidation over time (Edler et al., 2013; Flanagan et al., 2011; Hall, 2010; Howlett, 2009; Howlett and Mukherjee, 2014; Linder and Peters, 1989). These cognitive legacies refer to the historical stratification of different institutional aims; which mirror the dominant policy framings characterising the evolutions of state preferences for R&I strategies. They can be operationalized along the lines of the technological policy ideal types theorised by Ergas (1987)[21].

21 As pointed out by Cantner and Pyka (2001), the indirect classification method theorised by Ergas (1987) represents a crude insight on the technology policy of a specific country. Anyhow, given the comparative breadth of his classification and the richness of details it is able to embrace, it still represents a very useful heuristic tool in order to classify macro-level policy trends in R&I along different historical and political contexts.

Diffusion Oriented paradigm

It concerns strategies aimed at upgrading knowledge competences among different sectors of R&I governance system. The main goal of public intervention is widely defined as of increasing overall national economic capacity by concentrating on a series of processes: investments in economic infrastructures, technology transfer, cooperative R&D, creation of university and industry links (Cantner and Pyka, 2001; Ergas, 1987). Within this style, governments do not display long-term preferences for any specific sector of knowledge creation and development, but they rather endow heterogeneous sectors approximately for the same extent.

Research targets are broadly defined, as well as the spectrum of industrial and technological sectors involved as possible recipients. Policy decisions tend to be taken in a decentralised manner. Meaning, central governmental agencies paly a limited role in implementation, leaving room for a greater involvement of actors from the private sector (Ergas, 1987). More broadly, these strategies focus on the acquisition, diffusion and assimilation of new technologies in industry, rather than aiming at creating brand new sectors (Chiang, 1991).

Mission Oriented paradigm

Governments have a strong hand in the R&I process, by selecting specific technological sectors, they support large industrial efforts and organize research through large public institutions mainly in selected sectors (Borrás and Seabrooke, 2015). Policy programs are distinguished by a high degree of centralization, together with the central determination of goal and a restricted arena of technologically sophisticated agents participating in the execution of programs (Foray et al., 2012). Public actors play a central role in the innovation process, in both leading the generation and exploitation of radical innovations, and in the creation of entirely new industries (Chiang, 1991). The target of intervention is clearly defined and associated with technological objectives and future economic applications. In relation to that, it may emerge a tendency toward the concentration of investments in large companies, which have at their disposal the necessary infrastructure to develop these programmes (Ergas, 1987).

Finally, a consistent share of publicly funded research is performed in house, meaning within public research organisations or laboratories (Cantner and Pyka, 2001) (or through military R&D investments Ergas, 1987).

Mission and diffusion-oriented policy styles represent two ideal types for different dominant policy framings, providing actors with a particular world view on the appropriateness and consequentiality of different policy mixes in the R&I sector (Campbell, 1998; Sanz-Mendez and Borrás, 2001).

Therefore, they influence policy design process shaping problem interpretation and the definition of strategies to solve them. Indeed, despite policy makers seem to have a large choice concerning which policy instrument to select; in reality, they tend to repeatedly choose them from a much more limited set of alternatives conditioned by the technical and political legacy of previous interventions (Cashore and Howlett, 2007; Howlett, 2009, 2005; Mahoney and Thelen, 2010). That is why policy design doesn't take place in a *vacuum*, but rather in a political context where different policy styles do not substitute their predecessors, but develop new features, adding to the existing structures of priorities (Gassler et al., 2008).

The design of alternative policy strategies is conditioned by the legacy of previous interventions and by the characteristics of the dominant governance arrangement into force. Therefore, long-term state and societal preferences can shape the political debate around possible alternative design, hence constraining partisan preferences (Jungblut, 2015).

If we translate these dynamics within the on-the-ground policy making process, where collective political actors compete with each other in order to get the legitimate power to govern, it is clear how R&I policies can mirror different political priorities[22]. Specifically, the two main lines of differentiation between diffusion and mission-oriented paradigms reflect well established preferences on what governments should do, and how they should make it happen. The structural differences between these two paradigms, though not as sharp as they may at first appear to be, play a relevant role in explaining different patterns of R&I governance trajectories (Ergas, 1987). Consequently, we would expect to see different trends in the distribution of government attitudes for R&I policy mix, given the different beliefs on the accuracy and effectiveness of instruments associated with different dominant paradigms. More specifically:

H1: in countries characterised by a dominant diffusion-oriented paradigm, it will be more likely that governments will display preferences for less authoritative and more automatic instrument mixes.

H2: in countries characterised by a dominant mission-oriented paradigm, it will be more likely that governments will display preferences more authoritative and less automatic instrument mixes.

In representative democracies citizens' opinion and preferences are supposed to be articulated and aggregated by parties and other type of political organisations. Consequently, we would expect that

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22 Because, ultimately, the objectives of innovation policies have to do with the different national traditions and form of state market society relations not to mentioning the ideology of government in office (Edquist and Borrás, 2013, p. 1514).

different preferences concerning R&I policy styles could be present in relation to different political parties, to the extent that electoral competition can be thought as being about the control over resources and their different management. Following on that we would expect that changes in governing parties, those political actors producing legitimate framings, can open windows of opportunity to undermine the dominant ideational framing in national R&I strategies. Indeed, as argued by Hall (1993), changes in the dominant political framing can come along with a combinations of different political aspects, like the position of institutional advantage of some actors, the resources they can command and exogenous factors affecting the power of one set of actors to impose its paradigm over others. These conditions likely represent the post electoral moment, when new political actors take office and can be able to redirect the dominant R&I policy style towards the framings representative of their interests (Capano, 2009; Natali, 2015).

Indeed, elections represent an institutionalised window of opportunity where new ideas (and policy entrepreneur who support them) can find a place into decision-making venues and alter dominant policy styles. Policy rationales evolve from a highly path dependent process (Laranja et al., 2008), instruments can become bearers of lock-in effects (Capano and Lippi, 2017), and policy makers tend to avoid being politically related with past instruments mixes that are not associated with their political framings (Voß and Simons, 2014). Different parties in government can find themselves in a situation of constrained party preferences (Jungblut, 2015), given that the process of political preferences formation is shaped by the legacy past political struggles (Kriesi, 1998, p. 177).

Consequently, we would expect a trade-off between the willingness of new governing parties to modify the dominant policy style into force and the room for manoeuvre they have given the characteristics of the instrument mix inherited from previous governments. Therefore, we expected that the characteristics of cabinet turnover will likely influence the evolution of governments' preferences for policy mix features, namely:

> *H3: the more similar the political orientations between incoming and outgoing governments, the less authoritative will be the diachronic evolution of instrument mix preferences.*

Therefore, by diachronically comparing the evolution of instrument mix preferences for different governing party (along the lines of instrument dimensions), it will be possible to map out the connection between actors' partisan positions and policy instrument preferences in R&I sector. We expect that in parallel to the change of party in government, and of their policy style preferences, a change in the preferences for R&I instrument mix characteristics will likely occur. Ultimately, this could help us investigating the counteracting effect of institutionalised window of opportunities (cabinet changes) and the persistence of certain policy paradigm characteristics (mission VS diffusion oriented), on the evolution of governmental policy mix preferences.

3.8 Institutions

Institutional structures influence actors' behaviour to different extent. Primarily, by producing regularities on aggregate behaviours, by shaping how actors build their expectations regarding others' actions (John, 2012). They manipulate the functioning of agent coordination, according to how differently powerful actors are distributed within their structures (Borrás and Edler, 2015; Lepori, 2011). Ultimately, they mediate individual choices (Powell and DiMaggio, 1991) influencing information exchange and the strategies various actors are able to pursue (Peters, 2000). Their relevance for R&I policies is striking, to the extent that by its inherent nature the sector is characterised by policy making responsibilities lying on the remit of different ministerial organisations (Edler et al., 2016; Edler and Fagerberg, 2017). It is exactly because of the blurring of competences between R&I responsibilities, and the dispersion of power among different organisations that in order to understand their operating system it is necessary to take into account formal institutions side by side to informal ones. There is often a tendency to think of formal and informal institutions as alternatives, but these structures assist one another, and together they represent the backbone of the governance arrangement (Borrás, 2009; Peters, 2012). This is because, even if formal institutions define the rules of the game (North, 1990), many of the core interactions among actors take place informally[23].

Consequently, in order to coordinate their functional responsibilities, policy makers have developed different strategies to harmonise competences among the various ministries.

In the literature we find different conceptualisations of these practices, Braun (2009) call them external, and internal, coordination practices, focusing on the type of ministerial coordination necessary to guarantee the coherence of public action. Whereas Verhoest and Bouckaert (2005)label them as horizontal, or vertical, specialisation strategies, which also recalls strategies to purposefully align departmental structures in order to enhance policy capacity.

Both typologies portrait how differently governments have framed the political priorities to be tackled in terms of formal institutional structures and coordination practices necessary to fuel policy making process. In the specific case of R&I policies we conceptualised these different ministerial organisation structures as follow:

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[23] Consequently, it is necessary to make a distinction, formal institutions refer to the rules and procedures that are created, communicated and enforced through channels widely accepted as officials (Helmke, Levitsky, 2004:727). While informal institutions are socially shared rules that can be created communicated and enforced by the willingness and the ability of powerful or entrepreneurial actors. They represent the decision-making practices led by informal norms, intermediation rituals among actors, which are often enforced outside officially sanctioned channels (Helmke, Levitsky, 2004; Culpepper,2011).

Internal Specialisation Patterns

Overall competences related with R&I have been centred around one *superministry* (Braun, 2008b), who has acquired all the capabilities and decisional leadership over the entire policy sector. The differentiation of responsibilities take place within a unique organizational structure in a vertical manner among departments or directorates. Attempts of coordination hinge upon intra-organizational bargaining, hence transaction costs between different areas are internalised. Different tasks across the policy cycle are split-up among departments within the same organisation and issues of administrative coordination, can be tackled in the shadow of ministerial hierarchy.

External Specialisation Patterns

Policy responsibility are decoupled among functionally homogeneous organisations, and specialisation is organised horizontally among peers. Ministers attempt to coordinate externally, by means of different type of interdepartmental bargaining (Braun, 2008a). In many national examples these have been supplemented by the creation of platform for interministerial dialogue (e.g. the CIPE in the Italian case) or common budgeting procedures (e.g. the MIRES in the French case). The most relevant drawback of this strategy is related with the fact that normally, decision-making venues that do not have their own organizational identity, tend to be an arena for exchanging information dependent upon the political will of singular ministers (Braun 2008a); rather than an effective policy-making laboratory.

In both cases of ministerial specialisations an encompassing R&I policy strategy has been parcelled through a differentiation of responsibilities either internally or externally. Despite their different shapes, both experience transaction cost problems, related with the need for coordination between actors. Indeed, they all require to strike a balance between coordination, in terms of designing an all-encompassing policy strategy, and specialization, related with the calibration of policy mix according to specific contexts. The success of alternative structures is highly dependent upon the capacity to create dialogue among different policy responsibilities; therefore, the formal picture of how things work, based on codified procedures and organization of competences among ministers, can tell us only part of the dynamics taking place in the governance of R&I.

Consequently, we can hypothesize that (formal) institutional structures can influence the ability of different ministries (or department) to collaborate:

> *H4: countries undertaking similar ministerial specialisation strategies (formal institutions)*
> *will likely adopt similar coordination practices (informal institutions).*

Indeed, the way through which policy makers foster synergies to enhance the effectiveness of their interventions is more flexible, and it is bound to be affected by different internal agreements and entrepreneurship of actors. These alternative strategies (informal institutions) influence their internal policy ability (Giest, 2016; Lepori, 2011; Trein, 2017). Because, if coordination or dialogue is difficult, policy objectives and instruments may not be appropriately designed and implemented; consequently, each minister (or department) can decide to design policy to maximize their interest, without an overall consensus for a holistic R&I approach (Chung, 2013). Therefore, institutions serve as (potentially) integrative structures to add stability to the system, but given the fact that they interact with actors, their interests and ideas (Blyth, 2003), they can also trigger unintended effects and they might not be fully equipped for different issues. Because, the larger and the more complex governmental bureaucracies become; therefore, the higher their level of specialisation, the more likely it will be that competitive behaviours would emerge among departments (Chung, 2013). In case of high level of organizational fragmentation, it will be more challenging to collectively agree on a unique strategy for public action. Consequently, we will expect that institutional fragmentation will affect ministerial strategies of action to the extent that it requires a minimum degree of coordination in order to avoid tensions between policy making responsibilities.

3.9 Interests

In policy making activities requiring technical competencies and skills that public decision makers cannot provide by themselves, like in the case of knowledge or technological intensive activities (e.g. R&I policies), public actors are likely to delegate certain tasks to external agents[24]. Consequently, policy makers become somehow dependent upon target groups' resources in order to translate their different framings into practices. This two-way bond reflects the inability of contemporary governments to move unilaterally, neglecting preferences and resources of other social actors (Bressers and O'Toole, 2005; Fraussen, 2014; Smits et al., 2010).

Since, policy tools refer to the aspect of policy intended to motivate target population to comply with a policy or utilize policy opportunities (Schneider and Ingram, 1993, p. 338); certain instruments' features are necessarily shaped on the basis of target population characteristics. Therefore, despite

[24] Private sector business enterprises are dominant players in the field of scientific, engineering and technological activities to the extent that they operate a very large proportion of the scientific engineering, technological activities used in the economy, and they play a large role in developing human resources engaged in all these activities (Arnold, Boekholt, 2003:2). But these can also include public research operators in the field of R&I, like universities, Public Research Organisations, Laboratories.

the different preferences between decision makers' and target groups, a minimum extent of agreement for the entrusted activities should be found, because target groups have increasingly acquired the power to nullify, or alter, the operation of policy instruments (Woodside, 1986).

This consensus will be grounded on the final characteristics of the instrument mix selected, since the extent of competence delegated to third party, reflects the room for manoeuvre left to them in the application of public authority (Salamon, 2002b). Therefore, the relationship between governing actors, and the performers of R&I activities, revolves around the various type of contracts stipulated among the parts; which are subject to the instability of power balance between policy makers and target groups (Braun, 1993). To overcome uncertainties, policy makers have developed different intermediation strategies to institutionalize conflict, such as the creation of R&I funding organisations, which can help the dialogue between policy makers and target groups (Braun, 1993; Van der Meulen, 1998b). In many countries, specialized research and innovation agencies are appointed to the program management and development of national R&I strategies, with the task to translate political guidelines, or thematic priorities, into different practices (Nauwelaers and Wintjes, 2008). More broadly, the creation of specialised agencies is also a practice related with the development of New Public Management (NPM) principles, according to which national bureaucracies increasingly rely on external bodies and committees to formulate and implement their policies (OECD, 2005). In the specific case of R&I policy, NPM has consistently shaped the forms of public action, introducing decentralisation, contract management, privatisations, PPPs and more generally the dispersal of power to quasi-state and non-state actors (Borrás, 2009; Flanagan et al., 2011).

Within this context, public agencies represent an intermediary actor located in-between different societal spheres, with the task to institutionalise social interfaces and to create common contexts for action (Hartmann and Kjaer, 2015) These actors can display different organizational characteristics, which can be thought to mirror various structures of interest intermediation between policy makers and target group. To operationalise the varieties of intermediation strategies we build upon the typology of Arnold, Boekholt (Arnold and Boekholt, 2003) in order to provide an improved classification, as illustrated in Figure 3.5

MINISTRIES

Mono principal

Multi principal

different minister
different performers

R & I PERFORMERS
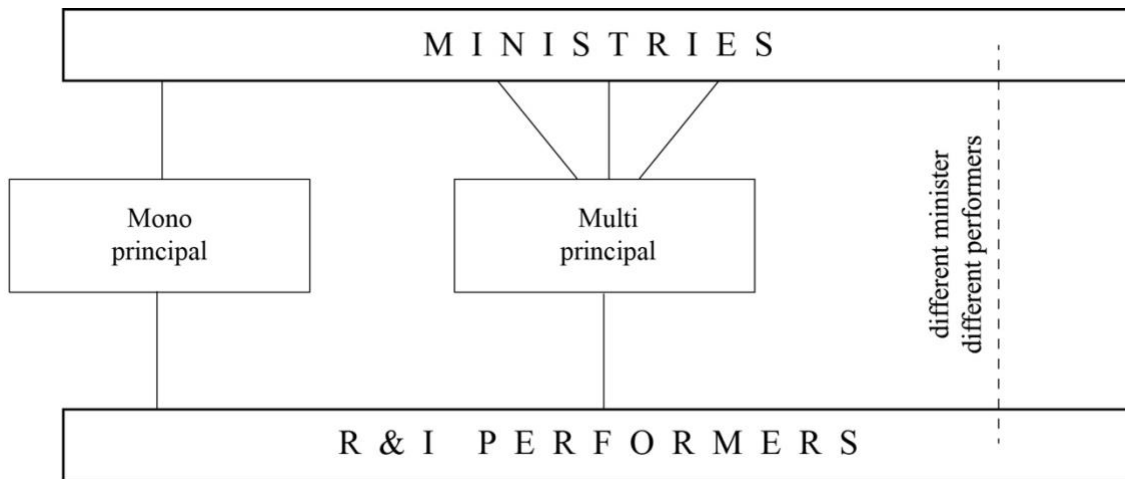
Figure 3. 5 The variety of intermediation strategies

The first typology of agency is the mono-principal agency (Arnold and Boekholt, 2003), which is politically bounded to only one governing actor, but it can (potentially) deal with one or multiple agents. The second type are multi-principal agencies (Arnold and Boekholt, 2003), they represent broader management platforms that can be employed by different ministers for different target populations. In this case their organizational structure can be used as a system in order to define coordination mechanisms among ministers (multi-principal), while trying build a dialogue with different R&I performers. Finally, there are instances in which governing actors do not make use of any intermediary actor to stipulate delegation contracts with different target groups. In these cases, policy makers interact directly with the universe of performing agents on the basis of their responsibilities; and Research and Innovation policies are therefore steered directly by the minister (or ministries), under the supervision of the Parliament (OECD, 2014, p. 125).

The variety of policy management competences devolved to intermediate agency[25], will likely influence both the relationship among policy makers and with R&I performers. This is closely related with the fact that the inclusion of intermediary actors can represents a strategy to externalise and de-politicise conflict between policy makers and R&I performers, by making use of technical and managerial motivations. Nevertheless, the three morphologies of intermediation are not all immune to the necessity of internal ministerial coordination. Indeed, in both the second (multi-principal) and the third (direct interaction) typologies, the internal policy making fragmentation is simply transposed to the relationship with R&I performers. Since ministers play the role of coordinating objectives and instruments (Chung, 2013), in case of organizational fragmentation it will be more challenging to collectively agree on a unique strategy for public action. Consequently, the more demanding it will

25 These can be research councils, ministerial agencies, technological agencies, depending on the national specificities. Despite their different areas of interests, all these actors share the role of intermediary between the principal and the agent.

be to concertedly motivate target population to modify their behaviours, given the high likelihood of internal incoordination. On the other hand, R&I performers could manage to exploit these deadlocks at their favour, in the effort to see their interest represented. Following on that we will expect that:

H5: the higher level of institutional fragmentation and the higher the capacity of R&I performers to behave as a political constituency, the more likely it will be to have an instrument mix characterised by low coercive, and more automatic instruments.

In many national contexts R&I priorities at the governmental level are defined in a very broad way, because these are then translated into specific thematic programmes at the level of agencies (Nauwelaers and Wintjes, 2008). Therefore, public agencies can shape instrument mix characteristics both because of their role in the face of state executive and because of their relationship with R&I performers. In case of agency controlled by multiple principals, we could expect that the coordination problems ministers are facing, will likely influence their capacity to give a consistent mandate to an intermediary agency. Similarly, in the case of direct intermediation strategies, since ministers interact directly with different R&I performers, we could expect different strategies not to be automatically funnelled into a shared framework of action.

Therefore, in the presence of R&I performers able to collectively mobilize their resources, we could expect that their powers to nullify, or alter, the operation of policy instruments could be enhanced by the lack of policy-making common framework of action. Consequently, this will likely impact the characteristics of the instrument mix, paving the way for more permissive (less coercive shape) instruments, together with a greater R&I performers' power in the management of their activation (more automatic delivery structures).

3.10 Conclusions

The ultimate goal of our research is to understand the political dynamics embedded within policy design process, and how the interactions between differently motivated actors within different ideational and institutional contexts, could influence policy mix evolution. Given the complexity of R&I decision-making processes, we adopted an approach that intersects different insights on the role of ideas (as the influence of dominant framings in a given political system); the opportunity structures provided by the institutional system (internal coordination and specialisation between bureaucrats) and the role of target population (the strategies for interest intermediation). These factors are consistently intertwined in the influence they play on alternative policy strategies, because policy instrument selection and design into different packages, contrary to how it has been portrayed so far, it is not a rational, linear and purely technical exercise. Indeed, it rather represents a *muddling through*

(Lindblom, 1959), an inherently political process involving different actors, interests and constraints (Linder and Peters, 1989; Peters, 2000).

We aim at investigating how different cabinets have differently formulated their R&I decisions, and the extent to which different ideas influenced in this process. Moreover, we will explore the extent to which decision makers took target group interests into account during the policy design process (Skodvin et al., 2010), and how differently powerful actors did manage to exploit institutional organisation structures to influence the final shapes of policy mix evolutions.

From a theoretical perspective, this research aims at improving existing theories on policy instrument and it uses them as proxies for understanding actors' preferences for different behavioural characteristics of public action. Building upon the contribution of the existent scholarship, we propose a more accurate classification of policy instruments, considering both the behavioural and political characteristics embedded in different tools.

4 Chapter 4: The research design

In order to investigate the process of policy instrument selection (and its outcome) in the R&I sector, we decided to adopt a country-level unit of analysis. Indeed, as demonstrated by the comparative study of Nelson (1993), there are consistent differences among various systems regarding their set-up, investments in R&D and performance at the national level. That is because, ultimately, differences in R&I systems mirror differences in national economic and political priorities.

Therefore, since countries differ in terms of their economic specialisation patters, industrial specialisations have different requirements with respect to their demand of skills, finance and political strategies. Hence, the knowledge infrastructure evolving parallel (and in response) to R&I sector, and through interactions with the political system, tend to acquire a distinct national flavour, which is likely to be further strengthened by differences in political and institutional structures (Edler and Fagerberg, 2017). For all these reasons, it is meaningful to adopt a country-based unit of analysis also because most public policies directly affecting the characteristics of R&I policies are designed at the national level (Edquist, 2001b).

On the other hand, as the literature points out (Flanagan et al., 2011; Perry and May, 2007; Tödtling and Trippl, 2012, 2005; Ulnicane, 2016), national governments are embedded in a multi-tiered governance structure where, in addition to a national perspective also a regional and European one should be taken into account.

The supranational actor has manifested increasing interest for the role that research and innovation can play for the economic and social development of its member state. Important pillars of this process have been the creation of the European Research Area (Edler et al., 2003), as well as the increasing support for horizontal learning among the actors involved in R&I policy design at the EU level (Tamtik, 2016; Veugelers, 2012). Nonetheless, despite the relevance of European institutions, the real political battle over funding allocation decisions, and strategies, seems to take mainly place at the national level. This is closely related with the fact that inside the political space defined by internationally accepted models for R&I policies, the overall system concerning national public intervention in the economy, together with the specificities of national strategies, defines each specific country policy profile (Thèves et al., 2007). Therefore, despite a consistent intensification of supranational policy making, there are still evidences that governments remain in the business of governing, since the adoption of certain European procedures and policy instruments is considerably influenced by the national policy legacy, context and interest (Capano et al., 2012; Héritier and Lehmkuhl, 2011).

As further developed in the following paragraphs, in order to shed light on the role European actors might have effectively played in the national policy design of our two cases, we decided to use interviews as a trial test, in order to supplement the information provided by the literature on this topic. Indeed, the interview questionnaires included a set of standardized questions (the same for different "type of actors" across the two cases) on the role of the European Union, with respect to national R&I policy making. The same practice has been adopted in the case of regional level, which is nonetheless a variable we took into consideration during the case selection process, given the similar devolution path the two case studies have undertaken. Therefore, each interviewee either, policy maker or stakeholder or expert, coming from different organisations, has been asked to reply the same set of questions on this topic.

The chapter is organised as follow, we begin with an overview of the research design techniques adopted, and their close connection with the dimension of the theoretical framework described in the previous chapter. Then, we move to the case selection, data generation and analysis techniques. To conclude, we are going to discuss the piloting process for the European and regional issues.

4.1 The research design techniques

The ultimate goal of our research is to understand the dynamics, actors and processes embedded in R&I policy design activities, which are ultimately meant to influence policy mix features. In order to put these theoretical insights into practice, it is necessary to consider the different level of analysis characterising our factors of interest. Indeed, ideas are said to represent a proxy for a more general understanding of the political stakes related with alternative R&I policy mix scenarios, and programmatic beliefs about its contents. They refer to the political payoffs related with different instrument choices, together with a more general understanding of the overall cabinet attitudes with respect to national R&I policy mixes. Differently, institutions and interest, support the interpretation of the internal dynamics taking place along the policy instrument selection process both internally, regarding the coordination between ministers/department with complementary R&I responsibilities; as well as externally, concerning the interactions between policy makers and target population, and their capacity to influence this process.

Consequently, ideas remain at a higher level of abstraction, to the extent that they provide information on the various patterns of cabinets attitudes for alternative instrument mixes. Differently, institutions and interest guide us through the roots of the political dynamics, and actors' relationship taking place along policy design process; hence climbing down the ladder of abstraction to the on-the-ground shaping of events. The Figure 4.1 below, helps us to explain this differentiation.
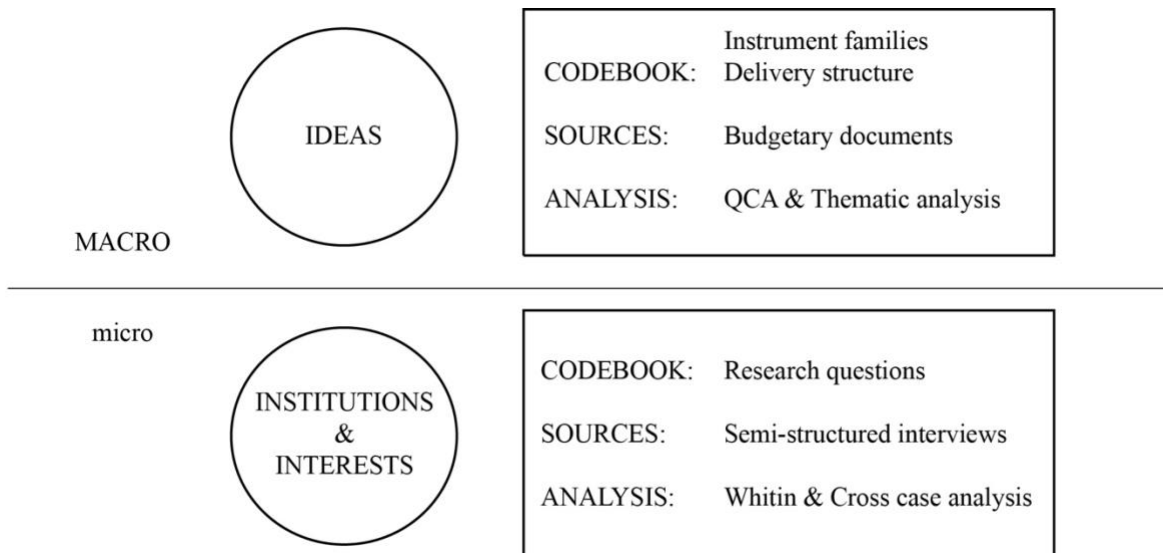
Figure 4. 1 The methodological strategy

Indeed, by analysing different political attitudes of governments (e.g. ideas), we investigated the way different cabinets have framed national R&I issue. While, by looking at the interactions between different ministerial organisation structures (e.g. institutions), the patterns and the content of intermediation practices with target population (e.g. interests), we illustrated the political process that led to the calibration of different mixes.

The choice to place ideas at an upper level of abstraction (compared to interest and institutions), is reflected by the adoption of a different set of methodological procedures for data generation and analysis. Indeed, as we will discuss in further details in the following paragraphs, the analysis of ideas makes use of documents (specifically of budgetary documents) and investigate them through a methodological approach inspired by both Qualitative Content Analysis (QCA) (Schreier, 2012) and Thematic Analysis techniques (Boyatzis, 1998). While, institutions and interest stand at a lower level of abstraction, and they were analysed jointly, to the extent that both factors were said to shape actors' interactions along design process. Differently from the previous case, the data generation process relied on a set of experts and stakeholders' interviews, which have been analysed through a second codebook inspired by within and cross case qualitative data analysis techniques (Miles and Huberman, 1994). Therefore, in both cases we analysed our data through qualitative data analysis procedures, which basically consist of the search for patterns and ideas in the data that help explaining why those patterns are there in the first place (Bernard and Ryan, 2010, p. 109). These approaches allowed respectively to systematically reduce data, while describing and interpreting the meaning of the sources (Schreier, 2012); to explore and compare contents between (and within) cases (Miles and

Huberman, 1994). To develop the analysis, we employed the computer-aided software Nvivo12, which allowed to systematically analyse and compare our data.

The distinction between these two levels of analysis allowed first to account for the different theoretical relevance of these concepts, while also supporting the triangulation of various sources, which helped to balance (and compensate for) the drawbacks related with data collection techniques and the specific nature of the sources employed. More specifically, in the case of interviews, interviewees may (un)consciously misinterpret a given situation or question, as well as imposing current knowledge on recollection of unconnected events in the past. Because, ultimately, interviews concerns what people say, and how they say it, as opposed to what people actually do or think (Buse et al., 2005, p. 187). In the case of document analysis, thought collecting reliable, and often accurate, information on the policy mixes adopted; we might fall in trap of overlooking the dynamics of informal interaction (what happens behind the scenes of document drafting), which stand often at the core of the policy design process. Consequently, each technique represents a piece of a broader picture intended to capture different perspectives of a phenomenon, while trying to validate the findings by complementing, and providing additional cover to each other (Dür, 2008).

These data have been supplemented in their interpretation by relying on the information provided by secondary literature on Research and Innovation policies and especially by the ERAWATCH, lately called "RIO-Country", reports. These documents were yearly produced by the Research and Innovation observatory of the European commission (JRC-IPTS) to support the mutual learning process and the monitoring of Member States' efforts. They provide country-based data on the context in which actors operate, assessing the performance of national research system and related policies in a structured way; therefore, representing a useful source of information for tracking developments in R&I policy mixes, and more broadly changes in the national governance of the sector.

4.2 Case selection

In order to unfold the dynamics characterizing policy instrument selection process and the casual pathways leading to the selection of specific instrument mix characteristics we adopted a comparative case study approach. Our unit of analysis was set at the country level and the procedure for case selection followed a combination of different logics (Gerring, 2007).

Since, ultimately, we were interested in understanding both the role of different actors in shaping policy instrument selection process, as well as to explore the characteristics of policy mixes according to our new theorization; our choice was inspired by both exploratory and estimate strategies (Gerring, 2016). Therefore, we selected France and Italy, on the basis of the variance they display in the theoretical factors of interests (exploratory) (Seawright and Gerring, 2008), and we adopted a

longitudinal estimate strategy to intensively investigate the effects of their overtime variation on the evolution of policy mix.

Longitudinal estimate strategies are usually based on a single case study (Gerring, 2016); nevertheless, since we were interested in the examination of both the dynamics of policy instrument selection (process) and the characteristics of the formulated policy mix (outcome), we decided to enrich our analysis with insights coming from the exploratory diverse case study research design. This methodology allowed to achieve a high level of variance among our variable of interest (e.g. what Patton (Patton, 2002) defined as maximum variation sampling), so that our cases were likely to be representative, in the minimal sense, of a broader population (Seawright and Gerring, 2008).

The diversity in the theoretical factors of interest, allows to consider the combination of possible causal pathways leading to specific instrument mix characteristics; so that we could account for alternative causes (or combination) of an outcome (Gerring, 2016). Their interaction was investigated according to a typological logic (Alexander and Bennett, 2005), which allowed to specify the combination between different theoretical factors, and to identify their conjunctive effects (underlining causal pathways) on policy instrument selection process; ultimately helping to generalize (in a limited way), possible future events of the same type. That is why this type of case selection strategy is ultimately said to be both exploratory and confirmatory (Gerring & Cojocaru, 2016). This combination of techniques was useful to both eliminate the factors which were not relevant to explain instrument selection, as well as to estimate the causal pathways leading to alternative instrument mix characteristics. Ultimately, we were able to test the validity of our typology of policy instrument classification, and its capacity to contribute to a more fine-grained understanding of the reasons behind their selection.

Our two cases display a high degree of variations in the characteristic of our theoretical factors of interests. With respect to the ideal types of R&I ideational paradigms, France consistently overlaps with the mission-oriented type. Indeed, it is historically characterized by a tradition of industrial *Grand Programmes*, where governments use to have the primacy in the selection, and support, of specific technological sectors. Differently, the Italian case displays many similarities with the diffusion-oriented ideal type. Therefore, different governments did not show long-term preferences for any specific sector of knowledge creation and development, but they rather endowed heterogeneous sectors approximately for the same extent. Consequently, research targets were rather broadly defined, as well as the industrial and technological sectors involved. Figure 4.2 and 4.3 below,

briefly summarises the extent to which these ideal types have effectively influenced Government Budget allocation choices[26].
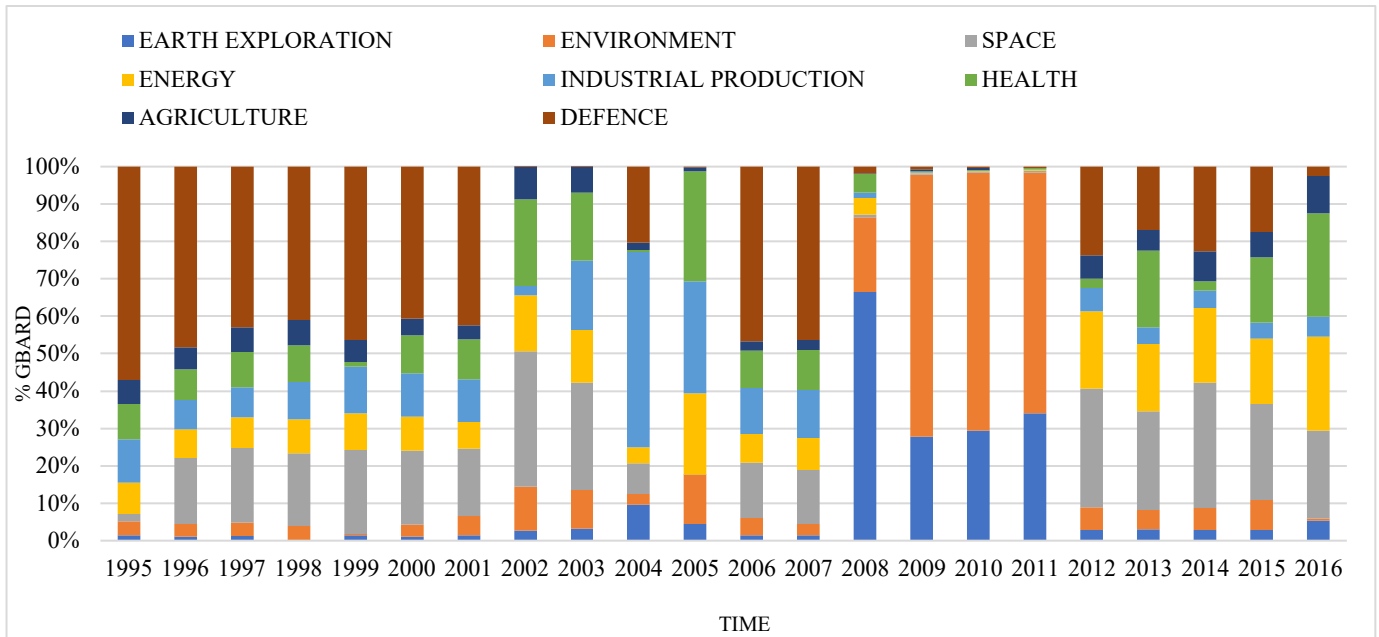
Figure 4. 2 GBARD by sector of performance France
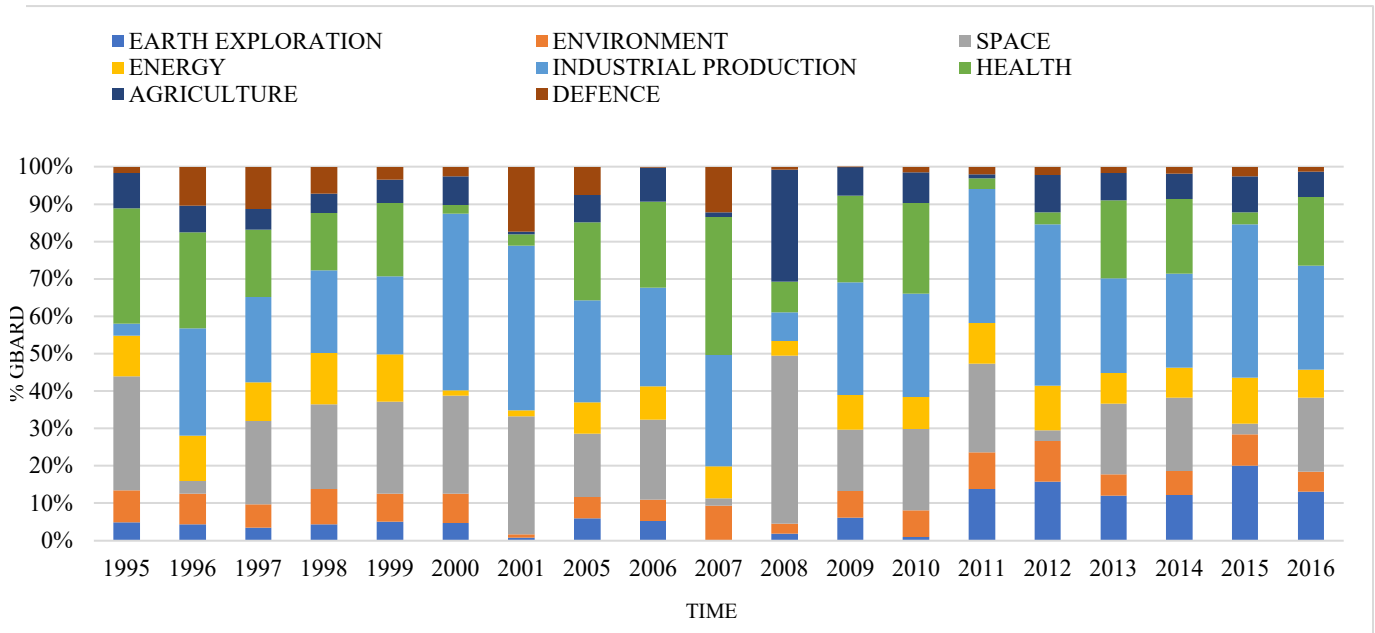
Figure 4. 3 GBARD by sector of performance Italy

[26] The Figures (4.4 and 4.3) above summarize GBARD national statistics, which refers to Government Budget Allocation for research and Development. Source: EUROSTAT statistical office of the European Union. Data elaborated by the author.

The colours of each column refer to the different sectors of investments, as a percentage of the total yearly national R&D investments. In the French case it is possible to identify a specific periodization in investments decisions, both in terms of share of total budget allocation per year as well as in terms of overtime consistency across sectors (especially for defence, environment space and earth exploration). These features mirror some of the constitutive components of the Mission oriented type (Berger, 2016), characterized by the choice to invest in specific technological sectors associated with national objectives and strategies for economic development. In these cases, policy makers were able to provide a vision, a specific framing of R&I objectives, and to mobilize actors.

In the Italian case the annual share of investments is much more heterogeneous and, despite some cases (space and Industrial production), it displays a high degree of variation both over time and across sectors. This closely mirror the characteristics of the diffusion-oriented ideal type (Gallo and Silva, 2006; Sirilli, 2010), where governments do not display long-term preferences for any specific sector of knowledge creation and development, but they rather endow heterogeneous sectors approximately for the same extent. As Figure 4.2 and 4.3 suggest, the mission and diffusion oriented ideal types represent a proxy for the attitude of different countries to develop specific strategic choices in terms of R&I investments. It reflects both the national political priorities (how different political preferences have been translated into R&I issues) as well as the different ability to design long-term national policy strategies.

Another theoretically relevant difference between our two cases refer to the strategies they selected for their interest intermediation practices.

In the French case it was well widespread the strategy of relying on different type of public agencies, like the national research agency (ANR) for the financing of public research, or the OSEO agency for the support of industrial innovation projects. The move towards public agency took place during the time period under investigation, therefore making even more relevant the within country comparison "before" and "after" these events (Gerring, 2016), as well as the cross-country comparison with and highly comparable case that decided to pursue a different strategy. The Italian case was mainly characterised by direct intermediation practices, usually between each minister and their related constituencies. As extensively discussed in the following chapters, this case has had some short-term experiences with public agency, but these actors had a short life, and a minor role in the intermediation with interests in comparison with the responsibilities left in the hand ministries.

Differently, in the case of ministerial organisation structures France and Italy share some (formal) similarity in their institutional specialization patterns. In either case, R&I policies competences lie under the remit of the minister for Higher Education and Research, and the minister with economic competences (called Minister of Economic Development in the Italian case, and Minister of Economy

and Finance in the French case). Since ministerial organisation is not strictly determined by law, for the most part different institutional structures tell us how national governments had differently think about policy problems and alternative strategy to tackle them (Peters, 1998).

Given that at the moment of case selection the characteristics of the national policy mix were not known, this similarity represented a good proxy for some extent of congruity between the two cases, therefore supporting a solid baseline for their comparison[27]. Moreover, the similarities in formal institutional structures didn't prescribe any specific pattern of interaction between ministries, which was rather the dynamic of interest investigated during the analysis. Actually, these were similarities in the so-called formal institution al structures (Helmke and Levitsky, 2004), therefore they represented just one side of the coin. Whereas, the informal ones, those related with consolidated practices of interactions between actors needed to be discovered during the analysis, therefore it seemed pointless to equate their theoretical contribution in explaining internal policy making interactions. For what concerns the characteristics of our outcome of interest, policy mix, these have been defined in parallel with the case study analysis. Because, official database or document typically do not capture policy mix characteristics, their operationalization required first hand data collection and interpretation (Rogge and Reichardt, 2016). This analysis provided also to be a necessary exercise in order to test the validity of the innovative instrument classification typologies proposed by our research.

When we select country as unit of analysis for case study investigation, we have to be aware that their history, culture and society, all come together with the theoretical factors we are interested in; consequently, there might be multiple sources of extraneous variance (B. Guy Peters, 1998).

Since we were interested in the role that ideas, interest, institutions (and the combination of thereof), play in shaping the politics of policy instrument selection, during the selection for our cases we accounted for the similarity of some background conditions, in order to avoid their interference on the activities of our theoretically relevant factors.

Overall, France and Italy have similar national economic size, they are respectively the second and third largest European economies in terms of contribution to the European Gross Domestic Product, right after Germany[28]. They display similar patterns of competence distribution among actors, namely a context where specialized research and funding are (mainly) kept as central competences, while competences in lover level of education, cluster policies and technology transfer (and related incubation activities) tend to be devolved at the regional level. Moreover, they both share the

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[27] To the extent that, differently to outcome (Gerring, 2016) or extreme case studies (Seawrtight, Gerring, 2008), diverse case studies do not have to display extreme values on the outcome of interest, which in our case was not known in advance.
[28] https://ec.europa.eu/eurostat/web/products-eurostat-news/-/DDN-20180511-1?inheritRedirect=true (last access, September 2019); http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do (last access, September 2019).

professor privilege (Lissoni and Montobbio, 2015) in patent regulation legislation, granting the titulary of invention to researchers. They have very similar administrative traditions, to the extent that the Italian administrative system is, in many respects, one of the most Napoleonic outside France (Spence, 2014, p. 104). Both countries face private under investments in R&D, and public contributions occupies the lion's share of the Gross Domestic Expenditures in this sector.

Ultimately France and Italy, despite being two diverse case, display sufficient similarities that allow to hold constant some of the factors that are not theoretically relevant to explain the process of policy instrument selection, but which can nonetheless influence its dynamics. From the perspective of R&I policies, France and Italy are two apparently similar and binary systems nevertheless, within this similarity, there are also very different approaches characterizing national policy making dynamics. Contrasting these different characteristics is useful in order to explore issues around the politics of policy instrument selection and more broadly alternative causal pathways that led to the selection of specific policy mix characteristics.

4.2.1 The Case study analysis (time)

Since observations from case studies are constructed diachronically (by observing case through time) (Gerring, 2009), evidences about historical sequences (Rueschemeyer and Stephens., 1997) are needed so as to explore the influence that different patterns of actors' interaction might have had on policy design processes, and on the resulting policy mix characteristics.

By adopting a periodization strategy, within and across country, on the basis of different cabinet periods, we have been able to assess the overtime impact that changes in key explanatory variables might have had on the selection of different policy instrument characteristics, and resulting policy mixes.

Analysing time according to shifts in cabinet organisation was meaningful to the extent that it provided a useful proxy for the likely variations in the drivers expected to influence policy instrument selection process. As extensively discussed in Chapter 2 and 3, the theoretically relevant concepts for explaining policy instrument selection, are bound to be affected by variations the power balance within the executive. Indeed, the institutional variable (coordination of R&I competences in the executive), represent different ways to interpret R&I policy strategies. Therefore, since ministerial organisation patterns are not strictly determined by law, for the most part they represent a political choice based on governmental priorities and strategies. In the same vein, the dominant policy styles, can be thought as driven by different ideas, which can therefore vary on the basis of different party government. Similarly, the type of interest intermediation patterns, the shape and the missions of different intermediary agencies, can vary according to different executives.

Moreover, the focus on the shift of government composition is closely related with the political perspective adopted throughout the research, which cannot hence overlook the influence of changes in cabinet composition. Because, ultimately these actors are those who primarily detain the power and legitimacy to steer the direction of policy strategies. Consequently, we adopted a time-frame for the analysis starting in 1998, a year in which both countries experienced a consistent reorganisation of the national R&I structures, and we followed their evolution until 2010[29]. The total number of years under investigation is line with the appropriate time framework for examining policy change identified by the literature (Sabatier, 1986), and it is able to take over many of the constitutive elements that have shaped national R&I policy mix.

4.3 Macro-level: ideas

In order to investigate how political orientations of different cabinets influenced the formulation of national R&I policy strategies; more broadly, the role that different ideas had in R&I policy instrument selection, we relied on the analysis of national budgetary documents. Because documents are not only produced, but they are also productive (Prior, 2003, p. 84); therefore, they are social facts, which are created, shared, and used in socially organised ways (Atkinson and Coffey, 1997, p. 47). These records provided information on the contingent R&I preferences across different cabinet periods, to the extent that they accounted for the characteristics of the political and historical moments in which they have been drafted. Indeed, they provide data on the context in which actors operate, they represent means for tracking changes and developments in R&I policy mixes. Moreover, they represent an effective source for gathering data when events cannot longer be observed (Bowen, 2009); their analysis is instrumental to sharpen ideas, conceptual boundaries and to clarify the relevance of categories (Charmaz, 2003). Indeed, various policy problem framings, can be extrapolated by the document itself, to the extent that they can make clarity on policy making perspectives (Yanow and Schwartz-Shea, 2013).

For the French case we analysed the *annexes jaunes* ("yellow appendix"), these documents accompany the yearly budget law, they include a report on the state of the art, and on the budgetary resources, devoted to a specific policy sector, in our specific case Research and Innovation.

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29 Actually, the Italian case focuses on a slightly longer period, namely until 2012. This choice was related with the fact that we decided to include in the analysis the Monti cabinet period. This executive represents a case of so-called "Cabinet of Experts" and it took the lead in a period in which Italy was caught in the financial storm due to the worsening of the sovereign debt crisis in Europe. Consequently, we believe that, given the specificity of this cabinet, as well as the political, economic and historical context in which it came to power, it was worth to analyse R&I policy design through a period of severe budgetary constraints.

While, for the Italian case, we analysed the Economic and Financial Planning Document (*Documento Programmatico di Economia e Finanza* -DPEF-), which outlines, in a medium-long term perspective the policy commitments of each governments (also the National Research Program, when present, was drafted according to the guidelines included in this document). For both countries these documents are drafted by the government and presented to the Parliament; therefore, by interpreting government as a unitary actor (Bäck et al., 2017), they provided highly comparable information necessary to trace the general pattern of cabinet orientations. The selection of similar typologies of documents among France and Italy, allowed for a high degree of comparability of the information. Indeed, due to the yearly-based institutional nature of these reports it has been possible to control for eventual biases, while maintaining a high degree of scope-similarity among the sources.

Therefore, by analysing these documents it was possible to reconstruct the architecture of different R&I political orientations from the perspective of decision-makers (Giest, 2016). The different cabinets' political orientations for different policy instrument components, have been used as a proxy to trace their preferred strategy for action in the R&I sector.

This allowed to locate different national governments within a common space for analysis, and to compare their policy mixes attitudes over time and across countries.

The total number of sources analysed was equal to N= 32 and equally distributed among the two cases. Nonetheless, because of national political specificities, and contingent events (which are far behind our will and possibility of action) it was not possible to analyse the same number of sources for each cabinet periods. Consequently, the results of our analysis (as discussed in Chapter 6 and Chapter 8) have been weighted according to the number of sources analysed, to maintain a high degree of comparability between the different periods, and across the two cases.

In order to interpret our data, we adopted a methodological approach inspired by Qualitative Content Analysis (QCA) (Schreier, 2012) and Thematic Analysis (Boyatzis, 1998) techniques, and we ran the analysis through the support of Nvivo 12 software. The QCA methodology was useful to systematically reduce data and describe the meaning of categories, through the latent examination of their contents (Schreier, 2012). Similarly, thematic analysis drove us across the interpretation of the patterns in the data, and supported our analysis on the occurrences and frequency of information; while maintaining a systematicity in coding procedures (Boyatzis, 1998).

Accordingly, we developed a codebook closely related with the dimensions characterizing the phenomenon we are looking at (policy mix), following a concept-driven strategy. This was drafted on the basis of the theoretical categories applied to describe different instruments dimensions, namely authority and automaticity. Each dimension has been assigned to a specific node, for example the family of regulation instrument was a node, the family of information instrument another node and

so forth, according to the characteristics of each category30. This choice was related with the fact that we aimed at investigating the variation in cabinet preferences for the principle of inducement contained in different mixes. Moreover, these documents, did not often provide a description for all instruments' components, but they simply provided information regarding the ultimate goal of public action.

Overall, the analysis was developed by coding different portions of text to meaningful concepts of our codebook (nodes), which recalled the main themes of analytical interest for the research.

Such procedure might have been subject to consistency issues, related with the interpretation of specific information and their inclusion within different categories. Consequently, after the coding process, we run a reliability test in order to assess the consistency of our data analysis exercise. Even though the coding procedure was autonomously developed by one researcher, and not by a group, it was still possible to assess the solidity of our procedure by using a coding comparison query. An indicator for coding consistency is the K-coefficient, a statistical measure which takes into account the amount of agreement that could be expected to occur by chance among different coding (or coders) choices, it varies between total agreement (1) and total disagreement (0)31.

Following the methodological suggestions of the current literature (Schreier, 2012), after 60 days from the end of the coding procedures, we went through a second coding exercise in a representative sample of our data32 and we run the coding comparison query in order to assess the reliability of the second round of coding and compare the results with the first round. We first assessed the coding reliability using as unit of analysis the paragraphs coded, this provided a K coefficient of 0,86 for unweighted values and 0,91 for weighted; while in the case of sentence-base reliability the scores of the K coefficient were respectively of 0,86 and 0,9133. Consequently, after assessing the high degree of coding reliability, we carried on our analysis looking for patterns among nodes, in order to shed light on the different instances of political orientation along different cabinet periods.

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30 In the case of automaticity, given its variation in terms of "degree", the different categories have been created by grouping dimensions on the basis of the extent of policy-makers' involvement in instrument management, as discussed in Chapter 3.

31 http://help-nv11mac.qsrinternational.com/desktop/procedures/run_a_coding_comparison_query.htm (last access October, 2019).

32 The literature provides that the subsample should be at least 10% of the total sample. In our case, out of the total 36 sources we identified a subsample of 8 sources, four for each of our country, which were representative of more than the 20% of the total sample

33 In the case of unweighted values sources were treated equally, regardless of their size, during the calculation; while for weighted values source size was taken into account when calculating the overall results for each node.

4.4 Micro-level: institutions and interests

As discussed in earlier paragraphs it is necessary to account for the fact that documents are highly context-specific, therefore they have to be integrated with other sources (Bowen, 2009). Moreover, contrary to the case of ideas, institutions and interest support our interpretation on the dynamics taking place during policy instrument selection process both internally (coordination between ministers/departments with complementary R&I responsibilities) and externally (interactions between policy makers and target population); and their capacity to influence the resulting instrument mix characteristics. Therefore, besides being at a "lower level of theoretical abstraction", they also rely on different data in order to assist our interpretation, namely semi-structured interviews. Throughout the research we have adopted both experts and then stakeholders' interviews, with the theoretical and empirical purpose of differentiating the role and the information gathered from the two groups of actors.

Although some of the questions included in the interview questionnaires were kept constants (so as to understand different actors' preferences on the same issues), many of them have been differentiated according to the role played by the interviewee within the national R&I governance.

The sampling technique didn't adhere to quantitative conceptions of representativeness (Bogner et al., 2009, p. 103). Hence, we defined our sample by adopting insights from two different approaches, criterion based (or purposive sampling) and theoretical sampling techniques (Ritchie and Lewis, 2003). Our ultimate goal was to keep the sample as heterogeneous as possible in order to include all the main organisations involved in the national R&I governance. Therefore, following a theoretical sampling procedure, we selected actors on the basis of their characteristics and roles in the policy process so as to control for the relevance of each interviewee's profile and experience according to the potential contributions these could provide to our analysis. Moreover, this technique provided ample room for manoeuvre during the analysis, allowing for (when needed) an iterative process between sample selection, fieldwork and analysis (Ritchie and Lewis, 2003). As for the selection of experts, we relied on the information gathered from their CVs and from the relevance their personalities might have in the national public sphere on this topic (such as highly ranked scientists, coverage in the media, participation in conferences or seminars, both popular and scientific, concerning R&I themes).

Then, we enlarged our sample on the basis of snowball techniques, according to which the researcher asks people who have already been interviewed to identify other people they know who fit the selection criteria (Longhurst, 2003; Ritchie and Lewis, 2003). This technique allowed to both account for selection criteria related with the perceptions of knowledgeable observers (our experts), which is

defined in the literature as reputational methods (Knoke, 1993), as well as to get first hand contacts with further relevant interviewees. Table 4.1 below summarises our sample of interviewees

TYPE	ROLE IN THE NATIONAL CONTEXT	COUNTRY
INTERVIEWEE 1	Stakeholder	Representative of Universities (involved in movements for university)	Italy
INTERVIEWEE 2	Expert	Advice to government in R&I issues	Italy
INTERVIEWEE 3	Expert	Advice to government in R&I issues	Italy
INTERVIEWEE 4	Expert	Academic expert on national R&I	Italy
INTERVIEWEE 5	Stakeholder	Minister of Economic Development	Italy
INTERVIEWEE 6	Expert	Former director of National Public Agency in R&I ("insider view")	Italy
INTERVIEWEE 7	Stakeholder	Representative of national PROs	Italy
INTERVIEWEE 8	Experts	Advice in R&I issues to different (mainly private) stakeholders	Italy
INTERVIEWEE 9	Stakeholder	Minister of Higher Education and Research	Italy
INTERVIEWEE 10	Stakeholder	Confindustria (confederation of industrials)	Italy
INTERVIEWEE 11	Stakeholder	Conference of Italian University Rectors	Italy
INTERVIEWEE 12	Expert	Academic expert on national R&I	France
INTERVIEWEE 13	Expert	Advice to government in R&I issues	France
INTERVIEWEE 14	Expert	Advice to government in R&I issues	France
INTERVIEWEE 15	Expert	Former director of departments in different R&I-related ministries ("insider view")	France
INTERVIEWEE 16	Expert	Advice in R&I issues to different (mainly private) stakeholders	France
INTERVIEWEE 17	Stakeholder	Minister of Higher Education and Research	France
INTERVIEWEE 18	Stakeholder	Conference of University Presidents	France
INTERVIEWEE 19	Stakeholder	Representative of CNRS (involved in movements for university-PROs)	France
INTERVIEWEE 20	Stakeholder	MEDEF (confederation of industrials)	France
INTERVIEWEE 21	Stakeholder	Minister of Economy, Finance and Industry	France
INTERVIEWEE 22	Stakeholder	National Research Agency	France

Table 4. 1 List of interviewees

Therefore, out of our total sample of 22 interviewees we maintained a high degree of comparability both within case (in terms of coverages of the organisations involved in national R&I sector) as well as across case, to the extent that many interviewees played the same roles within their own national contexts.

For the sake of conceptual clarity, we defined experts as those individuals who possess the necessary knowledge to structure collective problems, and/or to find the most appropriate alternatives to solve them (Dente, 2014, p. 50). The most relevant characteristic these individuals must fulfil, is not having been directly involved in the policy-making process as representatives of political interests. Therefore, experts were researchers, or scientists, who worked in academia or public research organisations and possess an education title or consolidated experience in a specific field (Rimkutė and Haverland, 2015). By gathering information from individuals with any direct stakes in the process, but with the necessary knowledge to understand its dynamics, we were able to have a first understanding of how R&I issues were structured within different national contexts, and the specific "open questions". Differently, in the case of stakeholder interviews, the goal was exactly to interviews those actors involved in the policy making process, to investigate the cognitive perceptions and values shaping their action. We decided to interview one actor per each organisation involved in the national R&I governance, as a proxy to understand its strategy during the period under investigation.

Therefore, in the trade-off between accuracy and representativeness, we decided to opt for the value added that a greater diversity in the sample could provide to the analysis. We interpreted the information gathered from interviewees as a proxy for the perspective of their organisation of affiliation, and we integrated this information with secondary literature, in order to reconstruct the details of different processes.

Expert and stakeholder interviews were analysed through a methodological approach to qualitative data analysis inspired by within and cross-case techniques (Miles and Huberman, 1994).

Starting with the within case analysis, we were able to understand how the contents of interviews supported our expectations regarding the way in which actors' interactions influenced policy making process. Basically, through the support of a software (Nvivo 12) portions of data were assigned to a specific set of concepts (codebook) in order to interpret and organize the information gathered on the patterns characterising actors, their interactions and their relevance in influencing policy instrument selection. The analysis of interviews transcripts allowed to explore the information provided by different interviewees and to reconstruct policy instrument adoption from different actors' perspectives. Then, with the cross-case approach, we were able to go through an in-depth investigation of the similarities and differences (in terms of information coded) across our two cases

so to understand the extent to which our theoretical expectations were supported by the evidence gathered (Burns, 2010; Chmiliar, 2010; Mathison, 2005; Miles and Huberman, 1994).

In order assure consistency between the data gathered through interviews, and the framework of analysis, the codebook reflected both the content of the interview protocol and the research questions driving our investigations. Consequently, we adopted codes of the pattern coding type (Miles and Huberman, 1994), because we aimed at directly matching portion of our interview transcripts to our research questions.

4.5 A multi-tiered governance structure: piloting process from experts' interview on regional and European influence.

Despite the intensification of supranational policy making, there are still evidences that governments remain in the business of governing, since the adoption of certain European procedures and policy instruments is considerably influenced by national policy legacy, context and interest (Capano et al., 2012; Capano and Piattoni, 2011; Héritier and Lehmkuhl, 2011). The case of R&I policy represents a peculiar example because this policy sector has been included within the Open Method of Coordination (OMC) strategy since its quite early stage of development. By its very nature, the OMC represented a non-legally binding set of recommendations and guidelines, which attempted to find a balance between Members states decision-making autonomy and a centrally imposed "one size fits all" European policy (Buchs, 2007; Pochet and Porte, 2002). It worked through coordinated agreements among representatives of member state on benchmarks and indicators to measure best practices, then each member state had to transposes these guidelines into national and regional policies.

Issues related with research and innovation were included in European Public documents form the early 1990s, with the Green Paper on Innovation and the First Action Plan for innovation in Europe (Seravalli, 2009). With the adoption, by the European Council, of the Lisbon strategy in 2000, there has been a clear focus on developing a knowledge-based economy in Europe through investments, especially in research and innovation. This led to both the introduction of a stronger focus on R&I by the objectives of the European Structural Funds in support for regional policies, and to a clear linkage of research policy to innovation, acquiring an undisputed place as a core element for national competitiveness (Reillon, 2015).

Furthermore, also European regulations have changed accordingly, in order to ease the diffusion of innovation-oriented policy among Member States. For example, the reform of clauses granting exemptions on competition policy regulation concerning R&D agreements. Indeed, with the new rules of 2000, the EU is said to have moved away from legalising approach to competition law, toward

an economic approach based on analysis of market impact of these type of agreements and the potential market dominance of large R&D alliances (Borrás, 2009, p. 6). With the modification of the Treaty on the Functioning of the European Union by the Treaty of Lisbon in 2007, research policy was transformed from a supportive to a shared competence, enabling the EU to adopt binding acts in this policy sector (Reillon, 2015, p. 2). Furthermore, the following European strategy for growth (EU 2020 Strategy for smart, sustainable and inclusive growth), presented in March 2010 further increased the relevance of research and innovation in supranational policies. In parallel with the increasing awareness on the relevance of localised opportunities for innovation development, and following on from the Lisbon agenda, European Programmes started to support regional development through the promotion of innovation-related interventions (Prange, 2008). One empirical example of this process has been the increase in the share of funds allocated to innovation-related activities in cohesion policies (Seravalli, 2009); or in the framework of the new regulation on European Regional Development Funds (ERDF)[34]. This required that between 50-80% of the funds have to be dedicated to, at least, two of the following objectives, namely: strengthening research, technological development and innovation; enhancing access to ICT; competitiveness of SMEs, of the agricultural sector and the fishery/aquaculture sector; supporting the shift towards a low-carbon economy in all sectors (Reillon, 2015).

Therefore, it seems that national government could take advantage and leverage European instruments to design R&I policy in their own national context weighing out potentially negative factors (Prange, 2008). According to some scholars (Seravalli, 2009), regional innovation policy can represent a partial revision of the classical European cohesion policies and the usual top-down redistributive practices, toward a more horizontal-oriented approach. Nonetheless, we have to keep in mind that, despite the role European Union could play in pushing toward regionalisation in some policy areas regional initiatives are to a large extent related to intra national framing of problems (Olsson and Åström, 2003).

Consequently, European institutions play a role in the framing of European Research and Innovation strategies, as well as in identifying the objectives related with specific structural funds.

On the other hand, also national governments take part in European decision-making process; therefore, theoretically they could be able to influence the framing of different objectives.

Consequently, given the interplay between national and supranational policy making capacity in shaping national R&I policy objectives we decided to run a piloting exercise during our interviews in order to understand the perceptions across our two cases. This consistent of including a set of

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[34] Regulation EU No 1301/2013 of the European Parliament and the European Council 17/12/2013.

similar questions regarding the influence that European Research and Innovation policy making is able to play in national policy design practices.

According to the results of our interviews, the major European constraints national policy makers are facing in designing their policies are related with state aid regulation, which is perceived as reducing their room for manoeuvre to directly intervene in the industrial sector (INTERVIEWEE 8, INTERVIEWEE 5, INTERVIEWEE 12, INTERVIEWEE 21). It clearly emerges an inclination to emulate some successful European experiences at national level, like the European Research Council, while trying to transpose some of their principles at the national level (INTERVIEWEE 2, INTERVIEWEE 13, INTERVIEWEE 15, INTERVIEWEE 14; INTERVIEWEE 3; INTERVIEWEE 12).

There is also a widespread agreement concerning the active role that national policy makers play in the definition of the European R&I agenda (INTERVIEWEE 7, INTERVIEWEE 10, INTERVIEWEE 2). Moreover, these objectives tend to be broadly framed, leaving enough room for manoeuvre in identifying national goals (INTERVIEWEE 22, INTERVIEWEE 11, INTERVIEWEE 2, INTERVIEWEE 18)

In addition to the European perspective also a regional one needs to be considered, because of the increasing evidence that the governance of innovation policies has been more and more oriented toward a multilevel governance dimension (Flanagan et al., 2011; Perry and May, 2007; Tödtling and Trippl, 2012, 2005). In both countries' regions have frequently complemented government measures, particularly in the framework of State-region contracts, competitiveness clusters, academic research, and industrial and commercial activities. For our cases the involvement of regional and local authorities has sometimes increased the complexity of national policy strategy, triggering administrative confusion, and the layering of similar instruments across different territorial levels (INTERVIEWEE 14, INTERVIEWEE 10). Regional governments are perceived as a complementary funder of national R&I interventions (INTERVIEWEE 16), as well as the best administrative level to implement specific national policies (INTERVIEWEE 17, INTERVIEWEE 5, INTERVIEWEE 2).

In both the cases of regional and European relevance for national policy design, our interview piloting process suggest how, despite the importance of these dimensions, they do not seem to heavily interfere in national instrument design practices. This is because R&I tend to be a sector which could heavily contribute to country economic growth; therefore, the scale of interventions is often kept at national level (Tamtik, 2016). The interaction and networks between actors are shaped by national institutions; and national governments play a central role in their establishment (Chung, 2013, p.

1053). That is the reason why, ultimately, a country-based level of analysis is the most suitable to understand the underling dynamics of policy instruments selection.

4.6 Conclusions

Our research design relies on a combination of different sources (budgetary documents, experts and stakeholders' interviews) and analytical techniques. Each of them represents a piece of a border picture intended to capture different perspectives on policy instrument selection process, while trying to validate the findings by complementing our data. The analysis of these sources followed a methodological approach inspired by both Qualitative Content Analysis (QCA) (Schreier, 2012) and Thematic Analysis (Boyatzis, 1998) in the case of budgetary document; while within and cross case techniques (Miles and Huberman, 1994) for interviews.

These approaches allowed respectively to reduce data, while describing and interpreting the meaning of the sources (Schreier, 2012); and to explore and compare contents between (and within) cases (Miles and Huberman, 1994). To develop the analysis, we employed computer-aided software Nvivo12, which allowed to systematically analyse and compare our data.

Since, ultimately, we were interested in understanding both the role of different actors in shaping policy instrument selection process, as well as to explore the characteristics of policy mixes according to our new theorization; our choice was inspired by both exploratory and estimate case selection strategies (Gerring, 2016). Therefore, we selected France and Italy, on the basis of the variance they display in the theoretical factors of interests (exploratory) (Seawright and Gerring, 2008), and we adopted a longitudinal estimate strategy to intensively investigate the effects of their possible overtime variation on the evolution of policy mix.

The decision to focus our analysis at the country level was also supported by the results of a piloting procedure through which we asked our interviewees their perceptions on national and regional influence on policy making.

In the next chapters, which dig into the dynamics of our two cases, we are going to put into practice our design and to test its validity as useful heuristic to understand the politics of policy instrument selection in the French and Italian research and innovation sector.

5   Chapter 5: The French Case study

Today French R&I policy is organised according to different national plans (the national research and innovation strategy SNRI, launched in 2009 and replaced by the SNR in 2014), the Investment for the future plan and the "new industrial France" plan implemented under the Hollande presidency (OECD, 2014). These strategies are the result of a long transition process which began in in the late 1990s. In the present chapter we will diachronically review all the most relevant public interventions that have been shaping the national R&I strategy. This context is historically characterised by a tradition of "large industrial programmes". Starting from the beginning of 2000s there has been a great increase in the support for companies working in the field of ICT, and the development of technological research networks on a regional basis (European Commission, 2002a), which culminated somehow with the competitive cluster policy in 2004.

After the creation of the ANR in 2005, public research has been moving towards more competitive oriented project funding systems for public research; which was matched with an increased autonomy of universities in 2007.

In the following paragraphs we will go through the most important policy initiatives that have shaped the French R&I system from the late 1990s until the 2013 (approximately).

As displayed in Figure 5.1, we will dig into the process that stand behind the mandate given to Henri Guillaume for drafting the report, which than shaped public interventions in R&I with the adoption of 1999 Law on innovation and research and the 2003 Innovation plan.

Then we will investigate the fragmented landscape of measures in support of SMEs, the adoption of the Competitive cluster strategy (2004) and the parallel developments in the Research sector, with the adoption of the 2006 research act and the creation of the OSEO and ANR public agencies.

Finally, we will briefly touch upon the 2007 Law on the liberties and responsibilities of universities and the Law for the modernisation of the economy, in order to get to the Plan for the Future investment strategy.
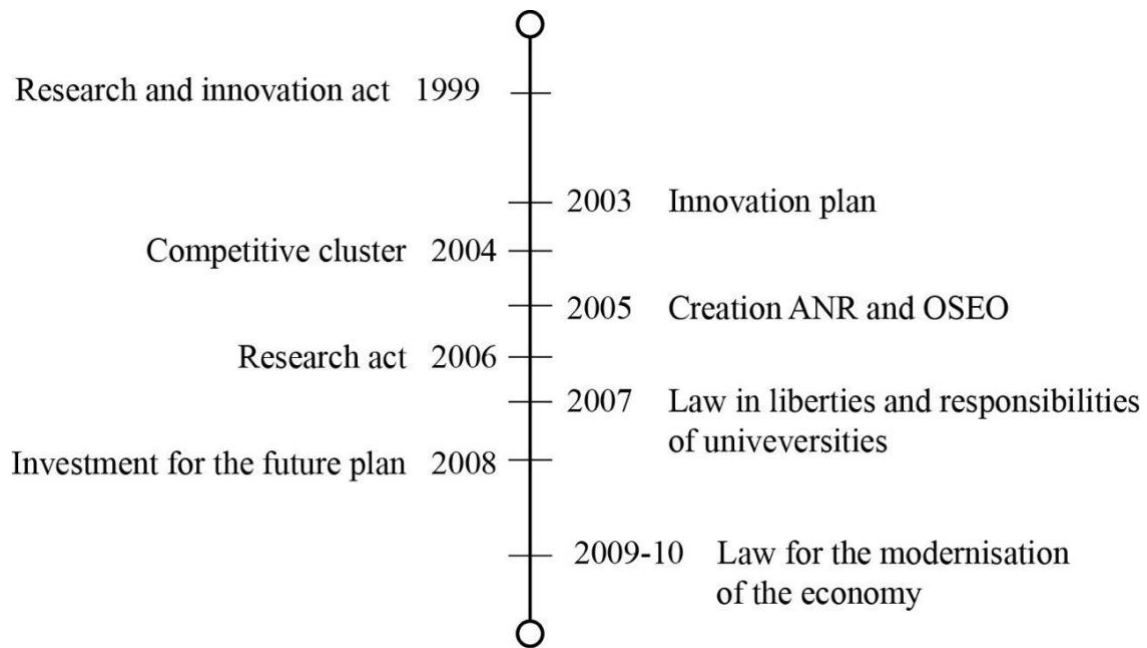
Figure 5. 1 The chronology of the case (France)

As discussed in Chapter 2 we adopted a broad perspective on the study of R&I policy sector, because we believe that both knowledge production and knowledge exploitation systems need to be considered jointly. Nevertheless, the interactions between these two spheres might not be easy to build in reality. Especially for the French case, that has been historically characterized by a separation between "research", considered as a privilege of the public realm and "innovation", perceived as an activity belonging to the private sphere (European Commission, 2004a).

Therefore, this chapter first analyses those public strategies of intervention which attempted to adopt an encompassing, holistic-oriented (Borras, Edquist, 2019), view on the components and synergies, of the R&I sector. This means policy mix targeting different R&I performers, with an emphasis on creating coordination among these two subsystems. Then, we will investigate those strategies that tend to be focused on either the research or the innovation component.

The structure of the chapter is meant to provide the reader with a first understanding of the more encompassing R&I policy interventions, so as to comprehend how more "segmented" interventions could be differently integrated within those views. Indeed, we do believe that all these interventions equally influence the evolution of the R&I, despite the fact that some are ad hoc designed with a broader systemic logic. Finally, the chapter descriptively analyse the evolution of policy instrument characteristics adopting an historical, within-case, perspective and pave the way for the comparative analysis of policy mix evolution following in Chapter 6.

5.1 The national governance of R&I

R&I activities tend to be related with heterogeneous governing tasks, to the extent that different research centres are attached to different ministries. Nevertheless, two ministers play a prominent role to play in this sector, namely the Minister of Higher Education and Research and the Minister of Economy Finance and Industry. The great difficulty embedded in this ministerial organization structure is related with the required coordination between these two sectors, in the effort to ensure linkages among them (OECD, 2014). At the highest level of the governance structure seat the president of the republic and the Prime Minister, usually advised by the High Council for Research and Technology (HCST), made up of major figures in the research and innovation field.

As we can see in Figure 5.2 the Minister of Higher Education and Research, together with the Minister of Economy Finance and Industry, occupy the primacy in the national R&I policy making. Together with sectorial ministries they design the National Strategy for Research and Innovation, which will then define the funding streams towards different operators. After 2010 also the *Alliances* started to play a role in the priority setting exercise, as representative of different public stakeholders in specific research domains. With the creation of the Investment for the Future Plan (2009-2010), another actor has emerged in the realm of R&I policy design definition, the General Commissariat for Investment (CGI). This is a committee, which takes decisions on the thematic allocation of competitive funding in close connection with Prime Ministers' priorities.
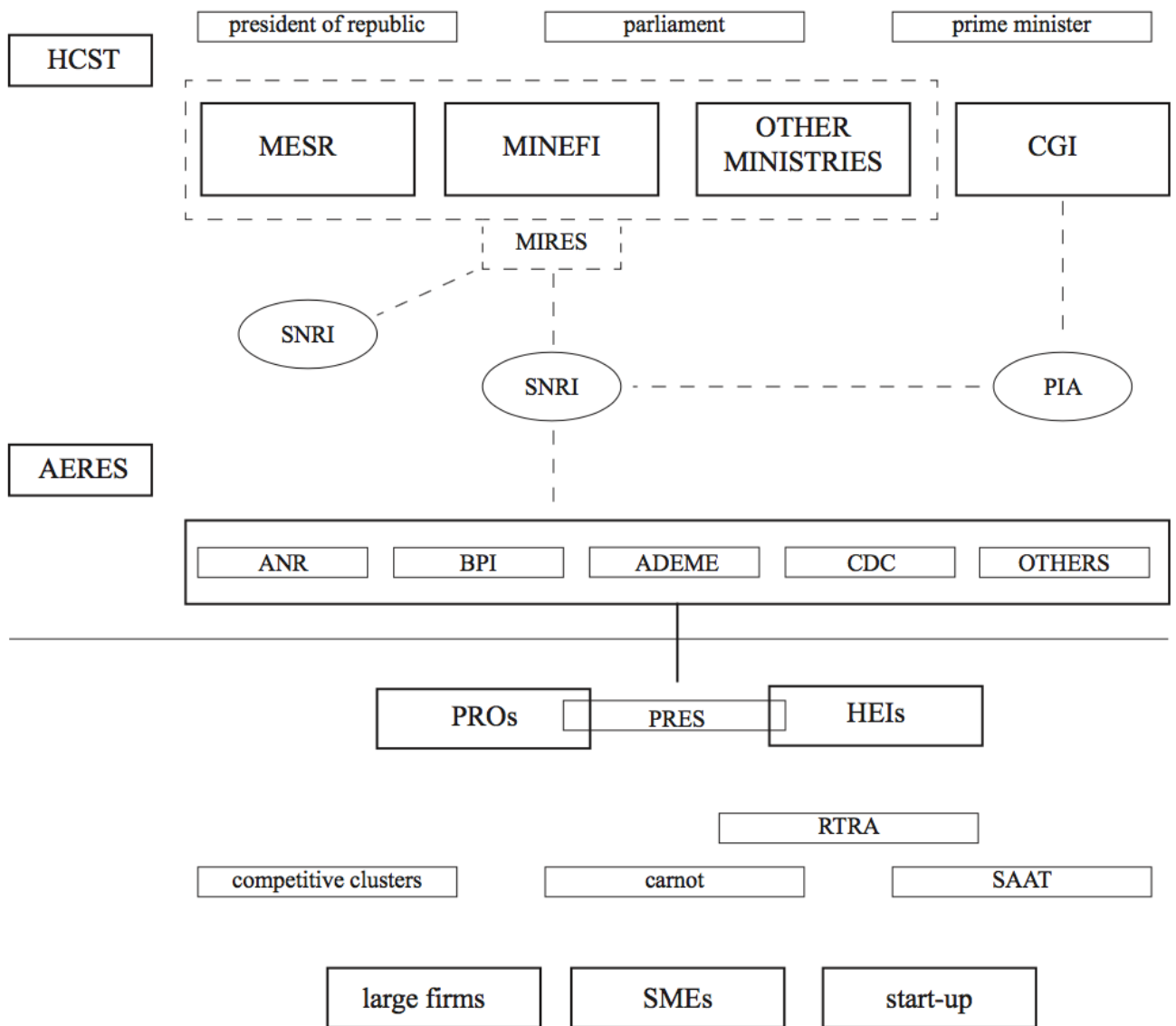
Figure 5. 2 The governance arrangement (France)

Among the operators we find the National Research Agency (ANR), created in 2005 with the task of funding research, mainly on a competitive basis, which became one of the main operators of the PIA program. The BPI France, which is a public investment bank financing innovation activity through a different portfolio of actions, from the provision of loans and guarantees, to the shadowing and consultancy of innovation projects. It is the main operator for R&I in the private sector and it resulted from evolutions and merging of first ANVAR and then OSEO. ADEME, Environment and Energy management Agency in charge of the implementation of the Investment for the Future program, and other sectorial actions. The *Caisse des Dépôts et Consignations* CDC (Deposits and Consignments Fund), is a state bank which funds companies and is heavily involved in innovation and SMEs financing (OECD, 2014).

Then, among R&I performers we have Public Research Organizations and Higher Education Institutions, together with Research and Higher Education Cluster (which basically groups these actors on a thematic, and geographical, principle). Then the hybrid organizations of R&I performers including (potentially) both private and public operators, like competitive clusters, Technological Transfer Acceleration Companies; and finally, the different private R&I performers.

5.2 **The Public R&I Performers**

Public Research Organizations

The French higher education and research structure has a mixed nature, mainly because of two reasons. The first refers to the deep, and cultural, separation between highly selective *Grandes Écoles* (mainly oriented towards the training of the future French élites) and universities. This delineates a dual tertiary education system especially in disciplines like science, engineering and management (Veltz, 2007).

The second reason is related with the nature of the public research system, that is split between two actors, Public research organizations, mainly devoted to research activities (e.g. basic-research oriented CNRS[35], or applied oriented INSERM) against the low commitment of university faculty members (Musselin and Paradeise, 2009a).

During the 1960s, in the attempt to fill this gap, CNRS put in place a system of partnership between its personnel and university groups (called *unite mixte de recherche*)[36] (Mustar and Larédo, 2002). These joint research units are fully fledged research groups of small and medium size, often physically located within universities; they are made up of mixed personnel (also in terms of employment status) and are under the dual supervision of the related University and PROs[37].

The powerful role of PROs in the public research realm, is closely related with their legacy as pillars of the publicly led Grand Programs, which used to absorb the majority of French R&I strategy in the 1950s-1980s. Following on from the disappearance of what has been a central model of public intervention ("Colbertism") the state has inherited a set of public research organizations (Mustar and Larédo, 2002).

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[35]This is the largest Public Research Organization in terms of number of researchers, and it is focused on multidisciplinary basic and applied research. It usually combines responsibilities for strategic planning and programming with a role as research performer (OECD, 2014; Schoen et al., 2008).

[36] This approach is not unique, since INSERM or medical research has also generalized it, and other research institutions such INRA and IFREMER have also been active in this respect (Thèves et al., 2007, p. 394)

[37] These units accounted for the 88% of the 1303 CNRS units in 2000 and 95% of the 1029 research units in 2012 (OECD, 2014, p. 129).

Indeed, starting from the 1930s onward many public research institutes were created at the mercy of different Ministries or public research programs. In the 1980s this resulted in a dispersed landscape of organizations with various legal status and fragmented competences (Théry, 2004).

A first attempt to reorganize the landscape of PROs was the 1982 Law (*Loi de Programmation pour la recherche et le développement technologique de la France*), through which these organizations were given a new specific status and structure, according to their roles and competences:

- EPIC Industrial and trade related public institution (*Établissement public à caractère industriel et commercial*). They are aimed at conducting finalized research and their areas of interventions tend to overlap with administrative public services, industrial and commercial public service missions. To some extent these were designed to fulfill the technology transfer role between academic research and business[38].

- EPST Scientific and technological public institution (*Établissement public à caractère scientifique et technologique*), which conduct upstream research[39].

The underlining logic of intervention aimed at rationalizing the system of public research organization and enhance their collaboration. Another move in that direction, especially towards the mobility of researchers between PROs, was the provision of the civil service status to all the researchers employed by EPSTs. This new status empowered research laboratories to establish cooperation around specific projects with scientific and industrial partners (Chesnais, 1993).

For what concerns their governance, each PRO (except for the CNRS, which is solely under the supervision of the Minister for Higher Education and Research) was moved under the double supervision of the Minister for Higher Education and Research and the functional minister related with the specific research area. EPSTs were linked to their supervising ministries through a multi-year contract, which defined general objectives, and determined the internal allocation of resources among priorities and research teams (OECD, 2014).

Universities

Historically universities haven't been a pivotal actor in R&I landscape especially because in the French context they were quite young institutions. During the French revolution they were suppressed, and before the late 60s these were re-organized into faculties (Musselin and Paradeise, 2009a). Since the law Faure (1968) universities, with the new status of public institution of scientific and cultural nature, replaced the faculties and were designed to became an autonomous actor. Indeed,

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[38] For a complete list please refer to http://www.enseignementsup-recherche.gouv.fr/cid49700/etablissements-publics-a-caractere-industriel-et-commercial-e.p.i.c.html (Last access May, 2019).

[39] For a complete list please refer to : http://www.enseignementsup-recherche.gouv.fr/pid25357/etablissements-publics-a-caractere-scientifique-et-technologique.html (Last access May, 2019).

they were entitled with the power to define their statutes and internal structures, their pedagogical methods.

With the Loi Savary (1984) university presidents acquired (potentially) important powers, like: directing the university, concluding agreements and conventions, managing revenues and expenses. With the Organic Law on Finance Acts (LOLF) approved in 2001 and entered into force in 2006, the introduction of new management rules (performance measurement, transparency) asked universities to perform a true cost calculation, to set up accounting costs. This was strengthened with the 2007 Law on the autonomy of university, which provided increasing power to university presidents, by transferring to them authority over their technical staff, new responsibilities on recruitment, the management of technical and academic staff and the power to decide on real estate (Musselin, Paradeise, 2009). Together with the introduction of the compulsory definition of the 4-year contract with the Minister of Higher Education and Research.

Overall, despite some research activities remained inside university, the division of labour between HEIs and PROs was still pronounced. This partitioning was even deepened by the law 1982, which granted the civil servant status to full time researchers within PROs (Musselin and Paradeise, 2009b). As we will discuss into details in the following paragraphs different instruments have tried to support the connection between the three different actors of the French research and HE system, experiences like the PRES tried to pool the research activities and the resources of these actors together. Nevertheless, also from the opinions gathered by our interviewees, the cleavages universities *versus* PROs and universities *versus Grandes Écoles* seemed still persistent.

5.3 Encompassing Research and Innovation strategies

Since the end of the 1990s, France has extensively debated the decline of its Research and Innovation system. The discussion mainly concerned its organizational structure, which dated back to the 1982 *Loi de programmation et orientation de la recherche*[40].

This was coupled with early reflections concerning the increasing willingness to start evaluating university performance (Rapport Croizer, 1990) and on the need to reform the composition of their financing system (Text proposed by *Conférence des présidents d'université*, 1994[41]). After the end of an historical phase of major state-led public research programs and a combined hardening of budgetary constraints, the government seemed inclined to start taking charge of the main issues which were thought to hamper the modernisation of the French R&I system: low efficiency of the

[40] Loi n° 82-610 du 15 juillet 1982 d'orientation et de programmation pour la recherche

[41] This text called for a "overhaul" of university financing system and a greater participation of local authorities, business and families, because the current system of exclusive financing by the state was perceived as no longer suitable to cover their needs (https://www.vie-publique.fr/politiques-publiques/enseignement-superieur-universite/chronologie/).

technology-transfer structures, low mobility of researchers, inadequacy of legal, financial and fiscal conditions for the creation of innovative companies (European Commission, 2002a).

Therefore, at the end of the 1990s the need to take over these problems was evident for both policy makers and stakeholders, but no clear direction was provided yet.

This mission was jointly given by the ministry of Research, the Ministry of Economy and Finance and Industry and the Secretary of state for the Industry[42] to Henry Guillaume. They asked the honorary president of ANVAR and Vice-president of ERAP[43] an in-depth analysis of the organisations and activities financed through the national Civil Budget of Research and Development, with the final goal to put forward alternative propositions on how to increase the effectiveness of national strategies.

The *Rapport Guillaume* (1998), in line with the concerns expressed by public authorities, highlighted the general difficulties policy makers were facing in organising, and boosting interactions between public research and industrial system. The main conclusions of the report were that the quality and potential of French research did not meet the needs of industrial sectors as easy as in other countries. Following on that, the report identified the following weaknesses:

- A marked division between Higher Education and Public Research Organisation, between different Public Research Organisations and between universities and engineering schools. These issues were closely related with the peculiar type of organizational structure that was characterising the R&I national environment (as we will discuss in further details in the following Chapter 6);

- The complexities embedded in the instrument for technology transfer, which did often represent a barrier to the access of SMEs;

- The inadequacy of investments in risk-capitals (venture capitals and seed-capitals), that were still insufficient to cover the start-up phase of new technological enterprises;

- The lack of a consolidated national strategy for the coordination, implementation, evaluation and support of industrial research;

- The lack of diversification in state investments, which were still focused on a limited number of industrial groups and sectors[44].

The reflection conducted by Henri Guillaume, was followed by the organisation of a national consultation with stakeholders, *Les Assises de l'Innovation* (1998), involved in the different spheres

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[42] Rispectively: Claude Allegre, Dominique Strauss-Khan, Christian Pierret.

[43] *Entreprise de recherche et activités pétrolières* (entreprises for oil research and activities), it was a state-owned French petroleum company.

[44] Specifically, for many years, research priorities targeted raw materials, energy independence and defence (European Commission, 2002). As confirmed by Figure 4.2.

of research and innovation (scientific, technological, financial, industrial). This was preceded by seven regional meetings, focusing on specific technological areas, organised by research organisations in liaison with local and regional actors. It involved policy makers and different public and private stakeholders of R&I sector, in order to gather opinions and suggestions on the design of R&I national strategies.

5.3.1 The Law on Innovation and Research

The suggestions provided by the Guilliame report, especially with regards to the barriers to innovation, have been almost directly channelled into the 1999 Innovation act (*Loi sur l'innovation et la recherche*[45] also known as *Loi Allegre*). This strategy consisted of an instrument mix oriented towards improving the diffusion of results from research towards the business world. It attempted to breakdown the deeply rooted mutual deference between academia and industry, while providing new tools for risk-capital development.

The instrument mix hinged upon different measures supporting the mobility of researchers in private firms, by easing their participation in the creation (and management) of innovative firms[46]. Therefore, trying to encourage them to participate in the establishment of private companies to develop the results of the research work carried out. On the same line, it aimed at boosting the cooperation between research and industrial sectors by providing universities with the opportunity to create their own commercial and industrial business services (SAIC *Services d' activites industrielles et commerciales*) and to develop projects with the industrial sector and regional partners (RRIT *Reseaux de Recherche et d'Innovation Technologique*, CNRT *Centres Nationaux de Recherche Technologique*, Regional Incubators). Finally, it designed innovative solutions for venture capital development (Co-investment funds for young enterprises and Seed-capital development), horizontal measures to help enterprises supporting their R&D expenses (CIR *Crédit Impôt Recherche* amendments) and to promote the creation of new technological based firms (National competition for creation of new technology-based). The following table provides the relevant characteristics for each instrument.

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45 Loi n. 99-587 du 12 juillet 1999 sur l'innovation et la recherche.

46 Specifically, by extending the power of the existent legislation the 1999 Law on innovation and research, at art. 2, increased the freedom of public research performers in the commercialization of their discoveries, amending the previous regulation provided by Loi n. 82-610 du 15 juillet 1982.

Instrument	Content	Shapes Family Delivery Target
Industrial and Commercial Business Services (SAIC)	It allowed universities to create new organisations to structure and manage their activities of research exploitation (e.g. activities for which an enterprise can request a service, valorisation of research activities, general management of universities' commercial activities).	Technology Transfer Organisation [regulation #l ow coercive] [mixed automatic] [HEIs + PROs]
Technological Research and Innovation Network (RRIT)	It clustered all the players in a technological field or industry: PROs, SMEs, universities and engineering school, professional associations and unions, technical centres, interest groups. Bottom-up approach for deciding objectives and large autonomy left to the project partners.	PPPs [information # high coercive] [mixed automatic] [HEIs + PROs + SMEs]
National Technology Research Centres (CNRT)	Ad hoc legal public private partnerships aimed at creating links between public/industrial research, as a vector for technology transfer. Created in the context of State Regions contracts. They mainly involved large companies as industrial partners	PPPs [information # high coercive] [mixed automatic] [HEIs + PROs + Enterprises]
Regional Incubators	Consulting structures in support of technologically based firms through different services: training, advices and funding system.	Consulting service (incubators) [information # high coercive] [low automatic] [HEIs + PROs]
Co-investments in fund for young enterprises	It took up minority participations in young technological enterprises, or together with the investment funds established in the European Union. It intervened under the same conditions as private investors. CDC and France State were the major underwriters.	Equity participation [low automatic] [expenditure # high coercive] [Start-ups]
Seed Capital Fund for development	Seed-capital funds on major areas of technology at the national level, with the partnership of public research institutions and private investors. Through regional incubator structures it allowed the development of regional seed-capital funds to invest 75% of it in enterprises linked with public research. CDC was the major investors with 30%of total funding.	Cash Advance [expenditure # coercive] [low automatic] [Start-ups]
Tax Credit for Research Expenses	Extension for expenses associated with researchers working directly in R&D project.	Tax reduction [Expenditure # Medium coercion] [high automatic] [SMEs]
National Competition for the creation of technology-based firms	National competition opens to anyone willing to set up a new technology-based firm. It supported the best projects through a grant and by providing services to newly created firms.	Competitive Funding [expenditure # low coercion] [low automatic] [SMEs+ researchers]

Table 5. 1 Instrument mix Law on innovation and research

Overall, the policy mix displayed an exhortatory attitude. Indeed, through a mix of highly coercive, but not highly authoritative instruments, it mildly required certain behavioural changes from the target population; by providing the direction in which to go (through moral suasion) compensated by the provision of different types of subsidies. The CNRT and RRIT instruments were both aimed at creating networking between actors of the innovation process, to overcome the divide between public research and industrial world. Despite the similarity of instruments' features, the mix addressed to different industrial partners, namely SMEs and big enterprises, envisaging the cleavage between private R&I performers analysed in the following Chapter (6).

5.3.2 The innovation Plan

The *Loi allegre* has dominated the Research and innovation policy agenda until 2003-2004, during the enactment of this strategy the country has undergone through a period of intensive transformations in the field of Research and Innovation sector. The underlining logic of intervention was driven by the belief that France needed a more favourable institutional (and legal) framework for the cooperation between public and private research actors, as well as for the development of research results by public actors (especially in the form of start-up companies).

The second step of this systemic transformation was grounded in the understanding that national innovative capacity was closely related with national economic development strategies. Therefore, in December 2002 the Minister delegated for Industry and the Minister delegated for Research and new Technologies presented some guidelines regarding a plan to boost innovation which strengthen a series of measures undertaken in 1996 and in 1999 with the Innovation Act. This strategy was discussed by R&I stakeholders in a national consultation which lasted three months. In the meanwhile, the competent ministers went through a series of individual meetings with industrial managers, public and private researchers, experts and investors.

This process culminated into the *Plan pour l'innovation* published in April 2003. This was made of six main axes of intervention which concerned: encouraging the market of business angel investors (SUIP *Société Unipersonnelle d'Investissement Providentiel*), the support for highly R&D intensity enterprises (JEI *Jeune Entreprises Innovantes*), the redefinition of the role of ANVAR (towards an agency aimed at ensuring national consistency between the measures implemented at the regional level, while providing expertise to local authorities), the valorisation of research in enterprises (extension of the CIFRE47 *convention industrielle de formation par la recherche*) and finally an effort to increase the awareness among student regarding the opportunity of research and entrepreneurial occupations.

Instruments	Content	Shapes Family Delivery Target
CIFRE convention	It supported the recruitment of students and researchers by private enterprises to undergo joint applied research projects supervised by enterprises and public universities/laboratories.	Targeted funding [low automatic] [expenditure # low coercion] [SMEs]
Supports to projects by Young Innovative companies	It helped young and highly innovative firms to overcome the first years of existence by providing tax credit in favour of R&D investments.	Tax exemption [high automatic] [fiscal # low coercion] [Start-ups]

47 This instrument was into force since 1981.

Unipersonal Risk Investment Company (SUIP)	It aimed at mobilising individual investors (business angels) by granting corporate tax exemptions and income tax exemptions (for a fixed period).	Tax exemption [high automatic] [fiscal # low coercion] [Start-ups]
Entrepreneurial House	It allowed Higher Education Institutions to develop offices to open up universities to the business world (raise students awareness of entrepreneurship, exchange of good practices, promotion of entrepreneurial culture).	Targeted funding [expenditure # low coercion] [mixed automatic] [HEIs+ PROs]
Industrial Property pre-diagnosis	It aimed at assessing enterprise needs in terms of industrial property rights through consultations with experts	Consulting service [information # high coercive] [low automatic] [SMEs]
Tax Credit for Research Expenses	Extension of the exonerations granted with the 1999 Innovation act	Tax Reduction [Fiscal # Medium Coercion] [high automatic] [SMEs]

Table 5. 2 Instrument mix Innovation plan

The redefinition of the role of ANVAR culminated in its merge with the former and BDPME (Development bank for SMEs) and the creation of OSEO in January 2005. This agency became the main public operator in the field of innovation in charge of the implementation and monitoring of national policy, especially for enterprises (European Commission, 2005a). Overall, the policy mix was characterised by a low degree of coercion and a marked preference for both automatic, and not automatic, subsidies. In this case a clearer orientation toward SMEs and highly innovative companies was pursued.

5.3.3   *The investment for the Future plan*

In the following years different interventions were adopted in the Research and Higher Education sector (Research Act, 2006; Law on the liberties and responsibilities of universities, 2007) and in the industrial and technology sector (SME Pact, 2005; Law for the modernisation of the economy 2008), as discussed in the following paragraphs.

Only in 2007, with the elaboration of the National strategy for Research and Innovation (*Stratégie Nationale de Recherche et d'Innovation* SNRI) policy makers get back towards a more encompassing approach in designing R&I policies. The definition of the SNRI was directed by the Minister of Higher Education and Research, but revolved around the consultation with the scientific community and other R&I operators. It was a five years strategy aimed at building a coordinated action to meet Great Societal Challenges. Despite the coordination effort embedded in its definition, the SNRI was not set at the operational level, and it didn't allow to allocate budget (OECD, 2014), resulting a smooth exercise of aligning the agenda between players, rather than a plain joint policy making exercise.

Nevertheless, it was influential in identifying the thematic areas for the following R&I strategy designed under the Sarkozy presidency: The investment for the future plan.

The "*Investissement pour l'avenir*" plan (PIA) was focused towards the improvement of the long-term growth potential of the French economy. It aimed at boosting productivity, increasing competitiveness, supporting employment and equal opportunities by promoting investments and innovation in 5 priority sectors: higher education and research; industries and SMEs, sustainable development and the digital economy.

The program was initiated by the budget law of 2010, with the objective of covering the period 2010-2020, on the basis of the recommendation of an expert commission chaired by Juppé and Rocard (two former Prime Ministers). This committee was set up by the French government, following the 2008 economic and financial crisis, in order to identify the priority sectors for the new strategic investment plan (Eparvier et al., 2009).

The final report was transmitted to Sarkozy the 19th November 2009 and it agreed upon an amount of 35 billion euros in favour of innovation. It basically, recommended giving priority to investments in Higher Education and research, plus other areas to be taken into account for the effectiveness of national R&I system: "the emergence of the city of tomorrow"; the digital economy, renewable energies, transport of the future, life science and support for innovative SMEs.

After the implementation of this program an innovative governance structure has been put in place under the competences of a new coordination committee created in 2010, the *Commissariat Général à l'investissement* (CGI). It was responsible for steering and coordinating the overall coherence of the PIA scheme, it coordinated interministerial policy design under the authority of the PM as well as the cooperation among other governmental bodies responsible for the distribution of funds. It ensured the transparency and quality of the selection procedures, the allocation of funds to existent operators, as well as the overall coherence of the strategy. The program was organised as follow: a first phase of preparation of agreements between the PM and each of the operators (ANR, OSEO/BPI France), a second phase for the management of the calls for project.

The governance of the strategy involved different actors: the ANR was responsible for the higher education and research fields[48], ADEME[49] for actions related with the energy and ecological transition, OSEO (BPI-France) for the support to companies and industries. Moreover, the

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[48] It was in charge of managing the calls for proposals, setting up the evaluation and selection process, preparing the grant agreements, funding the selected teams, monitoring the activities in their development and providing the impact analysis.

[49] *Agence de l'environnement et de la maitrise de l'énergie* (Environment and Energy management Agency). It was an EPIC, which participated in the implementation of public policies in the fields of environment, energy and sustainable development. The agency also supported project financing, from research to implementation, in the following areas: waste management, soil conservation, energy efficiency and renewable energies, row materials, air quality, the fight against noise, the transition towards the circular economy and the fight against food waste (https://www.ademe.fr/lademe Last Access May 2019).

Commissariat-General was aimed at controlling major public investments of the state, by keeping a permanent inventory and organisation of independent counter-expertise.

Ultimately the PIA was translated into competitive calls for national projects around themes prepared by the CGI and its operators. Projects were evaluated by a jury of independent experts, sometimes international, bringing together high-level competences to select innovative projects with high growth potential. The investment for the future plan included 9 measures: financing of equipment for research/technological infrastructures (EQUIPEX); providing financial support to leading lab or public research institutions aimed at international competition (IDEX, IRT, LABEX, IEED); financing of research in health, biotechnology and biomedical fields (IHU; Health and Biotechnology actions); creating interface structures between academia and industry (SAAT; France Brevet).

Instruments	Contents	Shapes Family Delivery Target
Excellence initiatives IDEX	It aimed at connecting, on a territorial basis, Higher Education Institutions, *Grandes Écoles* and research institutions recognized for their scientific and pedagogical excellence. They aimed at ensuring their visibility and attractiveness on an international scale (also for the economic actors).	Competitive Funding [expenditure # low coercion] [low automatic] [HEIs+PROs]
Health and Biotechnology Programmes	It aimed at reinforcing the expertise of French research in the Health and Biotechnology sector, by funding research in different subfields (e.g. bioinformatics, Nano-biotechnologies, and various "cohort50".	Competitive Funding [expenditure # low coercion] [low automatic] [HEIs+PROs]
Technological Research Institutes (IRT)	It supported the creation of 4 to 6 Technologic Research institutes, within existing French campuses. These institutes, through public-private partnerships on research, innovation and education, reinforced existing competitiveness clusters, in order to help the country reaching international level in diverse economic fields, and thus create growth and jobs.	Targeted Funding [expenditure # low coercion] [low automatic] [HEIs+PROs+SMEs]
Hospital- University Institutes IHU	It aims at supporting the creation of foundations associating one University, one hospital and several research institutes on an excellence programme in the field of care, crosscutting research and clinical and applied research.	Targeted Funding [expenditure # low coercion] [low automatic] [HEIs+PROs]
Technological Transfer Acceleration Companies SAAT	It supported technology transfer acceleration companies. These will be mostly owned by a consortium of HEI and research centres. Their mission is to focus on the valorisation of public research through innovative strategy in respect to patents, industrial partnerships, creation of SMEs, and researchers' mobility. They will act as service provides in the field of research valorisation for their shareholders and other potential clients.	PPPs [information # high coercion] [mixed automatic] [HEIs+PROs]
Excellence Laboratories LABEX	It aimed at selecting excellent research laboratories and providing them with the financial means to compete with international research institutions, attract internationally recognised researchers and perform high level research and education programmes.	Competitive Funding [expenditure # low coercion] [low automatic] [HEIs+PROs]
Excellence Institutes in the Field of	It aimed to create five to ten Institutes (IEED) on campuses with international visibility. Each of them could benefit from public financial support, targeted investments and support in long-term strategy development. The overall objective is to build up several	Targeted Funding [expenditure # low coercion] [low automatic] [HEIs+PROs]

50 A cohort consists in following for several years, or decades, a population of subjects, healthy or sick, in order to accumulate reliable knowledge on their health. It can help improving the prevention, diagnosis and treatment of a wide range of serious and life-threatening diseases (e.g. cancers, heart diseases, diabetes, arthritis) (http://www.enseignementsup-recherche.gouv.fr/cid51358/cohortes.html).

Carbon-free energies IEED	campuses with the capacity to aggregate public and private investments around promising research projects on energy efficiency.	
Excellence Equipment EQUIPEX	It aimed at investing in infrastructures in view of boosting the French Research and accelerate research breakthroughs, at reducing the delay in the acquisition of medium-sized equipment, especially those that fit with the national strategy for research an innovation.	Targeted Funding [expenditure # low coercion] [low automatic] [HEIs+PROs]
France Brevet	It was a public enterprise (owned by the state and CDC) serving the valorisation and protection of French technological innovation. Its mission is to support companies in valuing their innovations by structuring their intellectual property and by defending it around the world.	Equity Participation [expenditure # high coercion] [low automatic] [HEIs+SMEs]

Table 5. 3 Instrument mix Investment for the future plan

With the design of the PIA the government developed a new intervention model, where central administration, through CDC, made contribution in equity participation in the capital of the SATT (33% of their capital), similarly to the *France Brevet*, sovereign patents fund. This system can be defined as "holding model" (Eparvier et al., 2011), where through the provision of different funds the central administration possess financial stakes in innovation organization, without the cost associated with their management. This structure was mirrored by the high share of targeted funding characterizing the strategy and the increasing professionalization of the national bureaucracy with the prominent role of public agencies like ANR, OSEO and ADEME.

Overall the policy mix was characterized by a high share of expenditure-oriented and low coercive instruments, which were matched with the relevance of the political (government and CGI) role in setting the priorities for the competitive funding.

The Investment for the future plan has been maintained and extended also in the following presidencies. The second wave of PIA (PIA 2), in 2014 under Hollande, slightly reoriented the strategy toward a more prominent role of the digital economy and it increased the number and the specificity of the sectors of investments. The last wave (PIA 3), was implemented by Macron in 2017 and it became part of the broader *Grand Plan Pour L'investissement strategy*, with the goal of improving cooperative behaviours in R&D and related areas. Differently from the former strategy PIA 3reduced the number of sector of investments[51] and transformed the CGI in the *Secrétatiat General Pour l'Investissement* (SGPI).

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51 https://www.gouvernement.fr/le-programme-d-investissements-d-avenir (Last access May, 2019).

5.4 The reforms in the Research Sector.

The French public research system hinged upon universities and large public research organizations (as portrayed in Figure 5.2), the largest of which was the CNRS. These organizations, unlike other countries in the world, played a great role in the structure of French public research scenario (OECD, 2014).

Their relevance was closely related with the historical development of French public research infrastructures, which used to be highly supported by the state and to focus on few sectors, related with major national companies, responsible for the industrial exploitation of the research undertaken by public organizations (Mustar and Laredo, 2002).

This model allowed for key technological breakthroughs in some sectors (e.g. space, railways), but its limitation become clear after the emergences of new technological sectors, like for example ICT technologies (European Commission, 2000a). At the end of 1990s policy makers became increasingly aware of the fallacies of their R&I structure, especially for what concerns the diffusion of research results through industrial sectors, and more generally the lack of systematized connections between public research and enterprises (especially SMEs).

The 1999 innovation act and the 2003 Plan represent the first attempts to solve these issues.

Governmental efforts to raise innovation awareness, especially for economic development, were going hand in hand with the discourse on the decline of the national structure of research. This debate has been mainly focusing on the systems' organization, which dated back to the 1982 research act, and whether or not it could be one of the main causes for the average performance of the French R&I system.

As a first attempt to tackle these issues, the government designed the *Pacte Pour la recherche*, an action program for public research, aiming to restore French competitiveness (Arnold, 2007). Originally, the reform of the research system, which was first outlined in the innovation plan presented by the Ministry delegated of research and new technologies in 2003, was expected to be launched in the second quarter of 2005. The first draft of the bill faced strong criticisms by the representatives of Public Research and Higher Education institutions, consequently the approval process was delayed.

Indeed, in the meantime, a movement *Sauvons la recherche* (SLR) representing public research and higher education institutes kicked off in 2003. Some researchers chose to voice their worries to the press and to put pressure on the government regarding the design of the new Law for Research.

They expressed concerns regarding the plan to launch a National Research Agency (ANR) for the funding of research, its increasing budgetary power and its subordinated role in terms of ministerial control. Researchers were afraid that this would be detrimental for the multidisciplinary nature of

EPSTs, like the CNRS, and it would allow the government, rather than the research community, to pick and choose new areas of research (Schoen et al., 2008). In their words: "this piloting is done by the prince, and as such the direction will change with the mood of the prince[52]".

On the same line, they also claimed that the increasing political focus on applied research should not overlook the relevance of basic research, since these are both necessary for their mutual development. The triggering event (April/May 2004) for the beginning of a strong protest movement, was the decision of the Minister in charge of Research to change the status of 550 life-long research positions and transform them into fixed terms contracts. This unveiled a profound unease throughout the French research system and dramatically highlighted very sensitive issues such as lack of funding, excessive administrative burdens and, more fundamentally, the inadequacy of the status of researcher as defined by the legislation into force (Law 1982).

Apart from the reintegration of the researchers and the creation of further university positions, the movement triggered a vivid national debate which culminated, thanks to the mediator role played by some exponents of the institutional and scientific world, into the "*États généraux de la Recherche*" (The General State for Research) in 2004.

This initiative gathered researchers and citizens, first at the regional and then at the national level, to make proposals in view of contributing to the design of the new *Pacte Pour la Recherche.* In the meanwhile, also internal pressures pushed for a reform of the research system.

Indeed, in 2005 the Court of Audit release a report (*La gestion de la recherche dans les universités*), which supported some of the measure included in the Pact for the Research for what concerned public research in universities. The report proposed to increase the management autonomy of universities, the creation of a single evaluation authority and to enhance the concentration of universities in order to gather their resources to be able to compete internationally.

5.5 The Research Act

After all, at the end of 2005 the Research act bill was presented to the Parliament by the Minister of National Education and the Minister delegated for Higher Education and Research, to be finally approved in the spring 2006. One the main underlining elements of the Research Act was a commitment to increase public R&D funding, in order to achieve the European agreed 3% of GDP goal by 2010. This strategy revolved around different axes of intervention.

The first aimed at encouraging public research actors to engage in joint research projects, with other Higher education/ PROs institutions in order to increase their critical size (PRES *Pôles de recherche*

[52] [...] "*Ce pilotage est le fait du prince, et comme tel, le cap changera avec l'humeur du prince*" [...]
http://sauvonslarecherche.fr/spip.php?article1481

et d'enseignement supérieur). It also provided the opportunity to create partnerships between public research excellence initiatives and industrial actors populating the local competitive cluster (RTRA *Réseaux thématiques de recherche avancée*). These were complemented by a time-limited targeted funding in case of research that involved socio economic partners (enterprises or SMEs) in the development of innovation (*Carnot Award*). In the same vein, through the creation of an Industrial Innovation Agency (AII *Agence de l'innovation industrielle*)[53], also medium-term public programs for industrial innovation were implemented (PMII *Programmes mobilisateurs pour l'innovation industrielle*).

The governance of the system was consistently modified through the creation of an agency devoted to the rationalization of the research system evaluation (AERES *Agence d'évaluation de la recherche et de l'enseignement supérieur*) as well as an advisor council (HCST *Haut conseil pour la science et la technologie*), which was created to support the President of the Republic on science and technology decisions.

Finally, also the landscape of research funding system was modified. Traditionally public research was funded through contract mechanisms between the state and the research performing institutions, with the creation of the ANR (*Agence nationale de la recherche*), the government was clearly moving from a mechanism of block grants towards a system of competitive and targeted funding.

Instruments	Content	Shapes Family Delivery Target
Research and Higher Education Clusters PRES	Contractual tool for grouping Higher education/PROs in geographical proximity (district, department, region) to pool their resources and create a unique cluster to manage research, education and valorisation activities	Contract [regulation # low coercion] [mixed automatic] [HEIs+PROs]
Thematic Advanced Research Networks RTRA	Funding structure for research units in geographical proximity, able to gather high level researchers working on a specific thematic field and interact with local industrial clusters.	Targeted Funding [expenditure # low coercion] [low automatic] [HEIs+PROs]
Carnot Award	It awarded (with funding) a limited number of pubic research entities or private research organizations with general interest goals, for their implication with the socio-economic partners. (these are supposed to be the French counterpart of the German Fraunhofer).	Competitive Funding [expenditure # low coercion] [low automatic] [HEIs+PROs]
Mobilizing programs for industrial innovation PMII	It aimed at creating and supporting consortia between enterprises, research laboratories and SMEs devoted to the creation of highly innovative and commercially viable products (within 5-10 years).	PPPs [Information # high coercion] [mixed automatic] [HEIs+PROs]
Agency for the evaluation of research	This agency encompassed all the previous agencies in charge of research evaluation. It evaluated research institutions, research	Agency for Evaluation [regulation # high coercive] [low automatic]

[53] In September 2004 the government commissioned a report to Jeanl-Louis Beffa (the CEO of Saint Gobain company) on industrial policy. The report, "*Pour une nouvelle politique industrielle*", concluded that French industry wass currently specialized in low-tech sectors, which explained the relative industrial decline of national economy. The experts' recommendations were to promote a new industrial policy based on the creation of a new agency, the Industrial Innovation Agency (AII), with the task of coordinating medium-term industrial programs (European Commission, 2005a).

and higher education AERES	teams and education institutions, allowing to concentrate assessment and evaluation of public research and teaching institutions within one agency.	[HEIs+PROs]
High council for science and technology HCST	It advised the President of the Republic and the Government in matters related with science and technology. The members were highly distinguished personalities appointed directly by the President of the Republic for four years.	Advisory Committee [regulation # low coercive] [low automatic] [HEIs+PROs]
National Agency for Research ANR	It administered competitive research funding allocation. It took over the support action previously conducted with the technology research fund (FRT *Fond de la recherche technologique*) and national science fund (FNS *Fond national de la recherche*)	Funding Agency [regulation # high coercive] [low automatic] [HEIs+PROs]

Table 5. 4 Instrument mix Research act

With this strategy new instruments have been introduced to cluster universities on a regional basis, in the effort of reducing fragmentation (Schoen et al., 2008). The underlining policy rationality of the PRES was related with the perception that in a context of international competition, the acquisition of a critical size by federations of universities, *Grandes Écoles* and PROs would enhance their visibility (the size matters for the calculation of international performance rankings) and therefore increase their attractiveness.

Ultimately, a greater size was meant to strengthen their influence in steering French research and as a way to bridge universities with other higher education and research actors, while respecting their heterogeneous status. According to Musselin and Paradeise (2009) this strategy for developing incentives for research excellence and clustering among institutions through bottom-up mechanisms eventually activated by territorial actors (e.g. president of universities, heads of research organizations, regions, local industries) accelerated the blurring of competences between Higher Education Institutions and Public Research Organizations.

To some extent the RTRA instruments followed the action of some of the instruments included in 1999 law for research and innovation (e.g. CNRT and RRIT), with the slight difference that these networks were thematic; therefore, hinging upon selected research and industrial sectors.

The instrument mix was characterized by a majority of low coercive instruments, designed to leave target group enough room for manoeuvre in engaging in joint research activities. This was compensated by structural changes in the governance of the sector through the introduction of an evaluation agency (AERES) and a funding agency (ANR), which could be read as an attempt to consistently rationalize the system, devoting particular attention to systematize its evaluation and funding procedures.

5.6   The reforms for Higher Education Institutions

The following step in the reform of the national R&I governance structure was a transformation of university governance mainly defined by two long-lasting legislative interventions, the *Loi Farue* (1968) and the *Loi Savary* (1984). A first attempt in the direction of enhancing their autonomy, was proposed by the Minister for Youth, National Education and Research Luc Ferry in 2003[54]. Ultimately, the Minister gave up on his reform proposal under the combined pressures of the student unions, the Prime Minister and the President of the Republic, who feared students and academic uprising[55]. Nevertheless, the issue of the role of universities in the national R&I structure, and more generally the willingness to modify their internal governance structure, was still politically relevant at that time and it was simply put aside, waiting for the right window of opportunity.

The right event to bring back on the table the role of University and Public research was the release of the 2003 Shanghai ranking were French universities scored a lower performance than expected. As claimed by Musselin (2017), this event came to reinforce the initiatives that had been already ongoing, rather than triggering new ones. On the public research side this was translated in the 2006 research pact, whereas on the university side this helped to overcome the stalemate of the Ferry proposals, which finally culminated in the 2007 Law on the freedom and autonomy of universities. Another support in the direction of the approval of this reform was the election of a new President of the Republic, Nicola Sarkozy, who endorsed the reform as one of the main goals of his mandate.

Designed in combination with the 2006 research act, specifically with regard to PRES clusters, the *Loi Relative aux Libertés et Responsabilités des Universités* (LRU Law on the Freedom and Responsibilities of Universities) aimed at providing a central position to higher education institutions (specifically universities) in the R&I system (Zaparucha, 2010). It reduced the size of universities administrations councils, while increasing the role of university presidents, who had the possibility to became the project manager of each institute strategy, also for the recruitment of technical and academic staff. Indeed it allowed universities to recruit (within certain limits) academic and administrative staff on "temporary contracts", without providing the status of civil servants, they could offer salaries or bonuses which were not dependent on the national salary scales and impose teaching duties that were different (higher) than for civil servants (Musselin, 2013, pp. 27–28). University administration councils began to open up to social and economic actors, by including

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[54] This proposal has to be read in the light of the historical phase France was undergoing. Indeed, during the same years, the government manage to successfully implement the 2003 Innovation Pact, while starting up the draft for the future Pact for Research (2006).

[55] Which was actually the case, one year after, with the SLR movement in the context of the 2005 Pact for Research proposal.

external personalities as: representatives of local/regional authorities, entrepreneurs or executive managers of companies and representatives of the economic and social world.

Overall, universities acquired greater budgetary and financial management competences of their institution, in conjunction with this it became obligatory for them to sign a four-year contract (*contrat quadriennaux*) with the ministry of Higher Education and Research for a shared management of their strategies.

The underlining logic of the LRU was to put universities at the center of the systems as main operators of public research. This ran in parallel with the increasingly undermined role of Public Research Organizations in terms of funding powers, following from the creation of ANR and the decline of their evaluation role after the establishment of the AERES (Musselin, 2017).To some extent with the LRU policy makers attempted to counterbalance the loss of power and resources of PROs with an increase in the social, economic and networking role of universities (especially from a locally/regionally- based perspective). After this law few large universities have emerged (e.g. *Université Pierre et Marie Curie, Paris-Orsay*), nevertheless these remained weaker compared to other international research institutions, and much of their research was still done in mixed research units, some of which were controlled by the CNRS or other PROs (OECD, 2014).

The last piece of our chronological overview on the evolution of Higher Education and Public Research system, fall outside our strictly analytical period of interests. Nevertheless, I believe that even a brief reference to the changes it generated might be useful to understand the macro-level evolution of the sector.

After the presidential election of Hollande (May, 2012), and the take office of a new cabinet. The newly elected Minister of Higher Education and Research (Geneviève Fioraso), on July 2012 organized a national consultation process among the actors of the French Higher Education and Public Research system, with the aim of gathering their opinions for the definition of a new law on Higher Education. This was approved in 2013, *Loi relative à l'enseignement supérieur et à la recherche* (Law on Higher Education and Research), and it provided both breaks and continuity points with the previous 2007 LRU strategy. Specifically, it carried on the site policy/research cluster strategies undertaken by the previous governments but it replaced the PRES with Communities of Universities and Institutions (COMUE). The latter, despite the similarities of objectives, differentiated themselves form the PRES given the greater freedom left to Higher Education and Research actors to create their own associations form, without any clear reference to the criteria of excellence[56]. Moreover, the law transferred to regions the mission and the budget to develop and disseminate scientific and technical

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[56] With the government Hollande the concepts of excellence and performance are no longer present in texts or speeches, and the objectives of rebalancing and redistribution regain some legitimacy (Musselin, 2017, p. 67).

industrial culture; it increased the involvement of external actors in the governance of universities by providing for the acceptances of externals as voters for the election of the president of the university.

5.7 Business actors: the industrial and technological sector

French research and innovation policies were for a long time characterised by a tradition of highly centralised and sectorial public R&D "*Grand programmes*", coordinating large state PROs and state-owned firms *"Champions Nationaux"* in domains such as aerospace, nuclear energy or telecommunications. The *leitmotiv* of this system was the following: to develop a pilot public research projects in-house (public administration, research agency, Public Research Organisation), matched with the support of one or more national champions, charged with the industrial exploitation and commercialisation of new discoveries (Mustar and Laredo, 2002).These were large firms belonging to the oligopolistic French business, in some cases they were nationalised enterprises (or with just a majority share owned by the state) or normal business enterprises behaving much in the same way as firms with public capitals (Chesnais, 1993, p. 193)

Despite nowadays we can still distinguish a consistent share of government budget allocations for Research and Developed flowing toward specific sectors (as provided in Figure 4.2), over the past 20 years this policy paradigm has evolved. Indeed, according to Mustar and Laredo (2002) since the beginning of the 1990s, government priority setting logic has started to become more open towards bottom-up oriented strategies, and some of the classic grand programmes have been replaced by network-based initiatives.

On the other hand, this was coupled with low private R&D resources mobilisations which, in spite of the increase compared with the past, still relied to a significant extent on few and partly state-owned enterprises (Schoen, 2008). Despite R&D investments in this sector were not easy to capture, French economy was only moderately oriented towards high research and technological intensive manufacturing activities (Antonie et al., 2013). Overall, the system suffered from the lack of small and medium size technology-based companies; governments seemed to have changed their rhetoric from large companies, however these actors were still (even if more indirectly) benefiting of the lion's share of public support for R&D (Eparvier et al., 2009, p. 21)

Over the last decades the gradual refocusing of French State intervention in industry tended to hinge upon the discourse on "new industrial policies", which viewed competitiveness, and meeting community needs as the major drivers for economic development. Examples of this new narrative were the National Research and Innovation Strategy, launched in 2009 (and replaced by National Research Strategy in 2014) and the Investments for the future plan adopted between 2009 and 2010 (OECD, 2014).

5.8 From the "Champions Nationaux" to the "Gazelles"

Since the 1945 several actors of the French economy were consolidated into nationalised services (Banks, Gas, Electricity), the public control of industry and finance was further deepened until the end of the 1980s when, under the Mitterand (and the later Chirach I) presidencies, facing serious fiscal constraints, the state began its privatisation policy (Chandler, 2014).

At the beginning of the 1990s the French central model of state intervention (Grand Programmes) was almost disappeared following the privatisation of the majority of formerly public companies (Mustar and Laredo, 2002).

In 1993 Chesnais was writing: *France is a country in which there is a continuous talk about the importance of SMEs and innovation, but where, barring a few exceptions, one finds only limited evidence of their role as active components of the innovation system"* (p.193).

In the decades following this statement the landscape of French R&I has changed together with its instrument mix, paving the way for a more relevant role of SMEs. Differently from other contributions (see Mustar and Lared 2002), we do not believe that these changes have caused a paradigmatic shift toward a new mode of state intervention, to the extent that path dependence effects are still dominant, despite the introduction of new instrument mix characteristics (as demonstrated in Chapter 6).

Indeed, the policy legacy of the "Grand Programmes" model was difficult to dismantle, as confirmed by the low level of private participation in the R&D effort and the well-pronounced, and steady, state propensity for certain sector of R&D investment. Nevertheless, some measures devoted to SMEs and more network-oriented approaches were already in place since the early 1980s (CRITT), overtime these have been compensated in their actions and layered with various other instruments.

This transition period towards an increasing focus on SMEs was characterized by the proliferation of thematic research and technological networks aimed at bringing together the (numerous) actors at the local level and help enterprises familiarize with various funding (differently) tailored to their needs.

Starting from the 1980s we can group instrument mix according to three different underlining focus:

- Targeted actions to support innovation activities (ATOUT, SOFARIS, API, Innovation Award, Support investments in key technologies, FCPI);
- Targeted actions to enhance researchers' mobility and employment opportunities in SMEs (CORTECH, ARI, DRT, Post-Doc recruitment);
- Development of incubation and technology transfer services (CRITT, CRT, RDT, PFT).

Despite the stratification of sometimes very similar instruments the underlining logic of policy mix evolution was to boost the creation of different partnerships between the institutional actors involved

in the R&I field (regional authorities, Higher Education Institution, PROs, public agencies) in order to reach enterprises not targeted by traditional innovation initiatives.

The underlining goal was to make them aware, and especially guide them through the "jungle" of funding designed by public authorities. So, the mix aimed at persuading local stakeholders to create collaborative innovative network in exchange of subsidies identifying more or less accurately the indented behavioural change, by relying on locally-based networks of public actors

The following table provides an overview of the vast range of stratified instruments into force in the period 1980s-1990s.

Instruments	Year	Content	Shapes Family Delivery Target
Support to innovative projects (API)	1979	It provided zero interest rate loans to SMEs to develop innovative projects	Soft Loan [expenditure # high coercive] [low automatic] [SMEs]
SOFARIS (*Société Française de garantie des financements des PME*)	1982	The scheme aimed at providing economic guarantee to entrepreneurs who did not have easy access to bank loan in order to develop their SMEs business	Economic Guarantee [expenditure # medium coercive] [low automatic] [SMEs]
Technology diffusion within SMEs (ATOUT)	1984	Targeted funding to support SMEs project aimed at improving their technological level (technical and commercial feasibility studies, pre-competitive research in priority sectors)	Targeted Funding [expenditure # low coercion] [low automatic] [SMEs]
Innovation Award	1991	It aimed at increasing general SMEs awareness of innovation. Specifically, it rewarded SMEs' and research institutes which had successfully used patents for business or innovation development	Competitive Funding [expenditure # low coercion] [low automatic] [HEIs+ PROs + SMEs]
Key technologies development	1996	Targeted funding aimed at supporting the development of key technological areas in SMEs.	Targeted Funding [expenditure # low coercion] [low automatic] [HEIs+ PROs + SMEs]
Mutual fund for innovation (FCPI)	1997	Risk mutualization instrument to promote investments in innovative SMEs by buying funding shares in exchange of fiscal benefits.	Equity Participation [expenditure # high coercion] [mixed automatic] [SMEs]
Support for the recruitment of technicians on innovative projects (CORTECHS)	1988	Targeted funding aiming to associate researchers with enterprises through the development of one-year research project to stimulate innovation within SMEs.	Targeted Funding [expenditure # low coercion] [low automatic] [SMEs]
Support to Recruitment for Innovation (ARI)	1988	Targeted funding aiming at supporting SMEs to reinforce their R&D personnel and resources by hiring a post-graduate/ under graduate.	Targeted Funding [expenditure # low coercion] [low automatic] [SMEs]
Technological Research Diploma (DRT)	1997	Targeted funding aiming at supporting SMEs to reinforce their R&D personnel, by allowing young engineers to take a high degree diploma while working in an SME.	Targeted Funding [expenditure # low coercion] [low automatic] [SMEs]
Post-Doc recruitment	1998	Targeted funding aiming at supporting SMEs to reinforce their R&D personnel by hiring Post-Doc researchers.	Targeted Funding [expenditure # low coercion] [low automatic] [SMEs]

Regional centre for Innovation and Technology Transfer (CRITT)	1980	Partnership between Minister of Higher Education and Research and local authorities, providing SMEs with technological services. Local interfaces between public research business, adopting HEIs and PROs competences to increase technological level of SMEs.	Consulting service (incubators) [information # high coercive] [mixed automatic] [HEIs + PROs + SMEs]
Technological Resources Centres (CRT)	1996	Label (jointly assigned by the Minister of Higher Education and Research and the Minister of Economy Finance and Industry) intended to certify the good quality of the services provided by different CRITT	Label (quality standard) [regulation # medium] [low automatic] [HEIs + PROs + SMEs]
Technological Development Network (RDT)	1990	Incubators associating an informal network of different institutional actors working in the field of technology transfer and SMEs support at the local level (DRRT, DRIRE57, ANVAR, CRITT). They have the ultimate task to monitor CRITT.	PPPs [information# coercive] [mixed automatic] [SMEs]
Technology Platforms (PFT)	2000	They form a network of Higher Education Institutions, engineering schools, universities and CRITT, providing access to equipment, training and expertise to SMEs.	PPPs [information# coercive] [mixed automatic] [HEIs + PROs + SMEs]

Table 5. 5 Business-oriented policy mix (1980s-1990s)

The evolution of the policy mix reflects a pattern of instrument selection oriented towards the adoption of very similar policy instrument shapes addressed to the same target (SMEs) (e.g. Stratification (Capano and Lippi, 2017)). The underlining *leitmotiv* was a layering of different instrument intended to gradually trigger a move from a Grand Programs pattern towards a more SMEs-oriented approach.

For what concerns targeted actions aimed at supporting innovation activities and researchers' mobility, despite the reiteration of similar instrument shape-target group combinations, (e.g. in the case of researcher recruitment they cover different spectrum of skill development projects) no evident inconsistencies can be stressed in the evolution of the policy mix[58].

Differently, the case of incubator and technology transfer organizations is more striking. The regional centre for innovation and technology transfer (CRITT), created at the beginning of the 1980s, were the first locally based interfaces between public research and SMEs. These were based on partnerships established between the minister of Higher Education and Research and local authorities, financed by state-region contracts and, in some instances, by small business. Their nature could be defined as "bottom-up" to the extent that the competences they were focusing on were related to the characteristics of the local stakeholders involved.

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57 The DRRT (*Délégation régionale à la recherche et à la technologie*) and the DRIRE (*Direction régionale de l'industrie, de la recherche et de l'environnement*) are regional delegated offices, respectively of the Ministry of research and the Ministry of Economy, Finance and Industry. These decentralized departments were created in 1983 and they were charged with the regional implementation R&I national policies.

58 As further developed in Chapter 6, a fine-grained analysis of the different policy making organizations in charge of the formulation of the overlapping instruments will shed light on how do formal organizational structure influence policy mix evolution.

On the one hand, this logic allowed to target services to the specific needs of local actors involved, while on the other hand, this freedom left room for the overlapping of services by different CRITTs, causing dispersion of public resources. Therefore, in order to limit these drawbacks, in 1990 policy-makers designed the Technological Development Networks, with the aim to coordinate and monitor the actions of the different actors involved in incubators and technology transfer services at the local level. These included, the newly created, ministerial delegated office (DRRT and DRIRE), the ANVAR and the different thematic CRITTs. Moreover, in 1996 a joint decision of the minister of Higher education and Research and the Minister of Economy Finance and Industry introduced a labellization procedure in order to further coordinate the system of local interfaces, the Technological Research Centre (CRT). This certified the good quality of the services provided by different CRITTs. Finally, in 2000 with the creation of the Technological Platforms (PFT), policy makers aimed at harmonizing and bringing coherence to the varieties of regional actors involved in technology transfer, with the underlining goal of promoting the third mission of public education and training institutions. The PFT was designed to create an additional superstructure comprising different actors involved in local incubation activities in order to first inventory the interventions in place, and secondly to boost their integration.

The diachronic evolution of the instrument mix suggests a design strategy based on the overtime stratification of slightly different incubation structures. With the underlining motivation of chasing coherence between the instrument into force, this allowed policy makers to gently steer a so-called bottom up mix towards their preferred dynamics of action. Ultimately, the consecutive adoption of different highly coercive instrument shapes (incubators) allowed policy makers to persuade target population towards their intended aim, and to promote the uptake of the subsidies for innovation activities and researchers' mobilities included in the instrument mix. The potential recipients of the services provided by these structures were the technological research partnership promoted with the 1999 Innovation act, namely: the technological research network (RRIT) and the national technology research centres (CNRT). The former were public-private partnerships developed between public research and private actors working on a specific topic (e.g. micro and Nano technologies, telecommunications, water and environmental technologies) chosen by the actors involved in the partnership. The latter was also a public private partnership which brought together public research laboratories and private research centres affiliated with big enterprises.

Therefore, even if the target had consistently shifted from the past, going towards the direction of SMEs and local stakeholders, the *modus operandi* of public authorities, doesn't seem to have changed much being mainly cantered on an inducement "subsidies in exchange of intended behaviour", and a still relevant role of public agency in the delivery.

At the beginning of the 2000s the Law on economic initiative (*Loi Dutreil* 2003) and the introduction of different new shapes of funding instruments, displayed a slightly modified public attitude towards establishing interactions with R&I performers. Indeed, the instrument mix into force in the period 2000-2005 (circa) was characterized by a mix of different expenditure-based instruments like: the proximity investment fund, the Participatory Priming Law (*Prêt Participatif d'Amorçage* PPA), the Innovation Development Contract (*Contrat de Développement Innovation* CDI), the Technological fund of funds (*Fonds de Fonds Technologique* FFT) and the Gazelles programs.

Instruments	Year	Contents	Shapes Family Delivery Target
Proximity Investment fund	2003	Investments fund for investments in SMEs on a specific regional zone	Investment Fund [regulation # medium coercion] [low automatic] [SMEs]
Participatory Priming Loan (PPA)	2005	OSEO loans funding early stage of innovation projects in SMEs	Loans [expenditure # high coercion] [low automatic] [SMEs]
Innovation Development Contract (CDI)	2005	OSEO loans funding mature (>3 years old) SMEs innovation projects in SMEs	Loans [expenditure # high coercion] [low automatic] [SMEs]
Technological fund of funds (FFT)	2005	Public equity participation in venture funds investing in technological enterprises	Equity Participation [expenditure # high coercion] [low automatic] [SMEs]
Gazelles	2006	Support to promote venture and development capita for Gazelles (most fast-growing SMEs)	Tax Exemption [fiscal # low] [high automatic] [SMEs]

Table 5. 6 Late business-oriented instrument mix

In this second phase it seemed more evident the shift in the attitudes of public actors towards target population. By a mix of information and persuasion, and indirect financial participation to support innovative activities, they stepped back from the "subsidies in exchange for expected behaviour", leaving more room for manoeuvre to target groups, at the expenses of a more competitive oriented source of funding. The increasing push towards an active role of SMEs was accompanied by the definition of a more supportive legal framework with the adoption of the Law Dutreil (2003) aimed at facilitating business creation through a combination of administrative simplification and tax reliefs. So, after a first period (1980s-1990s) of "carrots" in exchange of expected behaviours, the instrument mix rationale has changed. Therefore, even the high coercive nature of the mix (constrained freedom of action for target population), policy makers invested less authoritative energies on inducing SMEs towards their expected behaviours.

5.9 The cluster approaches

In 2005, while the minister of national education higher education and research, together with the minister delegated for Higher education and research were struggling to put forward their proposal for a Pact for Research, the minister of Economy, Finance and Industry approved several relevant measures for the development and support of national innovative enterprises.

First of all, in 2004, the minister presented the *pôles de compétitivité*, territorially-based competitive clusters aiming at fostering the synergetic development of specific sectors, or a technology, through active partnerships between the clusters' members. Specifically, they were aimed at bringing together, in a particular area and on a particular theme, companies of all sizes, public laboratories and training establishments. Their purpose was to support innovation, by promoting for example collaborative R&D projects between stakeholders (OECD, 2014, p. 197).

These networks were territorially defined by the coexistence of an highly specialized industrial basis matched with research and education potential that, through the creation of partnerships, could have access to funding under privileged conditions and rebates on corporate and social taxes (European Commission, 2005a). Their establishment followed from the release of three different expert reports.

The first, the Ailleret report (2003), through an analysis of the development of knowledge economy in France, stressed the rich potential of the R&I system, but also pointed out some inconsistencies, such as: the lack of coherence between the interventions of local actors, the complexity of the instrument mix into force and the extent to which their intricate nature could hamper the effective exploitation of some service by SMEs.

The second report was produced in 2004 by the Agency for spatial planning and regional actions (DATAR), arguing in support for the development of an industrial policy based on synergies between localized agglomerations of enterprises, scientific and technological potential. Demonstrating how this pattern was successfully developed worldwide.

Finally, the Blanc report (2004)[59], by analysing the national economic structure since 1945, highlighted the French economic and social handicaps that did not allow a sufficient level of economic growth, despite the competitive level of investment in basic research. The reports suggested that a new model for economic development revolving around public research organizations, universities and entrepreneurs was needed.

The guidelines emerging from the three reports were channelled into the strategy of the competitive clusters adopted in September 2004. The design of the *pôles de compétitivité* represented a clear attempt to reorganize and enhance the competences developed, both from public actors and R&I

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[59] This report responded to the request of the Prime Minister in his letter of September 30, 2003 which awaited the definition of concrete measures that could promote the establishment of competitiveness clusters.

performers' perspective, through previous interventions. Their ultimate goal was not to act directly on, but rather to create an ecosystem for stakeholders where innovations could flourish.

Overtime, this was combined with the development of a new approach for state action, which hinged upon the design of a public procurement-based instrument mix. Indeed, in 2008, following on from the Law for the Modernization of the Economic, public procurement became established in the French system, through a strategy based upon a mix of three different instruments: the SMEs Pact, the *Passerelle Programe* and the "French-Style" Small Business act.

Instruments		Contents	Shapes Family Delivery Target
SME Pact	2005	It established Public Agency, large private companies, *pôles de compétitivité* procurement targeted to SMEs	Public Procurement [expenditure # high coercive] [high automatic] [SMEs]
***Passerelle* programme**	2007	Targeted funding for SMEs aimed at supporting tripartite financing for the development of the SME pact procurement.	Targeted Funding [expenditure # low coercive] [low automatic] [SMEs]
"French-Style" Small business act	2008	Allows SMEs preferential access to public procurement (assign then 15% of the average yearly share of their high technology marked, R&D and technological studies)	Public Procurement [expenditure # high coercive] [high automatic] [SMEs]

Table 5. 7 Cluster I instrument mix

The policy mix for Procurement was composed by these three instruments which integrated procurement provisions for SMEs coming from different private and public actors, or the government, together with a targeted funding managed by OSEO to encourage SMEs to engage in the related call for tenders. For what concerns the design of public procurement measures they were deeply inspired by the American "small business act" of 1953[60].

Finally, this instrument mix was followed by the introduction of two different shapes of economic instruments, always targeted to help SMEs financing their innovation activities, namely: the *aide au projet d'innovation stratégique industrielle* (ISI) and the *Fond Stratégique d'Investissement* (FSI).

[60] This framework was the milestone of US SMEs policies, which affirmed the need to prioritize the action of public authorities towards these actors. Other countries, as the UK and the Netherlands designed very similar instrument inspired by the US example (OECD, 2014).

Instruments		Contents	Shapes Family Delivery Target
Support to innovative industrial strategic project ISI	2008	Targeted funding devoted to help SMEs with high growth potential to develop disruptive innovation as a part of a collaborative project involving other companies/competence centres	Targeted Funding [expenditure # low coercive] [low automatic] [SMEs]
Strategic Investment Fund FSI	2009	Public equity participation as minority shares in French companies carrying out industrial projects creating economic benefit and competitiveness	Equity Participation [expenditure # medium] [low automatic] [SMEs]

Table 5. 8 Cluster II instrument mix

Both instrument shapes were aimed at supporting the advancement of SMEs business. In the first case, this was an instrument mainly devoted to supporting SMEs' financing, while in the second one the policy maker basically became a shareholder of the company.

5.10 The "crédit impôt recherche"

On the one hand the evolution of French R&I policy mix has been characterized by the frequent stratification of different instruments, while, on the other hand, it is worth noting the case of a specific instrument shape introduced in 1983 and still alive nowadays: The Research Tax Credit (*Crédit Impôt Recherche*, CIR). This is a horizontal, non-discriminatory across sectors, fiscal instrument aimed at supporting R&D investments by means of tax incentives calculated on the basis of their expenditures. It was introduced in a period characterised by the decline of direct state financing of R&D, as a strategy to boost private contribution to national innovation efforts. Despite its overtime calibration across multiple cross-sectorial goals (e.g. national competitiveness, cooperation between SMEs and PROs, employability of PhDs), its underlining logic of interventions was meant to increase the competitiveness of companies by supporting their R&D expenses.

To date this measure is still into force, and in 2013 it has been supplemented by the introduction of an "Innovation Tax Credit", which was exclusively targeted to SMEs. More generally, despite being the main form of fiscal contribution to business R&D, it was complemented by a system of reduced rated of taxation for capital gains from patent transfers and other support mechanisms devoted to young innovative enterprises (JEI) (OECD, 2014).

The final shape of CIR is made of two credit calculation components:

- A volume share, determined upon the R&D expenditures incurred over one year;
- An increase share calculated according to an augmentation of expenses in relation to the average expenditure over a benchmarking period.

The balance between these two different components, and the calibration these have undergone during the 36 years of its existence, are an important indicator for the final aim of the instrument and its most likely recipients.

Indeed, at the time of its introduction the CIR was incremental in nature, therefore the tax relief was proportional to the increase in the company's R&D expenditure compared to a benchmark period and renewed by legislative provision on a multiyear basis (3-5 years). It consisted of 25% of the increase for a maximum ceiling of 3 Million Francs. Consequently, recipients of this instruments were subordinated to this time span in making their projects and to the effective yearly increment of R&D expenses. According to some evaluation reports, "*the mere fact of taking into account an increasing share made this device a marginal instrument, except for companies in their first years of life and some companies constantly increasing R & D*" (Larrue et al., 2006, p. 89).

Following the release in 2003 of a report from the Tax Council criticizing the measures as being quite unattractive for enterprises because of its complexity, the budgetary law for 2004 heavily intervened on its nature:

- the legislative provision of the CIR was stabilized and transformed from a multi-year to an annual basis;
- the instrument was divided into two components, one increase-based (45%) and a new part calculated on the volume of expenses (5%);
- increase of the ceiling to 8 Million Euros of maximum expenses.

The volume of expenses component allowed to calculate the tax benefit on the basis of each projects, rather than being dependent upon the expenses undertaken in previous years, so the credit was no longer calculated in dynamic terms, but it was only taking into account the volume of research spending. The first argument for that change was simplification: the incremental system resulted in specific calculation difficulties that made it more impenetrable and forced SMEs to hire costly specialist services to "optimize" their tax declarations. Additionally, an incremental credit did little to incentivize companies whose R&D expenditure was stable over time, for example after a previous pike (OECD, 2014, p. 189).

With the 2006 budget law the CIR was modified again by the introduction of:

- new costs as eligible expenses (patent protection expenses; subcontracting fees for research made by PROs, universities or technical research centers; expenses related with employment of PhD and their contractual stabilization);
- the immediate reimbursement of research tax credit in the year of creation, and the following four, for young companies (younger than 5 years old);
- an increase in the benefits calculated on the volume of expenses (10%);

- a shrinkage for those calculated on an incremental basis (40%);
- maximum expenses ceiling increase to 10 Million Euros.

Finally, with the budget law of 2008 the tax credit has been consistently reshaped to acquire the characteristics of the system that is still largely in place today, namely:
- A suppression of the increase-based component;
- A strengthening of the volume-based component: a tax credit of 30% of research investments will be granted for investments up to 100 Million Euros and of 5% beyond;
- The eligibility of all the expenses classifiable as research (the OECD Frascati Manual definition);
- The ceiling has been eliminated.

The evolutions of this instruments mirror to some extent the changes taking place in the R&I system at large. The 2004 reform took place almost at the same time of the cluster policy implementation, and it was somehow meant to simplify the CIR system usage by SMEs, which were one of the pillars of cluster development. With the 2006 intervention, the tax credit included new eligible expenses related with the subcontracting of research made by PROs, Universities and other research centers. In the same period, with the 2006 Research Pact new contractual tools for grouping HEIs and PROs in geographical proximity were created (PRES). Those actors, together with the competitive clusters, might have been the beneficiary of the sub-contracting research services included in the CIR.

More generally, the CIR represents a relevant measure in the overall R&I French instrumentation. Indeed, following on from the privatization of process, the relevance of the tax credit has been reversed within the national policy mix[61]. Also, foreign companies contributed to this shift, to the extent that the features of the CIR were perceived as an incentive to move R&D activities in France (Ministére de l'education nationale de l'enseignment supérieur et de la Recherche, 2014).

5.11 Conclusions

The evolution of the policy mix in the period 1980s until late 1990s reflects a pattern of instrument selection oriented towards the adoption of very similar policy shapes addressed to the same target (SMEs). It clearly portraits the characteristics of what Capano and Lippi (2018) identify as the "Routinisation", meaning the layering of different instrument in order to change the direction of instruments' action and stabilize their action into a more consistent and coherent action. This is also

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[61]It represented a credit of EUR 4.5 billion in 2010, and it has represented around EUR 5 billion per year since then and could reach EUR 7 billion per year once fully operational (French Court of Auditors, 2013), i.e. between 4 and 6 times the amount of direct aid and around one-third of public R&D expenditure (in which is it not counted) (OECD, 2014, p. 188).

confirmed by the OCED (2014), which clearly highlights how in the French case, instruments tended to be created overtime without systematic discussion on the mix already in place, therefore hampering their reciprocal effectiveness and the possibility of State oversight.

The French system has undergone consistent changes in the last decades, due to an acquired relevance of the structures devoted to the support of technology transfer. Nonetheless, their success in altering the overall governance principles dominating the sector are affected by a lack of long-term perspective and an intricate institutional landscape (Dosso, 2014). Therefore, despite an increasingly attention toward technology transfer and the creation of specific organizations for its development, the system can still be characterized as mainly mission-oriented (Berger, 2016).

With the 1999 Innovation law policy makers seemed to be quite dependent for the disclosure of their strategy on the cooperation of R&I performers, as demonstrated by a majority of mixed and automatic instrument delivery structures. Hence, the strategy attempted to provide R&I performers with generous room for manoeuvres in the enactment of certain instrument shapes, while prescribing the "direction where to go" autonomously, because of the overall high coercive nature of the mix.

With the 2003 innovation plan there was a clear shift towards SMEs and start-ups as main targets of public interventions. The instrument mix was characterized by low degree of coercion and a quite pronounced propensity towards automatic instruments, therefore R&I performers had more autonomy in the use of instruments behavioural incentives.

With the competitive cluster strategy of 2005 there was a clear attempt to reorganize and enhance the competences developed, both from public actors and R&I performers' perspective, through previous interventions. The ultimate goal was to trigger, by mainly exploiting the set of incentives already in place, the creation of an ecosystem for stakeholders where innovations could flourish; leaving great decisional freedom to R&I performers. With this strategy policy makers attempted to debunk the long lasting hierarchical and vertical national system, by attempting to ease locally based interaction between research, education and business. Nevertheless, their evolution and especially the increased relevance for public procurement instruments overshadow the "bottom-up" approach, under the role of public actor as innovation customer. Overtime, this was combined with the development of a new approach for state action, which hinged upon the design of a public procurement-oriented instrument mix. Indeed, in 2008, following on from the Law for the Modernization of the Economic, public procurement became established in the French system, through a strategy based upon a mix of three different instruments: the SMEs Pact, the *Passerelle Programe* and the "French-Style" Small Business act.

With the implementation of 2006 Research act and the creation of the ANR (funding agency) and AERES (evaluation agency), policy makers seemed to be willing to take back the reins of the

situations by introducing an evaluation-based logic for funding allocation to R&I performers. Moreover new instruments (PRES), have been introduced to cluster universities on a regional basis, in the effort of reducing fragmentation (Schoen et al., 2008); which was then combined with the increasing university autonomy provided by the application of the 2007 Law on university reform. Ultimately, with the application of the PIA the government developed a new intervention model, in which through CDC it contributed to equity participation by acquiring shares of innovation organizations, without being directly involved in their management (Eparvier et al., 2011).

Therefore, despite some smartly designed connections among different instrument mixes, the overall evolution of national strategy seemed to be stuck in the grip between a state-led, quite coercive approach and a more R&I performer-based strategy.

6 Chapter 6: Case study II, the policy instrument selection in the French case

In order to understand the forces underpinning the evolution of R&I policy mixes, we designed an interpretative framework which intersect different insights on the role of ideas (as the influence of dominant framing in a given political system); the opportunity structures provided by the institutional system (internal coordination and specialization between bureaucrats) and the role of target population (the strategies for interest intermediation). These factors are consistently intertwined in the influence they play on actors' choices, by shaping the policy design process and, ultimately, the characteristics of policy mixes. By breaking up the influence that their different combinations might have on actors and their strategies, it has been possible to disentangle the political dynamics behind the selection and assemblage of different instrument mixes. This helped us understanding how, given the opportunities and constraints provided by the governance characteristics, actors interacted for the selection of policy instruments, and the extent to which this influenced the evolution of instrument mix components.

The chapter is organized according to our variables of interest. In the first section we investigate the role of ideas, and their influence in terms of cabinet turnover and path dependent effects. Then, we analysed the interaction between formal an informal institutional structure, by digging into interministerial coordination practices. Finally, we examine the different structure of interest intermediation by looking at both the role of public agencies and the bargaining powers of R&I performers.

6.1 Ideas

Policy instruments are not politically neutral devices, to the extent that they can alter power dynamics (Lascoumes & Le Gales, 2007; Salamon, 2002), influence policy issues framing (Baumgartner and Jones, 1993) and ultimately produce different patterns of opportunity and constraints on a given target population (Schneider and Ingram, 1990). Their selection can be read as an ideational process to the extent that instruments embed different framings concerning the individual perceptions on a given problem, and possible strategies to tackle it. Therefore, theoretically their choice would be exposed to the influence of different political and ideational dynamics.

In order to investigate the counteracting effect of institutionalised windows of opportunities (cabinet changes) and the persistence of long-lasting R&I institutional aim (Mission *versus* Diffusion oriented) on the evolution of governmental policy mix preferences, we diachronically compared the preference

mix for different cabined periods. By using policy instrument characteristics as a proxy for government preferences, we were able to map out the connection between actors' partisan positions, long-term preferences for R&I strategies and their overtime evolution.

Table 6.1 cross-tabulate the percentage of coding references for different cabinets according to the different *type* of policy instrument preferences 62. In order to allow the comparability of the sample under investigation, and a meaningful interpretation of the codes, all the share of coding references for each instrument *type* have been weighted according to the number of sources analysed63.
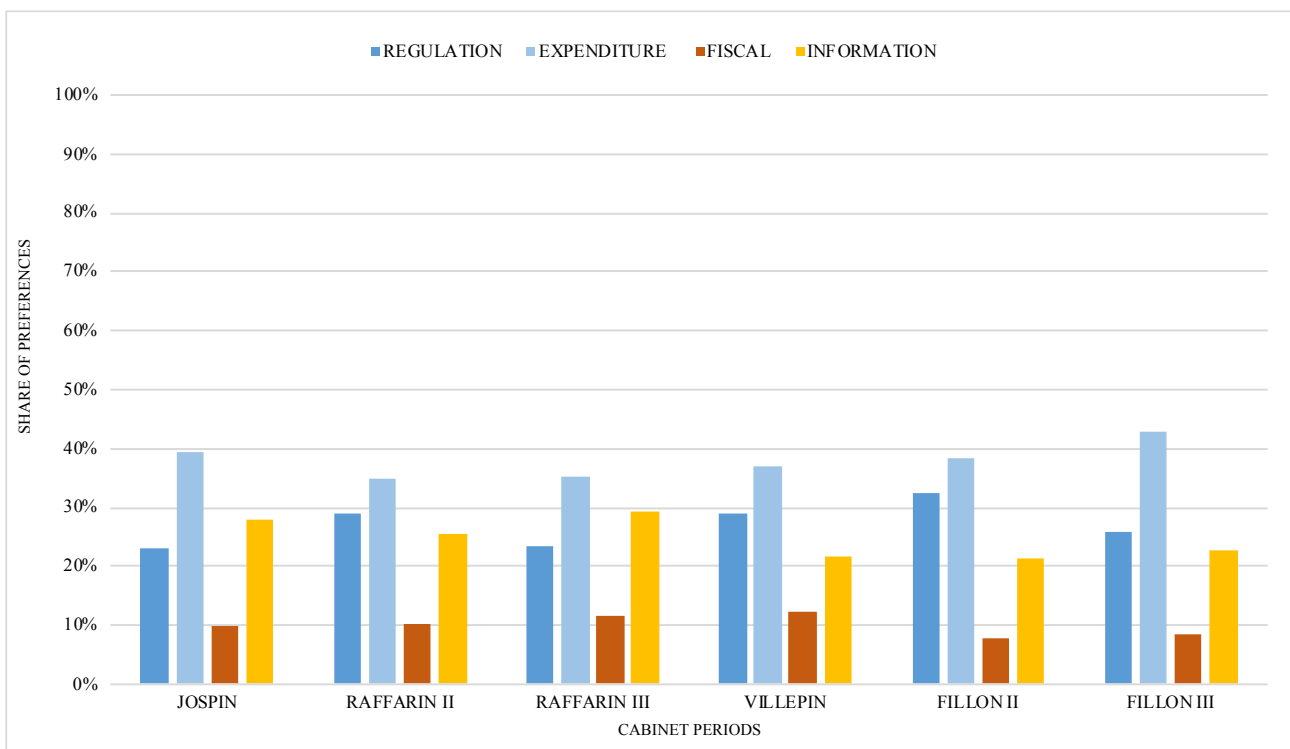
Figure 6. 1Type of policy instrument preferences (France)

On the left side of the table (Y axis) we find the shares of coding, while on the bottom side of the table (X axis) we find the different cabinet periods under investigation. At this point, it is necessary to highlight a peculiarity of the French case, namely the presence of a period of co-habitation between a president of the republic (Chirac I) right wing oriented, together with a prime minister (Josipn) left-wing oriented. The type of data collected, and the typology of coding procedures adopted, do not

62 Each column represents the percentage of codes assigned to each instrument category over the total share of codes assigned to each policy mix in a given cabinet period. Therefore, the different columns are comparable and their sum is equal to 100%; meaning the total share of preference for an instrument mix in a given cabinet period. The same logic is applied to Figure 6.2 for the case of instrument delivery component, and for the Figure 8.1 and 8.2 of the Italian case in Chapter 8.

63 Due to data accessibility issues, we were not able to analyse the same number of documents for each cabinet period. Therefore, the weighting procedure allows to maintain a high degree of comparability between different periods.

allow to differentiate the preferences between these actors[64]. For this reason, we decided to focus on prime minister's preferences.

The left-wing oriented Jospin cabinet shows a policy mix preference pattern characterised by a high authoritative attitude (23,39% of preferences for legislative and 40,06% for expenditure instruments). This might sound consisted with the strategy aimed at changing the path from previous right wing oriented Juppé cabinet. On the same line, the next right-wing government Raffarin II shows a slight increase towards the preferences for a more authoritative mix (28,81% for legislative and 35,59% for expenditure) followed by a second mandate characterised by a decrease in this share of preferences (23,53% authoritative and 35,29% expenditure).

Finally, the last cabinet under the presidency of Chirac (II), the Villepin government, is characterised by an increase in the preferences for more authoritative tools, namely 28,42% of preferences for legislative and 36,84% for expenditure instruments.

The first Fillon government under the new Sarkozy presidency, display an increase in the preferences for more authoritative mix (32,47% for legislative instruments and 38,31% for expenditure instruments) followed by a second mandate, Fillon II, distinguished by a decrease in the total share of preferences for more authoritative mix (legislative instruments dropping at 25,71% and expenditure at 42,86%).

Table 6.2 shows cabinet preferences for different degrees of instruments' automaticity, therefore it tells us the attitudes for the diverse types of relationship between policy makers and target population established within the management of different tools' enactments.

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[64] Indeed, at this stage of the analysis, by treating government as unitary actors, and by using budgetary document as the main source of analysis it was impossible to grasp the different nuances between Prime Minister and President of the Republic preferences.
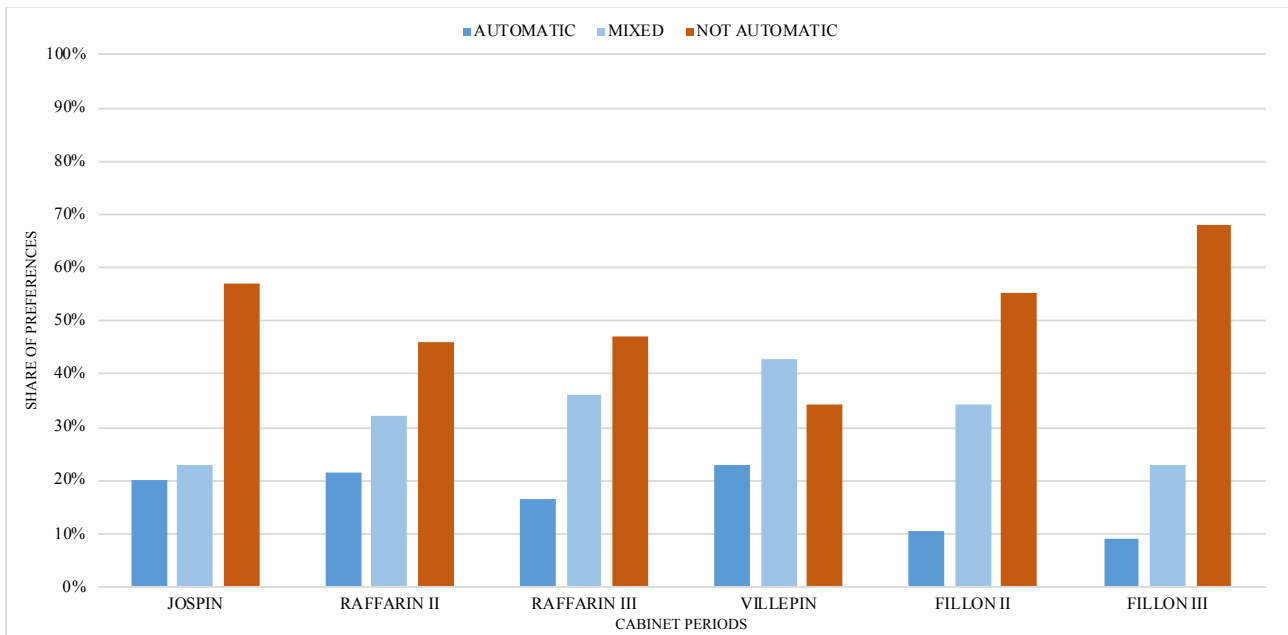
Figure 6. 2 Policy instrument delivery structure preferences (France)

Looking at the overall distribution of cabinet preferences along the period of analysis it is worth highlighting the overtime high average of preferences for not automatic delivery structures, which reaches peaks of 57,16% of the total mix in the Jospin cabinet and respectively 55,21% and 68,18% in the two Fillon mandates. On the other hand, also the high share of preferences for mixed, therefore more collaborative-oriented, delivery structures, is interesting. The average share for mixed type of instruments score high values in the case of Raffarin III government (36,11%) and Villepin cabinet (42,62%), that is actually the only case in which it represents the highest share of preferences for the whole mix (which is, on average, dominated by preferences for less automatic delivery structures).

6.1.1 Cabinet turnover

We expected that in parallel with cabinet turnovers, a change in the preferences for instrument mix characteristics will likely occur. To the extent that cabinet shifts represent an institutionalised window of opportunity where new ideas (and the policy entrepreneurs who support them) can find a place into decision-making arenas. Changes in cabinet composition should influence policy mix evolution inasmuch as different parties in government can find themselves in a situation of constrained party preferences (Jungblut, 2015) since the legacy of past political struggles shape political preference formation (Kriesi, 1998, p. 177). Accordingly, we would expect a trade-off between the willingness of new governing parties to modify the dominant policy style into force and the room for manoeuvre they have given the characteristics of the instrument mix inherited from previous governments.

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Therefore, the more similar the party politics orientations between incoming and outgoing governments, the less authoritative will be the diachronic evolution of policy mix preferences.

The preference trend displayed in Figure 6.1 does not completely confirm our expectations.

In the case of the first cabinet period the turnover between left-wing Jospin cabinet and right-wing Raffarin II confirms an increasing authoritative evolution of policy mix as well as the second mandate of Raffarin (III), therefore confirming our expectations regarding political incoming and outgoing phenomena.

Differently, the same party Villepin cabinet shows an increasing preference share for more authoritative mix, despite the political continuity with the two previous governments. There might be some specific reasons for this phenomenon.

First, the new government was appointed after the defeat of the 2005 European constitution referendum, strongly endorsed by Chirac and the previous government. After this event, Raffarin tendered his resignation for the third time, Chirac accepted and appointed Dominique Villepin as Prime Minister (Kam and Indridason, 2009, pp. 51–52). As pointed out by Levy et al (2008) many votes against the approval of the European constitution represented a signal of dissatisfaction with the economy and more generally with the Chirac's administration, rather than a blame against the European proposal. Therefore, the appointment of Villepin represented a political attempt to regain the trust of French population, bringing back the traditional republican French model promoted by the Chirac presidencies. Secondly, the Villepin cabinet managed to overcome the long-lasting stalemated on the reform of the research system, by approving the highly contested research act put in the pipeline by the previous Raffarin cabinets. Therefore, some extent of continuity between the two periods could be expected.

Reading in-between the lines of the increase in the share of preferences for a more authoritative mix we can both see the continuity with policy proposals of previous cabinet (and the implementation of highly authoritative instruments, like the creation of AERES and ANR) together with a national strategy aimed at promoting the model of state interventions characterizing the Chirac era. Nevertheless, we have also to interpret this trend in combination with the results displayed by the preferences for mixed delivery instruments (Figure 6.2), scoring the highest values of the sample in this period; therefore, mirroring also preferences for an increasing reliance upon the collaboration with R&I performers for the enactment of policy instruments.

Finally, the last increase in the share of preferences for authoritative mix of the Fillon II cabinet, followed by a decreasing trend in the Fillon III period, mirrors the influence that a change in the President of the Republic can have on the overall instrument mix pattern. Indeed, the Fillon II cabinet has been the first one with Nicolas Sarkozy as President of the Republic, after more than a decade of

Chirac presidencies. The new elected president based his agenda (and electoral campaign) upon the rhetoric of the "rupture" with the traditional French way of doing things, as well as portraying himself as "an outsider who would break the status quo"(Cole et al., 2008).

Therefore, despite the political party continuity of the two leaders, a deviation in R&I policy strategies supported by a new President of the Republic seems plausible to take place.

To conclude a politically-oriented policy mix preference alternation trend seems to be meaningful but, it is also consistently subject to internal national political and electoral dynamics like the case of Villepin government. Nevertheless, also the increase in preferences for highly authoritative mix for electoral purposes, is symptomatic of the political payoff a greater extent of governing power invested in R&I can have in electoral terms.

6.1.2 Path dependent effect

The dominant cognitive background embedded in the policy mix into force delineates the most appropriate model for public action in the R&I policy sector, while consolidating power relations between actors. Therefore, from a diachronic perspective, the likelihood of any policy change is affected by the extent to which actors gains or lose access to advantages they associate with past designs. Therefore, new policy making initiatives are bound to be affected by, long-terms legacies emerging from earlier rounds of decision-making activities, (Edler et al., 2013; Flanagan et al., 2011; Hall, 2010; Howlett, 2009; Howlett and Mukherjee, 2014; Linder and Peters, 1989) .

Diffusion and mission-oriented paradigms reflect well established preferences on what governing actors should do and how they should make it happens. Consequently, in the case of French mission-oriented legacy of institutional aims we would expect that it will be more likely that governments will display preferences for more authoritative and less automatic instrument mix characteristics.

The general trend of preferences for more authoritative and less automatic instrument features seems to be confirmed by the results in Figure 6.1 and 6.2, and the path dependent effect of mission-oriented R&I paradigms seems to be predominant on the evolution of cabinet R&I instrument mix preferences. This is also confirmed by the dominant trend of preferences for more authoritative policy mix (mirroring the legacy of a state-led R&I policy tradition); and the constant high share of preferences for not automatic instruments. The high peaks of preferences reached in the Jospin and Fillon cabinets, portray the relevance of state role in the strategies characterising the outset of a new French R&I policy after the *Grand Programmes*, and the new "holding model" (Eparvier et al., 2011) of public interventions.

Moreover, the high, even if more discontinuous, share of preferences for mixed type of delivery systems is coherent with he acquired relevance of networking practices and the increased attention

towards technology transfer structures. As demonstrated by the Raffarin III and Villepin cabinets, which coincide with the introduction of the competitive cluster strategy and the new contractual agreement to group research and higher education institutions into cluster (PRES).

Therefore, in the French case, policy instrument selection process seems to be truly linked to the nature of the general governance context and long-term cognitive legacy embedded in national R&I strategies. And when policy makers have to decide upon how to shape the existent mix, given the constraints set in force by previous choices, they seem to prefer falling back on consolidated strategies.

6.2 Institutions

Public interventions in the field of R&I tackle transversal policy issues (Jochim and May, 2010; Peters, 2005) related with knowledge production and exploitation practices, which do not easily fit into departmentalised structures and areas of responsibility of formal policy-making institutions (Pelkonen et al., 2008). Therefore, in addition to the formal institutional distribution of competences, some measures for the coordination among decision making organisations must be adopted as well. Because, the way actors manage to find a common terrain for action, will likely avoid redundancies between instruments, therefore influencing the final characteristics of the policy mix. On the other hand, as demonstrated by organizational studies (Scharpf, 1997), different departmental identities can make collaboration between policy makers affiliated to different institutions more difficult.

The Minister of Higher Education and Research (MESR), and the Minister with delegated competences for Industry represent the two fundamental institutions of French R&I governance structure. Their attributions and names have been slightly modified along different cabinet periods; nevertheless, the public governance of R&I has remained almost intact over the last decades. The roles of these ministries reflect the fact that R&I policies are inherently made of two substantive components (research and technology development) which might be more or less integrated according to policy making capacity and foresight. On the same line, given the external ministerial specialization strategy adopted by French institutions, some extent of collaboration among ministers, and internally within departments, might be needed to assure policy mixes encompassing action in both research and innovation aspects.

In the following paragraphs we will dig into the evolution of different ministerial coordination practices to investigate how these structures did actually influence the patterns of ministerial interaction.

6.2.1 Ministerial coordination practices

As briefly explained in Chapter 5 while describing the evolution of Public Research Organisations, during the era of the Grand Programs the French R&I institutional system was highly fragmented.

In the aftermath of the WWII the relaunch of French scientific policy was supported by a focus on nuclear energy, which led to the creation of the Commissariat for Atomic Energy (CEA) in 1945; together with the creation of the High Council for Scientific Research in 1954. Two years after the "*Colloques de Caen*[65]", De Gaulle created three different organisations devoted to the coordination and advice in French R&I policy-making, namely:

- The interdepartmental committee for scientific and technical research (CIRST), a deliberative decision-making body devoted to interministerial coordination and chaired by the Prime Minister;
- The advisory committee on scientific and technical research (CSRT)[66];
- The General Delegation for scientific and technical research (DGRST), an interministerial body responsible for the preparation and execution of research policies[67].

Each ministry was highly specialised in the support and development of research in its own specific domain, which resulted in the proliferation of different mission oriented Public Research Organisations supervised by heterogenous governmental departments (Mustar and Laredo, 2002).

This structure of responsibilities between different functional ministers and their affiliated research institutions was modified with the 1982 Law on Research, which was a first attempt to rationalize the overall governance structure, and coordinate the national strategy according to two lines of interventions.

The first one, implemented a financial division between EPSTs and their parent ministries with the transfer of budgetary responsibilities to a single ministry in charge of research. Consequently, all mayor public research organisations were put under the double remit of the MESR and their specific functional minister. Even if the latter had preserved "joint guardianship", the unwieldy nature of the budgetary mechanism is too well known for the eventual impact of such a separation not to have been weighed up (Mustar and Larédo, 2002, p. 63).

The second one regards the introduction of a new national budgetary procedure for the allocation of resources in the field of research through the creation of the Civil Budget for Research and

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65 Global project for scientific development (held in 1956), gathering 250 among scientists, public administrators, civil servant, industrialist, member of the parliament and journalists to discuss about the future of science and research in the country. The underlining aim was to draw the lines for a modernization programs of French Higher Education and Research.

66 Abolished and replaced in 1982 by the Higher Council for Research and Technology (CRST), a forum for dialogue between stakeholders chaired by the Minister of Higher education and Research,

67 This will be abolished in 1982 and replaced by the minister of Research and Technology.

Technological Development (BCRD). This was a budgetary platform defining the credits for public research within a single procedure. It was led autonomously by the minister of Higher Education and Research, leaving the possibility for sectorial ministers to participate at the definition of the budget. The BCRD covered funding for public research organisations and incentive funds, namely the National Fund for Science (FNS) dedicated to fundamental research (but not to Higher Education which had another specified budget[68]), and the Technological Research Fund (FRT) dedicated to industrial researchers and EPICs.

To these funding it is necessary to add the Fund for Enterprises Responsibilities, under the full responsibility of the Ministry in charge of industry, supporting aids to enterprises and partnerships.

With the definition of the BCRD policy makers decided also to dust off the CIRST (created in 1958, but it wasn't convened anymore from 1981 onwards), an interdepartmental decision making committee for the definition of R&I policies, only rarely activated as a decision-making procedure (European Commission, 2003a).

Nevertheless, the relevance of BCRD as an instrument for interministerial coordination should not be overestimated. Indeed, when a research sector was deemed as strategic for a given ministry this had the possibility to negotiate directly with the minister of Finance. So that their R&I budget appropriations entered in another section under their full management responsibilities, thus overtaking the coordination competences of the Minister for Higher Education and Research. This was a quite simple process especially for the minister of industry which has been integrated in the ministry of economy and finance since 1997 (Cytermann, 2006).

A second attempt to enhance R&I policy making coordination was focused on the embedded division characterizing the higher education and public research landscape. This came as a part of the broader reform of public management supported by the Constitutional bylaw on Finance Act (LOLF) approved in 2001.

Indeed, for the first time in 2006 state budget was defined according to the provision of the LOLF, which attempted to provide a common framework for budgeting procedures in the field of R&I by creating an interministerial mission for Research and Higher Education (MIRES). This promoted the aggregated presentation of all the budgetary resources that the State devotes to the production, transmission and transfer of knowledge in the field of scientific research, technological development and Higher education, widening the scope of the BCRD (which didn't include the last category of endowments). Basically, all the credits in the budget law were grouped by missions and then organized according to different programs referring to a specific policy field. In first instance it was

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[68] Coordinated Budget for Higher Education (BCES).

created as a voting unit, in order to simplify budgeting procedures, then slowly also an intermnisterial coordination component was added.

Within this context the Minister responsible for research was in charge of coordinating government action among the different ministers involved in public research. It was the primary interlocutor of the minister responsible for budget during the preparation phase of the budget law and of the parliament during the examination and vote of appropriations.

The drawbacks of this coordination platform were primary related with the fact that it didn't provide any obligations for joint programming, so each minister could participate in the mission simply by including its autonomously designed program. Therefore, once again, the Ministry in charge of Research was a king without a kingdom, to the extent that it was appointed with the role of coordinator among the ministers with transversal competences in R&I, but it was not provided with the necessary powers to steer them towards an effective interministerial decision making.

A successive mild attempt to promote coordination between ministers in R&I policy making was provided by the introduction of the National Strategy for Research and Innovation (SNRI), which aimed at framing research and innovation as the component of a unitary and encompassing national strategy. Approved by the Council of Ministers in September 2008, it was a document providing long-term political orientations for national research and innovation policies.

Differently from previous instruments, this strategy was restricted to the definition of broad political objectives, identifying a common agenda for the stakeholders involved in the formulation of the strategy for a period of four years (2009-2012). It was a bottom-up priority setting process involving research, business and civil society stakeholders, identifying three main Social Challenges national R&I policies should be directed at, namely: health, environment and ICT.

According to these broad themes state would allocate resources and plan its R&I activities.

This strategy became more relevant with the approval of the "Investment for the Future Program" (PIA), to the extent that this investment plan, at least for its first wave of application (2010-2014), was in line with the main priorities of the SNRI (Eparvier et al., 2011). Nevertheless, the binding power of this strategy was limited to the extent that it was not set at the operational level, and it didn't allocated budget, circumscribing its action to the provision of thematic guidelines for R&I national themes (OECD, 2014).

In combination with implementation of the PIA program, another policy-making committee was created, the *Commissariat Général à l'Investissement* (CGI). Rather than a pure instance of coordination, this committee was much more an attempt to re-centralise some of the R&I policy making competences under the authority of the Prime Minister. In line with the investment priorities identified within the Juppé-Rocard commission, the Commissariat closely followed the enactment of

the program, it drafted contracts with the agencies in charge of the implementation (ANR; CDC; ADEME), providing specifications to supplement calls for proposals and finally ensuring the overall consistency of the investment plan through yearly reports of activities.

The CGI action didn't display any explicit attempt of coordination, or interaction, with other ministers involved in the R&I national effort, and its funding were not explicitly included in the national Governmental Budget Allocation for Research and Development since they were considered as investments (Lepori et al., 2017).

6.2.2 The actual patterns of ministerial interactions

According to the OECD (2014) country evaluation, the coordination between ministers involved in R&I policy making seemed to be effective at some level; but it was lacking at the strategic level, since each minister could autonomously establish its own priorities and schemes. This evaluation was symptomatic of the poor success of the above-mentioned strategies for interministerial coordination, which might have faced some obstacles related with the interweaving forces characterising the national governance of the sector.

As described in Chapter 5 French higher education and public research structure has a mixed nature, characterised by different public stakeholders with different role and legacy of power.

On the one side, there is a profound separation between highly selective, élites oriented training, *Grandes Écoles* versus universities. While, on the more research-oriented side, there is a deep separation between public research organisations and universities, inherited from the legacy of a prominent public-led research and technological programs. Therefore, the mixed nature of public research landscape, and the extent of cooperation between public research actors, may hinder ministerial collaboration for R&I strategies.

The way different governments have tried to re-equilibrate the power between these actors, and to design an encompassing national R&I strategy could be traced by following the evolution of ministerial organisation structures in the sector, as a proxy for different framings of the issue.

Nevertheless, as claimed by the two interviewees representatives for the Minister with delegated competences in Industry and the Minister of Higher education and research, this cannot provide all the details necessary to understand national R&I strategies: *"It is not possible to explain everything through administrative organisation; this can be rather a symptom.[...]this type of reunification (between ministers with R&I competences) often requires a strategy, since it is not the reunification itself that makes the strategy, but rather the opposite".*

Therefore, the selection of an external ministerial specialisation pattern, could actually be symptomatic for the lack of an all-encompassing R&I national policy strategy. However, it is worth to highlight that ministerial organisation structures haven't always been like that.

Indeed, at the time of approval of the 1982 law on research, which exactly attempted to reorganise the system by introducing a financial division between public research organisations and their parent (functional) ministers, the competences for Research, Economy, Finance and Industrial Policies were merged within a unique ministerial organizational structure.

This pattern has changed in the following decades, in parallel with the clear dismissal of state role in national Grand Programs and the two ministers have been separated.

The ministry of industry has been merged within the broader Ministry of Economy and Finances (MINEFI), and industrial policies started to became less and less a matter of direct, targeted public intervention (Mustar and Larédo, 2002). As reported by our interviewee (INTERVIEWEES 20-21) the weakening of the role of a (unique) Minister devoted to industrial competences went hand in hand with the abandonment of French sectoral industrial policy, and the move toward a horizontal-based industrial approach; consequently, industrial competences have been merged within the boarder structure of MINEFI. This was a minister with a strong organizational legacy, and the industrial component experienced some difficulties in finding its own space within this organisation. This situation evolved in parallel with the implementation of the *pôles de compétitivité* (in 2004), when a new division of competences within the MINEFI and the consequent creation of two separated institutions (promoted under the Sarkozy presidency), allowed the industrial component to slowly find its place again.

Whereas, on the research side the ministerial organisation was evolving around the competences for national education, higher education, research and technology; with the establishment of the first Ministers of Higher Education and Research in 1993, under the Balladur cabinet. In the following decades the competences for these policy fields were differently organised on the basis of functional delegated ministers, to be finally merged into a unique Minister for Higher Education and Research under the last Raffarin Cabinet (during that period the proposals for the Research Act were under discussion).

In addition to the frequent changes characterising the evolution of their formal institutional structures, the coordination between these two R&I institutions was further complicated by their different framings concerning the innovation process. Indeed, also according to our interviewees, the Minister of Higher education was perceived has having an approach highly oriented towards basic research, and despite some openness towards the role of enterprises, it still remained the "minister of Public Research Organisation". So, whenever PROs or HEIs faced problems, they would be the focal point

of MESR intervention, rather than the role of enterprises and applied research (INTERVIEWE 21-15-).

The MINEFI was perceived as mainly oriented towards helping enterprises and the innovations developed by them; whereas the MESR had a vision of innovation related to PROs (EPICs). So, the main issue was that these two ministers had different framings of the innovation processes, and its related issues, because they referred to different "constituencies", therefore they saw things differently (INTERVIEWE 17).

Consequently, at worst, some degree of competition could even arise between the two ministries; in any case this pattern of interactions prevented an overall view of the system, and much of the national R&I strategy depended on the individual in charge of the ministries concerned (European Commission, 2003a). As suggested by one of our experts:

*"[...] it is true, it can be conflictual the relationship between different ministries with shared R&I competences, but not always. For example, in 1999, when the innovation law was approved, Claude Allegre and Dominique Strauss-Khan got along very well (*INTERVIEWE 15*).*

Indeed, as mentioned in the case study description at Chapter 5, these ministries jointly gave mandate to Henri Guillaume in order to draft a report on national Research and Innovation activities in France. This cooperation, and the suggestions provided by the report, gave birth to the most relevant French interventions in the field of R&I during the 2000s. Firstly, the design of the 1999 Innovation act, which consistent of an instrument mix aimed exactly at creating synergies between research and business world, therefore among the different "constituencies" of the two ministers. And, secondly, the Innovation plan in 2003, which boosted and strengthen the strategies implemented by the former law. The coordination embedded in the policy mix characterising these two strategies was related with an underlining logic of boosting cooperation between public and private R&I performers, therefore overcoming the strictly ministerial-constituency limitations stressed by interviewees.

In addition to the internal and external collaboration forces, the MESR was also highly exposed to institutional (and more informal type of) relationships with different functional Ministers (e.g. Minister of Ecology and Energy; Minister of Transportation…).

Indeed, as we have seen in the previous paragraph, despite the adoption of the BCRD, the MESR played the role of formal coordinator, despite different functional ministers preserved enough powers to develop their own strategy for research, by interacting directly with the Minister with budget competences (Cytermann, 2006). Similarly, in the case of the MIRES, despite the introduction of an integrated monitoring of governments' research programmes, each functional minister preserved its own budget, and competences, over the design of ministerial research strategies (OECD, 2014). Therefore, the nature of the MESR piloting capacities remained rather incomplete.

Ministers with integrated competences in R&I did design a unique mission for governmental research strategy, but actually the programs making up the strategy clearly mirrored different functional research competences showing how actually the dialogue between project managers (different ministers) was less structured than among department within a unique ministerial organisation (Cytermann, 2006).

Certainly, as highlighted by our interviewee (INTERVIEWE 17), the mainly consultative nature of these strategies, the weak role of some specific interministerial forums (e.g. CIRST) and the lack of any type of incentive for collaboration hampered their success.

This is confirmed by the fact that different national functional ministers still play a relevant role in the allocation of funding for public research (Lepori et al., 2017), especially in the definition of contracts with their supervisees (Public Research Organisations).

The table below provides an overview of the MIRES organisations in 2012. The MESR was the major contributor to the mission, with five programs funded out of the 10 included in the strategy.

Programme	Title	Funding ministry
142	Higher education and agricultural research	Ministry of Agriculture, Food and Forestry
186	Cultural research and scientific culture	Ministry of Culture and Communication
190	Research in the fields of sustainable energy, development and planning	Ministry of Ecology, Sustainable development and Energy
191	Dual-use research	Ministry of Defence
192	Research and higher education in economic and industrial fields	Ministry of Economy and Finance
150	Higher education courses and university research	MESR
172	Multidisciplinary scientific and technological research	MESR
187	Research in environmental and resource management	MESR
231	Student life	MESR
193	Space Research	MESR

Table 6. 1 The Ministerial contribution to MIRES (2012)

Among the programs autonomously financed by the MESR it is worth noting the characteristics of two programs. The programme 172, which funded PROs like CNRS, INSERM, INRIA (institutional block funding), the ANR (competitive funding) and tax incentives like the CIR; and the programme 150 financing only HEIs under the supervision of the MESR, since also Higher Education was an area highly contended between ministries. Indeed, some of the schools considered to be the most prestigious ones, e.g. *Grandes Écoles*, fell under the supervision of other functional ministers (for example the *Écoles des Mines* was under the supervision of the Ministry of Economy and Finance),

who were extremely reserved against any attempt of interference by the MESR (Cytermann, 2006, p. 88).

If we look at the programs under the competences of other ministers than the MESR, these were mainly ministers detaining a joint supervision of a PROs: the Minister of Agriculture with the INRA; the Minister of Economy and Finance (INRIA), the Minister of Defence (CNES).

Unfortunately, disaggregated data were not available, but the nature of the ministerial-based programs, and the fact that these ministers supervise some specific Higher Education Institutions and PROs, can be symptomatic of a still persistent functional-based ministerial struggle for power[69].

Consequently, the coordination game between public actors involved in the governance of national R&I policies is complex, the boundaries of their institutional competences are sometimes fuzzy and path dependent effects seems to play a relevant role in the distribution of power among actors.

Under the Sarkozy presidency, within the framework of the Investment for the Future Plan, a new layer was added to the complex national governance of the system, through the creation of the General Commissariat for Investments. As argued by one of the experts we have interviewed: *"with the CGI they didn't create coherence among the organisations involved, but rather competition between ministers and the PIA"* (INTERVIEWE 15).

After the centralisation of decision-making competences under the supervision of the Prime Minister, and the implementation of the program through public agencies, there seemed to be any organic link with other ministries. In the case of the IDEX program, the Technological Research Institutes and the creation of Technological Transfer Acceleration Companies (especially those within the competitiveness clusters), the PIA interacted closely with the MERS and the Minister with delegated competences on Industry[70]. While, on the other hand, the general system of allocation of funding did not create any link between the ministers in the affected areas of competences, resulting in systemic frictions between the old and new institutions with overlapping missions and different operating methods (OECD, 2014, p. 42).

According to one of the experts we have interviewed, the CGI represented a very powerful actor in the interpretation of the PIA, since every decision regarding the allocation of funding had to be negotiated with the committee (INTERVIEWE 12). Also, Musselin (2017) argued that as a result of

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[69] When presenting the MIRES architecture to the Higher Council for Research and technology (CSRT), an observer noted a certain correspondence between the programs of the other ministers and the major technical bodies of the state (*Corps d'état*): "energy and industrial research" *Corps de Mines,* "Equipment transport and habitats" *Corps des Ponts*, "Dual research" *Corps des ingénieurs de l'armement,* "Higher education and Agricultural Research" *Corps du Génie rural et des Eaux et Forêts* (Cytermann, 2006, p. 87). A relevant detail for understanding the whole picture is the fact that many of the personnel in the *corps* are people coming from a Grandes Écoles training.

[70] For what concerns the integration of the PIA within the broader framework of Ministerial programs it is worth noticing that after 2014 the CGI reports to the Minister with delegated competencies to Industries, in the effort to ensure operational cooperation with other innovation programs. Before it was reporting to the Prime Minister only (OECD, 2014).

the increasing relevance of the Commissariat, the MERS was increasingly marginalised and deprived of the control over some of its necessary means of intervention.

Nevertheless, it is striking to notice how, the CGI was introduced "above" the complex system of interactions between ministers and R&I performers, which was smartly circumvented through the leadership role of the committee, which was exclusively under the supervision of the Prime Ministers, and consequently of the President of the Republic.

6.3 Interest

French R&I policy making has an extensive record of consultations with R&I performers, the first case date back to 1956, with the *Colloque de Caen*, followed by *Les Assisses Nationales* (1981), which anticipated the adoption of the 1982 law on research, and by the consultation during the design of the 1999 Innovation Plan and the 2003 Innovation Act. While, as mentioned in Chapter 6, following on from the beginning of the SLR movement in 2003 a national dialogue was organised in 2004 (the General state for Research) in order to collect R&I performers' opinion regarding the features of 2006 Research act. Ultimately, the most recent consultations took place during the definition of the National Strategy for Research and Innovation (2009), then again in 2010 with the Roundtable for Industry and finally in 2013 with the National Conference on Higher Education (*Assises de l'einsegnement superieur*). These events were meant to create a more favourable environment for building consensus among R&I performers (OECD, 2014). Therefore, as expressed by one of our interviewees, they often represented consultative, rather than strategic, forum for discussions in which the establishment of an effective collaboration seemed impossible to reach (INTERVIEWE 19).

Consequently, as argued by one of our interviewees (INTERVIEWE 17) the shift towards public agencies by ministers (making reference to the trend started in 2005) could exactly be interpreted as being driven by the search for neutrality and professionalism, aiming at compensating policy makers' competencies and externalize the management of highly salient issues.

6.3.1 *The creation of the Agency for Research Funding (ANR)*

The relationship between EPST, HEIs and the Minister of Higher Education and Research defined a complex mechanism of funding streams and interactions including also different functional ministers according to specific policy issues.

Major research organisations were linked with their respective parent minister by contracts[71], which assigned them general objectives, that were then taken into consideration during the internal allocation of priorities between research teams. Similarly, universities negotiated contracts with the Minister of Higher Education and Research, which involved the provision of specific funding allocations.

Within this system of power relations EPSTs detained a considerable supervisory latitude in their strategic choices and internal allocation of resources, therefore being quite influential in setting national research priorities (IGAENR, 2012). Because, despite the institutional architecture designed for the definition of the MIRES and for the discussion of PROs' budget, the arbitration on budgetary appropriations for research didn't take place on the basis of major research themes, but it was essentially done by the operator itself (French Court of Auditors, 2013). Moreover these organizations brought together under a single authority different functions that in other countries tend to be spread out among several institutions: the orientation, funding, execution and evaluation of research in their respective fields (OECD, 2014, p. 125).

Therefore, as expressed also by some of our interviewees the public research landscape looked quite unbalanced. On the one hand, universities seemed to be "less powerful" because they were fragmented across the national territories; whereas big PROs, essentially financed by the state, were bigger organisations with a structured network of national laboratories, which allowed them to design a well-structured national strategy (INTERVIEWEES 17-21).

As already mentioned in Chapter 5 this divide was not only functional, but to some extent it was also cultural[72]. Indeed, it is striking how this cleavage was also present in the movement (SLR) against the 2006 Law on Research, as reported by one of our interviewees involved in the group (INTERVIEWE 19): *yes, it is true, the relationship between PROs and universities have always been a little bit difficult. [...] Initially, the SLR movement was structured around mainly PROs researchers. Then, we quickly realize that it was necessary to open the movement to universities as well, and actually some of them joined the protest. But I think that, already by the selection of the name ("Save the Research") some people from the universities believed that they weren't concerned.*

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[71] The contractual nature of the relationship between research performers and policy makers was introduced by the 1982 law on research and further enhanced by the 1999 *Loi Allegre*, but their provision became compulsory only in 2007 with the approval of the law on the autonomy of universities (Art.7).

[72] As argued by one of the experts we interviewed (INTERVIEWE 13): *"it is necessary to understand that in France universities didn't use to be relevant institutions. Differently from other countries, the executive élites are not trained within universities. This is historically related with French Revolution, at that time universities were related with the church. Since the revolution was anticlerical, we have created new élites detached from the church, with the creation of the Grandes Écoles; which has been enhanced during the Napoleon era, and in 1945 with the creation of ENA. Therefore, French bourgeoisie trains their children in the Grandes Écoles, not at universities. In these institutions the goal is not to "learn to do" but to "learn to learn", therefore French élites tend to be quite detached form research and science (with the exception of some highly intense Grandes Écoles institution e.g. École Normale Supérieure or École Polytechnique)".*

A push towards changes in the power balance between PROs, and Universities was given by the 2007 Law on the autonomy of universities that, by leveraging on some of the instruments approved by the 2006 law on research, attempted to introduce an evaluation culture in the management of public funding systems73. The underlining logic of the LRU was to put universities at the centre of the system as main operator of public research (Musselin, 2017)74, which ran in parallel to a transition from a fully-block funding based research system towards a system in which funding for research were also assigned on a competitive basis.

The ANR, established in 2005, changed its status becoming in 2007 a public agency in all respect, with administrative and financial decision-making autonomy, under the supervision of the Minister of Higher Education and Research. The agency took over the support actions previously financed through the FRT and FNS; subsidizing basic and applied research undertaken by public research organizations, universities and SMEs; as well as some direct institutional funding to research laboratories (Arnold, 2007; Lepori et al., 2017). Moreover, from 2010 onwards it has been appointed as the manager of the competitive funding system introduced with the Investment for the future plan (PIA). Its underlining mission concerned the funding of research performers, according to the thematic priorities identified by the government, and these resources complemented PROs and Universities budget allocations.

Over the years some researchers have expressed their concerns regarding the increasing power of the ANR and its direct ministerial control, claiming that this would have been detrimental to the multidisciplinary nature of PROs, mirroring the strong disagreement between governmental authorities and scientific community on who should identify national research priorities (Eparvier, Patrick; Turcat, Nicolas; Schoen, Antonie; Carat, Gerard; Nill, 2008). This has also been confirmed by one of our interviewees (INTERVIEWE 22): *it is true, at the beginning the ANR was badly perceived, because there were already research operators, working on their programs…but everyone was doing its own thing in a corner. These researches were all relevant in their fields, but on the other hand we noticed that there were different scientific small and divided groups according to different themes.*

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73 It is worth noting how this law was one of the strong suits of Sarkozy presidency, who was Minister of Economy Finance and Industry during the previous legislation, at the time when the 2006 Law on research was approved. Therefore, this might be also a reasonable interpretation for its coherence with the newly approved Law on the autonomy of universities.

74 An example for that logic was the creation of PRESs (Research and Higher Education Clusters), a contractual tool for grouping Higher Education and PROs in geographical proximity, in order to pool their resources and create a unique cluster to manage research, education and valorisation activities. They represented a strategy to aggregate the different components of public research according to different thematic.

The expression of concerns from the research community regarding the capacity of the ANR to establish thematic priorities for French public research, paved the way for some changes in the governance of the organisation, with the introduction of the "Alliances" in 2010. These were coordination institutions bringing together different public stakeholders in a given research domain to enhance coordination (Zaparucha, 2010); they were involved in the programming of the agency and they played a role in the priority setting exercise.

As argued by the OECD (2014), the new role of Alliances within the design of ANR priorities entailed reinstating the planning function itself within the PROs, which run counter to the previous trend of separating powers (p.131). On the same line, the discontent of the research community pushed the ANR to introduce, in the same years, the first round of "*Programmes Blanc*", reserving a share of the budget allocation to non-thematic programs. Therefore, despite the introduction of an agency devoted to research funding allocation, the main constituencies of the sector detained a relevant bargaining power, and they managed to influence the nature, and powers, of the ANR.

The budget allocated to ANR has been gradually increasing until 2009, when it levelled off and began to drop, with a slight increase in the last two years, as demonstrated from the table below [75].
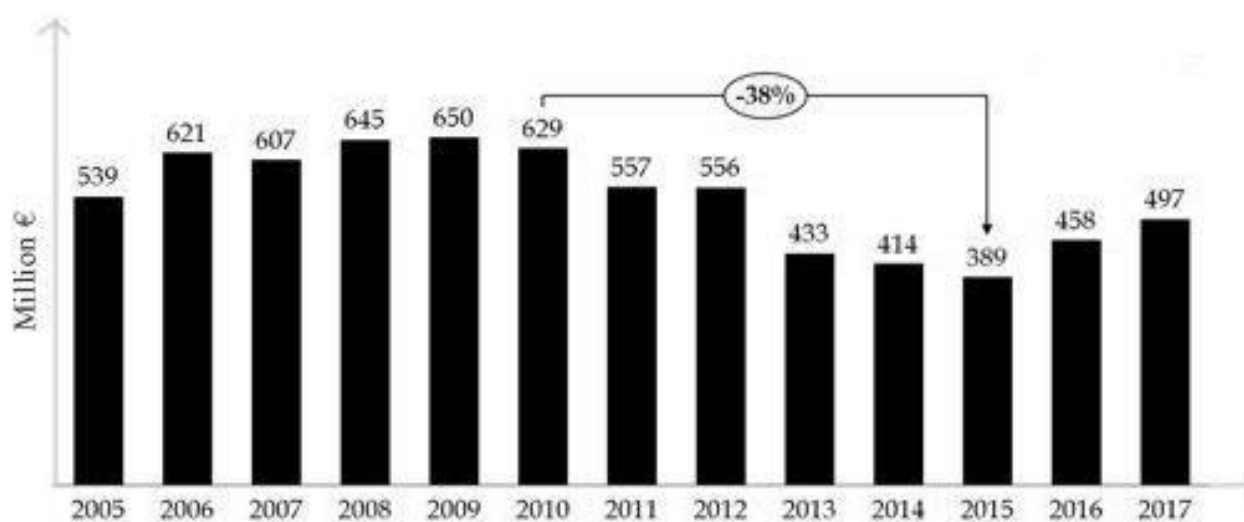
Table 6. 2 Evolution of budget allocation of the ANR (2005-2007)

The endowment provided by the agency comes from the intervention appropriations included in the program 172 of the MIRES (see Table 6.1), and after 2010 from the PIA funding.

The reduction in the allocation of funding to ANR has been initially justified by a shift towards a system of direct institutional funding allocation to PROs, as decided during the *Asisses de la*

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[75] Taken from senate legislative report for the draft of the budget law 2019 http://www.senat.fr/rap/l18-147-323/l18-147-32315.html (Last access 8 May 2019).

recherche 2012 by the Government (Hollande). On the other hand, this argument was no longer valid in recent years, to the extent that several EPSTs have experienced a reduction in their institutional funding streams76. Therefore, the reduction of the ANR's budget allocation did rather flow into credits for project operators in the form of recurring grants.

Consequently, despite the initial inflow of funds, and the flexibility in terms of changes in the governance arrangements, the ANR has struggled to find its position in the French R&I system that according to the OECD (2014) remained sensibly weighted towards PROs. This was somehow in line with the results of the country report by Lepori et al. (2017), according to which the overall importance of project funding in the French public research system is rather low, and Public Research Organisations have a pivotal role in the management of public funding for research.

6.3.2 The Private R&I Performers: an agency (ies) to rule them all

The cleavages cutting across French R&I policies do not solely emphasize the divides existing among public research operators, to the extent that also the division between Public and Private actors is still quite pronounced. As argued by one of our interviewees (INTERVIEWE 13): Actually, the rupture between academic research and innovation in France is a very important, and long-lasting problem. The mistakes are shared to the extent that French universities have never enjoyed working with companies, and companies have not really enjoyed working with academic research either.

According to the Berger Report (2016)77 the last 15 years of reforms in the French R&I system have mainly been designed to correct the perceived inabilities of the academic scientific community to establish linkages with industries; by replacing their role in the marketing of products and services resulting from the scientific advancements made in laboratories.

In the former paragraphs we have extensively discussed the role public research performers played in this game, therefore it now becomes necessary to investigate the other side of the coin, meaning how did private R&I performers influenced the evolution of policy design and the way policy makers interacted with them.

The French industrial system was historically characterized by "Grand Programs", a legacy difficult to dismantle, as clearly demonstrated in the case of public research performers. This was further deepened by the low level of private participation in the R&D effort and the well-pronounced long-lasting governmental attitude to invest mainly in specific sectors. Following on from the beginning

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76 As stated in the legislative report for the draft of the budget law 2017 http://www.senat.fr/rap/l16-140-325/l16-140-32514.html (Last access 8 May 2019).

77 This report was commissioned in 2015 by the Minister of Economy, Industrial and Digital Technologies (Emmanuel Macron), and the Minister for Higher Education and Research (Thierry Mandon) to Suzanne Berger, professor at the MIT and expert in technology transfer.

of the liberalization era, there has been an increasing propensity to sustain the development of national companies towards the acquisition of a dominant position in the international market, together with a more systemic support to the network of SMEs (BCG & CM INTERNATIONAL, 2008).

Overall, the system suffered from the lack of SMEs technology-based companies, governments seemed to have changed their rhetoric towards large state-led companies. However these actors were still (even if more indirectly) benefiting from the lion's share of public support for R&D (Eparvier et al., 2009, p. 21). Therefore, as demonstrated in the following paragraphs, the dichotomy Big Enterprises *versus* SMEs has been persistent since some decades in French R&I policies.

The landscape of private R&I performers was highly heterogenous, with different waves of salience on the role of SMEs as drivers of innovations and the persistent bargaining power of big enterprises on the background. Nevertheless, as demonstrated in Chapter (5), even if the targets might have changed overtime, moving towards SMEs, the *modus operandi* of public authorities didn't seem to have changed much being mainly centred around an inducement "subsidies in exchange of intended behaviour". This trend could be easily confirmed by the type of public agencies populating the wide landscape of public intervention towards innovative SMEs, and the evolution of their nature.

For what concerns public strategies aimed at the valorisation of research results in the industrial system, and more broadly public support to SMEs, a public agency was in place since 1967: the ANVAR. With its 24 regional offices around the country, the agency played a double role by monitoring the evolutions and results of innovative sector of the economy, while assisting SMEs development. It provided support through interest-free loans for SMEs, repayable in case of successful projects; together with information guidance, access to consultancy services to support the creation of partnerships among actors. During the 1990s it started to focus more directly towards SMEs. In parallel with the actions of ANVAR, in 1982 the government introduced a specialized financial institution with a public-interest mission: SOFARIS. This agency aimed at the management of the guarantee funds coordinated by CDC[78], European and regional finance. In addition to them a third organization was created in 1997, the Development bank for SMEs (BDPME), which provided public guarantees for high risk investments, therefore working in partnership with private credit system institutions.

In 2005, almost in co-occurrence with the creation of competitive clusters, all these agencies were merged into a unique organization OSEO, a holding company owned by the state mainly reporting to the MINEFI, with the status of a private company and a mission of public interest (Schoen et al., 2008). The tasks of this organization have been structured around three subsidiaries programs, corresponding to the activities of the former organizations in place, meaning: project-based support

[78] This is a state bank which funds companies and is heavily involved in innovation and SMEs financing (OECD,2014).

for innovative technologies (ex-ANVAR), loans guarantee system supporting banks and providing equity contributions to innovative SMEs (ex-SOFARIS) and the financing of business investments in partnership with other organizations (ex- BDPME) (Dosso, 2014). This merge was in line with one of the strategic orientations defined in the 2003 Innovation Plan to make OSEO the main public operator in the field of innovation, in charge of managing and implementing the measures established by the government to promote innovation – especially towards SMEs (European Commission, 2005a).

Before the creation of this umbrella organization, the budget allocation in support for R&I in the private sectors, especially those devoted to SMEs, were managed in a fragmented way by the three organizations in addition to the delegated regional offices related with the Minister of Higher Education and Research and the Minister of Economy Finance and Industry (the Regional Research and Technology Delegation DRRT and the Regional Division for Industry, Research and Environment DRIRE).

Therefore, the establishment of OSEO represented a strategy to rationalize the structure of innovation support for SMEs, along with the implementation of Competitive Clusters, which were also hinging upon the cooperation of these actors. So, after a period of stratified intervention towards SMEs and the delegation of their implementation to three different agencies, with the reorganization of OSEO policy makers re-centralised the implementation of R&I interventions under the supervision of the MINEFI.

The nature of OSEO has been evolving over time, firstly in 2008 with the absorption of the Industrial Innovation Agency (AII), created within the framework of the competitive cluster policies. Following this merge, OSEO became the manager of the interministerial fund for collaborative projects.

Then, in 2010, after the kicking off the Investment for the Future Plan, OSEO, together with ANR mainly for research-oriented projects, became one of the operators of the program.

Ultimately in 2013, after the election of the new President of the Republic, OSEO disappeared for being incorporated, together with a branch of CDC and the Regional Fund for Strategic Investments, within a new public institution called BPI France. This was a public investment bank financing innovation activity through a different portfolio of actions, from the provision of loans and guarantees, to the shadowing and consultancy of innovation projects.

The evolution of this agency represented a clear proxy for the state approach towards private performers in R&I. In the case of OSEO, policy makers were behaving such as private banks, providing out-of-market loans to innovative enterprises; with the supplement of consultancy services. Whereas, in the case of BPI France, the state became a shareholder of the innovative projects, being more centred around the innovation potential of the enterprise. This seemed to be in line with the

"public holding model" (Eparvier et al., 2011) described in the case of the PIA where, through the provision of different funds, the central administration detained financial stakes in innovation organizations, without the cost associated with their management.

As reported by one of our interviewees (INTERVIEWE 21), the main problem with OSEO was that it wasn't structured as a private bank, especially for what concerns prudential regulation, on the other hand this helped gaining freedom in managing highly innovative projects. Whereas with BPI we sort of overcame this issue; indeed, there has been an evolution towards taking risks in terms of innovative investments, which were closely followed by the agency that was autonomous in its (project investment) decisions.

Therefore, despite the different historical phases national innovation policy has gone through, the underlining logic of intervention towards SMEs has often been to (financially) support private actors, and accompany them through consultancy. A pattern of carrot and sermons, which attempted to blandly nudge heterogeneous and differentiated actors towards the preferred behaviours.

6.4 The role of tax research credit for business

As we have already stressed, the dichotomy big enterprises *versus* SMEs has always been a constant of French R&I policies. The path dependent lock-in effects related with the legacy of state led R&I programmes, which tended to rely on the cooperation of big national enterprises, seemed to have consistently influenced the evolution national strategies.

Right after the beginning of the liberalisation process, there has been a change in direction towards the role of SMEs, especially boosted by the creation of the competitive clusters. Then, as stressed in Chapter 5 the devotion towards SMEs decreased, and it was slowly included within the broader set of actions of the investment for the future program. Despite this fluctuating scenario, there has been an instrument addressed to support the innovative potential in big and small enterprises that did manage to survive from 1983 until nowadays: the research tax credit.

According to our interviewees the *crédit d'impôt recherche* (CIR) did manage to survive because it was created and modified by different party in government, therefore it was not clearly related with a given political faction (INTERVIEWE 13), moreover enterprises did like it and especially, as reported by one of our interviewees: as an MP use to say regarding to fiscal niches: it is good to abolish fiscal niches, but within each niche there is a dog that bites (INTERVIEWE 17).

Therefore, the combination between a strong constituency in support of the instrument, together with the intra party stratification process, crystalized the position of this instrument within the broader national policy mix.

As described in Chapter 5, this instrument has undergone through three different important phases of changes. The first one, with the drafting of the budget law of 2004, when the instrument was established (before it was based on a multi-year programming and after on a yearly-based) and the volume-based calculation of expenses was included. This reform was adopted under the mandate of Francis Mer, as Minister of Economy, Finance and Industry, a French business man, who had a prominent role within the MEDEF, the largest employer's federation in France.

As reported by one of our interviewees (INTERVIEWE 20): in 2000 the MEDEF published a report called "Priority measures to boost innovation in France"[79]. There, among other claims, the organisation clearly stated the need to reinforce the CIR, with a change in the methods for calculating the credit was needed, as well as the adoption of OECD definition for R&D (less restrictive than the French ones) and the general broadening of the base for credit's calculation[80].

The second important change of the instrument was adopted in 2006, therefore under a new Minister of Economy, Finance and Industry (Sarkozy) and right after the implementation of the competitive clusters. It introduced new costs as eligible for the tax deduction, as well as the possibility to subcontract research to third actors (e.g. like those involved in the future PRES or in the Competitive clusters) and an increase in the ceiling for expenses. Finally, the 2008 reform under the combination of the Christine Lagarde as Minister of the Economy Finance and Industry and Nicola Sarkozy as President of the Republic, suppressed completely the increase-based calculation, it adopted the Frascati Manual (OECD manual for collecting and using R&D statistics) for the classification of expenses and finally it removed any ceiling. As reported by our interviewee it seemed that effectively the evolution of the CIR somehow took inspiration from the suggestions made by the MEDEF report. The evolution and different calibrations of the instrument also suggested how this has been moulded according to different targets. Indeed, the balance between increase and volume-based calculation (finally removed by the reform 2008), awarded private actors who increasingly performed innovation over time or new enterprises which had no previous fiscal records of innovation and could benefit of a generous CIR in the first years of existence. On the other hand, the shift towards a full volume-based calculation of the CIR allowed enterprise to get a constant share of tax credit according to the amount of innovation financed, somehow penalising more dynamics, and less constant, innovative enterprises. Nonetheless, the most relevant change in terms of target population access to the instrument was the elimination of the expense's limits. The ceilings of expenses had been growing starting from 2003, moving up with the 2006 reform, to be finally completely removed under the

[79] "*Les mesures prioritaires pour une accélération du mouvement de l'innovation en France*".
[80] https://www.lesechos.fr/2000/12/le-medef-souhaite-une-loi-cadre-pour-linnovation-758745 (last access 13 May 2019).

Sarkozy presidency reform. These changes basically paved the way for big enterprises to exploit the benefits related with the R&D credit, since before, with the limit of expenses, they could only partially benefit of it. As claimed by some of our experts (INTERVIEWE 15): after the removal of the threshold the CIR has rather facilitated big enterprises.

If we look at the data from the yearly evaluation report on the CIR made by the Ministers of Higher Education and Research[81], the share of SMEs (blue area in the table below) benefiting of the credit is higher compared to the number of big enterprises (green area in the table below). On the other hand, when we look at the expenses of R&D declared, bigger enterprises tend to represent the lions' share of the credit beneficiaries.
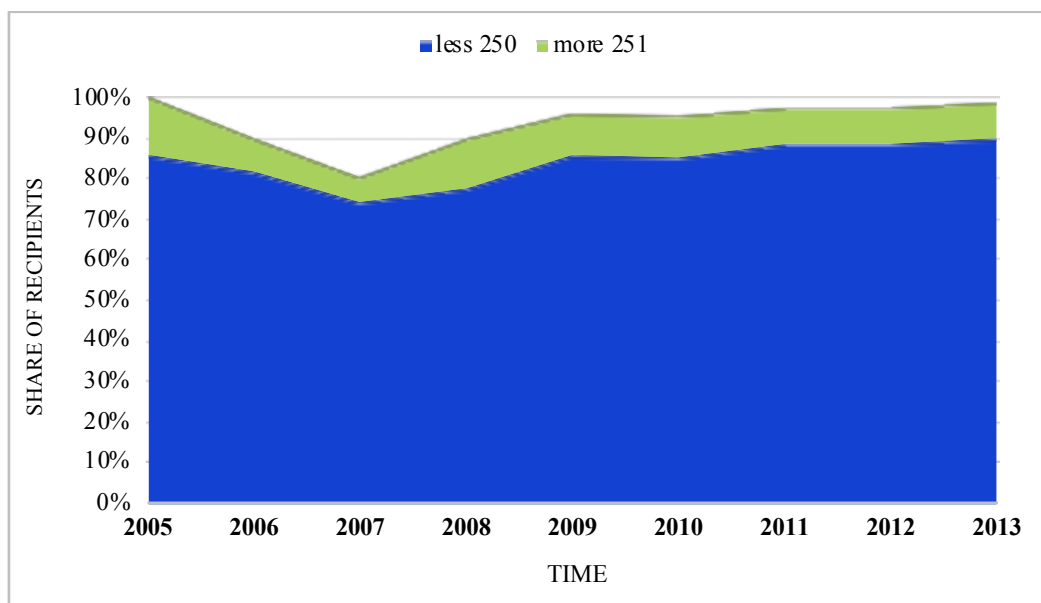

Figure 6. 3 Recipients of tax research credit by enterprise size

81 http://www.enseignementsup-recherche.gouv.fr/cid49931/cir-les-statistiques.html (Last access 13 May 2019).
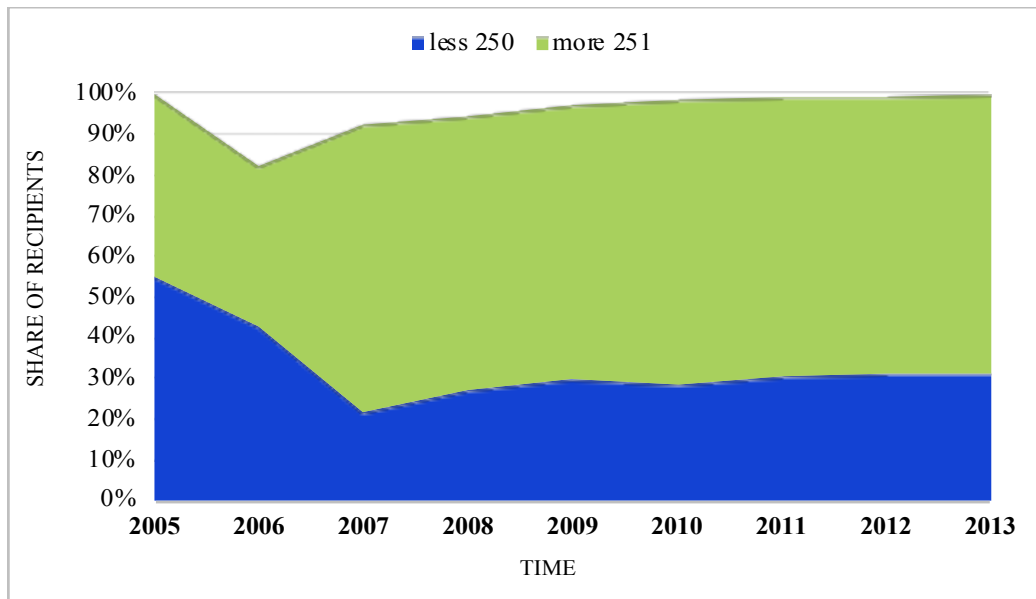
Figure 6. 4 Share of tax credit benefits by enterprise size[82]

As Figure 6.3 and 6.4 show, SMEs enterprises represent the largest share of private R&I performers applying for tax reduction within the CIR scheme with peaks of 86% of the total sample in 2005, 88,9% in 2012 and 89,8% in 2013. This trend seemed to be constant across all the period under investigation.

However, if we look at how much did actually different enterprises benefited of the tax credit, the situation is almost flipped over, with big enterprises reaching a peak of 69,5% of the total benefits provided in 2010 and stabilizing around that amount for the rest of the period under investigation. Moreover, it is also worth noticing that SMEs dropped from a value of 55% in 2005, to 21,7% in 2007, followed by a slight increase in 2008 (27,4%), which slowly increased to a last peak of 31% in 2013. Overall, despite its role in contributing to national research expenses, the CIR basically allowed to decrease fiscal pressure on enterprises, due to their investments in R&D. So, as argued by one of our interviewees, the tax credit became the only instrument really in the hands of enterprises, because all the others were exhortations from policy makers (INTERVIEWE 20).

In the French R&I sector, business demands were articulated both formally and informally. In the first case, consultation bodies like the Permanent Commission for Consultation with Industry (CPCI) advising the Ministry of Economic Affairs were called into question, bringing together experts from this and other ministries, industry representatives from the enterprise association MEDEF and other stakeholders. Moreover, also ad hoc consultative bodies drafting reports on specific issues on the behalf of the prime minister, and often chaired by industrialists, were another important mechanism.

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[82] Data elaborated by the authors according to the official statistics published by the yearly evaluation report on the CIR (Ministers of Higher Education and Research).

One example was the report by Christian Blanc (see 4.2) which initiated the creation of Competitiveness Clusters (Schoen et al., 2008, p. 22).

More informal channels of communication took place on an issue-base mechanism between the Minister with delegated competences in Industry and the MEDEF. Nevertheless, it is also important to remember that this federation mainly represented SMEs and, as affirmed by one of our interviewees (INTERVIEWE 20), big enterprises tend to run their business autonomously. They could rely on the lobbying of the MEDEF as a forerunner, but they could also interact personally with the Ministry. As stated by one of our experts (INTERVIEWE 12): probably this was not a standard practice between the minister and the employees of the ministry; but it was rather an action by exception, triggered by the political powers at the highest level when they wanted to interfere.

The possibility for big enterprises to have a voice in the policy making process, was also dependent upon the political attitudes of elected politicians, more specifically their openness towards the business world. The history of the CIR might have been shaped by these dynamics to the extent that also in contemporary literature we find many references to the cooperative attitude of the former President of the Republic (and Minister of Economy Finance and Industry), Nicolas Sarkozy, towards the industrial world. Indeed, he has described as an interventionist finance Minister, using his resources to create national champions and scare off foreign bidders (like the support in the merger between Gaz de France and Suez to create a "national champion" in the energy sector) and more generally as a friend of French business (Cole et al., 2008, p. 20). Therefore, the possibility to overcome formal channels of interaction was really dependent upon the political openness of policy makers towards the business world.

6.5 Conclusions

In order to shed light on the dynamics of conflict, and compromise, between the actors involved in the French R&I policy making we designed and approach which intersected different insights on the role of ideas (as the influence of dominant framing in a given political system); the opportunity structures provided by the institutional system (internal coordination and specialization between policy makers) and the role of target population (the strategies for interest intermediation).

For what concerns the role of ideas, we were interested in understanding the combined effect of changes in cabinet compositions and the feedback effects related with the accumulation of long-lasting policy framings influence and how their interaction affected the evolution, and characteristics, of R&I policy mixes.

Even, if a cabinet turnover political effect can be spotted, its effect is consistently hampered by the dominant path dependent attitude on policy mix preferences; characterising the peculiar stability of

the R&I French system (Berger, 2016). Therefore, policy instrument selection process seemed to be truly linked to the nature of the general governance context and long-term policy styles embedded in national R&I strategies. And when policy makers had to decide upon how to shape the existent mix, given the constraints set in force by previous choices, they seemed to prefer relying on consolidated strategies.

As suggested by the literature (Braun, 2008b; Chung, 2013; Smits et al., 2010), it has been recognised that the variety of national political and administrative institutions, and inter-institutions networks influence the ability of research and industrial actors to produce knowledge and innovation, as well as of policy makers to invest and regulate. The landscape of French R&I institutional organisation was organised according to an external specialisation strategy, to which many experimental strategies and forum for interministerial coordination have been layered on.

Many efforts were made to create a common venue for decision making, gathering different interviews, but as reported by many interviewees, the lack of incentives, nullified the effective power of these committees and the purposive participation of different actors. Indeed, coordination to be effective has to be done by members of government with responsibilities on the coordination of funds and policy options to ensure a high level political coordination and to enforce decisions (Henriques and Larédo, 2013, p. 7).

Many differences, especially in framing the issues related with R&I policy persist among the two ministries and the strategy to recentralize powers through the CGI seems to have only layered a further institution on the already intricated governance of the sector. In this specific case, the complex and interconnected system of interactions between minister, agencies and R&I performers was almost preserved and, smartly circumvented by the leadership of Sarkozy and the creation of the CGI, together with the entrepreneurial role played by BPI France. Therefore, by circumventing the clear problem of coordination at the core of an external specialisation ministerial structure (e.g. common budgeting), through the centralisation of some powers and the professionalisation of specific tasks (through public agency), a stratification strategy allowed policy makers to overcome decisional stalemates by delegating tasks to public agencies. So formally, institutional structures were coordinated, but informally there were still deep partisan and sectorial divisions among ministers with shared R&I competences. That was probably one of the reasons for the density of stratified intervention characterising the sector.

For what concerns the structure of interest intermediation this is quite fragmented between public and private R&I performers. In the first case, as pointed out by the OECD (2014), the limited role in the competitive mechanisms for the allocation of public research funding, does not make it easy for the political authorities to manage public research. With the introduction of the ANR there has been a

strong attempt by the government to change the mechanisms of public research funding allocation, as well as to provide some thematic orientations. Over the years of its activity, the adoption of non-thematic programs, and the inclusion of *Alliances* of public research actors softened the initial directive spirit of the agency. This underlining logic was somehow pursued by the PIA program as well, which identified areas of research priorities at the CGI/governmental level, providing a system of competitive funding. Consequently, the current public research system is combining elements of autonomous public research organisations, together with a model based on state-led programmes.

Differently, in the case of private R&I performers, there have been different waves of salience on the role of SMEs as drivers of innovation. Even if the targets might have changed from the past, the *modus operandi* of public authorities didn't seem to have changed much being mainly centred around an inducement "subsidies in exchange of intended behaviour". Therefore, despite the different historical phases national innovation policy has gone through, the underlining logic of intervention towards SMEs has often been to (financially) support private actors, and accompany them through consultancy. A pattern of carrot and sermons, which attempted to blandly nudge heterogeneous and differentiated actors towards the preferred behaviours, as confirmed by the evolution of public agency characteristics. As we have already stressed, the dichotomy big enterprises *versus* SMEs has always been a constant of French R&I policies. The path dependent lock-in effects related with the legacy of state led R&I programmes, which tended to rely on the cooperation of big national enterprises, seemed to have consistently influenced the overall national strategy. On the other hand, those actors seemed to have a bargaining power by exception, according to their cooperation with the MEDEF, and the different political attitudes of elected politicians, more specifically on the basis of their openness towards collaborations with the business world.

7   Chapter 7: The Italian Case study

The Italian R&I sector is characterised by a highly centralised governance structure hinging upon two institutions, the Minister of Higher Education and research (MIUR) and the Minister for economic development (MIUR). The landscape is further complicated by the fact that beside these two institutions important contributions to the evolution of the sector, and the desire to promote research and innovation practices, can also be found in other ministers (e.g. Health, Agriculture and Environment), who respectively detain different Public Research Organisations under their control like the National Institute of Health (*Istututo Superiore di Sanità*) and the Council for Agricultural Research and Analysis of Agricultural Economy. This is symptomatic of the fact that the problems of the national R&I system are not exclusively linked with a low level of investments in R&I issues, but also to a lack of coordination between the field of scientific research and industry (European Commission, 2001).

Historically, the Italian Innovation System relied on the on the coordination between public research institutions and firms, which use to be predominantly state-owned entities. As for the French case, this was matched with an important role of the public sector, both as a performer and financer of research and innovation activities.

The end of the 1990s was marked by the beginning of a process of public service modernization, which involved all the national administrative system, cutting across different sectors, the so-called Bassanini reform (Capano and Gualmini, 2011). This process redefined the mission of several public institutions, and the different cabinets involved in its implementation sought to place their own stamp on the reforms and, in so doing, slowed the process down by changing the focus of the reform (Spence, 2014, p. 109).

In the second semester of 2011 Italy was caught in the financial storm due to the worsening of the sovereign debt crisis in Europe; starting from 2012 the government concentrated its policies on public expenses reforms and on actions for promoting growth, including measures regarding R&D funding and the streamlining of the main research funds. This was also in line with a more general trend toward general reduction of funding in this sector (Nascia and Pianta, 2013).

Overall, the national policy mix evaluation displays on one side a high polarized instrumentation between business-friendly innovation initiatives, while on the other a "residual" approach towards Higher Education Institutions and Public Research Organizations (Nascia et al., 2012).

Bassanini reform   1998-00

Plan for digital   2003-05
innovation in enterprises
                    2006   Industria 2015
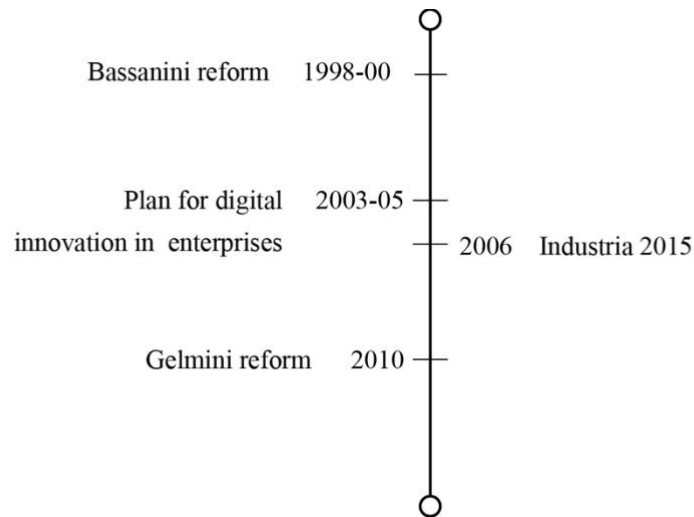
Gelmini reform   2010

Figure 7. 1 The chronology of the case (Italy)

The following chapter focus on investigating the most important policy events, as briefly summarised in Figure 7.1, and it is organized as follows. Firstly, we will broadly discuss the features of the national R&I governance structure then, we will dig into the instrumentation and the political process characterizing the policy design of encompassing Research and Innovation policy strategies. Then, we will discuss the reform characterizing the public research sectors, and the more general evolution of the national Higher Education Institutions. In section four we will chronologically describe and discuss the evolution of the instrumentation addressed to the industrial sector and finally the experiences of the industrial and technological districts taking place at the more regional level.

7.1   The National Governance Structure

The national R&I system basically consists of three groups of organizations: Universities and PROs, governmental institutions and enterprises. All of them, display a limited degree of interaction with each other, which indeed is considered as on the of the main weaknesses point of the national system of innovation (Malerba, 1993).

In spite of the systematic attempts to link the public and private research system, the two sectors are still fairly detached from one another. The former is mainly focused on research of academic nature and more generally detached from the needs of industries, which on the other side are characterised by a generalised lack of demand for scientific and technological research (European Commission, 2004b). The governance system enjoys a stable centre-of-government structure, via the development of multiannual national research plans, which are however matched with scarce monitoring procedures and uncertainties related with the availability of resources (Potì and Reale, 2011).

The image below summarises the characteristics of the national R&I governance.
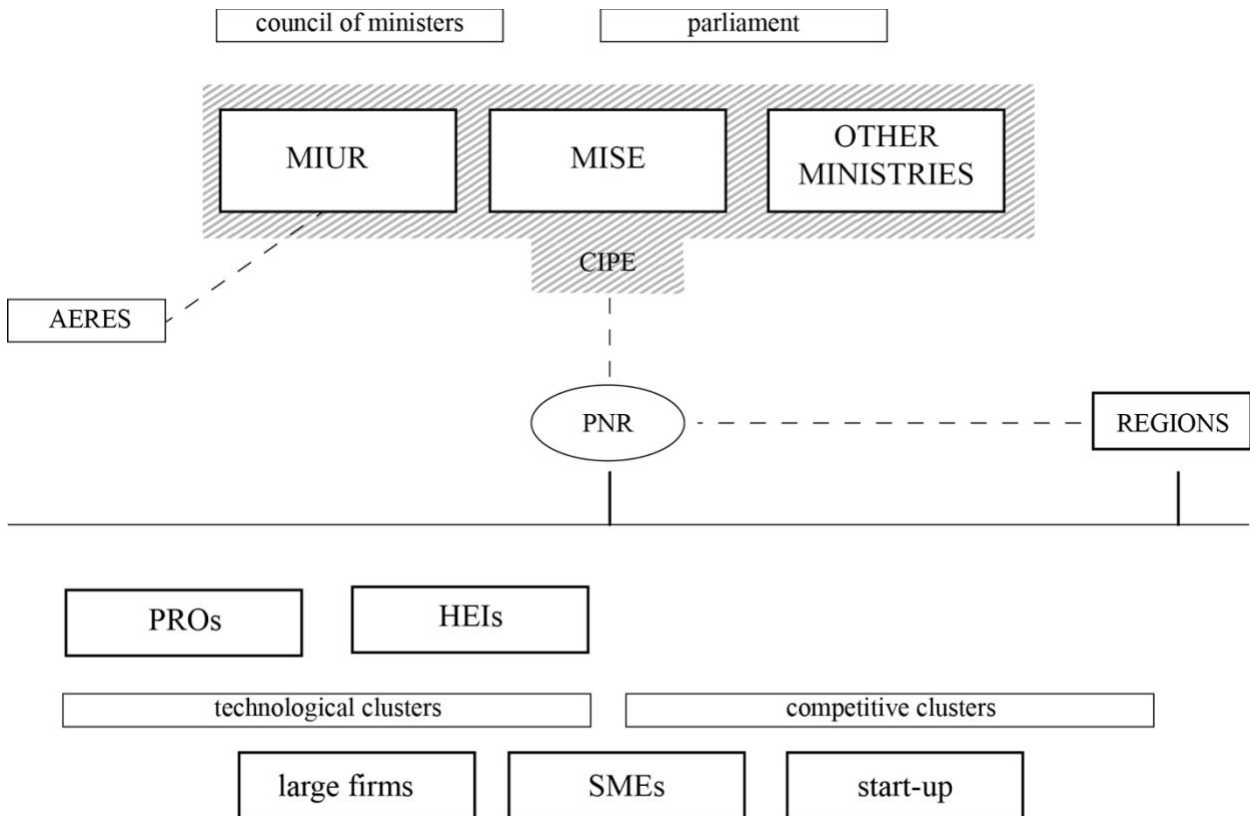
Figure 7. 2 The governance arrangement (Italy)

R&I activities tend to be related with heterogeneous governing tasks, to the extent that different research centers are attached to different ministries. Nevertheless, two ministers play a pivotal role in this sector, namely the Minister of Higher Education and Research and the Minister of Economic Development. The interministerial committee of economic planning (CIPE) develops functions of coordination in the field of planning and national economic policy, as well as coordinating the national economic policy with the community policies. Its main tasks include evaluating the DPEF, which defines the major strategic guidelines and the general economic strategy of the country, including the policy measures to foster Scientific research and Technology and the annual allocation of resources devoted to R&I (European Commission, 2006).

Overall public research activities tend to be mainly concentrated among Higher Education Institutions and Public research Organisations. While the hybrid organisation of competitive clusters, and especially technological clusters, potentially support the interaction between the different R&I performers.

7.2   The Public Research Performers

Public research Organisations

The National Council for Research (CNR) was set up in 1923, and since the creation of the MIUR it has been put under its supervision. It was the major national public research organisation (Reale and Morettini, 2017) supporting scientific and technological research, its activities covered different multidisciplinary scientific and technological fields. For a long time (from 1923 to approximately 2003), it has been in charge of the coordination and the funding support of national research policies. the first task was moved to the MIUR after its establishment (1989) and part of its financing activities were terminated some years later in the framework of an overall reform of public research organisation structures and powers.

The CNR operated on the basis of its own three-years activity plan, defining the guidelines and establishing objectives, priorities and resources for the organisation actions, in coherence with the National Research Program (Coccia and Rolfo, 2010). It carried out institutional research activities in coordination with the MIUR, its main financially responsible minister, but it also collaborated with different functional ministers on specific projects. Together with the CNR other Public Research Organisations were supervised by the MIUR, such as the Italian Space Agency (ASI) and the National Institute for Nuclear Physics (INFN), the most relevant in terms of share of funding[83]. In addition to them there are also public research bodies under the specific control of functional ministers, among the biggest:

- the National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA), under the control of the Minister of Economic Development and involved in research concerning energy, environment and new technologies;
- the National Institute of Health (ISS) under the supervision of the Minister of Health and involved in research concerning public health;
- the Council for Agricultural Research and Analysis of Agricultural Economy, under supervision of the Minister of Environment and involved in research concerning Agri-food related themes.

The national governance arrangement doesn't provide any clear platform for dialogue among them; therefore, their action rely on the guidelines provided by the National Research Program and by their own functional ministers' policy strategies.

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[83] For a comprehensive list of Public Research Organizations under the supervision MIUR please make reference to the following: https://www.miur.gov.it/enti-pubblici-di-ricerca .

Universities

Nowadays the Italian university system is made of 97 Higher Education institutions, of which 67 are State universities[84].

Historically, the system of funding for state universities was dependent upon governmental decisions, and it came together with restrictions on how these funds should be spent and distributed within the internal governance of the universities. The finance act of 1994 consistently reformed this system by introducing the Ordinary Financing Fund (FFO), a lump sum financing yearly assigned by the budgetary law devoted to cover universities' operating costs, which left universities free to decided how to use these funds

In parallel with that, during the late 1990s universities went first through a phase of "imposed autonomy" (Capano, 2008), then in 2010 a new dirigiste action of policy makers took place, allowing them to freely define their own statutes, under the condition defined by a tight ministerial regulation (Capano et al., 2016; Donina et al., 2015).

7.3 Encompassing Research and Innovation strategies

The beginning of the public research and innovation issues in the Italian case can be track down after the WWII, with the reorganisation of public research institutions. The National Research Council (CNR), founded in 1923, was transformed in Public Research Organisation in 1945, together with the creation of separate organisations from formerly included departments, like the National Institute of Nuclear Physics (INFN) established in 1945.

In 1962 it was created the first Minister (without portfolio) for the coordination of scientific research under the Presidency of the Council of Ministers[85]. The governance of the sector was characterized by a minister, without related institutional budget, who played the role of supervision and control. While the CNR had the leading role in the public research sector as both research performer and manager of the main R&I instruments, namely the so-called finalized projects (mission-oriented projects) and strategic projects[86] (Potì and Reale, 2006; Sirilli, 2010).

At the end of the 1960s a Special Applied Research Fund[87] (FSRA l. 1089/68) was created, it consisted of a revolving fund with the purpose to finance research focused on economic activities,

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84 https://www.miur.gov.it/web/guest/istituzioni-universitarie-accreditate.

85 The office of the Minister for the coordination of scientific research.

86 Finalized projects, were aimed at supporting knowledge developments in specific research sectors, selected by the CNR, aimed at universities, public research organizations and firms. While, strategic projects, which ended in 2002, were collaborative research projects at the national level on priority research themes identified by the CNR, evaluated by external experts selected by the CNR and exclusively directed at CNR.

87 Substituted by the Fund for Applied Research (FAR) in 1999 (d.lgs. 297/99).

the targets were industrial enterprises, research companies and public economic entities. The FSRA aimed at incentivizing research projects autonomously presented by R&I performers, together with a special attention towards creating network, by easing the creation of specific consortium between actors.

The first clear reference to innovation issues took place in 1982, with the creation of the Fund for Technological Innovation (FIT) (l.46/82)[88], devoted to research activities related with technological innovation and pre-competitive development. This was combined with the allocation of further resources to the Special Applied Research Fund, together with the inclusion of a targeted funding instrument, which allowed the minister in charge to devote an amount of the fund to specific (mission-oriented) research projects.

In 1989 (l. 168/89) the first Minister of Higher Education and Research was established, and a parallel trend towards a recentralisation of the national R&I governance at the mercy of the newly created institution slowly began. The following important event for the development of national R&I sector was the general reform of public administration undertaken by the newly elected government in 1996. Indeed, with the law 59/1997, so-called Bassanini I[89], the Parliament asked the government to examine the national Science and Technology structures, which resulted to be mainly affected by: a weak systematic approach; the lack of assessment and foresight activities, weak planning capacity in elaborating strategic programmes and a feeble diffusion of the results achieved by the S&T system (European Commission, 1999). The analysis of the minister of Higher Education and Research, was included in a document ("*Relazione alle camera del Ministro dell'Università e della Ricerca*[90]") and it followed the path defined by the Bassanini I, identifying five main steps for the reform process:

- The delegation of some of the competences to regions for what concerns incentives in favour of innovation and the realization of interventions related with European funds (d.lgs. 112/98);
- the design of a new governance system for public research (d.lgs. 204/1998);
- the re-organisation of existent public research institutions (d.lgs. 19/99; d.lgs.27/99; d.lgs. 36/99);
- a revision of the system of incentives devoted to the support of industrial research and technological innovation (d.lgs. 297/99; DM MIUR 593/00; DM MISE 16/01/01), specifically concerning the reorganisation of the funding system;
- the creation of "*Sviluppo Italia*" (d.lgs. 1/1999).

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88 The law on incentives for technological innovation was solicited by the great Italian groups, such as FIAT which was at the forefront in that period (Gallo, 2016, p. 18).

89 Which was part of a broader set of norms (l. 127/97; l.1919/98), so-called *Bassanini* reforms, aimed at reforming and simplifying the public administration system and decentralizing some tasks and functions to regions and local authorities.

90 Report to the Chambers of the Ministry of University and Research.

These principles have been developed through a fragmented package of reforms, which spread out along different years; and they have all been summarised in the following table.

Instrument	Content	Shapes Family Delivery Target
Reorganisation of the research system (d. lgs. 204/1998)	Introduction of the National Research Plan (PNR *Piano Nazionale di Ricerca*), which programmatically defined research activities to be promoted. The budget allocations defined in this document were included in the national economic planning document (DPEF *Documento Programmatico di Economia e Finanza*), yearly approved by the parliament.	Administrative Simplification [regulation # medium coercive] [low automatic] [HEIs + PROs+ Enterprises]
Special Applied Research Fund (FISR *Fondo Speciale Ricerca Applicata***)** (d. lgs. 204/1998)	Financed research projects on thematic areas according to the guidelines of PNR. Mostly collaborative projects at national level. It was jointly managed by the Minister of Finance and the MIUR (who had the titularity for the submission of financing proposals). It required the co-financing of the public administration interested (30% of the budget required).	Targeted Funding [expenditure # low coercive] [low automatic] [HEIs+ PROs+ Enterprises]
One stop Shop for Enterprises (d.lgs. 123/98)	It was a consulting service managed by municipalities (or aggregation of thereof) aimed at simplifying administrative procedures related with industrial activities thanks to the merge of different functions into a unique organization. Moreover, it also provided information advisory and corporate support for companies wishing to embark on an industrial activity.	Consulting Service [information # medium coercive] [low automatic] [SMEs]
Reorganisation of Public Research institutions (d.lgs. 19/99; d.lgs.27/99; d.lgs. 36/99	Aimed at reducing the overall number of Public Research Organisations and reorganise their internal departmental structure. In order CNR, ASI, ENEA.	Administrative Simplification [regulation #l medium coercive] [low automatic] [PROs]
FAR: Evaluation component	Managed by the MIUR, it was devoted to finance projects autonomously presented by performers, international projects, projects for the creation of research infrastructures, projects devoted to increase competitiveness, creation of new enterprises	Competitive Funding [expenditure #l ow coercive] [low automatic] [HEIs+ PROs+ Enterprises]
FAR: Negotiated component	Managed by the MIUR, it was devoted to finance research projects on themes identified by the minister.	Targeted Funding [expenditure #l ow coercive] [low automatic] [HEIs+ PROs+ Enterprises]
FAR: Automatic component	It contributed to the financing of recruitment for research personnel and outsourcing of research tasks to universities or public research organizations	Tax exemption [taxation #l ow coercive] [high automatic] [Enterprises]
FIT: Subsidized Loans	Managed by the MISE, it contributed to experimental development projects. Devoted to research programs below 3 million € and it covered 50% of the project expenses for max 8 years. The subsidized rate of financing was equal to 20% of the reference rate into force	Loan [expenditure # high coercive] [low automatic] [PROs+ Enterprises]
FIT: Interest Subsidies	Managed by the MISE, it contributed to experimental development projects. Devoted to research programs above 3 million € and related to a bank loan at market rate devoted to the financial coverage of the project. The interest rate contribution was 50% of the eligible costs, with a maximum duration of 8 years (on the original loan provided by the bank)	Targeted Funding [expenditure #l ow coercive] [mixed automatic] [PROs+ Enterprises]

FIT: Targeted funding	Managed by the MISE, it contributed to experimental development projects. It was a quota of the FIT devoted to finance up to 20% of the costs for projects related with the areas and themes identified by the minister (Up to the minister a share or the total FIT allocation could be devoted to " program of relevant interest for the technological and productive development of the country".	Targeted Funding [expenditure #l ow coercive] [low automatic] [PROs+ Enterprises]
Sviluppo Italia S.p.A.	Public sector national development agency, under the financial control of the Ministry for economy and finance. It had the task of promoting productive activities and attracting investments; promoting entrepreneurial activities; supporting public administration in financial and project planning; consultancy on the management of national and European incentives, especially for Southern regions and depressed areas.	Advisory Committee [regulation #l ow coercive] [low automatic] [HEIs+ PROs+ Enterprises]

Table 7. 1 Instrument mix Bassanini Package

In line with the general reorganization of Italian public administration, the first intervention (d.lgs. 112/98) aimed at vertically re-organise competence divisions between regions and the central state for what concerns R&I financing. It delegated competences related with a set of former R&I incentives (l.1329/65; l. 317/91; l. 140/97) to local actors and it created a unique fund devoted to finance these activities: the single regional fund. Moreover, it established an important novelty for the services devoted to SMEs: the one stop shops for enterprise. This consisted of a consulting service provided by municipalities (or aggregation of thereof), which played a twofold function: simplify bureaucracy for administrative procedures SMEs have to go through, while at the same time providing consultancy on industrial activities, information advisory and corporate support (European Commission, 2001).

The second intervention (d.lgs. 204/98) defined a new governance for the national system of R&I. The instruments adopted came together with a reorganisation of decision-making structures, the inclusion of R&I committees in the related ministries[91] and the introduction of an evaluation system for the public research sector (Sirilli, 2010). At the same time, policy makers aimed at linking national R&I strategies with the more general economic strategy of the country, by designing a procedure to approve the National Research Program (every 3 years), which consistently interweaved with the standard economic planning procedures, involving the Inter-ministerial Committee for Economic Planning (CIPE).

The revision of the incentive system (d.lgs. 297/99) eliminated all the previous interventions in the R&I policy field, organising inside a unique legislation the package of incentives devoted to industrial research. Moreover, it clearly defined the sphere of competences of the Minister of Economic Development and the Minister of Higher Education and Research, with their related funding availability. The Fund for Technological Innovation (FIT), managed by the MISE, was mainly

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[91] The Committee of Experts for Research Policies (CEPR), the Steering Committee for the Evaluation of Research (CIVR) within the MIUR; the Research and Training Commission within the CIPE and the creation of technical observatories for R&I issues within both the MIUR and the MISE (European Commission, 2002b).

oriented towards industrial research and pre-competitive development. It concerned aspects linked with the management of contributions aimed at making research support more consistent with the characteristics of the Italian industrial system. For implementing the measures, the granting of contributions was entrusted to one or more asset management companies (SGR *Società di Gestione Risparmi*) identified by tendering procedures from the minister, on the basis of the conditions necessary to assure an adequate performance of the service. Moreover, the limitations for investments (as provided by the first FIT) for big enterprises have been deleted (MISE, 2010).

While, the Fund for Applied Research (FAR), was managed by the MIUR, and it was mainly oriented toward industrial research, including training and dissemination of technologies deriving from the activities financed by the former. It aimed at stimulating industrial research projects autonomously presented by companies, and to favour the establishment of new companies (MISE, 2010, p. 34).

It represented a fundamental innovation in the national R&I instrumentation because for the first time, it financed industrial research with a strong focus on public-private collaborations, mobility of researchers and spin-off activities (Pierantozzi, 2007). The underlining objective was to facilitate, professors, researchers and their institutions, who wanted to transform a valid research project into a business venture of potential success, through the creation of a specific spin-off enterprise. It was inspired by a similar measure introduced in the French system (the SAIC, Industrial and Commercial Business Services, which was actually more direct in its goal), it provided the public research sector with the opportunity to pursue the creation of new business initiatives (Cobis, 2008).

The FIT and the FAR funds were meant to integrate each other's action, despite the long-term tendency to overlap. This drawback was closely related with the overtime reduction of the financial allocation for both funds, the general reduction in the number of applications, as well as the layering of multiple policy interventions upon their action (MISE, 2010, pp. 21–23). As we will discuss in the following paragraphs, these funds had a long history and they lasted for the whole period under investigation, despite the (sometimes) discontinuous allocation of resources, and therefore the impossibility to make use of their instruments on a yearly basis.

Finally, in 2000 a national developmental agency, called *Sviluppo Italia* (Development Italy) was created; with the mission of regional promotion, investment attraction and supporting the development in new technologies. In February 2000 Sviluppo Italia signed an agreement with the MISE, to set up new technology-based firms through spin-offs from public research. The task of the agency was mainly devoted to support professor, researchers and students interested in developing and marketing the results of their research activities. Moreover, in the July of the same year (d.lgs. 185/2000) the agency was appointed as the manager of incentives and selection of the projects, for

promoting the creation of new enterprises and the promotion of self-employment for the consolidation of different productive sectors (agriculture, industries and service sector).

The overall goal of the Bassanini reforms, and related legislative interventions, was to improve the efficiency of the national R&I system, by encouraging managerial and administrative decentralisation; reducing the distance between policy-makers and R&I performers (the target) by relying on a less coercive type of instrument mix, despite they low adoption for mixed and automatic types of instruments. This reform was mainly addressed to the coordination, planning and evaluation of the national research policy but it did not introduced any strong link between the amount of resources available and the lines of action of the national research plan (European Commission, 2006).

All of that took place in the broader framework of the devolution process, which provided regions with increased autonomy and power to design and manage R&I policies at the regional level. Following on that, these actors acquired the autonomy to define their own strategy in terms of R&I policies, and the national government kept the necessary competences to monitor and control their implementation in order to transfer best practices around the national territory (European Commission, 2002b). The titularity of the central government in this field was closely related with the fact that regional innovation plans presented by each region had to be agreed with the MEF, MIUR and MISE to make sure that the promoted initiatives were in line with the national R&D guidelines and policies. The financial resources involved to support such programmes usually tended to be shared between regional and national governments, and also drawn upon European structural funds.

7.3.1 *Plan for Digital Innovation in Enterprises*

In July 2003 the Minister for Innovation and Technology (MIT) and the Ministry for Economic Development launched the Action Plan for Digital innovation in Enterprises, which designed an integrated framework of measures to promote ICT-based innovation economy. It was devoted to support the access to Information Technologies and technology transfer activities by SMEs (European Commission, 2003b). The plan was implemented throughout two different waves (2003-2005), both involving the cooperation of different ministers with R&I competences, under the leading role of the MISE and the MIT, in close collaboration with regional actors.

The overall policy mix revolved around a combination of incentives, regulation and measures devoted at stimulating and coordinating public and private investments in technological innovations.

Instrument	Content	Shapes Family Delivery Target
Thematic Call for Innovation (Plan 2003)	By relying on the resources of the Found for Technological innovation (FIT) and the Found for Underutilized Areas (FAS92) the plan identified specific calls for proposals to finance innovation projects devoted to the implementation of ICT-related organizational system within SMEs.	Targeted Funding [expenditure # l ow coercive] [low automatic] [SMEs]
Thematic Research and Innovation calls (Plan 2003)	Creation of a specific fund devoted to finance research projects of significant scientific value, also with regard to health safety and technological innovation, for the years 2003-2004.	Targeted Funding [expenditure # l ow coercive] [low automatic] [HEIs+ PROs]
Riditt Project (Plan 2003-2005)	The Italian Network for the dissemination of innovation and technology transfer was managed by Institute for Industrial Promotion providing information and technical assistance services to the national R&I performers.	Consulting Service [information # medium coercive] [low automatic] [HEIs+ PROs+ Enterprises]
Guarantee Fund for SME (Plan 2005)	By relying on the resources of the Guarantee Fund for SMEs (approved with the l 662/96 and into force from 2000) a special section devoted to digital technologies was created. It provided public guarantee to SMEs in order to finance innovative projects related with ICT development. It facilitated credit access to SMEs, reducing the risk level of the credit given by banks and encouraging the consortium of enterprises in order to undertake common projects	Economic Guarantee [expenditure # medium coercive] [mixed automatic] [SMEs]
High-Tech Fund (Plan 2005)	Fund for public participation in risk capital of enterprises operating in High technology sectors (IT, electronics, nano-micro technologies, electro medical instruments). The participation addressed already established or to be established funds or may be implemented through a direct support to venture capital activities. It aimed at promoting the creation of innovative enterprises in high technology sector and attract traditional venture capital.	Equity participation [expenditure # high coercive] [high automatic] [SMEs]
Technological Vouchers	A financial facilitation (voucher) was provided to companies for the following activities: assistance to patent registration, business evaluation, technical due diligence and Ph.D. scholarships. Through this voucher SMEs and individuals could benefit of these services supplied by research institutes and universities accredited by the Minister of Innovation and technology.	Consulting Service [information # medium coercive] [mixed automatic] [HEIs+ PROs+ SMEs]

Table 7. 2 Instrument mix Plan for digital innovation in enterprises

The policy mix was highly integrated not only across the two plans but also within the existent policy mix, as demonstrated by the thematic call for innovation projects. Both digital innovation plans relied on expenditure instruments to support SMEs' projects, as well as on consulting instruments to enhance interactions with the public research sector. For what concerns technology transfer initiatives, the policy mix relied on information type of instruments, directed at improving the competitiveness of the productive system by strengthening and integrating the available supply of services for R&I activities. Especially the RIDITT project has been re-financed also after the years covering the two plans, because of its important contribution to the promotion of the competitiveness of the productive system (Gallo et al., 2008).

92 Introduced by the Berlusconi II cabinet through the budgetary law for 2003 (l.298/02), see paragraph 7.7 on technological and industrial districts.

Despite the predominance of low automatic type of instruments, the mix appeared to increasingly rely on the collaboration of R&I performers and on more automatic type of delivery structures.

Another important innovation of the plan was the joint policy making efforts of two ministers, in coordinating also specific collaborations among other ministries and regional actors. Indeed, the design of the two plans relied on a soft administrative decisional structure between the Minister of Innovation and Technology and the Minister of Economic Development, in order to identify the main lines of interventions. These, were then discussed with the other involved ministers and regions, with the open possibility to consult R&I performers.

7.3.2 The strategy "Industria 2015"

In the period between 2000 and 2006 R&I strategies were almost absent from the governmental policy agenda, which was mainly focused on specific one-off interventions included in the yearly budgetary law (as discussed in the following paragraphs) and on a revision of the governance for public research institutions and universities. With the election of the left-wing coalition lead by Romano Prodi in 2006, public actors took on again the political burden to orient R&I national activities, with the definition of the "Industria 2015" strategy.

This plan was the result of an increasing governmental awareness regarding the importance of innovation as a driver for economic development and competitiveness in the country, and it mainly aimed at creating an environment favourable to innovation and technology transfer. Its intermediate objective was to define major country goals on which to converge public action and the commitment of those actors operating in the market; while the ultimate aim was to ensure a strategic repositioning of the national economic system (Traù, 2009, p. 106). The program designed a medium-long term national strategy, and it tried to get head of the dominant legacy of one-time instruments (*meccanismi a sportello*), which demonstrated to be quite inefficient, due to the long time required to evaluate the projects to be financed, the instability of the funding allocations, as well as the wide discretionary space left to bureaucracy in funding allocation procedures (Sirilli, 2010).

Industria 2015 involved a high degree of governmental planning resources, through the top-down identification of technological and productive areas of interventions (energy efficiency, sustainable mobility, new technologies of life, new technologies for the made in Italy, innovative technologies for cultural heritage), as well as related innovation goals to be achieved; together with a broader involvement of local authorities, industrial actors, universities, public research organizations and the financial system[93]. It relied on a policy mix which included both automatic and generalized

93 http://www.industria2015.ipi.it/index.php?id=2

instruments, together with more selective measures tailored to the specific needs of the recipients, approved through the budgetary law for 2007 (l. 296/06).

As discussed in more details in the table below Industria 2015 hinged upon: information and expenditure instruments aimed at supporting innovative projects (IIPs); expenditure instruments aimed at helping (through public guarantee) enterprises' access to finance and automatic instruments, fiscal incentives, directed at supporting the implementation of innovative strategies by enterprises and legal provisions devoted at easing the creation of business networks among SMEs.

Instrument	Content	Shapes Family Delivery Target
Competitive and Development Fund (FCS)[94]	It financed IIPs related with the Industria 2015 plan. It brought together the resources formerly allocated to the FAS (fund for underdeveloped areas) and the Single Fund for Incentives to enterprises. The resources were allocated by the CIPE to the MISE.	Targeted Funding [expenditure #l ow coercive] [low automatic] [HEIs+ PROs+ SMEs]
Industrial Innovation Projects (IIP)	These were project developed in specific areas, as identified by the Industria 2015 strategy (energy efficiency, sustainable mobility, new technologies of life, new technologies for the made in Italy, innovative technologies for cultural heritage). They were managed by private managers[95], with the task to identify specific support mechanisms, to involve different research and industrial actors and determine the project development.	PPPs [information# high coercive] [mixed automatic] [HEIs + PROs + Enterprises]
Fund for Corporate Finance	It facilitated access to credit and risk capital for SMEs, providing public guarantee. It is meant to be cyclically financed by the interest of the beneficiary enterprises in addition to public funding. The criteria and priorities for the implementation of the operations, also with reference to the recipient company and the eligible expenses programs, were established by the MISE.	Economic Guarantee [expenditure # medium coercive] [low automatic] [SMEs]
Tax credit for research in enterprises	Tax credit devoted to investments in specific geographical areas and expenses related with: machinery, software and patents. The tax credit was given in proportion to the amount of expenses in surplus to the depreciation calculated for the taxable period, and it was under the titularity of the MISE.	Tax Reduction [Fiscal # medium Coercion] [high automatic] [Enterprises]
Fiscal Incentives for R&D investments	Tax credit equal to 10% of the expenses devoted to activities of industrial research and pre-competitive development. The tax credit increased to 15% in the cases of the research contracts stipulated with universities or public research organisations. The ceiling for maximum expenses is equal to 15 million euros. With the budgetary law of the for 2008 (l.244/2007), these ceilings were slightly modified. Indeed, the tax allowance for firms performing research activities in collaboration with universities rose to 40% of the expenses and the maximum amount of expenses to 50 million euros.	Tax Reduction [Fiscal # medium Coercion] [high automatic] [Enterprises]
Business Networks	This legal provision was devoted to the simplification of the legislation related with the creation of business networks among enterprises. It was aimed at enhancing organizational coordination among companies, especially SMEs, which aimed to cooperate, in the development of a specific projects or for the application to specific funding, but did not want to merge.	Contract [regulation # low coercion] [mixed automatic] [SMEs]

Table 7. 3 Instrument mix Industria 2015

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94 It will continue to finance existing law in the same way until the implementation decrees of reorganization of the legislation o subsidies come into force, but it will also finance IIPs. The basic idea is to improve the efficiency and effectiveness of the system by reducing the number of incentive tools.

95 Pasquale Pistorio (energy), Giancarlo Michellone (mobility), Alberto Piantoni (hi-tech for Made in Italy), Claudio Cavazza (Technologies for Health) and Andrea Granelli (innovative technologies for cultural heritage)

The first pillar of the strategy was the Competitive and Development Fund, which was devoted to finance Industrial Innovation Projects, directed by different private managers, selected because of their proven skills and experiences in the specific strategic sector. Those managers designed the criteria to identify the industrial, institutional and research actors to be involved in different projects; moreover, they defined the mechanisms to support projects' development and all the necessary regulations for their implementation.

The IIPs aimed at co-ordinating activities of large-scale public and private enterprises, industrial and technological districts and the world of research and innovation. Their objective was to encourage the creation of partnerships between universities, research centres, private enterprises and financial capital, of national and international scope, in order to implement medium/long-term industrial initiatives able to make industry more competitive.

The areas of interventions for these projects have been identified by the government, which then through the MISE has launched various calls for tenders, inviting industrial and research actors to create consortia and present project, according to one of the six areas of intervention.

Proposals were examined by the National agency for the Diffusion of Technologies for Innovation, an institution created by the 2006 budgetary law (Berlusconi II government), according to technical-scientific and economic criteria; then the MISE provided incentives to selected projects and together with the IPI it followed their management and administration.

The other four instruments of the mix were then balanced according to the specific needs of each approved project. One of the innovations of Industria 2015, was exactly that public support for industrial innovation processes aimed at overcoming the correspondence incentive-specific activity, and it drafted the instrumentation according to the characteristics of the initiatives to be realised. This was also reflected by the high share of mixed and automatic delivery structures adopted.

Indeed, the instrument mix was designed on the basis of a negotiation with the actors involved in the IIPs, considering also the financial commitment undertaken by involved enterprises. Within this system the role of the private managers was exactly to coordinate the interests of the actors involved, in order to define a well-suited instrument mix on the basis of the different projects' needs.

From a policy design perspective IIPs were the result of a strategic agreements and consultations between MISE, MIUR, together with the Minister for Innovation in Public Administration. Indeed, from both a financial perspective, due to the coordination of the funding attached to different ministers, and a policy-making perspective, in the process of approval of different projects, as well as for the appointment of project managers, the MISE closely interacted with the other ministers. This collaborative approach has been extended also at the local level, with the involvement of regions in the definition of IIPs strategies.

Moreover, Industria 2015 reorganized the existent funding mechanisms, not only in terms of logic of action but also from a technical perspective, through the merging of already existent funds. Therefore, it intervened in the fragmented and dispersed instrumentation that characterized national public R&I incentives for a long time, by merging different funding structures into the Competitive development fund, and by designing FIRST (Scientific and Technological Research Investment Fund), which was supposed to gather different funds under the titularity of the MIUR: the FIRB (mission oriented and basic research), the FAR (fund for applied research) and the PRIN (fund for basic research). The funding rationalisation process, was also supported by the creation of an organizational structure based on IIPs, which helped to concentrate resources on large projects and specific key sectors (Potì and Reale, 2010).

Despite the limitations related with the process for identification of the six areas of intervention, and the ample room for manoeuvre left to the project managers in shaping the characteristics of each projects, Industria 2015 represented the first programmatic governmental effort to steer R&I policies towards specific policy goals (Silva, 2007). The underlining (soft) mission-oriented purpose of this strategy, was modified by the newly elected Berlusconi cabined (IV), which introduced (budgetary law for 2009 l. 133/2008) the possibility to identify new technological areas to be added to the initial six by means of a yearly revision process (Traù, 2009).

7.4   The reforms in the Public Research Sector

Until the late 1980s the governance of the public research sector hinged upon a minister, with supervision and control role, together with the CNR, who had a prominent role as public research performer and manager. This governance was mirrored by a similar funding structure in place for public research, indeed the CNR had the titularity in the allocation procedures for funding related with strategic projects, and especially for finalised projects, which were basically multiannual research projects in specific sectors addressed to academic research.

Other instruments for financing basic research were managed by the MIUR, as the Research Programs of National Interests (PRIN)[96], scientific research projects freely proposed each year by universities and some other bodies, selected by the MIUR through an evaluation commission and co-financed with public funds. Differently from the projects managed by the CNR, the PRIN included a system based on experts' assessment, which evolved into a formally structured peer-review examination (Potì and Reale, 2007).

[96] In ministerial documents the acronym PRIN has been differently adopted, despite the reference to the same time of funding instruments. Until 1997 it was called 40% PRIN, from 1997 to 2004 COFIN-PRIN, and from 2005 PRIN. (Corradi, 2009, p. 147)

The PRIN started in 1981 as a fund for universities, then in 1994 changed name in COFIN, each program usually lasted two years; they were coordinated by a university professor, and carried out by research units belonging to different (or the same) universities. The financial participation of the MIUR for each individual project approved was the following:

- 60% of the eligible costs was provided to universities, that in turn internally assigned to their professors;
- 40% was allocated directly from the minister to the manager of the research projects.

In 1997 (DM MIUR 320/97), the 60% quota allocated through this fund was merged within the funding allocation directly provided to university by the MIUR, the newly created Ordinary Financing Fund (FFO)[97], and the remaining 40% was still bind to the PRIN procedures of ex ante assessment of national research projects.

With the approval of the d.lgs. 297/99, the governance of national R&I was consistently modified, redesigning the system to support industrial/public research and experimental development managed by the MIUR. First of all, with the Ministerial Decree 593/00, which basically put into practice the details of the reform, the stratification of previous legislative interventions[98] on public research funding was reorganised, with the aim of recentralising the responsibility for project funding allocation in the hands of the MIUR, together with a re-organisation of the existent public research institutions.

The role of CNR as funding agency was slowly brought to an end. The finalised projects started to receive less funding from 1990s and they were replaced by the creation of two new funding structures, directly managed by the MIUR with the support of specific organisations in the evaluation process. While the strategic projects of the CNR were terminated some years later (2002) in the framework of an overall reform of the public research organisation role and powers. With the approval of the budgetary law of 2001, the government Amato introduced the Fund for Basic Research Investments (FIRB) (operative after the approval of the Ministerial Decree 08/03/01). This was a competitive funding instrument, managed by the MIUR, and devoted to finance activities aimed at expanding scientific and technical knowledge not connected to immediate and specific commercial or industrial objectives. It also aimed at strengthening interactions between public and private actors, while supporting clustering in centres of high scientific quality, as summarised below.

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97 The finance act of 1994 radically reformed the funding of state universities through the establishment of the FFO (*Fondo Finanziamento Ordinario*). This is a lump sum budget university are free to spend as they wish to cover operating costs (Capano et al., 2016).
98 Law 46/82 (art.1-13); Law. 488/92; Law 346/88, Law 196/97 (art. 14); Law 449/97 (art. 5).

Instrument	Content	Shapes Family Delivery Target
FIRB (Fund for Basic Research Investments)	Competitive funding managed by the MIUR and financed through the budgetary provisions included in the FAR. It financed projects to upgrade large public, or public-private research infrastructures, basic research projects of high scientific of technological contents, strategic projects for the development of pervasive multi-sectorial technologies, the establishment and networking of highly qualified scientific centres.	Targeted Funding [expenditure #l ow coercive] [low automatic] [HEIs+ PROs]

Table 7. 4 Reform in public research sector I instrument mix

It financed basic (both oriented and not-oriented) research, in coherence with the objectives identified within the National Research Plan; and the main targets were Public Research Organisations and Higher Education Institutions. Together with the Special Applied Research Fund, approved in 1998 in the framework of the Bassanini Reform, it replaced the role of finalized project managed by CNR in financing public research activities.

After the beginning of the 2000s, and the related interventions for the application of the Bassani reform, the national policy mix devoted to public research sector followed a discontinuous evolution pattern, characterized by specific one-off interventions approved in the framework of various budgetary laws. Two important interventions characterised this period, the first one is related with a change in Patent Regulation, approved in the framework of the budgetary law for 2002, while the second is a tax incentive addressed to individual researchers approved with the budgetary law of 2004.

Instrument	Content	Shapes Family Delivery Target
Patent Regulation (l. 383/2001 art. 7)	In cases of employment relationship between a university or public administration having among its institutional aims research purposes, the researcher is the exclusive owner of the rights deriving from the patentable inventions of which she is the author.	IPR [Regulation# high coercion] [low automatic] [HEIs + PROs]
Tax Incentives to non-residential researchers (l. 326/2003 art. 3)	The income from employment or self-employment of researchers who (from the date of entry into force of this decree or in one of the five subsequent calendar years) began to carry out their activity in Italy, and who consequently become fiscally resident in the State, were taxable only for 10%, for the purposes of direct taxes, and did not contributed to the formation of the value of net production of the regional tax on productive activities. The incentive was applied in the tax period in which the researcher became fiscally resident in the territory of the State and in the two subsequent tax periods.	Tax Reduction [Fiscal # medium Coercion] [high automatic] [Researchers]

Table 7. 5 Reform in public research sector II Instrument mix

With the modification of the patent regulation system, the so-called "professor privilege"(Lissoni and Montobbio, 2015) was introduced. Therefore, despite professor had always enjoyed a free hand in dealing with IPRs matters (Lissoni et al., 2009, p. 601), after this new regulation researchers become the owners of the rights deriving from the patentable inventions produced as results of their research. Universities, and public research centres, have the authority to establish the maximum amount of the licence fees for the use of the invention by third parties. Nevertheless, in any case, the inventor was entitled to a minimum of 50% of the proceeds, or fee, for the exploitation of the invention.

While the second instrument, adopted by the Berlusconi II cabinet, promoted a tax reduction for non-resident researchers, either Italians working abroad wishing to come back to their home country, or foreign national residing aboard and wishing to work in Italy. Its ultimate goal was not only to contrast the widespread "brain drain" phenomenon tackling Italian knowledge sector, but also to support the technological and scientific growth of the country by easing the inward movement of new researchers. The overall evolution of policy mix in the sector of public research reflects the instrument polarization of the national R&I system and the "residual" approach adopted for Universities and Public Research Organizations, especially after the beginning of 2000s. This trend is also evident in comparison to the heterogeneity, and especially the higher share of instruments devoted to business actors, as extensively discussed in the following paragraphs.

7.5 The reforms for Higher education institutions

Higher education institutions are financed by the MIUR, who also manages the funding allocations for Public Research Organisations under its control, the Ordinary Fund for the Funding of Research Institutions and Bodies (FOE).

Until 1994 the system for funding state universities was dependent upon governmental decisions, and it came together with restrictions on how these funds should be spent and distributed within the internal governance of universities.

The finance act of 1994 consistently reformed this system by introducing the Ordinary Financing Fund (FFO), a lump sum transfers yearly assigned by the budgetary law devoted to cover universities' operating costs, which left universities free to decided how to use these funds.

Between 1995 and 2003 its allocation was based on a so-called historical component, calculated according to the educational production of each university ("formula funding"), in addition to further resources earmarked for specific governmental objectives. Starting from 2004, together with the institution of the CNVSU, (Committee for the Evaluation of the University System), a new funding procedure based on the assessment regarding the quality of teaching and the general working of the

university was implemented. The funding model for the FFO, was then tied to this evaluation procedure, establishing that one third of the fund was assigned to the basis of the number of students involved, one third on the outcomes of the educational process and the last share on the basis of number of researchers, the rate of success in the PRIN competition, and the income from research work commissioned from outside university.

From 2009 onwards, with the return to power of centre-right coalition government led by Berlusconi (Berlusconi IV cabinet), public funding to universities started to shrink consistently and to be allocated according to a mixed rationality: a share based on an historical basis (funding allocation of previous years) and a portion according to some performance indicators. Specifically, a new intervention[99] established that 7% of the total FFO would be allocated on the basis of the following criteria: quality of education supply and education results; quality of scientific research; quality efficiency and effectiveness of the teaching courses (Potì and Reale, 2009, p. 47).

This funding distribution logic was said to deepen existent local imbalances in the country, intensifying the already existent inequalities among Universities across the national territory (Capano et al., 2016)[100]. This would likely trigger a vicious circle by which the best universities will manage to obtain more funding, while the worst off will further deteriorate their position because of the inaccessibility to new funding.

The role of the CNVSU was replaced by the creation of a new agency, responsible for the external evaluation of the quality of the activities of Universities and Research Organisations receiving public funding: the ANVUR (National Agency for the evaluation of University and Research Institutes).

It was officially created in 2006 (d.lgs. 262/2006), under the Prodi II cabinet, but it only became operative in 2011, after having been through a change in government composition and a shift in the political majority. The agency was mainly devoted to evaluating national research activities, assessing the quality of university education programs as well as doctorates and Universities' third mission activities; it also set the minimum scientific performance requirements scholars must meet in order to be included in the national list of people qualified for recruitments in Universities (Potì and Reale, 2011). Given its nature of evaluation body, and the dependence of a share of FFO on the results of its assessment exercise, the agency was granted with organizational, administrative and financial freedom.

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[99] Specifically, through the approval of the d.lgs. 213/2009

[100] This process tended to favour northern universities, located in the wealthier areas of the country, which were more capable of coping with increases in student fees, more likely to have a higher percentage of students completing their degrees within the allotted time; more capable of performing better in the research field, and more capable of setting off better results in regard to the allocation of the bonus component of funding, against the reduction in overall state spending in the Higher Education sector (Capano et al., 2016, pp. 127–128).

For what concerns the broader evolution of the governance of national Higher Education system, the sector has been historically characterised by a dynamic of push and pull between state and universities. Indeed, the first tried to pursue different rationalisation of the sector, often characterised by many inherent contradictions, while universities tried to resist in keeping their traditional model (Reale and Potì, 2009). Everything started with the l. 168/89 and the creation of the MIUR, which attempted to recentralise control over national university governance, which use to be left in the hands of different specific university-related powerful oligarchies and ministerial bureaucracies negotiations (Capano, 2008). Moreover, form the early 1990s, universities were provided with the possibility to be governed by their respective statutes, without any possible constraint from the ministerial side, granting these institutions with full freedom in defining their own regulation, management and financial strategies. Given the law rate of implementation related with the drafting of university internal statues, in 1995 the government approved a regulation which obliged universities to do so, and by 1997 all Italian universities did manage to be in compliance with the new regulation. Nevertheless, this case of "imposed autonomy" clearly indicated the difficulty universities experienced when given the opportunity to make a constitutional decision (Capano, 2008, p. 486).

The landscape of the national governance of Higher Education institution was consistently modified by two legislative interventions of Letizia Moratti, the Minister of University and Research during the Berlusconi II and III cabinets. The reforms[101], aimed at modifying the recruitment system for university teaching and research personnel, by introducing specific criteria regarding the national scientific procedures for undertaking the academic career (*Abilitazione Scientifica Nazionale*). These provisions were then modified[102] by the design of the new reform for the university governance, approved in 2010 under the Berlusconi IV cabinet, the so-called "*Gelmini* Reform".

This intervention arose in a general climate were universities were perceived as "enjoying autonomy, without responsibility", in which pressures of similar reforms applied in other European Countries (e.g. the Law on the liberties and responsibilities of universities of the French case) were adopted to promote similar changes within the country. The "*Gelmini* Reform" consistently modified the internal governance structure of Italian universities, changing the structure of power distribution among different internal bodies, increasing the verticalization of power and decision making within its internal structures (Capano et al., 2016). University Rectors were assigned with increasing powers and the ability to design specific policy orientation strategies for their institutions, as well as with the titularity to nominate Directors-General, who were responsible for the overall management of university technical and administrative services.

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101 Law 230/2005 and d.lgs. 164/2006.
102 Art.16, C. 2 Law 240/2010.

Both the Senate and the Board of Governors were changed in their internal composition providing the former with the possibility to issue proposals in different areas (e.g. budgets, research teaching) and design internal regulations; while the latter with the power of strategic orientation for institutional strategy together with decisional powers with respect to budget, financial planning, administration and accounting function.

Another important innovation with respect to the Board of Governors was that a certain number of members should be individuals not directly involved with university administration (since at least 3 years), nevertheless their election procedure was left to universities' statutes choices. Moreover, the reform revised provisions regarding the recruitment of researchers and professors, it reorganised the internal structures of universities by abolishing faculties and providing departments with powers regarding the definition of scientific research, academic and recruitment business.

Evaluation principles seemed to be a relevant criterion of the new reform process, because in combination with the connection between university performance and FFO allocations, an Internal Evaluation Committee (*Nucleo di Valutazione*) was provided with the responsibility of assessing all teaching, research and service-based activity of each university[103].

As suggested by the existent literature, the "*Gelmini* Reform" seemed to be in line with the general tradition of external regulation in governing the national Higher Education sector. Indeed, as done in the past with the law creating the MIUR and the first moves toward government intervention in the university sphere; Higher Education Institutions have been left free to define their own statues, but under the invasive provisions of the new regulation (Donina et al., 2015). This reform could also be read as a neo-dirigiste reaction to the poor use that Italian universities have made of their autonomy (Capano et al., 2016, p. 108).

7.6 Business actors: the industrial and technological sector

Italy is characterized by an industrial specialization model based on traditional sectors, focused on intermediate technologies mainly relying on low internationalized SMEs. Overall, this structure suffers from a low propensity of enterprises to invest in R&I (Gallo and Silva, 2006). Economic specialisation is characterised by the dominance of low-to-medium technology sectors such as furniture, textiles and apparel, while it retains a leading position in design, agriculture, fabricated metal and non-metal products.

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[103] An important new duty of this body was to connect institutional governance with system governance: beside submitting the results of its assessment to the senior management of the university, which could use them for strategic planning it also acted as an operating arm of the ANVUR (Capano et al., 2016, p. 107).

Starting from the 1930s the economy was effectively run by means of state participation, relying on specific public institutions like the *"Istituto per la Ricostruzione Industriale"* (IRI), *"Ente Nazionale Idrocarburi"* (ENI). These actors formed part of state holding enterprises, which administered the majority of shares in the national leading companies (Spence, 2014, p. 105).

At the beginning of the 1990s, this system went through a new phase and the country undertook a process of disposal of the very large amount of state participations in the processing industry, in the banking system and in the utilities sector. This process slowed down at the end of the 2000s, and not all the privatization processes were concretely translated into practices. Nevertheless, it set forth the exit of public actors from those stakeholders potentially able to provide directions to the industrial development of the country (Traù, 2009).

From an instrumentation perspective, during, the 1980s-1990s, the design of public interventions in the R&I sector was focused on financing projects autonomously submitted by firms and automatic incentives were mainly directed towards the purchase of machinery. Due to the absence of any sectorial priority, the system endogenously favoured those firms which were able to submit requests for innovative projects and, especially to bear the costs connected with the delays in instrument activation and the effective provision of funding. The majority of public aids was devoted to a broad range of companies, while interventions specifically dedicated to SMEs and start-ups have been rare. A noteworthy exception was the l. 297/99 which focused on supporting spin-offs from public research (Gallo and Silva, 2006).

The shift towards an instrumentation based on fiscal instruments during the mid 1990s, has not always been effective, due to the overlapping of different initiatives and the lack of an overall consistent plan for action; which has been further exacerbated by the irregularity of public financing (European Commission, 2000b). Moreover, these interventions have not always been matched with measures of informative, and training, nature (e.g. information campaigns, consultancy services) necessary to support the demand of instrument for innovative activities by enterprises.

Overall, Italy had a relatively solid productive structure based on SMEs, which were among the main contributor to sustain employment and national economic growth; while large companies are still relatively weak and continue to shed jobs. As regard to the quality of human capital the country lays below the EU average, as its labour force largely consists of workers with medium to low skills (European Commission, 2004b). Indeed, Italian SMEs tend to mainly rely on product and process innovation, aimed at satisfying the demands of the clients rather than develop autonomous innovative strategies. Consequently, their demand for innovation is principally driven by the market and it is rarely strategic. Equipment, tend to be the most important source of innovation   in many

manufacturing firms, as confirmed by their small contribution to the development of research undertaken by research institutes (European Commission, 2000b).

Starting from 1997 new measures directly devoted to SMEs have been introduced, in order to encourage their expenditures in R&D as well as the employment of research personnel. Public interventions were exactly aimed at tackling the issues of low qualified labour force, as well as the difficulties enterprises face in acquiring new technologies.

One example is the Treu law (l.196/97) which supported full-time employment of professionals with PhD in research activities by SMEs, covering the costs of two years of contribution for each employee. The Law 449 of 1997, had the same objective of the previous one, but differently the incentive took the form of a tax credit per each employee with a PhD (or a researchers) seconded for a maximum of four-year period at a SMEs. Therefore, researchers could keep their job relationship with the relative University or PROs, and they could come back after the services period at a SME. Moreover, the measure allowed firms to use the fiscal incentives to pay for R&D projects carried out on their behalf by public research laboratories; this scheme had the objective of fostering cooperation between industry and public research institutions. Ultimately, SMEs have been sustained in their innovation activities also by the law 140 of 1997, which provided tax incentives related with a specific R&D-related expenses sustained by SMEs. The resulting policy mix is summarized in the following scheme.

Instrument	Content	Shapes Family Delivery Target
Employment in the field of Research (l. 196/97)	It focused on the employment of professionals with PhD to be hired for research activities in SMEs.	Targeted Funding [expenditure #l ow coercive] [low automatic] [SMEs]
Employment of researchers by SMEs (l. 449/97)	It focused on the employment of professionals with PhD to be hired for research activities in SMEs.	Tax Reduction [fiscal # Medium Coercion] [high automatic] [SMEs]
Tax incentives for R&D expenses (l. 140/97)	It provided tax incentives for R&D-related expenses. It had the ultimate goal of encouraging SMEs to make explicit their innovation activities	Tax exemption [fiscal # low coercion] [high automatic] [SMEs]

Table 7. 6 Business-oriented I instrument mix

Following on from the reorganization of the R&I governance at the end of the 1990s (the set of reforms related with Bassanini's laws), some of the measures devoted to SMEs were delegated to

regions (l.140/97); while central competences were grouped under the measures financed through the FIT and the FAR funds.

A new instrument mix, always devoted to SMEs, was approved with the budgetary law for 2001 (l. 388/2000), which was the last measure approved by the same centre-left governing coalition promoting the re-organization of R&I governance.

Instrument	Content	Shapes Family Delivery Target
Incentives for telematic connections in the textile-clothing footwear industry (art. 103 (5))	Tax reduction aimed at incentivise the development of telematic links, the speeding up of logistic flows, the exchange and acquisition of information, the creation of platforms for the development of standardised systems for the monitoring of the various phases of production and marketing. It was reserved to the textile, clothing and footwear sector in the attempt to increase the competitiveness of key areas of the "made in Italy".	Tax Reduction [Fiscal # Medium Coercion] [high automatic] [SMEs]
Incentives for E-commerce (art.103, C. 5-6)	Tax credit for investment programs aimed at the development of IT solutions to carry out electronic commerce activities and staff digital training. The eligible costs were related with hardware acquisition, software licences, consultancy services and advertising space online. The amount of the credit varied according to the beneficiaries. The minimum amount of the investment programmes should be equal to 30.000 €, and the tax credit varied 35-45% of total costs.	Tax Reduction [Fiscal # Medium Coercion] [high automatic] [SMEs]
Incubators for start-up (art. 106)	It provided technical assistance for the start-up of new innovative enterprises through qualified selected entities. The measure covered expenses related with the following activities: feasibility studies, infrastructures, organizational and financial assistance, training, technical assessment of the projects. The measure aimed at encouraging the creation of business incubators that could favour the birth of innovative companies through the provision of services supporting the start-up phase.	Consulting Service [information # medium coercive] [mixed automatic] [Start-up]
State participation in risk Capitals (art.106)	It provided state equity finance participation in risk capital for a minimum of 20% of the total capital of the enterprise. Alternatively, it could also provide funding to intermediary actors for the acquisition of a third enterprise capital quotas (in this case no more than 50% of the total amount of the enterprises' capital). It was managed by the MISE. In order to apply for this aid, enterprises had to present a 3-5 multiannual plan.	Equity participation [expenditure # high coercive] [mixed automatic] [Enterprises+ HEIs+ PROs]
Investments in less favoured areas (art.8)	The incentive consisted of a tax credit that enabled firms to offset both direct and indirect taxes for investments on depressed areas. The incentive was exclusively devoted to companies carrying out specific type of activities (mining and manufacturing, service, tourism, trade and building activities, production and supply of electronic power, steam, and hot water, fishing and water farming, transformation of fishing and water farming products).	Tax Reduction [Fiscal # Medium Coercion] [high automatic] [Enterprises]

Table 7. 7 Business-oriented II instrument mix

The underlining logic of the instrument mix aimed at incentivizing the adoption of ICT technologies in SMEs, as further promoted in the following years through the approval of the Plan for digital Innovation in Enterprises (as discussed above paragraph 7.3), as well as to support entrepreneurship. Indeed, the goal was to provide incentives to individuals to set up a new enterprise, or become self-employed, while providing assistance during the early years of activity (when high start-up costs and modest amount of business is typical) (European Commission, 2001).

With the election of the new governing coalition (2001), and the signature of the "Pact with the Italians" by the new Prime Minister Silvio Berlusconi, some measures devoted to relieve enterprise from taxation while performing R&I-related activities were taken, together with a broader revision of the instruments addressed to SMEs and an increasing involvement of the private banking system as an intermediary structure for the implementation of these tools.

The instrument package designed during the Berlusconi II cabinet mainly hinged upon specific one-off interventions included in the yearly budgetary law. The same policy strategy was also adopted for the design of a regulation-oriented type of instrument mix, which differently had more long-term perspective of actions and aimed at modifying the governance of the sector.

Instrument	Content	Shapes Family Delivery Target
Tremonti- Bis L. 383/2001 (art. 4-5)	It was a tax reduction for reinvested profits equal to 50% of the whole volume of investments in new instrumental goods exceeding the average amount of investments achieved in the last five years of taxation. It covered also expenses incurred in the training of personnel, which should be increased by no more than 20% of the cost of the remuneration due to the internal personnel during the training period.	Tax Reduction [Fiscal # Medium Coercion] [high automatic] [Enterprises]
Tecno-Tremonti (l. 326/2003 art.1)	It was a fiscal incentive for companies investing in R&D (product, process and organizational innovation). The incentive was equal to 10% of the R&D costs from the taxable income. In addition, a further 30% deduction was applied to the difference between the R&D cost of the current fiscal year and the average R&D costs during the previous 3 fiscal years. Among the expenses were also included costs of ICT related innovations. The same rule applied to SMEs that, pooling resources and creating consortia of at least 10 enterprises undertook innovative investments in information technologies.	Tax Reduction [Fiscal # Medium Coercion] [high automatic] [SMEs]
Creation of the Italian Institute for Technology (l. 326/2003 art.4)	Establishment of the Italian Institute of Technology (IIT). It was a foundation with the aim of promoting technological research and development of the country (mainly robotics, neuroscience, neuro technologies, computer science); jointly managed by the Minister of Economy and Finance, and Minister for Higher Education and Research	Research institute [Regulation # Low coercion] [low automatic] [HEIs + PROs]
Credit securitization (l. 326/2003 art.2); D.M. MEF 16/09/2004)	Provided by the l. 326/04 and made operational in 2004. It reorganised the financing structure of R&I for the MIUR and the MISE. It foresaw the securitization of outstanding national credits in short-term financing by the two Ministries.	Administrative Simplification [regulation # medium coercion] [low automatic] [HEIs + PROs + Enterprises]
Facilitated Financing for ICT (FRI) (l. 311/04 art.4 C. 354)	This instrument provided subsidised loans in the form of capital advances by CDP (*Cassa Depositi e Prestiti*), a national investment bank, according to a multi-year repayment plan. The identification of the objectives and the different applications of the fund was defined in the National Research Plan and devoted to: technological innovation, industrial sector, tourism and craftmanship sector plus agriculture and services.	Cash Advance Expenditure # High Coercion] [low automatic] [SMEs]
New measures to support the Italian economic system (l. 80/05)	Modification of the incentive system for enterprises in underdeveloped areas (l.415/92; 488/92). It basically substituted non-refundable grants with subsidised loans involving the participation of the banking system.	Loan [expenditure # high coercion] [mixed automatic] [SMEs]

Table 7. 8 Business-oriented III instrument mix

The Tremonti Bis was a time specific instrument (including only the expenses performed between the 1st July 2001 and December 31st 2002) directed at sustaining the re-modernization of existing (or the construction of new) plants, the completion of pending works, the acquisition of new tools/instruments and items (also leasing contracts). Inspired by an analogous measure approved in 1994, it was improved in its action by including also expenses from training events organized within the companies or professional boards (European Commission, 2002b). It was followed by a very similar one-off intervention (in force only for 2004), the tecno-Tremonti, an automatic fiscal incentive, attempting to stimulate SMEs' R&I investments, by reducing their taxable income through a combination of R&D expenses and increment.

Differently from previous instruments, the list of eligible expenses for the fiscal deduction was broadly defined, therefore making it difficult to be easily applied by SMEs, and likely to be exposed to evasive behaviours by certain beneficiaries (on this point see Bersani, Letta, 2005 p. 16).

In addition to these short terms measures a more substantial shift toward a new shape of instrument, namely loans, was undertaken. The first step of this process was the securitization of the MISE and MIUR ministerial credits, which started to be progressively transferred to the Italian Credit Securitization Company (*Società di Cartolarizzazione dei Crediti Italiani*). This allowed to transform the out-standing credits into short-term financing. The resources made available through this mechanisms have been used to re-open the evaluation procedures for projects submitted under the FIT and FAR funding schemes (European Commission, 2006). Form a policy-making perspective this was meant to supplement the progressive decrease in available resources for the MISE and the MIUR instrument implementation, and especially the lack of re-financing for many measures.

In the same budgetary law, the *Cassa Depositi e Prestiti* (CDP), a formerly public bank, was transformed in investment bank operating on the behalf of the government (which represented its main shareholder). By acquiring the juridical status of a joint stock company, CDP allowed for the participation of private shareholders in its capital[104], and it became the financial intermediary to which were sold the shares of different companies held by the Ministry of Economy and Finance

This process was closely followed by another measure approved in the budgetary law for 2005: The Revolving Fund to sustain enterprises investments (FRI). It was finalized to grant easy terms credits to companies, and it relied on the role of CDP as manager for loans implementation. The rules for the functioning of the fund were decided by the CIPE[105], which established that least 30% of the finance was devoted to activities, programs and strategic R&D projects of companies to be carried out also

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[104] In May 2015 the share of CDP were divided as follows: 80.1% Italian Government; 18.4% Banking Foundations and the remaining 1.5% in CDP internal treasury shares (http://www.cdp.it/en/company-profile/mission-and-role/mission-and-role.html).
[105] (resolution 15/07/2005).

jointly with public research subjects. Overall, the fund was manly devoted to support initiatives for innovation promotion in less favoured regions, it was extended to technological districts, and supplemented in its funding procedures thanks to the Competitiveness Decree (l. 80/05).

Moreover, the same law modified the incentive system for enterprises in underdeveloped areas (as provided by the l.415/92 and 488/92). It substituted non-refundable grants with subsidized loans by involving, at the same time, the participation of the banking system. The recipient could get subsidized loans up to 50% of the required financing, while signing a contract according to which: a share of the financing (at subsidized rate) was provided by CDP, and the other share by banks at market rate. In both cases the economic judgment of the R&I plan submitted by the recipients was analysed by the bank granting a share of the loan, and the financing could last for a maximum of 15 years.

The last set of reforms of the Berlusconi II cabinet was included in the budgetary law for 2006, and introduced the following instrument mix.

Instrument	Content	Shapes Family Delivery Target
National agency for the Diffusion of Technologies for Innovation (l.266/05 art.1 C. 368d)	It carried out tasks related with the economic, financial and scientific evaluation of industrial innovation projects. It promoted and coordinated activities aimed at forecasting technological-scientific and economic development trends. It operated on the basis of a three-year activity program updated annually, which determined its objectives and priorities.	Advisory Committee [regulation # low coercion] [low automatic] [HEIs + PROs + SMEs]
Tax relief for patent registration (l.266/05 art.1 C.351-352)	Tax exemption on patent fees.	Tax exemption [Fiscal # Low Coercion] [high automatic] [HEIs + PROs + SMEs]

Table 7. 9 Business-oriented VI instrument mix

The mission for the National Agency for the Diffusion of Technologies for Innovation, was to gradually became a coordinating agent of the national R&I sector, especially for what concerns competitiveness of SMEs, industrial districts and the integration between public research and industrial sectors. However, after the launch of the initiative in December 2005, no major action has been undertaken by the government to follow-up on previous determinations regarding the tasks of this organisation (European Commission, 2006, p. 20). The same budgetary law provided also for the allocation of some resources, with the aim of paying off previous debt contracted by central government administration towards institutions, companies, individuals and various organizations, as well as the possibility to finance project adopted through the PICO (*Piano per l'Innovazione, la*

Crescita e l'Occupazione) in line with the objectives set out by the Lisbon strategy. These were gathered into a specific budgetary provision called innovation fund (l. 266/05, c.1:50).

Overall, the major novelty of the Berlusconi II cabinet was the inclusion of banks in the financing system of innovation, for R&I performers, this meant that they were now forced to comply with credit and lending conditions provided by the private banking sector. Indeed, the new financing system didn't appear as a friendly innovation for SMEs and micro-enterprises, because they were quite likely to face difficulties in meeting the requirements and conditions imposed by the private credit rules, therefore shrinking their ability to access credit (European Commission, 2006).

In essence, the introduction of a credit financing system for innovation based on banks, was aimed at easing the planning of resources for investments in innovation by enterprises, but it didn't provide any specific policy goal in terms of national R&I strategy (Gallo and Silva, 2006).

The newly elected (2006) centre-left cabinet coalition under the lead of Romano Prodi (Prodi II government), approved a first instrument mix with the crafting of the budgetary law for 2007, that included all the instrumentation provided by the Industrial 2015 strategy (see details of the strategy paragraph 7.3.2). This was a medium-long term national strategy aimed at promoting partnership among the actors of the national R&I governance (IPPs), in specific sectors identified by the government, through a mix of different types of instruments.

The following Berlusconi Cabinet (in office since May 2008), firstly modified the characteristics of the Industria 2015 strategy, by providing the possibility for the MISE to identify additional technological areas to supplement the six IPPs selected under the previous cabinet. Then, it introduced new instruments across different legislative interventions, as described below.

Instrument	Content	Shapes Family Delivery Target
Tax exemption on capital gains from start-up (l. 133/2008 art.3)	It established that capital gains were exempted from personal income taxes when: they have been possessed by at least three years, they came from young companies (no older than 7 years) and they were re-invested in the next two years in young start-ups that operated in the same sector as the first company. The maximum amount that could be tax-exempted was directly linked to a multiplier of the productive investments (material and immaterial goods and R&D expenses) carried out by the firm that originated the capital gain	Tax exemption [Fiscal # Low Coercion] [high automatic] [Start-up]
Italian Investment Fund	It was a private equity fund, dedicated to qualified investors, mainly financed by CDP and by other private banks. It was devoted to SMEs capitalisation and grouping for specific development projects.	Equity participation [expenditure # high coercive] [mixed automatic] [SMEs]
JEREMIE Fund	It supported the access to finance for SMEs via structural funds interventions, by offering credit and risk funding to SMEs and public guarantee to banks, in order to improve access to investment capitals by SMEs. It was devoted to activities aimed at: developing new products, securing and expanding market access.	Equity participation [expenditure # high coercive] [low automatic] [SMEs]

National Innovation Fund	It acted as an instrument to reduce investment risk for banks and financial intermediaries that participated in the funding/financing of innovative projects based on the valorisation and the use of patents. These resources aimed to help SMEs access to risk capital to finance innovative projects that made use of patents owned by SMEs.	Economic Guarantee [expenditure #l ow coercive] [mixed automatic] [SMEs]
Tax credit for firms financing research projects in universities and PROs (l.106/2011 art.1)	Aimed at promoting public research outsourcing from the business sector. The allowance was equal to 90% of the incremental expenses incurred by the firm financing the outsourcing of research activities to PROs and universities.	Tax Reduction [Fiscal # Medium Coercion] [high automatic] [Enterprises + HEIs + PROs]
Venture capital stimulation	It aimed at stimulating venture capital creation and adoption to finance the development of start-ups, by providing that revenues for the capital invested were not subject to taxation.	Tax exemption [taxation #l ow coercive] [high automatic] [Start-up]

Table 7. 10 Business-oriented V instrument mix

With the approval of the Law 99 of 2009 the government has been delegated with the task to reorganize the system of incentives devoted to territorial and industrial development. This process produced a new set of financial instruments and fiscal measures mainly devoted to support the development of start-ups.

In 2010 were launched the Italian Investments fund and the JEREMIE fund. The former was matched with the creation of an asset management company and it supported the development of SMEs' innovation projects through private equity instruments. The fund was participated by other private organizations as Intesa San Paolo (Bank), Unicredit (Bank), Nexi (bank), the General Confederation of Italian Industry (Confindustria) and the Trade Association of Italian Banks. While, the JEREMIE (Joint European Resources for Micro to Medium Enterprises Fund) for the Mezzogiorno established in November 2010 within the Plan for the South. It was an over-regional equity fund for temporary and minority participation in SMEs devoted to support the implementation of projects related with European structural funds (Potì and Reale, 2011). The expected returns from these investments were meant to be reinvested in the fund, leveraging its capital provisions. Finally, the National Innovation Fund, launched in 2011, supported SMEs in accessing risk capitals. It relied on the cooperation with two banks (Medio Credito Italiano and Unicredit), which had the task to evaluate the project and participate in the financing of the accepted ones, for a maximum of 3 million euros over ten years. These funds were matched with a new legislation defining the characteristics of Venture Capital Funds and providing public support for their development.

Ultimately, the policy mix was mainly composed of fiscal measures; it was aimed at reinforcing the role of private investors (especially business angels) in start-up finance, supporting new entrepreneurial activities, together with a tax credit promoting the interaction between industrial and public research actors, while providing fiscal incentives for the outsourcing of research activities to

the latter. This tool, attempted to strengthen the links and the cooperation among the actors of the national R&I system, to promote an increase in the (currently low) level of R&D investments by firms and ultimately to raise the amount of funds available for public research.

In conjunction with the third year of the Berlusconi IV cabinet, Italy was caught in economic and financial troubles due to the worsening of the sovereign debt crisis in Europe. The government resigned and left the floor to the emergence of the so-called "cabinet of experts" Monti government, in office from November 2011. This cabinet was operating under strict budgetary constraints, mainly aimed at the financial stabilization of the country. For what concerns the R&I sector, the Monti cabinet designed the following instrument mix, before resigning at the end of 2012 and going to general elections the following February.

Instrument	Content	Shapes Family Delivery Target
Tax credit Skilled workers (L. 134/2012 art.24)	Tax reduction equal to the 35% of the costs for employing high skilled workers (individual who had a PhD or a master degree and were employed in R&D activities). The maximum amount of reduction for each enterprise was equal to 200.000 euros per year. Later extended also to start-ups.	Tax Reduction [Fiscal # Medium Coercion] [high automatic] [Enterprises]
Fund for Sustainable Growth (L. 134/2012 art.23)	It was focused on technological innovation and it substituted the former fund to sustain enterprises investments (FRI) approved with the budgetary law for 2005. Managed by the MISE linked to Horizon 2020 guidelines and definitions. It simplified regulation and redefines the scope, the beneficiaries and the mix of incentives available for indirect financing.	Administrative Simplification [regulation #l medium coercive] [low automatic] [Enterprises]
Creation Agency for Digital Italy (L. 134/2012 art.23)	Creation of a new Agency for the implementation the strategy for the digitalization of the country, managing funds for R&D project based on ICT development. Suppression of the Agency for the Diffusion of Technology for Innovation, created with the budget law for 2006.	Advisory Committee [regulation # low coercion] [low automatic] [HEIs + PROs + Enterprises]
Start-up Law Legal framework for start-ups (l.221/2012 art.23)	For the first time an extensive regulatory framework has been arranged in favour of this type of companies by legally defining their status according to some specific parameters: newly incorporated entities (< 5years old), not distributing profits, dealing with the production, development and commercialization of innovative goods of high technological value. Its innovativeness was defined by the following criteria: at least 15% of company's expenses should be attributed to R&D, at least 1/3 of the total work force were PhD or alternatively 2/3 of the workforce must hold a master degree, the enterprise was the holder depository of a license/registered patent/software.	Administrative simplification [regulation # medium coercion] [low automatic] [SMEs]
Fixed fiscal costs (l.221/2012 art.26)	Those companies which fulfilled the characteristics of a start-up were exempted from paying administrative fees related with the official registration of the company.	Tax exemption [Fiscal # Low Coercion] [high automatic] [Start-up]
Tax exemptions for investments in start ups (l.221/2012 art.29)	If tax payers invested a share of their capitals, for a maximum of 500.000€ for at least two years, in one or more innovative start-ups (directly or through a collective investment saving organizations) they could benefit for four years of a deduction equal to 19% on personal income tax.	Tax exemption [Fiscal # Low Coercion] [high automatic] [Start-up]

Table 7. 11 Business-oriented VI instrument mix

The reforms on firms' incentives (l.134/2012) was based on the Giavazzzi Report[106], which aimed at reviewing the approaches adopted for funding loans and providing subsidies to firms (Nascia et al., 2012, p. 28). This brought into being a simplification of the financing structure related with the resources for technological innovation, the replacement of the Agency for the Diffusion of Technology for Innovation, with a new agency mainly devoted to ICT technology development and the definition of a legal framework for start-up companies. This was matched with fiscal incentives aimed at promoting the employment of high-skilled workers, the creation and the investments in start-up companies; ultimately these measures were complemented by other decrees focused on labour market and more general macroeconomic issues.

7.7 Industrial-Technological districts and regional policies

The Italian Industrial system is largely made up of SMEs, which represents over 95% of the total number of national enterprises, which tend to be mainly family-run business (Pierantozzi, 2007).

The development of this type of industrial actors hinged upon a specific organization of the productive system, characterized by geographical agglomerations of enterprises, specialized in a related sector of activity: the industrial district. Indeed, industrial districts represented homogeneous production systems with a concentration of industrial companies, of small and medium size, with high productive specialization. Within districts, enterprises were integrated with each other in different phases of the same production process. Historically, these productive systems have emerged in a bottom-up manner through the autonomous concentration of geographically close industrial actors, especially in the field of textiles, clothing, mechanics and leather. They reflected the capacity of economic, social and institutional forces in a given territory to promote themselves, making the most out of their resources locally available in terms of human capital, raw material and knowledge. Since the beginning of the 1980s the organization of production in traditional sectors (so called "made in Italy sector") in Northern regions had progressively evolved towards an organization based on districts. Over the years these expanded and consolidated, also in other regions, thanks to the successful mix provided by a combination of flexibility, usually related with the family ownership industrial structure, and the interactions with other firms in the district (Maio, 2014).

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[106] This was a report commissioned by the Council of Ministries to an expert, the economist Francesco Giavazzi, in order to review the system of government subsidies to firms. This report estimated a total amount of "unjustified" subsidies and argued their elimination with a parallel tax cut (Lucchese et al., 2016, p. 248)

The law 317 of 1991 was the first legal recognition of industrial districts, and it provided regions with the task to identify and finance this locally-based concentrations of enterprises, according to the ministerial guidelines defined by the MEF.

In the following years, the so-called Guarino decree (l. 140/99), defined the criteria in order to identify industrial districts, and this was accompanied with an increasing empowerment of regional actors in their identification and management role. More broadly, regions had increasingly gained autonomy in planning innovation and industrial support programs in their territory; these provisions were included in the set of delegated powers defined in the framework of the R&I governance reorganization (d.lgs. 112/98), as discussed in paragraph 7.3 of this chapter.

More specifically, regions were in charge of the promotion of applied and pre-competitive research, innovation and technology transfer programs. Consequently, they started to design their own strategies for regional innovation plans that, in order to become operative, had to be first agreed with the Minister of Economy and Finance, Minister for Higher Education and Research and the Minister of Economic Development to make sure regional instrumentation was in line with national policies (European Commission, 2006). The recognition of the industrial district was basically a bottom-up process, involving regions and local actors in finding an agreement over the organization of the productive system. Nevertheless, the government, mainly through the MISE, did still play a prominent role, with the drafting of standards and orientations for their identification by regional authorities.

The Berlusconi II cabinet introduced, with the budgetary law for 2003 (l. 289/02), a fund for underutilized areas, called the FAS. This fund, together with structural funds for national and regional operative programs (PON and POR), was aimed at financing regional policies for economic development. Therefore, industrial districts were supported through a mix of ordinary national budgets and resources for regional policy (which were themselves a mix of European structural funds and budget allocation from the FAS). Decisions regarding the allocation of resources related with the fund for underutilized areas were taken by the CIPE, where also the minister for regional authorities was included.

The FAS gathered the resources previously allocated directly by the MISE through the so-called Single Fund for Enterprises Incentives, which was managed collectively by all the ministers involved in the CIPE. The recentralization over the allocation of funds for industrial districts can be read as both a result of the political willingness to prioritize some aspects of the industrial district development, as well as the necessity to make decision involving differentiated and increasingly more powerful regional actors, on a collegial-basis.

With the budgetary law for 2006 the Berlusconi II cabinet outlined the characteristics and the methods for identifying industrial districts and it also defined their tax-related regulation. Then, the newly elected left-wing coalition lead by Romano Prodi, modified some of the characteristics of industrial districts organization through the 2007 budgetary law and a supplementary decree (d.l. 112/2008). These interventions were aimed at simplifying the tax regulation for industrial districts and they also included the Permanent Conference for Relations between the State, the Region and the Autonomous Provinces in the committee that determines the methods for identifying industrial districts. The former provisions, those related with taxation, were modified again by the new Berlusconi government in 2009 (d.l. 5/2009), going back to the regulation identified by the previous 2006 budgetary law; and they were supplemented by further tax benefits for enterprises involved in industrial districts (l. 122/2010). Ultimately, the Monti cabinet implemented a simplification of the procedures required to establish industrial districts (d.l. 83/2012). Although the legislation has been amended and modified several times, regions seemed to maintain the main responsibilities in identifying their local industrial districts (Pierantozzi, 2007).

For a long time, industrial districts have been the backbone of the Italian economy; however, over the years, this system started to show some weaknesses mainly related with the industrial and economic structure of involved SMEs. Indeed, Italian SMEs tend to be characterised by a low degree of internationalisation, low investments in innovation activities, the lack of a consolidated management culture as well as a structural difficulty in scaling up production (Maio, 2014). That is why, in order to keep up with industrial and technological development, a new format of industrial districts was implemented by the MIUR, the so-called technological district.

7.7.1 Technological districts

The design of industrial districts was replicated by the MIUR, with the promotion, within the framework of the 2002 ministerial policy strategy, of technological districts and the contextual publication of the call for tenders in order to promote collaboration among the future actors involved. This intervention shared many similarities with Industrial districts. Indeed, they were both related with the geographical proximity of the actors involved in the production system and the benefits connected with the underlining dynamics of their interaction. Nevertheless, technological districts differentiated themselves because, first they were not limited to SMEs (also large and technological intensive firms were involved and played a catalyst role); secondly, they mainly relied on highly qualified human resources and on the pivotal role of local public research centres. Indeed, they were meant to facilitate cooperation between scientific and technological players together with companies, to support their joint collaboration in developing competitive research projects (European

Commission, 2004b). Their ultimate goals was to realize R&I networks, territorially embedded on specific technologies, with the collaboration of small and large firms and with a strong orientation to the socio-economic valorisation of results (Poti et al., 2008, p. 33).

Ultimately, despite the territorial proximity of the actors involved, the economic and cultural bonds with the environment in which technological districts emerged, as from the case of industrial districts, they represented a broader recipient of governmental support compared to the former and they had also the ultimate goal of supporting national competitive capacity also internationally (Ministero dell'Istruzione dell'Università e della Ricerca, 2005). Therefore, despite the close similarities with industrial district, their design was presented as an innovative strategy in order to support the innovative potential of the Italian cluster capacity internationally.

From a policy instrument perspective, technological district represented PPPs between public research and industrial at the local level; they were supported by the MIUR, which provided the guidelines, and the funding, necessary for their establishment and development. Within this context also regional actors played also an important role, to the extent that they were the institutional promoters of these initiative, they established they coordination table at which local interested actors could participate, and they presented the official proposal to the MIUR. (Cobis, 2008). With the competitiveness decree (l. 80/05), technological districts were also provided with a specific funding stream to finance their initiatives, the FRI, which was devoted to activities, programs and strategic R&D projects of companies to be carried out jointly with public research centres.

7.8 Conclusions

Before the window of opportunity for change provided by the broader revision of national administration structures in the framework of the Bassanini reforms, national R&I governance in Italy was affected by: a weak systematic approach; the lack of assessment and foresight activities, weak planning capacity in elaborating strategic programmes and a feeble diffusion of the results achieved by the S&T system (European Commission, 1999). Despite the huge contribution of this reform in reorganising the national governance, specifically in highlighting the political relevance of these issues, its discontinuous implementation ended up reiterating the division of competences between ministers with shared R&I competences. This logic can be found in the persistent division concerning the titularity of the two main national research and innovation funds, namely the FIT, under the MISE, and the FAR under the MIUR. These two funds were meant to complement each other's tasks, but in many occasions they ended up overlapping in their actions (European Commission, 1999).

Despite the centralized governance structure of the Italian system of innovation, where it was clearly present a typical top-down culture for coordinating knowledge demands through the PNR and the

development of multi-annual strategy, the fragmentation and duplication of the measures was still persistent (European Commission, 2006). Indeed, the evolution of instrument mix characteristics didn't seem to follow any clearly identified long-term strategy; moreover, there was often misinformation between those who allocated the funds and the beneficiaries (De Maio, 2011). When policy were implemented the overall policy framework displayed a clear lack coherence, and given the layering of multiple measures the resulting objectives were not often carefully calibrated in their long- term effects (European Commission, 2005b).

There had been some positive experiences regarding the design of long-term national strategies like for example the case of Industria 2015, and the more enterprise-oriented cases of the two digital innovation plans. Nevertheless, we can conclude that national policy instrument selection practices in R&I were heavily affected by the scarcity of an "holistic" policy approach, and the general rationalities seemed to be that of approving yearly budgetary laws in which, on a case-to-case basis, different one-shot provisions were included. As already stressed at the beginning of this chapter, the resulting national policy mix is highly polarized between enterprise-oriented innovation initiatives and a "residual" approach towards Higher Education Institutions and Public Research Organizations (Nascia et al., 2012). This trend could easily be spotted throughout the chronology provided in the former paragraphs, were interventions devoted to the business sectors were prominent compared to public research ones.

To conclude, we can highlight the extent to which the historical evolution of instrument mix features suggests an increasing relevance of collaborative type of instruments, for example those based on the creation of Public Private Partnerships (like those found in the Industria 2015 strategy and in Technological districts). This tendency was also supported by the adoption of mixed type delivery structures relying on the collaboration of different actors in order to ease policy instrument implementation and uptake by recipients (like the inclusion of banks in the financing system for innovation). However, the increasing attention towards establishing collaborative relationships with R&I performer was not always matched with a sufficient effort in supporting, and stimulating, their demands for innovation. Indeed, as discussed in the next chapter, Italian R&I instrument mix display a consistent lack of culture and awareness about the possibilities this policy lever can offer to their recipients (Potì and Reale, 2011).

8 Chapter 8: Case study II, the policy instrument selection in the Italian case

In order to shed light on the dynamics underpinning the evolution of R&I policy mixes we designed and interpretative framework which intersects different insights on the role of ideas (the influence of dominant framing in a given political system); the opportunity structure provided by the institutional system (internal coordination and specialisation between policy-makers) and the role of target population (the strategies for interest intermediation). By unpacking the combined influence these factors have on policy instrument selection process, it has been possible to disentangle the political dynamics behind the selection, and assemblage, of different instrument mixes.

The chapter is organised as follows; we will first dig into the influence that the dominant diffusion-oriented framing characterising the Italian R&I policy making case played on the evolution of national policy mix characteristics. Then, we will investigate how different ministers with integrative competences in R&I did manage to create strategies for cooperation, while analysing the different coordination and specialisation strategies they adopted. Ultimately, we will discuss the alternative strategies for interest intermediation and more broadly, the characteristics of national R&I performers and their strategies for action in the broader national R&I governance space.

8.1 Ideas

Instruments selection is an ideational process to the extent that instruments embed different framings concerning the individual perceptions on a given problem, and possible strategies to tackle it. Therefore, policy design is a politically salient process exactly because the selection of policy instruments can alter power dynamics, influencing the opportunities and constraints provided to the target population (Lascoumes & Le Gales, 2007; Salamon, 2002, Schneider & Ingram, 1990).

Once selecting new policy instruments, policy makers are caught in the grip between their preferences on how to shape the existent mix and the room for manoeuvre they have, given the distribution of power and interest set in force by the legacy of previous instrument choices. Because, ultimately long-term state and societal preferences shape political debates around possible alternative design, hence influencing partisan preference formation (Jungblut, 2015). While, on the other hand, a shift in the power balance among the collective actors who possess the legitimate policy making power (e.g. cabinet changed) can open window of opportunities for new entrepreneurs to promote change.

In order to understand the counteracting effect of institutionalised windows of opportunities (cabinet changes) and the persistence of long-lasting cognitive legacies (Mission VS Diffusion oriented) on

governmental R&I policy mix preferences we diachronically compared the evolution of instrument mix attitudes for different governing coalitions, to map out the connection between actors' partisan positions and policy instrument preferences in R&I sector.

We expected that in parallel with changes of parties in government, and of their likely policy style preferences, a shift in the preferences for R&I instrument mix characteristics will likely occur.

Figure 8.1 displays the percentages of coding references for different cabinet periods according to the different types of R&I instruments preferences (as done for the France case in Chapter 6). In order to allow the comparability of the sample under investigation, and a meaningful interpretation of the codes, all the share of coding references for each instrument type have been weighed according to the number of sources analysed[107].
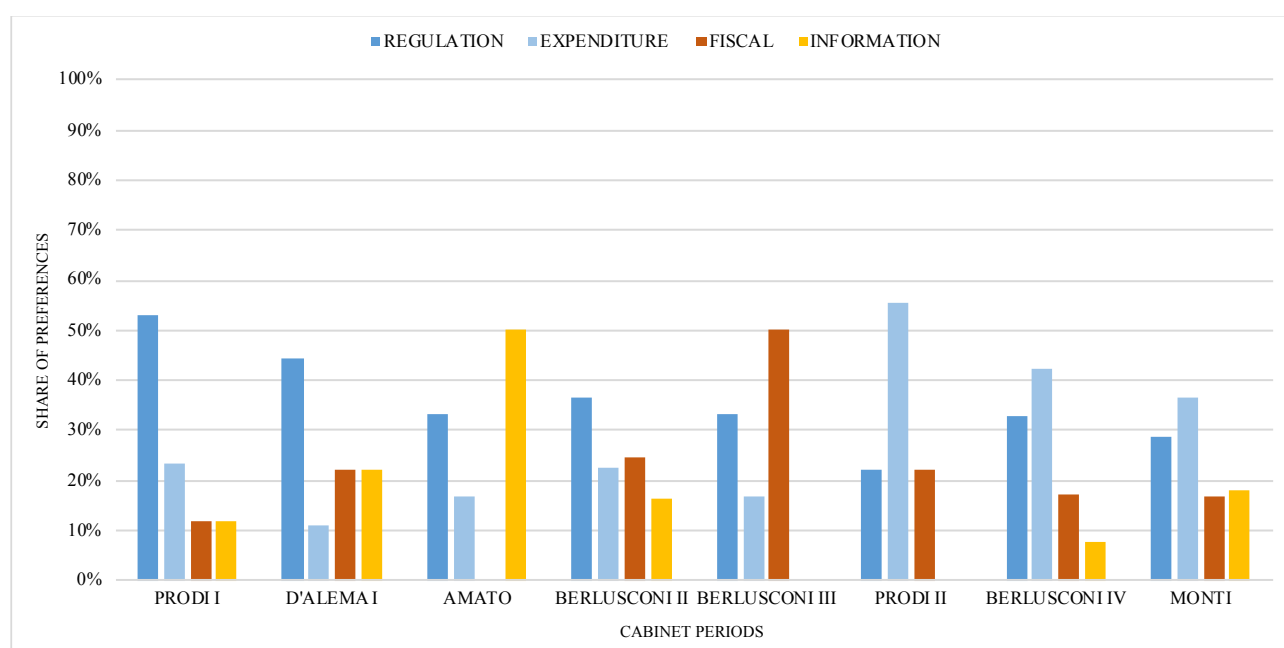

Figure 8. 1 Type of policy instrument preferences (Italy)

On the left side of the table (Y axis), we find the percentages of coding, while on the bottom side of the table (X axis), the different cabinet periods under investigation[108].

The left-wing oriented Prodi I cabinet shows a policy mix preference pattern characterised by a quite authoritative attitude (50% of preferences for regulation and 22,22% for expenditure instruments), it is followed by the D'Alema I cabinet, which displays a slight decrease in authoritative instruments preferences, and a parallel increase for fiscal (22,22%) and information (22,22%) type of instruments.

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107 Due to data accessibility issues, we were not able to analyse the same number of documents for each cabinet period. Therefore, the weighting procedure allowed to maintain a high degree of comparability between different cabinets.

108 For reasons of historical accuracy, it is relevant to highlight that we merged the two-consecutive cabinet of D'Alema (D'Alema I and D'Alema II) into one unique cabinet. This because only one economic programmatic document was produced during these two cabinets, and the ministry with relevant competences in the R&I sector were stable or exposed to limited variation in terms of political orientations across the two cabinet periods.

Finally, the last left-wing oriented cabinet of the first triplet (Amato), shows a decline in the preferences for more authoritative instruments (regulation 33,33%) in favour of an increasing share of preferences for less authoritative mixes, especially for information tools scoring 50% of the total cabinet preferences. The Berlusconi II cabinet, first right-wing oriented coalition of our time frame, displays a growth in the share of preferences for more authoritative policy instruments (36,73% regulation and 22,45% of expenditure instruments), at the expenses of a shrinkage in the share of information types of instruments, dropping at 16,33% of the total mix preferences. The following Berlusconi III cabinet, displays a generalised decrease in the share of preferences for authoritative instruments, which is characterised by an expansion in the share of preferences for fiscal instruments (50% of total mix preferences). The succeeding left-wing Prodi II cabinet scores an increase in the preferences for more authoritative instruments with a peak of 55,56% of preferences for expenditure and 22,22% for regulation instruments; followed by the last Berlusconi IV cabinet, characterised by a rise in the preferences for regulation instruments, which reaches 42 % of total instrument preferences. Finally, the so-called Monti "cabinet of experts", despite the decrease in the preferences for regulation instruments, shows an upward trend in the preferences for expenditures (37,68%) and fiscal (15,94%) instruments.

Figure 8.2 shows cabinet preferences for different degrees of instruments' automaticity, providing information on cabinets' orientations regarding the diverse type of relationships between policy makers and target population established within the management of different tools.
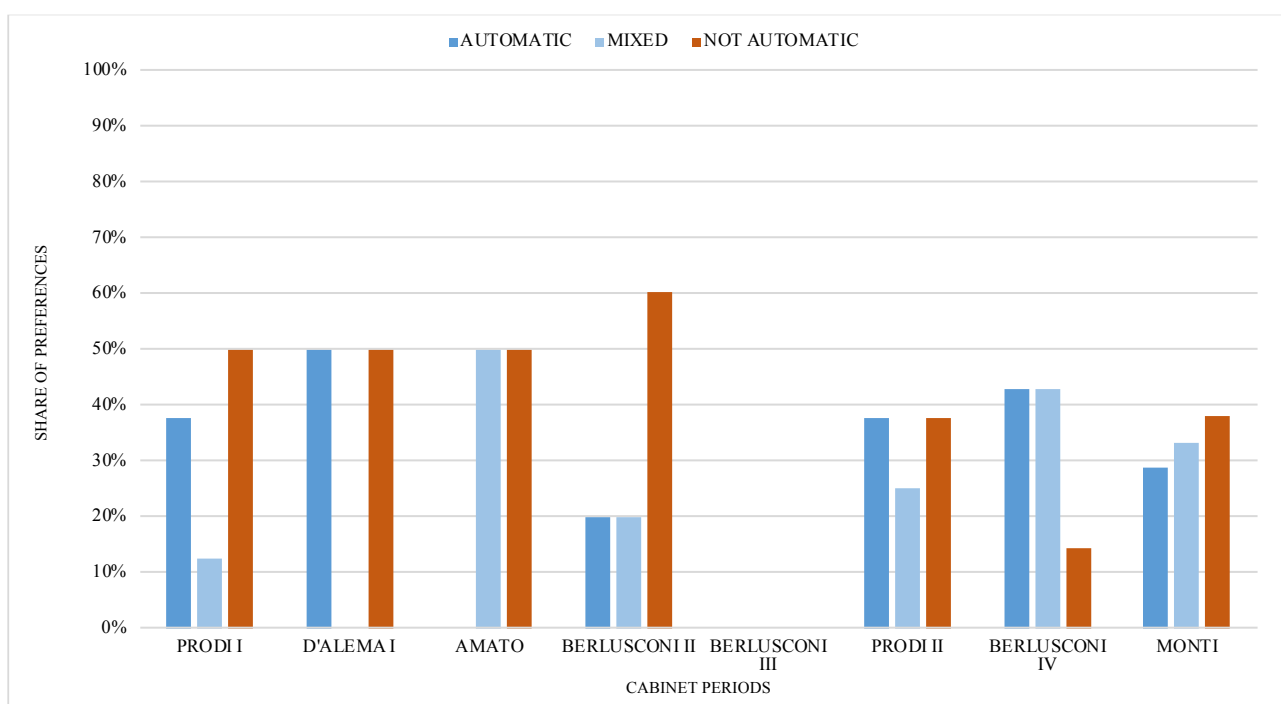

Figure 8. 2 Policy instrument delivery structure preferences (Italy)

The first three left-wing cabinets all display a stable share of preferences for not automatic delivery structures (50%); while preferences for automatic and mixed types of delivery are more skewed. With the Berlusconi II this percentage is increasing (with a peak of 60% of the preference in the first cabinet), despite the overall mix displays more balanced preferences for the other two types of delivery structures (20% of automatic and 20% of mixed) [109]. The preferences of the last three cabinet periods are more heterogeneously distributed among our typologies of instrument delivery structures. With the Prodi II government displaying a similar share of preferences for both automatic and not automatic instruments (37,50%) and Berlusconi IV cabinet, which shows a similar pattern but oriented towards automatic and mixed type of instruments (scoring both 42,86% of the total preferences). Finally, the Monti government displays an increasing trend for not automatic delivery (40%), followed by mixed (36,67%) and not automatic (23,33%) delivery types.

8.1.1 Cabinet turnover

We expected that changes in governing coalitions should influence policy mix evolution, specifically the more similar the party politics orientations between incoming and outgoing governments, the less authoritative would be the diachronic evolution of policy mix preferences. This pattern is closely related with the fact that changes in cabinet composition represent an institutionalised window of opportunity where new ideas, and the policy entrepreneurs who support them, can increasingly acquire decision-making powers.

To some extent the preference trend displayed in Figure 8.1 shows that a variation in terms of orientations for differently authoritative instrument mix is present between different cabinets, even though we cannot straightforward connect it with cabinets' political orientations. This trend is quite evident in the left side of our table were the first three left-wing cabinets (Prodi I, D'Alema I, Amato) show a decreasing preference trend for authoritative instruments, in line with the political coordination needed to implement the Bassanini reform package and supplemented also by their similar party politics orientation. This is followed by an increase of preferences for authoritative instruments in the case of the right-wing oriented Berlusconi II cabinet, and a subsequent decrease in the case of the Berlusconi III government. Conversely, this alternation pattern is less clear-cut in the second half of the table, where cabinets' instrument preferences are more heterogeneous among different politically oriented cabinets.

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[109] During the Berlusconi III cabinet period only one governmental economic programmatic document was produced. The fact that no preferences could be identified is closely related with the fact that these documents have an underlying programmatic nature; therefore, they do not always provide detailed information regarding the specific instrument mix each government aims to implement during its mandate.

In order to read through the lines of these trends it is necessary to consider two peculiarities for the Italian case, as emerged from our interviews. The first is the general low political salience of the issues. As pointed out by representatives of Higher Education Institutions, Public Research Organisation and the business world, R&I issues have never been a priority for Italian governments, and they have neither been central in their decision-making agenda (INTERVIEWEES 11-7-10).

The second is the inherent tendency of the system to wipe out what previous governments have done. Borrowing some of the words of Bassanini, the author of the reforms that modified the national governance of R&I sector: " even if those coming to power would like to continue the reforms designed and approved using the bipartisan method, they find it hard to explain to their own majority that there is no need to go back to square one; that what is needed is simply to forge ahead, to adjust, supplement and complete a reform that was fashioned together" (Bassanini, 2009, p. 376).

Therefore, as clearly stated by one of our experts (INTERVIEWE 8) on certain issues, related with economic, industrial and knowledge development of the country, there is no continuity from a political perspective even though, theoretically, on these issues they should all agree. These tendencies, matched with the instability of Italian governments, especially in comparison with the French case, can be interpreted as one of the triggering causes of the failure of Italian political system to provide sound governance, also in the case of R&I policies (Spence, 2014).

Italian politics has never fundamentally considered R&I themes as central for the development of the country, as demonstrated by our interviewees and the comparatively low level of R&I investment intensity of the country. This is also confirmed by the results discussed in the following paragraph, which exactly dig into the lack of a national political vision on R&I issues.

Consequently, the alternation trend among the different cabinets, should be interpreted under the light of the general tendency to destroy the legacy of previous cabinets, rather than on the specific political salience of R&I issues. Therefore, our expectations are partially confirmed, even though this seems to be a national policy-making pattern, rather than a specificity of the R&I case.

8.1.2 The path dependency effect

The dominant cognitive background embedded in the national R&I policy mix influence the balance between appropriateness and consequentiality policy makers are facing during policy instrument choice. This is why the technical and political legacy of past policy choices is said to influence new policy making activities, shaping the available alternatives (Bressers and O'Toole, 2005; Cashore and Howlett, 2007; Hall, 2010; Howlett, 2009). Diffusion and mission-oriented cognitive legacies reflect this historical stratification of different institutional aims, which mirror the dominant policy framing characterising the evolution of state preferences for R&I strategies. Therefore, in the case of dominant

diffusion-oriented institutional aims characterising the Italian case we would expect that governments show a high share of preferences for less authoritative and more automatic instruments.

Looking at the results in Figure 8.2 the path dependent effects of diffusion-oriented paradigm doesn't seem to be predominant on the evolution of cabinet R&I instrument mix preferences. Indeed, at a first glance the share of preferences for policy mix features seems to be more in line with a mission-oriented ideal type, given the average high share of preferences for highly authoritative and not automatic instruments types, rather than with a diffusion oriented one.

If we read these results together with the data on Governmental Budget allocation for R&D according to the sector of performance and the sector of investment (see Figure 4.3) it seems that Italy has a dominant preference pattern for an instrumentation of the mission-oriented type, but ultimately it uses the available mix in a diffusion-oriented manner. As claimed by one of our interviewee representatives of the business sector (INTERVIEWE 10): *"nowadays Italy has a very efficient R&I instrumentation, we do really have all we need. What is missing, is exactly the idea, a political leadership eager to invest in this sector, which will also able to drive the industrial sector to mobilize"*.

Some examples of this mismatch can be found in our data, as the case in the case of Figure 8.2 for D'Alema I and Prodi II cabinet, were automatic and not automatic instruments score the same share of preferences. Since different degrees of automaticity in the delivery structure of policy instruments mirror the extent of public resources necessary for instrument management, this tells us the highly ambivalence of different policy instrument application.

The issue of the lack of political leadership, and therefore of a specific political orientation of the national policy mix emerges also from the results of our interviews where different experts clearly point out this problem. Indeed, they exactly claim that politicians are not clear about where they want to go and how they want to get there. Instead of starting from a political vision on where to go, policy makers tend to begin from instruments because they can be more convenient, or simply eager to fulfil patronage dynamics, but on the other hand they say little if there is no idea behind them (INTERVIEWE 8). Political ideology doesn't seem to matter too much and policy mix characteristics seems to be rather a matter of satisfying the priorities of different political constituencies (INTERVIEWE 1).

This narrative on electoral constituencies acquires greater relevance if we consider that some instruments have been activated only for a specific short period of time (like the case of some one-off implementation of some fiscal instruments), such as if they were only meant to please the will of a specific electorate in a specific window of time.

Nonetheless, it is also relevant to notice that Italy has a strong legacy of mission-oriented policy and direct state participation in the field of R&I policies. Therefore, the reason for this mismatch between cabinet instrument preferences and effective investments in R&I sector can also be related with a legacy of slow and complicated (and probably not completely successful) transition towards a diffusion-oriented pattern.

8.2 Institutions

As for the French case, Italy pursued and external institutional specialisation strategy, according to which R&I competences are decoupled among functionally homogeneous ministerial organisations. The Minister of Higher Education and Research (MIUR) and the Minister of Economic Development (MISE) represent the two fundamental institutions of Italian R&I governance structure. Their internal organisation, name and competences have slightly changed during the period under investigation; despite that, the overall R&I governance structure has remained pretty stable.

Such governance structure reflects how this policy sector is inherently made of two substantive parts, research and technological development, which can acquire different relevance, and level of integration, according to policy makers visions and capacities. In the following paragraphs we will investigate the evolution of national ministerial coordination strategies, in order to understand the extent to which these practices affected ministerial interactions and ultimately policy mix evolution.

8.2.1 Ministerial coordination practices

The Italian national governance of R&I hinges upon two main actors, the Minister of Higher Education and research (MIUR) and the Minister for Economic Development (MISE), which detain shared competences in the design of national R&I instrument mixes. The roots of this organisation date back to the Bassanini reform (d.lgs. 297/99), which reiterated the already pronounced division of competences between the two ministers according to the titularity of their respective funds, namely the FIT, under the MISE, and the FAR under the MIUR.

This system hinged upon a linear understanding of innovation process, according to which the MIUR has competences related with the process that support blue sky and fundamental research, while the experimental development of this research, and eventually its market application, fall under the competences of the MISE. To some extent the MIUR covered the sphere of competences under the remit of the Frascati Manual, focusing its activities on research phases that are slightly behind the market; while the MISE made reference to the definition of the Oslo manual and it was more

concerned with how to transfer this research to the market[110]. As stated by one of our interviewees (INTERVIEWE 11) this separation of competences among ministers seems to suggest that there is one type of research that can be adopted to support economic development, and another type of research that cannot contribute to it; which in reality is not always the case.

An important consequence of this structure was that coordination practices among ministers were not clearly defined. The division of tasks between their policy instruments was blurred, causing a fragmentation of public competences, increasing the likelihood of clashes between their action, ultimately hampering the design of a homogeneous research and innovation national strategy.

This affected also the capacity of the target population (in the specific case mentioned during the interview enterprises), to navigate the system of available incentives resulting in the practice of applying with the same innovation project for different benefit schemes at the same time (INTERVIEWE 10).

A first attempt to coordinate the action of the ministers with R&I competences was the creation of the National Research Program (NRP), in the framework of the Bassanini reform implementation.

This document defined the national strategy for Research and Innovation Policies, by identifying the activities to be promoted and their respective budget allocations (almost) every three years. It was formulated by the MIUR after an extensive consultation with the actors of the innovation system and it was implemented after the approval of the CIPE (Lai, 2016).

The centrality of the MIUR was related with its role of coordinator during the drafting of the document, which required consultations involving the scientific and academic community, the representative of the business world and all the public administrations concerned by the plan. Furthermore, the CIPE annually assessed the state of implementation of the PNR on the basis of a report prepared by the MIUR. However, these reports are not available, and neither the CIPE's resolutions regarding the results are known (Sirilli, 2010, p. 78).

Despite the titularity of the MIUR in the drafting of this programmatic document, from our interviewees emerges that, in practice, the Ministry didn't detain an effective primacy in the coordination of the national R&I strategy. Indeed, (INTERVIEWE 9): *"[…] it is difficult to see this design in a coordinated and coherent way, the sensation is rather that of a set of interventions based on isolated spots. The lack of coordination is systemic because once a set of similar competences is established among several ministers, these administrations are of an equal level and it becomes difficult for a ministry to be the coordinator of the others because, in the end, their weight and institutional level is the same".*

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[110] As confirmed by our interviewees representative of these institutions (INTERVIEWEES 9-5).

Consequently, the centralization of competences in drafting the NRP to the MIUR didn't seem to provide effective results in terms of coordination among the two ministers. That is why, also from many of our interviews (INTERVIEWEES 10-7-9) it emerged how probably, moving R&I policy making competences upwards, under the remits of the Prime Minister, might be a possible strategy in order to overcome the deadlocks related with the interministerial management of the policy design. Because, ultimately, the weak monitoring system, as well as the scarce coordination between different Ministers are factors that can inhibit the achievement of good results in R&I policy making practices (Potì and Reale, 2010).

That is why a second strategy for coordinating ministerial action has been included in the national R&I policy making structure, through the support of the interministerial Committee for Economic Planning (CIPE).

This was a committee in charge of coordinating and planning national economic policy, its board members were the Prime Minister (President), the Minister of Economy and Finance (vice-President), the Vice- Minister of Economy and Finance (Secretary) and other Ministers whose presence was necessary to deploy the overall industrial and economic policies(European Commission, 2004b, p. 12).

Its major functions included evaluating the Economic and Financial Planning Document, which defined the major strategic guidelines and the general economic strategy of the country, including policy measures to foster Scientific research and Technology (like the National Research Plan) and the annual allocation of resources devoted to R&I (European Commission, 2006).

Therefore, the CIPE theoretically represented an additional forum, a director table, in which ministers with R&I competences could gather to discuss about national strategies, and especially funding allocations, under the coordinating role of the PM and the Minister of Economy and Finance.

In 2006, with the election of the Prodi II cabinet, the technical-administrative structures supporting the CIPE, until then operating within the Minister of Economy and Finance, have been transferred under the Prime Minister offices, at the department for planning and coordination of economic policy. The underlining logic of this new organizational structure was to strengthen the role of the PM in the coordination of economic policies, and related planning activities; while re-centralising the control over the interministerial policy making practices.

Nonetheless, despite the relevance of CIPE as a coordination body, the perceptions regarding its effectiveness are contrasting among our interviewees. Indeed, many (INTERVIEWEES 11-3-5) claims that actually the CIPE exactly mirrors the political dynamics internal to the current cabinet organisation. Therefore, when ministers meet at this table, they are already aware of the power balances among different ministries, and of their related funding allocations. Consequently, the CIPE

actually appears to be only a formal, rather than an effective, coordination table among ministers; because ultimately: "*policies are designed within the government and my feeling is that CIPE is not the platform through which public policies are effectively designed*" (INTERVIEWE 3).

Therefore, the coordination among ministries seemed to be left to the internal dynamics taking place within cabinets, and to the political attitudes among ministers. As suggested by one of our interviewee representatives of the MIUR (INTERVIEWE 9), the coordination between MIUR and MISE has smoothly taken place many times, especially thanks to the presence of personalities who have interpreted more correctly these issues compared to others. In certain cabinets the MIUR has been split into two separated institutions, and maybe during these periods the minister didn't manage to be a strong representative of the internal perceptions of R&I policies. Borrowing some words from our interviewee: "*it is exactly here the main issue of the Italian R&I governance system, because if everything can depend upon the strength, or not, of a single minister, it means that the architecture of the system is not solid and paraphs it should be reformed*".

Consequently, governmental capacity to build an encompassing national R&I policy seemed to be left in the hand of one of the two ministers (MIUR or MISE), which through their (eventually) entrepreneurial attitude could be able to create the necessary coordination among the two institutions, in order to define a shared national strategy. This governance failure was also perceived by R&I performers, who looking at the organization of the public structure have the impression that the two ministers do more or less the same thing (INTERVIEWE 10-11).

Therefore, as suggested by the existing literature (Potì and Reale, 2010) the coordination between MIUR and MISE needs to be improved for overcoming the traditional separation of the national system between research and innovation. Moreover, the organization of competences among these institutions should avoid the risk to fall in the trap of creating structures in which the bureaucracy derives its *raison d'*être only from the administration of subsidies, leaving apart the willingness to pursue a broader national strategy for development.

8.2.2 *The actual patterns of Ministerial Interactions*

The institutional landscape of national R&I policies has been historically characterised by a high level of fragmentation. Starting from the era of public participation in the national economy, through state owned enterprises, decisions concerning national industrial strategies were taken by two different ministers that were often in conflict, the ministry of Industry (established in 1948) and the ministry of state-holdings (established in 1956) (Maio, 2014, p. 248). After the suppression of the latter in 1993, in conjunction with the dismissal of many state-owned enterprises, the evolution of the minister

with competences on industry has been fluctuating among cabinet periods characterised by a reunification of different competences and moves towards their re-fragmentation.

An important step in this development has been the Bassanini reform that reunified all the ministerial competences related with industry, national and international trade and communications into a unique institution, the minister of productive activities. During the following governments its competences have been differently unpacked in detached ministerial institutions. The MISE as we know it today has been created in 2006, under the Berlusconi III cabinet, which provided this institution with the task to implement policies for the development of the national productive system and cohesion policies. Ultimately, the new Ministry has been internally organised in department and directorates, mirroring the different competences that have been merged from different institutions.

Similarly, the MIUR went through a long evolution process. The institution was created in 1989 (l. 168/89) and it merged the competences for scientific research and university education that had previously pertained to the Ministry without Portfolio for the Coordination of Scientific and Technological Research, the Office of the Prime Minister and the Ministry of Public Education (Capano et al., 2016). It slowly hollowed-out CNR's competences in public research policy, to recentralise powers in the newly created ministry.

During the period under investigation the minister has been divided into a Minister of Public Education and a Minister of University, Scientific and Technological research during the D'Alema I and Amato cabinets then, during the two mandates of Berlusconi it has been reunited under the MIUR. In the following Prodi II cabined it has been divided again in two institutions, for being then finally united under the MIUR from the Berlusconi IV cabinet onwards. In line with the statements of our interviewee (INTERVIEWE 9)[111], it was easy to see how the periods of minister unification under the MIUR correspond with the years in which the main reforms of Higher Education Institution and Public Research governance have been implemented.

In addition to the evolution of the MISE and the MIUR structures, it is also relevant to notice how these two actors have been supplemented in their actions by the creation of specifically innovation-oriented ministers. Like under the Berlusconi II and III cabinets, when a new minister for innovation and technology was created, and lately substituted during the Prodi II government with a minister for Innovation in the Public Administration.

The landscape was further complicated by the fact that beside the MIUR and the MISE, who played a major role in the national R&I policy making, important contributions to the evolution of the sector, and the desire to promote research and innovation practices, can also be found in other ministers (e.g.

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[111] Regarding the fact that during the period in which the MIUR was divided into two separated institutions, the minister didn't manage to be a strong representative of the internal perceptions of R&I policies

Health, Agriculture and Environment), who respectively detained different Public Research Organisations under their control like the National Institute of Health (*Istututo Superiore di Sanità*) and the Council for Agricultural Research and Analysis of Agricultural Economy.

Indeed, as the table below suggests the universe of ministers participating to the financing and development of R&I policies was highly heterogeneous.
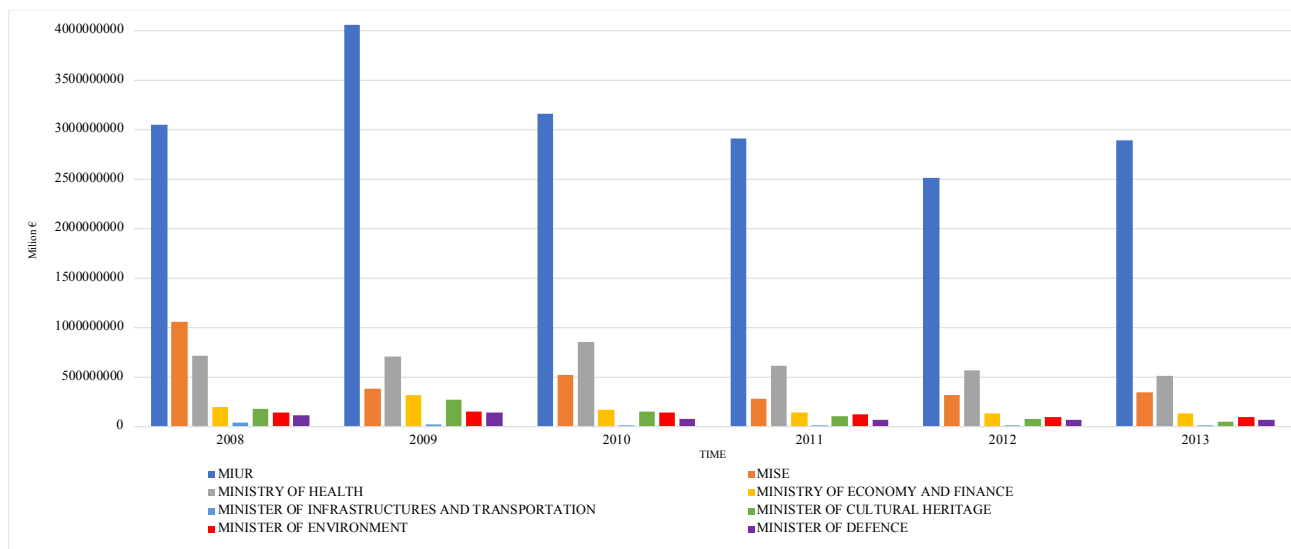

Figure 8. 3 Aggregate public expenses on R&I mission by Minister[112]

The MIUR was the main financial contributor to the national R&I policies, followed by an alternation between the MISE and the Minister of Health, who heavily contributed to the financing as well. The latter managed research funding in its specific field, and through its public research organisation, the ISS, it also took part to several initiatives and infrastructures in the field of Medical research as the European Clinical Research infrastructures Network (ECRIN) (Potì and Reale, 2011, p. 33).

This was once again symptomatic for the fragmentation of the national R&I strategy (INTERVIEWE 10). Differently from the French case no common budgeting procedure was planned and the agreements over the PNR concerned broad national goals, and did not provide any direction regarding the effective implementation of different measures. Moreover, as suggested by the literature, the lack of financial commitment to the multiannual strategies defined in the document has often resulted in unrealistic targets (Nascia and Pianta, 2013, p. 24) and unsatisfactory implementation (Grilli and Mariotti, 2006). Therefore, each minister could essentially carve out a niche for its own interventions

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112 Data elaborated by the author. Aggregate public expenses by administration and mission (research and innovation mission) source: https://bdap-opendata.mef.gov.it/content/rendiconto-pubblicato-serie-storica-spese-aggregato-amministrazione-e-missione-0; unfortunately only data from 2008 onward were available.

and when the areas overlap, coordination could be found internally between specifically concerned ministers (INTERVIEWE 5).

Nonetheless, some extent of coordination has been possible, but mainly thanks to the entrepreneurial activity of individual ministers, like in the case of the Industria 2015 design. As confirmed by one of our experts (INTERVIEWE 8), the success of the strategy was due to the fact that the Minister of Economic Development, did manage to rapidly exploit a political window of opportunity present at that time.

This is why, as also confirmed by another interviewee (INTERVIEWE 10), the strategy did manage to survive only for the period of the Prodi II, cabinet for being then modified by the following Berlusconi IV and changed in its underlining logic of action.

The collaboration between the Minister of Innovation and Technology and MISE in the drafting of the Plan for digital innovation in enterprises seemed to be smoother and more enduring compared to the Industria 2015. However, it is important to notice some relevant specificities, like for example the fact that the ICT strategies for enterprises were formulated across two cabinets of the same political orientation. Moreover, part of the instrumentation relied on the re-calibration of existing instruments toward the promotion of new technologies for enterprises, rather than on a brand-new set of instruments.

Once again this confirm the extent to which the coordination between ministers involved in the R&I is left in the hands of each specific institutions, or personalities, and no clear coordination practice is provided at the national level. As stated by one of our interviewees, Italy clearly displays a governance issue in the R&I policy sector, there is often a confusion between instruments and goal (INTERVIEWE 8), and the boundaries of competences between different policy making institutions are often fuzzy. This further hamper the policy-making capacity to design long-term national strategies and to politically prioritize R&I policy as a possible strategy for national development. That is why, often, the evolution of the national R&I policy mix is made up of fragmented instruments, which look like day-to-day administrative management, rather than a national strategy (INTERVIEWE 10).

8.3   Interest

The design of Italian R&I policies tends to be mainly performed at the governmental level, where the main priorities are identified. Consultations with key stakeholders are performed on a regular basis, however their involvement is still partial and has only limited influence on policy making (European Commission, 2006). Indeed, as suggested by one of our experts (INTERVIEWE 4): "the *inability to coordinate different actors, and the lack of a long-term political vision, make policy makers prisoners*

of actors who support their specific interests (who can be the business world, some powerful research centre or universities)". The majority of Italian cabinets during the period under investigation have never perceived R&I issues as strategic for their country, on the side of R&I performers this was mirrored by a fragmented structure of interest intermediation which jeopardized their power to influence policy making process. As argued by our interviewee (INTERVIEWE 9), nowadays there is a lower tendency toward the dialogue between ministers and R&I performers and if that is strictly needed, these practices are kept at the institutional level. To some extent this is also related with the fact that policy-makers are not solicited anymore by social partners or business representatives to do so; it almost seems like nobody has more interest in doing it.

Moreover, the national governance system doesn't envisage any specialized agency, which could help the dialogue between policy makers and target groups, supporting the program management and implementation of national R&I strategies. There have been some attempts to establish specific actors with similar competences (like *Sviluppo Italia* and the National Agency for the Diffusion of Technologies for Innovation), but their role has always been marginal, especially because of their short life. National R&I policies were steered directly by different ministers involved, under the supervision of the parliament. Consequently, there seems to be a high degree of dependency upon the political volatility, and the frequent cabinet reshuffles, characterizing the national political system at large.

8.3.1 The lack of an intermediary body

The governance structure of national R&I policies has not always been stable with regard to intermediations practices with R&I performers. Indeed, there use to be a quasi-agency actor, playing the role of intermediary between the public research world and the government, this role used to be played by the National Research Council (CNR).

Indeed, the CNR used to have a double function, it was both a research funder and performer. It managed the administration, and selection, of research projects financing free grants devoted to individual researchers (finalized projects), while carrying out its own research activities through strategic projects. The former, organized according to specific thematic fields of research selected by CNR, were administered by the research council after the financial allocation done by the CIPE and were mainly devoted to academic research. While the latter, were oriented by the internal research agenda defined by the council. They were evaluated by external experts selected by the CNR and were exclusively devoted to finance research activities of the organization (Potì and Reale, 2007).

With the establishment of the Minister of University and Research in 1989, and the implementation of the Bassanini reform (Ministerial Decree MIUR 593/00), the instrument mix into force was

reorganised with the aim of recentralising the responsibility for project funding allocation in the hands of the MIUR, together with a re-organisation of the existent public research institutions.

After the establishment of the Minister of Higher Education and Research the CNR has continued to manage its finalised projects (Sirilli, 2010), but its role of funding agency was slowly brought to an end. Indeed, these projects started to receive less funding from 1990s and were replaced by the creation of two new instruments, directly managed by the MIUR (both in terms of financing procedures and selection of thematic areas): The Fund for basic Research Investments (FIRB), and the Special Applied Research Fund (FISR). While, strategic research projects were terminated some years later in the framework of an overall reform of the public research organisation role and powers implemented in 2003.

The CNR went through a consistent administrative reorganisation process of its structures, together with other public research organisations under the MIUR supervision[113], its coordination functions were progressively moved to the MIUR. In detail, with the 1999 reform package, the government decided to merge the existing 316 research units, into about 100 institutes; however given the opposition and the bargaining power of the CNR personnel (who had the status of civil servants), it was impossible to accommodate the personnel as planned, with a consequent scattering of the institutes into more than 200 locations (Coccia and Rolfo, 2010, p. 139).

This reform was part of the broader administrative reorganization undertaken within the Bassanini process and, as argued by one of our interviewee (INTERVIEWE 7), at that time the CNR used to have a structure poorly suited to for the dominant leitmotiv "large is beautiful", according to which it took a great deal of concentration of resources into big structures to do research of high scientific quality.

While this reform was still underway, the CNR went through an additional, and more consistent, reform process, which aimed at restructuring the institution redefining its purposes, activities, principles and criteria of organization and functioning. This transformation was undertaken under the Berlusconi II cabinet by the Minister of Higher Education and Research Letizia Moratti (d.lgs. 127/2003). In a nutshell, differently from the previous intervention, this reform affected the scientific nature of the organization and its underlining competences and role within the broader national R&I governance. Inspired by the principles of project management, the CNR was reorganized according to 11 scientific departments, to which different institutes belonged to; these had the goal of directing projects and being the interface of the organization with external third parties (e.g. the government, the industrial world or universities) and research demands coming from the economic system (Coccia and Rolfo, 2007).

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113 Through the following legislative interventions: d.lgs. 19/99; d.lgs.27/99; d.lgs. 36/99.

The combination between these reforms, and a more general shrinking of public funding for research, did actually triggered the transformation of the CNR moving the organisation from scientific research institution, into a technological service-oriented actor, which compensated for the reduction of public funding through the provision of some specialized services like analysis and technical tests, technological services, quality service, environmental service (Coccia and Rolfo, 2010).

Therefore, at the end of this process the CNR totally lost its role as an intermediary agency of the MIUR, and became solely a performer of the national R&I system competing, together with other Higher Education Institutions, for funding to support their research activities.

Before this transition, the CNR was perceived as an extension of the university, maybe at the expenses of the relationship with the industrial world (INTERVIEWE 7) and, according to some of our experts (INTERVIEWE 6): *"it dirigistically selected which research sectors to push forward and in which direction. It used to behave as a public body".*

Despite the contrasting views (also among our interviewees) regarding the titularity, and the effectiveness, of its action there was without any doubt an agreement concerning its pivotal role in the public research governance. Therefore, it seems that underlining logic of this reform process was exactly to hollow out the research management competences of the CNR and recentralize these powers under the MIUR.

Nevertheless, as argued by one of our interviewees (INTERVIEWE 7), it seems that actually what was missing in this reform was a replacement of the CNR with another body that could perform the same function. This is actually also a widespread perception among the broader pool of our interviewee (INTERVIEWEES 9-10), who claim that the Italian R&I governance is lacking a unified political responsibility centre to whom different stakeholder can raise their claims and suggestions.

8.3.2 *The fragmentation of vested interests*

If on the one hand R&I performers are calling for a unified centre of political responsibility, and some of them go even beyond by calling for the establishment of a devoted public agency; on the other hand, is it relevant to notice the endemic fragmentation characterizing the representation of R&I performers interests on both the public and the private side.

Historically, the Higher Education sector has been characterized by a dynamic in which governments have tried to purse a rationalization of the sector, often characterized by many contradictions, while universities had always tried to resist and maintain their traditional model (Reale and Potì, 2009). During the late 1990s, universities had first went through a phase of "imposed autonomy" (Capano, 2008), then in 2010 a new dirigiste action of policy makers took place, allowing them to freely define their own statutes, under the condition defined by a tight ministerial regulation (Capano et al., 2016;

Donina et al., 2015). On the other side the CNR, as the biggest public research organisation, went through a long reform process which changed its nature, shifting from financer and performer to a position that, from a merely R&I governance perceptive, share many similarities with those of universities.

As reported by one interviewee (INTERVIEWE 7), even if in parallel with the end of the financer role the cohesion with the university has loosened, there is still a continuous exchange and collaboration between universities and the CNR. However, no clear collaboration structure was provided, differently to what happens in France with the mixed research unities, the opportunities for their interactions were left to the specific will of researchers. This was even more accentuated by the fact that after the reform process the CNR became an additional performer of the research sector, therefore somehow competing side by side with universities for public research funding.

Despite some peculiarities of the system, like for example the fact that differently from universities CNR's researchers have no teaching obligations, therefore the majority of its personnel was mainly devoted to research activities, these two actors seemed to display a quite cooperative attitude.

The situation was similar among different universities, as argued by one of our interviewee representative of the CRUI (The university association delegated with the power to guide and coordinate their autonomy); the rectors of different institutions could have heated debates, but at the end they do always managed to agree upon a common terrain for action. On the public research side, it is also worth mentioning the experience of the *Gruppo 2003* (Group 2003), established during the period of the CNR reform process, it gathered scientists working in Italy and appearing in the list of the world most cited researches within their specific scientific fields. The group drafted a manifesto addressed to policy makers, which listed the deficiencies affecting the Italian public research structure and proposed some alternative paths for reforms. Along the years, it managed to meet some of the Italian Presidents of the Republic in order to discuss and raise policy makers' awareness about these themes. Besides that, its action has been limited to the organization of press conferences, and to the promotion of some initiatives addressed also to the general public.

Nevertheless, all of that didn't seem to be enough in order to constitute a block powerful enough to play a relevant role in the R&I policy making process. As many of our interviewees suggests (INTERVIEWEES 8-4) universities did not really represent a dynamic actor in R&I policy making, there were some important research centers but overall, they were not powerful enough to guide the design of a policy and to be a stable interlocutor of the government.

If we turn on the side of the industrial and business actors, the panorama seems to reflect a similar endemic fragmentation.

The representation of the industrial world tended to hinge upon the General Confederation of Italian Industry (Confindustria), an association with voluntary membership, representing companies, their values and interests, at the institutional level. As suggested by the literature (Lanza and Lavdas, 2000), historically the business representation in Italy has been marked by an high degree of fragmentation.

According to some of our interviewees (INTERVIEWEES 8-11), nowadays this organization is facing the challenges that many representation bodies were already facing in the broader Italian political system. Some of our interviewees believe that this was closely related with the fact that Confindustria didn't truly believed in innovation as a motor for Italian economic development (INTERVIEWE 6).While others claim this was due to the fact that big enterprises, once more involved into Confindustria, and usually representing the biggest contributors in terms of national private expenses for R&D, have started to behave more autonomously in the national R&I governance and in their innovation investment choices (INTERVIEWEES 4-7-9). This was also reflected by the statement of our interviewee representing the MISE (INTERVIEWE 5), who argued that once designing ministerial strategies, in addition to the dialogue with Confindustria the minister also organizes one-to-one meetings with representatives of big Italian enterprises.

Therefore, there seems to be a widespread perception regarding the increasing incapacity of Confindustria to catch the requests of big enterprises in the field of R&I sector, which has been somehow translated into a greater attention towards the needs of SMEs.

The literature also suggests the ambiguity of the private sector role in the national R&I governance. Indeed, on the one hand Confindustria used to highlight the need to enhance the production of high qualities human resources in S&T field. While, on the other hand, the number of graduates hired by firms was one of the lowest in Europe (Poti et al., 2008, p. 19). This contradiction seemed to be symptomatic of a phenomenon our interviewee from Confindustria (INTERVIEWE 10) defined as the crisis of innovation demand of Italian SMEs.

Indeed, national Small and Medium-Size Enterprises were overwhelmed by the instrumentation at their disposal, and the role of Confindustria should have been to accompany these actors during the selection of the most suited instrument. Borrowing some words from our interviewees (INTERVIEWE 10): *"The confederation has always been very busy in dealing with the offer (establishing a dialogue with policy makers), but very little attentive to the demand side"*.

Alongside with the loss of representative power from Confindustria and more generally from the representatives of the public research sector, there are other types of interests that seemed to have gained ground, like the Presidents of regions. Indeed, as claimed by one of our interviewees (INTERVIEWE 9) there are lobbying interests, paraphs local ones, related to important productive

structures present in certain areas of the national territory that have increasingly started to strongly support politics.

This is closely related with the fact that the contribution of regions to the national innovation effort has increased in the last years thanks also to the activation of instruments supported by European Structural Fund. Indeed, regions have increasingly been provided with the power to design their R&I regional strategies, mainly oriented to the field of applied research, technology transfer and pre-competitive activities (European Commission, 2006; Sirilli, 2010). As far as curiosity driven research is concerned they didn't have a preeminent role (if not indirectly), while in the case of industrial clusters, local administrators were among the main actor of the network which varied in its characteristics according to the actors involved and the history of different local regulatory interventions (De Maio, 2011). Every region was capable of defining its own strategy and the central government kept the process monitored, to the extent that regional innovation plans presented by regions had to be agreed with the Minister of Economy and Finance the MIUR and the MISE to make sure that the regional initiatives were in line with the national R&D guidelines and policies.

There were also some drawbacks related with these developments, to the extent that the most advanced regions (in terms of output per capita and R&D investments intensities) had been more active in financing and developing their innovation strategies. This difference in the ability of local administrator to manage their policy strategies, and related resources could give rise to greater divergence in growth and development opportunities across regions (European Commission, 2004b, p. 8). Also Confindustria, as stated by one of our interviewees (INTERVIEWE 10), had started to develop a territorial strategy in order to coordinate with local representatives of the industrial confederation and open a dialogue with regional institutions. Nevertheless, the division of competences between national and regional level still suffer from various cases of overlapping, and some confusion regarding the competences of the various level of government involved (Gallo and Silva, 2006). Therefore, despite the increasing policy entrepreneurship of R&I performers and regional politicians at the territorial level, given the sometimes nebulous division of competences between central and regional governments and the only recent attempts of some industrial stakeholders to develop local strategies, it might probably be too early to clearly identify them as a pivotal stakeholders in the definition of the national R&I policy mix.

8.4 Conclusions

In order to shed light on the dynamics underpinning the evolution of R&I policy mixes we designed an interpretative framework that looked at the roles of ideas (intended as dominant cognitive framings), at the internal coordination and specialisation between policy makers and ultimately, at the different strategies adopted for interest intermediation. The combined influence these three factors play in the process of policy instrument selection could help us to interpret the political dynamics defining the selection, and blending, of different instrument mixes.

For what concerns the role of ideas we were interested in understanding the combined effect of changes in cabinet compositions, the feedback effects related with the accumulation of long-lasting policy framings and how their interaction influenced the evolution, and the characteristics of national R&I policy mixes. The results of our analysis suggested that a variation in terms of cabinet attitudes for different authoritative instruments was present between alternative politically-oriented cabinet periods. Nevertheless, given the inherent tendency of the system to wipe out what previous governments have done, and to erase the legacy of previous cabinet policies, we are confident to state that our expectations were only partially confirmed.

Moreover, a striking feature emerging from our analysis suggested how, overall, different cabinet periods displayed a dominant share of preferences for instrumentations of a mission-oriented type, but ultimately used the available mix in a diffusion-oriented manner. This was consistent with the lack of political leadership in R&I policy design characterising the Italian case and, more generally, with the inability to design a long-term R&I national policy strategy.

The variety of national (formal and informal) institutional organizations in the R&I sector was said to influence the ability of research and industrial actors to produce knowledge and innovation, as well as of policy makers to invest and regulate the sector (Braun, 2008b; Chung, 2013; Smits et al., 2010). Italy had pursued an external ministerial coordination strategy, which hinged upon the division of policy making competences between the Minister of Higher Education and Research and the Minister of Economic Development, with the open possibility to involve different functional ministers on a case-to-case basis. Our analysis suggested, as also confirmed by the results of our interviews, how the country clearly displayed a governance issue in the R&I policy sector. More generally, this was characterized by a widespread confusion between goal and instruments, together with a blurred division of competences between different policy making institutions. Indeed, coordination between different R&I policy making institutions was left to the internal dynamics taking place within the cabinet and to the cooperative attitudes of individual ministers. These features further hindered the policy-making capacity necessary to design long-term national strategies and to prioritize R&I policy as a viable strategy for national development. That is why, often, the evolution of the national R&I

policy mix seemed to be made of fragmented day-to-day interventions, rather than a combined blend policy instrument.

The structures for interest intermediation were quite fragmented both on the public and on the private side; moreover, the experiences of public agencies in R&I sectors had always been marginal and characterized by a short life. R&I performers claimed that Italy was missing a unified political responsibility centre in R&I, and given their inability to coordinate intermediation between stakeholders, policymakers actually seemed to be prisoners of those powerful actors able to mobilize the necessary resources to fulfil their specific interests.

These characteristics, matched with a similarly fragmented panorama in the field of public research and higher education performers, consistently complicated the process of interest representation in the assemblage of different instrument mix. Indeed, on the one hand policy makers seemed to be loosely attracted by R&I themes, both for their political ambitions and as a strategy for national economic development. While, on the other hand, R&I performers seemed to be unable to raise their voice in the attempt to influence R&I policy making process.

9 Chapter 9: Conclusions

The ultimate goal of the present research is to shed light on the political dynamics taking place behind the scenes of policy design processes; by investigating actors' stakes for alternative trajectories of change and how these have been shaped along the formulation process into different instrument mix characteristics. We aimed first at exploring the variations in R&I policy mix (by testing our new instrument classification typology) then, through an analysis of the way actors interact, we shed identified the causal pathways which can help to make sense of the political process behind the selection of alternative instrument mixes. Indeed, the novelty of our contribution stands exactly on explaining how tools are selected from the perspective of the actors making the decision.

Policy making processes are said to be shaped by conflicts and compromises among involved interests, by the rule system inherited from the past, and by the formulation of different cognitive and normative framings (Palier and Surel, 2005). Consequently, in order to understand their internal dynamics, we decided to break up the influence that different combinations of ideas, institutions and interests could have in shaping their developments. We designed a theoretical framework which intersects insights on the role of ideas (as the impact of dominant framings in a given political system); the opportunity structures provided by the institutional system (internal coordination and specialisation between bureaucrats) and the role target population (the strategies for interest intermediation) plays in policy design process.

More broadly, this perspective helped us to understand how actors interact for the selection of policy instruments, and the way this process influenced the diachronic evolution of policy mixes. The comparative analysis between Italy and France sheds light on the different national policy design practices, showing the various strategies (and sometimes legacies) according to which national instrument mix were blended. When we focus only on how different national governments use their legitimate power to shape public action (e.g. instrument families) our two cases share many similarities in their aggregate policy mix characteristics. But if we look at the aggregate characteristics of how different instruments exercise social control (e.g. instrument shapes) and the relationships between policy makers and target population (e.g. delivery structure) our results display a greater variety. These differences reflect the alternative approaches the two countries have undertaken to interact with target population, as well as the different degree of political entrepreneurship and organizational capacity of national R&I performers.

This conclusive chapter is organised as follow; first, we will briefly summarize the most relevant historical events characterising the evolution of national R&I sector in our two cases as extensively discussed in Chapters 5 and 7. Then, we will review the aggregate evolution of policy mix

characteristics, with a perspective on the behavioural changes required to the target population in order to trace the evolution of national R&I strategies and deepen the comparative analysis of our two-case studies. Then, we will go through all the theoretical factors of interest we have identified in previous chapters, and we will assess their contributions in explaining different perspectives of policy instrument selection process. Ultimately, in the general conclusion of the chapter we will wrap up on our contribution to the scholarship in the field, and we will discuss alternative policy implications.

9.1   The historical evolution of the two cases

As already discussed in Chapter 4 the French and Italian R&I sectors, are two highly comparable systems, despite some of the different political choices that have characterized their evolution.

Indeed, both countries have a long history of public-owned enterprises in highly intensive R&I sectors, which was accompanied by a pivotal role of public research organisations. At the beginning of the 1990s both cases went through a process of disposal of state participations in many sectors of the national economy. For the Italian case, due to the absence of clear sectorial orientations, the system endogenously tended to favour those actors who were able to autonomously submit request for innovation projects, and above all those who were able to bear the costs related with delays in instrument activation process and funding provisions. That is why Italy is said to display strong weakness in its capacity to adopt mission-oriented polices (Onida and Malerba, 1990). Indeed, despite these vulnerabilities are well recognised also in official strategic documents, their implementation attempts have been unsatisfactory for now (Grilli & Mariotti, 2006).

Differently, in the French case the dismissal process took another path and policy-makers did maintained a greater extent of participation in specific sectors of national economy. As argued by one of our interviewees (INTERVIEWEE 17): in the nuclear industry the state didn't went through an economic disengagement process, because it wanted to keep strategic autonomy. Indeed, we believe that there are given industries where it is needed to preserve (state)competencies, also from a geopolitical strategic perspective. This is not the "classic" type of State control, it is rather supervision.

The following figure, chronologically displays the main events characterising the history of the R&I policy sectors evolution in our two cases.
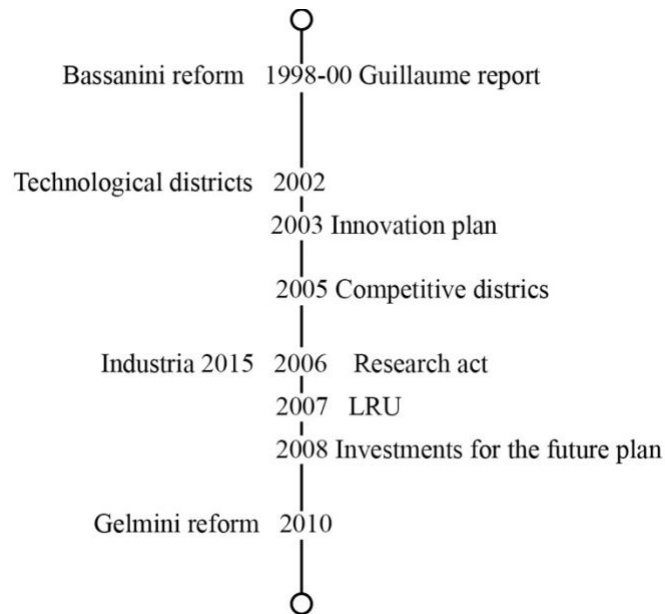
Figure 9. 1 The chronology of the two cases

In 1998 both countries systematically examined their research and innovation systems, through the report to the Parliament of the Minister of Higher Education and Research in the Italian case and with the *Guillaume* report in France; both triggered a reorganisation of national (and regional) institutions and of R&I strategic role for national economic development strategies. For the French case this process culminated in the drafting of the 2003 Innovation plan, followed by the Research act in 2006 and the Law on the autonomy of university in 2007[114]. While, in the Italian case the revision of national R&I governance found its place in the broader framework of a country-wide administrative reorganisation (the *Bassanini* package).

Looking at the chronology of national interventions in R&I it is possible to draw some parallels between the two countries. For example, in both "Industria 2015" and in the Investment for the future plan, national governments, either through the collaboration between ministers or the creation of a new organization (the French General Commissariat for Investment), policy makers identified specific technological and productive areas for R&I investments, while designing long-term strategies for national development.

Therefore, in both countries national governments detained the titularity to translate national objectives into R&I objectives. The Italian experience had a short life, because the underlining (soft) mission-oriented purpose of this strategy was modified by the newly elected cabinet (2008), which introduced the possibility to increase the number of sectors for investments (Traù, 2009). While, in

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[114] We already discussed in Chapter 5 about the timing and the drafting of these reforms.

the case of the Investment for the Future Plan the strategy was slightly reoriented and calibrated but it did manage to maintain a mission-oriented aim across different political mandates.

Moreover, both countries had quite developed records of interventions in the field of competitive clusters. In this sector Italy was the forerunner, since the beginning of the 1980s the organisation of production in traditional sectors of northern regions had progressively evolved towards a system based on districts. Over the years this format was expanded and consolidated also in other regions; it was accompanied by specific funding (e.g. Fund for underutilised areas, European structural funds) and legal provisions to simplify the division of competences between regional and national authorities. This design was replicated in 2002 by the Minister of Higher Education and Research, which established the "technological districts". These systems shared many similarities with industrial districts, despite the fact that the former was not limited to SMEs (also large technologically-intensive firms were called to participate) and it mainly relied on highly qualified human capital coming from public research centres.

The French cluster experience started in 2004 with the *pôles de compétitivité*, territorially-based competitive clusters aimed at fostering the synergetic development of specific sectors (or technologies) through an active partnership between members. These networks were territorially defined by the coexistence of an highly specialized industrial basis matched with research and education organisations that, through the establishment of partnerships, could have access to funding under privileged conditions and rebates on corporate and social taxes (European Commission, 2005a). Differently from the Italian case, the French industrial clusters were almost directly steered from central government, and the local base mainly represented the most suitable administrative level to implement such strategy. Indeed, already in 2008, the *pôles de compétitivité* became one of the main recipients of a public procurement-based instrument mix. Therefore, once again, France and Italy went through very similar policy design experiences, but in the first case these were mainly centrally steered, while in the latter a national framework was missing, and strategic choices were mainly left in the hands of regions.

Finally, both our cases implemented a reform of higher education system during the time frame under investigation. The French reform, the Law on the autonomy and responsibility of Universities (LRU), reduced the size of universities administrations councils, while increasing the role of their presidents. Overall, universities acquired greater budgetary and financial management competences of their institutions, together with that it became obligatory for them to sign a four-year contract (*contrat quadriennaux*) with the ministry of Higher Education and Research for a coordinated management of their strategies. The underlining logic of the LRU was to put universities at the centre of the system as the main operators of public research. This ran in parallel with the increasingly undermined role

of Public Research Organizations in terms of both funding powers, following on from the creation of ANR, and evaluation role, after the establishment of the AERES (Musselin, 2017).

The 2010 Italian reform (*Riforma Gelmini*) arose in a general climate were universities were perceived as "enjoying autonomy, without responsibility", in which pressures of similar reforms applied in other European Countries were adopted to promote similar changes (Capano, 2008).

As for the French case, the law modified the internal governance structure of universities, the provisions regarding the recruitment of researchers and professor as well as the power and competences of internal university organisation structures. The two reforms shared many similarities (e.g. increasing financial and managerial autonomy of universities; promoting a push towards a competitive-based funding provision) and they both represented a good example of external regulation in governing the national Higher Education sector.

This historical overview of the most relevant reforms our two cases had went through justifies our claim regarding the highly comparable nature of the French and the Italian R&I systems. These two countries share many similarities in their R&I policy-making experiences; however, if we narrow down the focus of analysis, it is possible to highlight the differences embedded in their heterogeneous paths of evolution.

9.2 The Evolution of the Policy mix

As discussed in previous chapters, policy instruments are said to be highly context dependent (Edler et al., 2016); therefore, the actors and the institutional contexts in which they operate become crucial in determining their effects (Flanagan et al., 2011). Decisions regarding policy design tend to be made in a nested context characterised by a complex regime of goals, related instruments and settings, in which new elements have to be adjusted within the existing framework (Cashore and Howlett, 2007). For all these reasons, even though instruments may be, in some theoretical or technical sense substitutable (any instrument could achieve any end), in practice they differ in a number of ways, making their selection a complex political matter (Howlett, 2005).

The typology of policy instrument classification proposed in this research aims exactly to put forward a more accurate classification of R&I policy instruments, considering both the behavioural and political characteristics embedded in different tools. Since, ultimately, instruments refer to the aspect of policy intended to motivate target population to comply with a policy, or utilize policy opportunities (Schneider and Ingram, 1993, p. 338); we believe that the relationship between decision makers and target population can help us to understand the underlining logic of instrument action. Indeed, even if some policy instruments might look similar in the ways they define, or approach, a problem, there will always be substantial differences not only in terms of the concrete details of how

instruments are chosen and designed, but also in terms of the context in which instruments are applied (Borrás and Edquist, 2019, p. 228).

Taking into account all these factors, the following series of tables summarize the characteristics of the French and Italian R&I policy mixes during the period under investigation.
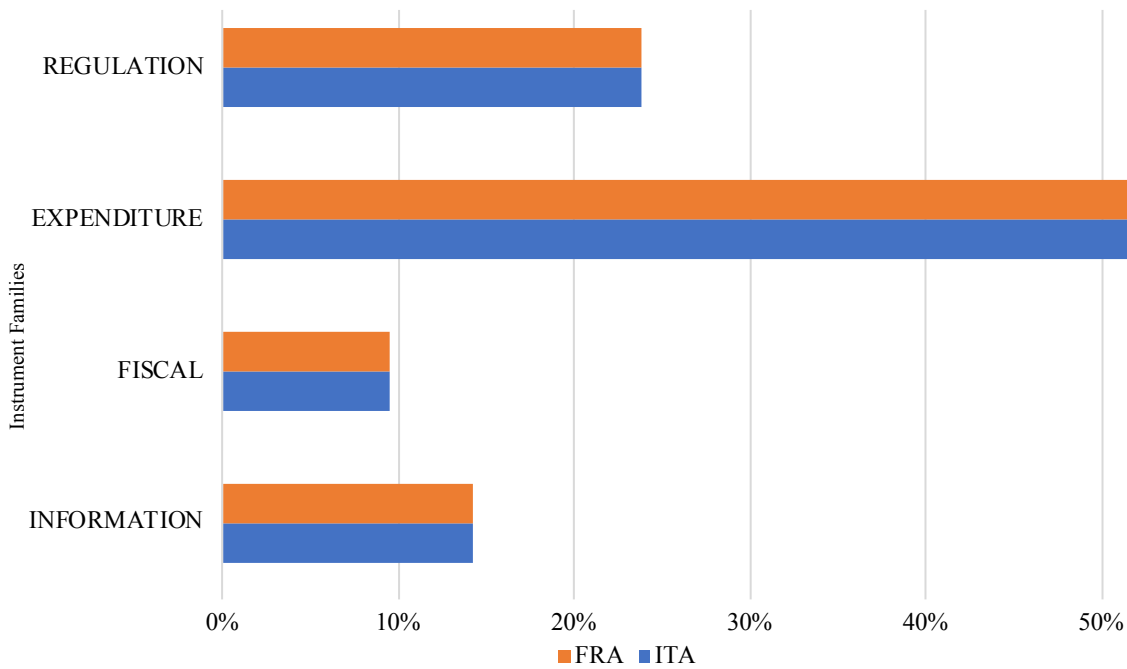

Figure 9. 2 Share of instrument families in France and Italy policy mixes

Before discussing this information, an analytical caveat is needed. The following tables display the frequency of different policy instrument components (family, shape, delivery components) across the two cases under investigation. Previous researches (Capano et al., 2019) have already demonstrated the extent to which the mix of instrumental shapes makes a difference regardless of the 'quantity' of shapes of the same family of substantial instruments introduced. Following on that, the scores for different instrument components in our tables do not show the aggregate frequency distribution of the shapes, but they rather focus on the frequency distribution of different combination of instrument characteristics (e.g. a specific combination of Family, Shape and Delivery). This choice was motivated not only by the results of similar analytical exercises, but also because the underlining

logic was to understand the relevance of specific instruments components across the overall policy mix evolution[115].

Figure 9.2 shows the distribution of instrument families across the R&I policy mix of France and Italy. As discussed in Chapter 3 these typologies show the way governments use their legitimate power to shape public action. From this perspective our two cases display similar results; characterised by a high share of expenditure instruments (more than 50% of the total mix), which is consistent with the underlining redistributive nature of R&I policies. This is followed by the regulation family (24%), information (14%) and ultimately fiscal instruments (10%). These results confirm the binary characteristics of our two cases and are substantially in line with the similar developments they have experiences in the R&I sector as confirmed by the chronological evolution of their policies (Figure 9.1).

However, each family of tool displays a high degree of heterogeneity regarding the way in which their basic inducement is moulded to obtain compliance from the target population; because policy instruments containing similar inducement principles can be actually applied in different ways (Vedung, 1998). Indeed, even if instruments can be grouped into families according to the degree to which governments use their power, each of them displays a high level of variation in their action content, meaning in the different extent of constraints they can enforce (Woodside, 1986). Because, in addition to social control, any tool embeds a particular way of exercising it, influencing how target population will behave, by privileging some actors and interest over others (Kassim and Le Galès, 2010; Lascoumes and Le Gales, 2007). Consequently, in order to acquire a deeper understating of how social control is exercised, and more broadly of the degree to which target population is free to choose alternative behaviours, it is necessary to focus on another unit of analysis, namely instrument shapes.

[115] Indeed, thanks to this approach it has been possible to clean up the effect of the layering of multiple similar combinations of tools on the diachronic evolution of instrument mix (which was extensively discussed in the case study analysis).
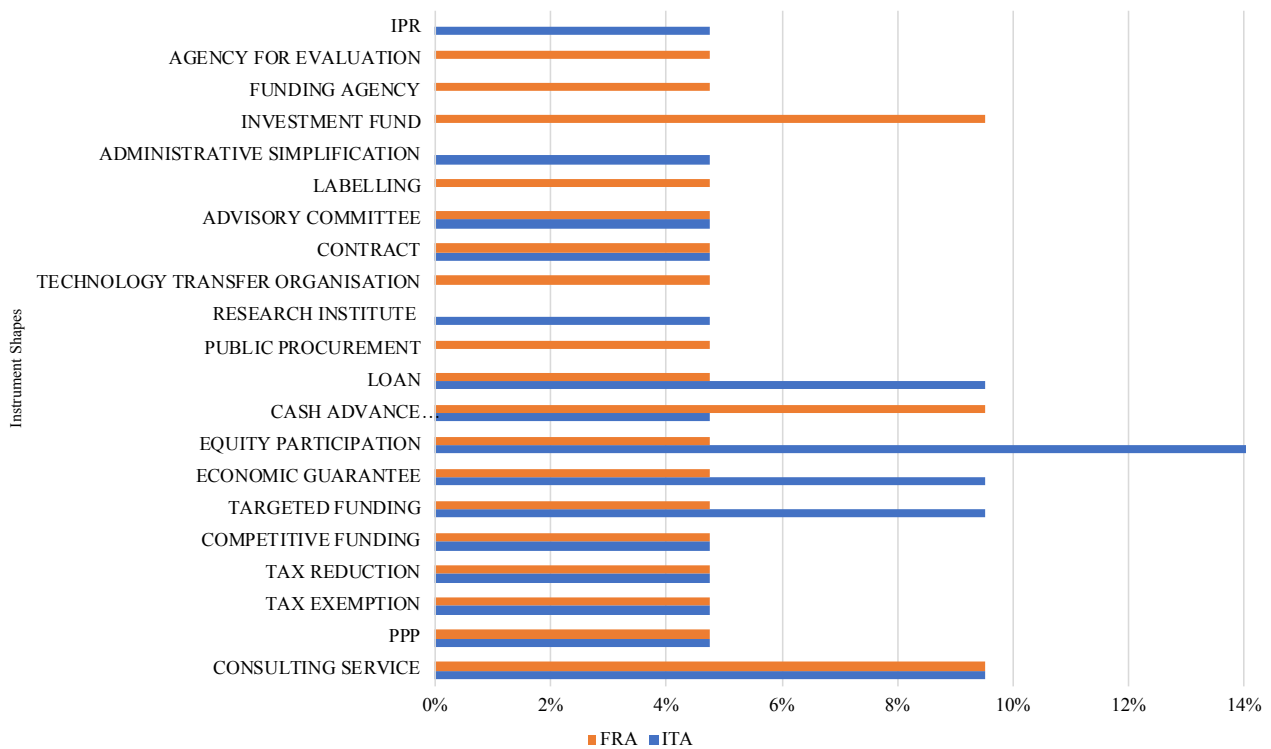
Figure 9.3 Share of instrument shapes in France and Italy policy mixes

The shapes are grouped by families (from the most to the least authoritative), and ordered from the most to the least coercive in Figure 9.3.

In this case our sample displays many differences in terms of both the type of shape and their coercive power. Indeed, the French policy mix is mainly characterized by highly coercive regulatory instruments (e.g. agency for evaluation, funding agency) and by highly coercive expenditure type of instruments (e.g. public procurement and cash advance). While, the Italian mix, despite containing a highly coercive regulatory shape, after the introduction of a new patent regulation legislation; it tends to be mainly oriented towards a mixed level of expenditure-based coercive shapes (e.g. equity participation, economic guarantee and targeted funding). In the bottom-half of the table the two countries tend to acquire more similarities, especially for what concerns the presence of less coercive expenditure shapes like competitive funding, and more heterogenous shapes of the information and fiscal families. Figure 9.4 focuses on the variety of delivery components which come together with the evolution of national policy mix.
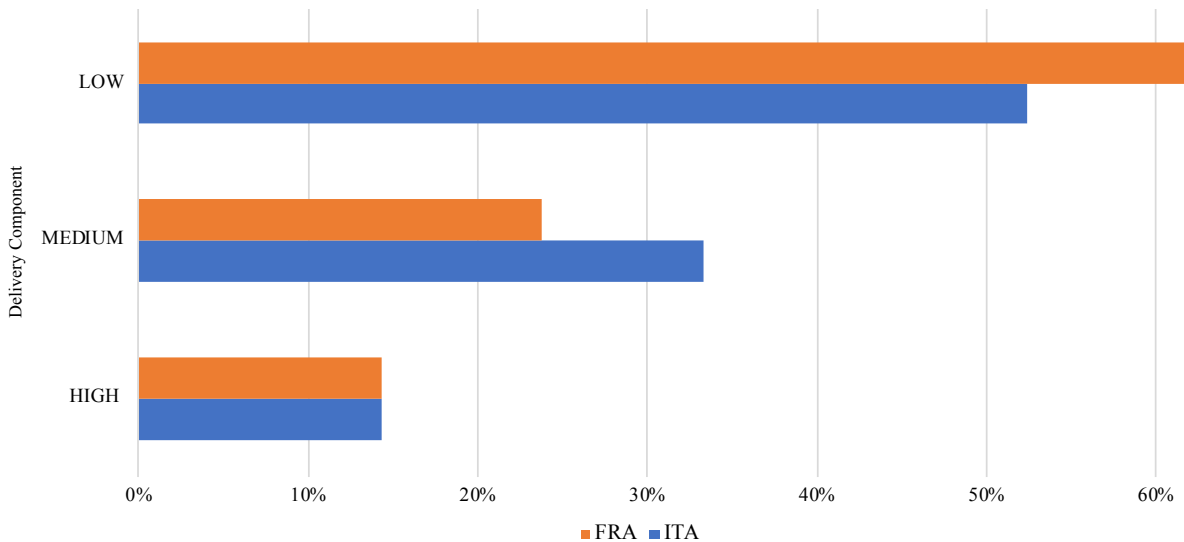
Figure 9. 4 Share of instrument delivery structures in France and Italy policy mixes

With delivery component we mean the type of governing arrangement accompanying each instrument, which basically substantiate the type of relationship between policy makers and target population. It provides insights on those actors who have the power to steer instrument action along the management process; describing the parties involved in a particular policy instrument management (Bouwma et al., 2017). The French policy mix is highly polarised between low and high automatic delivery structures. This pattern basically recalls a governance arrangement in which instrument activation process is either in the hands of policy makers (or their supervised public agencies) or left to existent organizational structures like the market or the fiscal system. Similarly, Italy displays an equal share of highly automatic delivery; while medium components exhibit an increase in the representativeness at the expenses of a reduction in low automatic delivery.

In this case the governance arrangement is more evenly distributed among the three typologies, with an interesting 33% of mixed delivery structures, which portraits the increased relevance that private banking sector has acquired as intermediary actor in the governance of Italian R&I national instruments.

Overall our two cases display a similarly sophisticated instrumentations, nevertheless it is worth to highlight how when focusing only on the authoritative components of instrument families the two policy mixes look the same; while, when looking at the distribution of shapes and delivery structures this similarity is consistently attenuated.

These evidences support our main theoretical claim regarding the necessity of a more accurate instrument classification typology, which needs to be able to grasp the constitutive differences embedded in instruments shapes. Indeed, ultimately, these characteristics define the essence of social

control exercised through public action, while shaping the relationship between policy makers and target population. Therefore, if we want to understand the way in which different "techniques of governance" affect the reality in which actors interact, a focus on the different shapes and delivery structures seems to be needed.

As discussed in previous paragraphs, our two cases have followed a binary path of evolution on their R&I policies; however, if we look at the specific dynamics characterising these developments, their constitutive differences seem more evident. Likewise, they display a high degree of similarity in the distribution of their instrument families; while, when looking at instrument shapes and delivery structure they display a highly differentiated pattern. Consequently, France and Italy can be said to share many similarities concerning the degree to which governments use their legitimate power to shape public action; while they undertook different strategies with respect to the way social control is exercised (instrument shape) and the preferred type of governing arrangements accompanying policy instruments (delivery component).

Another great difference between the policy mix evolution of our two case studies is the additionality effect of different policy instrument components, so the way instrument mix are diachronically shaped, and eventually re-calibrated.

In the French case it is relevant to highlight how, despite changes in the Prime Minister (or in the President of the Republic), many proposals for reforms displayed a high degree of continuity like the case of the proposal for Higher Education reform put forward by Luc Ferry in 2003 and the ultimate shape of the Law on the Autonomy and Responsibilities of universities finally approved in 2007. Despite the initial fragmentation of national strategies, as reported in the analysis of the Guillaume Report, it is possible to trace its overtime evolution towards the design of long-term national R&I missions. Differently, the Italian case is much more fragmented, R&I policy mixes are mainly designed through one-off interventions approved in the framework of various budgetary laws. As argued by our INTERVIEWEE (10), this pattern doesn't only create redundancies, which sometimes lead to the overlapping of similar instrument shapes; but it especially creates confusion on the target population which tend to be lost in the jungle of very similar tools at their disposal.

Therefore, even though the two countries share a stable centre-of-government R&I structure (as displayed by the similarity in instrument families Figure 9.2); the Italian case suffers from an inherent fragmentation and duplication of instruments, that is matched with a scarcely effective monitoring and the uncertainties related with the implementation process and availability of resources (Potì and Reale, 2011). Therefore, if we interpret layering as a "mode of designing institutions through which policy makers intervenes additively to affect related behaviours" (Capano, 2019 p.5), we can differentiate the layering for equilibrium pursued in the French case and the attempts of layering for

change characterising the Italian context. Indeed, in the former, experiences like the evolution of the Research Tax Credit (*Crédit Impôt Recherche*) and the Incubator and Technology Transfer Organisations (see Chapter 4), suggest an underlying design logic aimed at chasing coherence through the stratification of multiple (often similar) instruments. Whereas, in the Italian case the systematic tendency to design one-off instruments, approved in the framework of broader national decrees, allude to an attempt to trigger changes by exploiting the window of opportunity provided by systematic national policy design practices, like the drafting of the yearly budgetary law, rather than to a broader systemic logic.

9.3 Ideas

Innovation rarely represent a goal in itself, but rather a means to achieve broader political goals. National R&I strategies represent one of the instrumental paths through which governments attempts to reach these wider purposes, by means of meso-level innovation goals. Consequently, how these objectives have to be translated into innovation-intensity targets, and the way in which these interventions should be balanced represent a relevant political matter (Edquist and Borrás, 2013).

Therefore, it is plausible to expect that different actors would have different stakes with respect to the positive (or negative) spill-overs various interventions can trigger. Meaning, the choices of alternative designs for public policy interventions in R&I should represent the result of different political framings concerning both problems interpretation and the expected benefits from the application of a given set of policy instruments.

The existent literature displays a clear shortcoming regarding the relevance that political ideas can have in shaping the design of R&I policy strategies, many studies overlook its relationship with party politics and more generally with government ideology (Bergek et al., 2015; Bhattacharya et al., 2017; Wang et al., 2019). We know that the political context can differently influence the availability of financial resources for investments in R&D (Bergek et al., 2015), but it is still unclear how do party politics preferences influence policy-makers attitudes in selecting specific R&I policy instrument characteristics. Therefore, with our analysis, we aimed at investigating this type of decisions, using as a proxy policy instrument characteristic; more broadly, we were interested in understanding how do the political preferences of different cabinet periods influence the formulation of national Research and Innovation policy strategies?

We also know that problem-solution framings tend to cluster in long-term paradigms, acting as a lens that filter information and focuses attention on specific issues (Wilson, 2000). Consequently, different framings can be able to influence various sets of social and political values, interpretations of the reality and images of target population, shaping the characteristics of the overall governance

arrangement (Capano and Lippi, 2017; Edler et al., 2016; Sanz-Mendez and Borrás, 2001). That is why, during our investigation, we also focused on explaining how governmental instrument mix preferences have evolved against different cabinet periods and the feedback effects related with the accumulation of long-lasting institutional aims attached to different dominant R&I paradigms.

Our two cases reflected different traditions of cognitive legacies in the R&I; specifically, France can be assimilated with the mission-oriented tradition while Italy with the diffusion-oriented. Consequently, we expected that in the first case it was more likely that governments would display preferences for a more authoritative and less automatic policy mix; while, in the diffusion-oriented case, we expected that cabinet preferences would rather cluster towards less authoritative and more automatic instruments.

As discussed in Chapter 6 and 8 our expectations were only partially confirmed.

Indeed, in the French case the path dependent effect of mission-oriented R&I paradigm seems to be predominant on the evolution of cabinet R&I instrument mix preferences. This is also confirmed by the dominant trend of preferences for more authoritative and less automatic instruments.

Therefore, policy instrument selection process seems to be truly linked to the nature of the general governance context and long-term cognitive legacy embedded in the history of national R&I strategies. And when policy makers have to decide on how to shape the existent mix, given the system of interests and institutions set into force by previous choices, they seem to prefer falling back on consolidated strategies, rather than breaking the path with innovative solutions.

Differently, in the Italian case, the path dependent effects of the diffusion-oriented legacy don't seem to influence the evolution of cabinet preferences for different R&I instrument mixes.

Indeed, at first glance, the distribution of preferences seems to be more in line with a mission-oriented ideal type, given the average high share of highly authoritative and not automatic instruments types, rather than with a diffusion oriented one. If we read these results together with the data on Governmental Budget allocation for R&D according to the sector of investment (see Chapter 4 on case selection) it seems as if Italy shows a dominant preference pattern for an instrumentation of the mission-oriented type but, ultimately, it uses the available mix in a diffusion-oriented manner [116].

Moreover, since we were deeply interested in understanding the relevance that different political ideas could have in shaping the design of R&I strategies, we investigated the extent to which the characteristics of different cabinet turnovers would likely influence the evolution of governments' preferences for policy mix features. We expected a trade-off between the willingness of new

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[116] Some examples of this mismatch can be found in our data, as in the case of Figure 8.2 for D'Alema I and Prodi II cabinet, were automatic and not automatic instruments score the same share of preferences. Since different degrees of automaticity in the delivery structure of policy instruments mirror the extent of public resources necessary for instrument management, this tells us the highly ambivalence of different policy instrument application.

governing parties to modify the dominant policy style into force and the room for manoeuvre they had given the legacy inherited from previous governments. Specifically, we hypothesized that the more similar the political orientations between incoming at outgoing governments, the less authoritative would be the diachronic evolution of instrument mix preferences.

The trend displayed by the French case doesn't completely confirm our expectations. Indeed, an alternation of different politically-oriented policy mix preferences seems to be meaningfully present; however, this is also consistently subject to internal national political and electoral dynamics. Nevertheless, these results are symptomatic of the related political payoffs that alternative choices in the design of national R&I strategies can play in the party politics battle field.

Similarly, also in the Italian case some variations for differently authoritative instrument mixes are present, even though we cannot straightforward connect these results with cabinets' turnover because of two specific features characterising national R&I policy design. The first is related with the general low political salience of the issues: R&I issues have never been a priority for Italian governments, and they have neither been central in their decision-making agenda (INTERVIEWEES 7-10-11). Indeed, the Italian cultural landscape has historically displayed a generally widespread negative outlook toward science and technology (Nuvolari and Vasta, 2015, p. 282).

The second factor refers to the inherent tendency of the system to wipe out what previous governments have done. Newly elected governments tend to find hard to explain to their own majority that there is no need to go back to square one every mandate, and that what is needed it simply to forge ahead, to adjust what has been previously done (Bassanini, 2009). Consequently, the alternation trend among different cabinets, should be read under the light of the general tendency to destroy the legacy of previous cabinets, rather than the specific political salience of R&I issues.

In both cases, the authoritative component of policy mix preferences is somehow influenced by political variation in the governing party. For what concern the path dependent effect of long-lasting R&I cognitive framings, their influence is evident in the French case, which displays an overtime evolution in line with our expectation. While, for the Italian this effect is less evident and it is somehow intertwined with some cultural and political peculiarity related with national R&I policy design practise. Overall, from our results it emerges that the politics of R&I does not mirror traditional cleavages and that its political salience is highly context dependent.

9.4   Institutions

Traditionally, Research and Innovation issues lie within the remit of different ministerial responsibilities, whose task division varies according to different national contexts (Edler et al., 2016; Edler and Fagerberg, 2017). From an institutional organisation perspective, R&I policies (like for

example climate policies (Van Asselt et al., 2015), migration policies (Scholten et al., 2017) and health care policies (Trein, 2017)), stand at the intersection of "classic policy sectors". The way in which national R&I responsibilities have been organized mirrors different national specificities reflecting their institutional systems, the different framings of R&I issues and of related policy strategies. Since ministerial organisation is not strictly determined by law, for the most part different structures tell us how national governments have differently framed policy problems and the political priorities to be tackled (Peters, 1998).

The literature recognizes the influence the variety of national institutions, and inter-institutional, networks play in shaping the ability of research and industrial actors to produce knowledge and innovation, as well as the set of problems related with policy areas characterised by the integration of different responsibilities, like the case of R&I policies (Braun, 2008b, 2008a; Chung, 2013; Edler and Kuhlmann, 2008a; Griessen and Braun, 2008; Koch, 2008; OECD, 2005; Pelkonen et al., 2008; Smits et al., 2010). Our contribution builds on these evidences and attempts to move forwards the focus of analysis, in order to investigate how the different morphologies of formal (and informal) ministerial organisation patterns have influenced the ability of policy makers to design instrument mix able to consider multiple traditional subsectors of public action. More specifically: how did the internal policy making ability in R&I policy sector was challenged by the underlining necessity to integrate different policy responsibilities? And, to what extent did different policy mix choices addressed (un)balanced or (un)coordinated blend of instruments to their targets?

Both our cases pursued an external specialisation pattern. Indeed, their R&I policy competences lie under the remit of the minister for Higher Education and Research, and the Minister with economic competences (called Minister of Economic Development in the Italian case, and Minister of Economy and Finance in the French case). Consequently, since the success of this institutional organizational structure is highly dependent upon the ministerial capacity to create dialogue among different policy responsibilities, we expected that countries undertaking similar ministerial specialization strategy would likely adopt similar coordination practices

France and Italy have been historically characterized by a high level of institutional fragmentation in the R&I sector. In the first case, higher education and public research structures have a mixed nature, involving three different (and sometimes conflictual) actors, the *Grandes Écoles*, Universities and Public Research organisations. Moreover, functional ministers, often closely related with one of the above-mentioned actors, still play an important role in the allocation of funding for public research (Lepori et al., 2017). Similarly, in Italy, dating back to the era of state owned enterprises, decisions concerning national industrial strategies were taken by two different ministers that were often in conflict, the ministry of Industry (established in 1948) and the ministry of state-holdings (established

in 1956) (Maio, 2014, p. 248). Moreover, as for the former case, also functional ministers do play an important role in the evolution of the sector, by contributing to the research mission of their controlled Public Research Organisations.

In line with the high degree of similarities France and Italy show in the dynamics characterising R&I policy responsibilities distributions, they also experience a deep divide in the framings of R&I issues by ministers with joint responsibilities. Indeed, the different ministers involved seem to perceive their responsibilities according to a linear understanding of the innovation process, where one minister deal with research, while the second has the titularity over the experimental development phase, and eventually its market application (INTERVIEWEES 5-21-17). Accordingly, different ministers with integrative R&I competences are also perceived as having two different and separate constituencies. Indeed, the Minister with research responsibilities refers to PROs and universities, while the Minister with competences in economic development is mainly oriented towards helping enterprises and the innovations developed by them (INTERVIEWE 17).

So, given the combination between different institutional perspectives on R&I issues, and the different constituency-based nature of this relationship, policy-making coordination[117] practices have not always been a smooth process. The following Table 9.1 summarizes the coordination practices implemented by our two case studies.

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[117] Here coordination can be intended as the spectrum of activities in which one party alter its own political strategy to accommodate the activity of others in pursuit similar goals (Zafonte and Sabatier, 1998, p. 480).

FRANCE	ITALY
The Civil Budget for Research and Technological Development -BCRD- (1997): It was a budgetary platform defining the credit for public research within a single procedure. Autonomously led by the minister of Higher Education and Research, leaving the possibility for sectorial ministers to participate in the definition of the budget. Its relevance as an instrument for interministerial coordination should not be overestimates. Because, when a specific research sector was deemed as strategic for a given ministry, this had the possibility to negotiate directly with the minister of finance.	**National Research Program -PNR- (1998):** It was a document which programmatically defined national strategies for R&I, by identifying the activities to be promoted (almost) every 3 years. It was formulated by the MIUR after an extensive consultation with the actors of the innovation system.
Constitutional Bylaw on Finance -LOLF-(2006): It provides a common framework for budgeting procedures in the field of R&I by creating an interministerial mission for Research and Higher Education (MIRES), widening the scope of BCRD. The minister responsible for research was in charge of coordinating government action among different ministers. But it didn't provide any obligation for joint programming, so each minister could participate in the mission simply by including its autonomously designed program.	**Inter-ministerial Committee for Economic Planning -CIPE- (2006):** National Committee in charge of coordinating and planning national economic policy. It represented an additional forum, a director table, in which ministers with R&I competences could gather to discuss about national strategies (especially funding allocations) under the coordinating role of the PM and the Minister of Economy and Finance. In 2006 it has been transferred under the PM office, to strengthen its role as coordinator while re-centralising the control over the interministerial policy making practices.
National Strategy for Research and Innovation -SNRI-(2008): It was a bottom-up priority setting process involving public research, business and civil society stakeholders, to identify the main Social Challenges national R&I policies should be directed at. The investment for the future plan (for the 1_{st} wave of application) was in line with these priorities.	
Commissariat Général à l'Investissement **(CGI):** National Committee with the task of managing the implementation of the Investment for the Future Plan. It coordinated interministerial policy design under the authority of the PM as well as the cooperation among other governmental bodies responsible for the distribution of funds. It ensured the transparency and quality of the selection procedures, the allocation of funds to existent operators, as well as the overall coherence of the strategy.	

Table 9. 1 Coordination practices in France and Italy

In the French case there has been a first attempt to coordinate policy making with the BCRD where, despite the role of formal coordinator attributed to the Minister for Higher Education and Research, different functional ministers preserved enough power to develop their own strategy, sometimes nullifying the cooperative effort of the whole platform (Cytermann, 2006). Similarly, in the MIRES, despite the introduction of an integrated monitoring, each functional minister preserved its own budget, and competences, over the design of individual research strategies (OECD, 2014). Therefore, the programs making up the strategy clearly mirrored different functional research competences showing how actually the dialogue between project managers (ministers) remained consistently unstructured (Cytermann, 2006). Also the binding power of the National Strategy for Research and Innovation was quite limited, to the extent that it was not set at the operational level, and it didn't allocate budget, circumscribing its action to the provision of thematic guidelines for R&I national themes (OECD, 2014). Under the Sarkozy presidency, within the framework of the Investment for the Future Plan, a new layer was added to the complex national governance of the system, through the creation of the General Commissariat for Investments (CGI). Rather than a pure instance of coordination, this committee was much more an attempt to re-centralise some of the R&I policy making competences under the authority of the Prime Minister[118]. In line with the priorities identified by a group of experts, the CGI managed the enactment of the Investment for the Future Plan, but it didn't provide any explicit attempt of coordination or interaction with the other ministers involved in the R&I national effort (Lepori et al., 2017).

In the Italian case any common budgeting procedure among ministers involved in R&I was implemented. The PNR mainly concerned the definition of broad national goals, and it did not provide any direction regarding the effective implementation of different measures. Moreover, the lack of financial commitment to the multiannual strategies defined in the document has often resulted in unrealistic targets (Nascia and Pianta, 2013, p. 24) and unsatisfactory implementation (Grilli and Mariotti, 2006). The formal titularity of the MIUR in drafting this programmatic document didn't assigned any coordination power to this actor; consequently, as supported by our interviewees, this centralization of competences didn't seem to provide any effective results in terms of coordination among the ministers involved (INTERVIEWEES 10-7-9). In the case of the CIPE, despite its re-centralization under the Prime Minister office, this committee tends to mirrors the political dynamics internal to the current cabinet organisation; therefore, it represents only a formal, rather than an effective, coordination table among ministers (INTERVIEWEES 11-3-5).

[118] As argued by one of our experts: "with the CGI they didn't create coherence among the organizations involved, but rather competition between ministers and the PIA" (INTERVIEWE 15).

Consequently, our expectations regarding the similarity of coordination practices adopted by countries undertaking analogous ministerial coordination practices were confirmed. Indeed, both France and Italy pursued similar coordination strategies which didn't actually implemented any binding obligation to the ministers involved in R&I policy design.

Moreover, both countries have tried to recentralise their coordination powers. First Italy, with the mild attempt to bring the CIPE structures under the Prime Minister office; then France adopted a similar strategy by adding a new layer to the complex national governance of the system with the creation of the General Commissariat for Investments.

As suggested by the literature, the most relevant drawbacks of various ministerial coordination practices are related with the fact that normally, these decision-making venues, do not have their own organizational identity, and they tend to be an arena for exchanging information dependent upon the political will of singular ministers[119](Braun 2008a); rather than an effective policy-making laboratory.

Consequently, as confirmed by our interviewees (INTERVIEWE 9), the coordination among minister is left to the internal dynamics taking place within cabinets, and to the political attitudes among ministers.

Indeed, when coordination was reached (e.g. in the case of Industria 2015 for Italy; in the case of Research and Innovation act and of the Innovation plan for France[120]), this was due to either the entrepreneurial capacity of a specific minister or to the collaborative attitude between individuals in charge of different ministries. These dynamics are symptomatic of a failure in the national governance of R&I, because if the ability to design R&I policies is left in the hands of the entrepreneurial attitudes, and individual willingness towards collaboration, of each minister this means that the architecture of the system is not solid enough to function autonomously (INTERVIEWEES 9-10-17-21).

In the Italian case this can be read as one of the cofounding drivers of the fragmentation and duplication characterising national R&I policy mix evolution. Indeed, when a set of very similar, and poorly defined, competences is established among ministers of an equal institutional weight, it becomes difficult for one minister to take the lead. This would likely increase the tendency for these two actors to work autonomously and to ultimately design very similar instruments. A systematic institutionalisation of these dynamics can further hamper the policy-making capacity to design long-term national strategies and to politically prioritize R&I issues as a possible strategy for national development.

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[120] As confirmed by our interviewee (INTERVIEWEES 8-9-10-15).

Differently, France has tried to overcome the impasse of R&I ministerial competence divisions by creating a new institution, the General Commissariat for Investments, which had become the pivotal actor in the management of the Investment for the Future Plan. Indeed, Musselin (2017) argues that as a result of the increasing relevance of the Commissariat, the Minister for Higher Education and Research was increasingly marginalised and deprived of the control over some of its necessary means of intervention. This approach seems to share many similarities with the strategy of layering for equilibrium generally pursued by the French case in the R&I policy design. Indeed, the CGI was introduced "above" the complex system of interaction between ministers and R&I performers, which was almost preserved, and smartly circumvented through the leadership role of the new committee. This allowed to recentralise the identification of national priorities for the development of R&I strategies, without creating any effective and organic link with other ministerial strategies (OECD, 2014).

9.5 Interests

In policy making activities requiring technical competencies and skills that decision makers cannot provide by themselves, like in the case of knowledge or technological intensive activities, decision-makers are likely to rely on the collaboration of external actors (Guston, 1996). This suggests how in R&I policy design practices it has increasingly become necessary to consider that governments are not anymore simply and unilaterally authoritative, but they are instead dependent upon the action, acquiescence or support of others, which they do not directly control (Bressers, O'Tolle, 1998; Goetz, 2008; Salamon, 2012; Glasser, 2008 in Nauwelaers, Wintjes, 2008; Mazzuccato, 2017).

These dynamics are in line with some of the arguments illustrated for environmental policies (Kammermann, Ingold, 2019; Ingold et al., 2018; Dermont et al., 2017; Gross, 2007; Varone, Aebischer, 2001); according to which also the preferences of target population become important, to the extent that the lack of stakeholders' support, or legitimacy, for the behavioural change proposed by a new instrument can hamper cooperation and undercut successful implementation.

Indeed, when actors are cooperating to produce a public good (like knowledge), some extent of preference alignment between the principal and the agent is needed, in order to limit free-riding behaviours (Braun, 1993)[121]. On the one hand, this provides R&I performers with the power to shape the final instrument mix and to steer policy design process towards their expected benefits. While, on the other hand, a portion of this population can miss the opportunity to see their interests represented, because of their incapacity to identify shared needs and behave as a political constituency.

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[121] This is what Trein (2017) in is framework of analysis defines as actor responsiveness

Consequently, in addition to the internal ability of policy makers (e.g. coordination of ministerial responsibilities), we also have to consider their capacity to account for the characteristics of their target population, which will ultimately influence the design of the right inducement. Therefore, also policy recipient matter, but since their heterogeneity in R&I sector we still know little about their strategic behaviours. For these reasons, it becomes relevant to investigate: How do target groups relate to the policy process and the actors involved in these dynamics? And to what extent do the different strategies of interest intermediation influence the characteristics of the instrument mix selected?

To overcome these uncertainties, and in the attempt to institutionalise potential conflicts, policy makers have developed different strategies which rely on the design of intermediary agencies, who can help to translate political guidelines, or thematic priorities, into different practices (Glasser, 2008 in Nauwelaers, Wintjes, 2008). As discussed in previous chapters, these actors acquire different morphologies according to the number of principals and agents they are related with. Moreover, there are also cases in which any intermediary institution is provided and ministers dialogue directly with target populations.

Therefore, we would expect that different combination between R&I performers able to collectively mobilize their resources, and institutional fragmentation among decision-makers (e.g. coordination problems between R&I ministers), will likely impact the characteristics of the instrument mix. Specifically, the higher the capacity of target population to nullify or alter the policy process, and the more severe the institutional fragmentation is, the more likely it will be to have more permissive (less coercive shapes) instruments and a greater R&I performers' power in the management of their activation (more automatic delivery structure).

Our two cases show very different attitudes with respect to the intermediation strategies adopted to interact with target population. French R&I policy making has an extensive record of consultations with R&I performers (as discussed in Chapter 5). These practices are closely related with the inherent heterogeneity of actors populating the system in terms of institutional characteristics, powers and functions; which often mirrors clear divides in their capacity to influence policy process. The national public research landscape looks quite unbalanced, on the one hand, universities seem to be "less powerful" because they are dispersed across the national territory; whereas PROs, essentially financed by the state, are organisations with a structured network of national laboratories, which allow them to design a well-structured national strategy (INTERVIEWEES 21-17).

This divide is not only functional, but to some extent also cultural122, to the extent that this cleavage was also present in the movement (SLR) against the 2006 Law on Research. A push towards changes in their power balance was given by the 2007 law on the autonomy and responsibilities of universities, which aimed to put universities at the centre of the system as main operators of public research (Musselin, 2017), while moving from a fully-block funding based research system towards a system in which funding for research were also assigned on a competitive basis. Nevertheless, this shift was only partial, and short-lived, because as reported by Lepori et al. (2017) the overall importance of project funding in the French public research system is rather low, and Public Research Organisations get back to a pivotal role in the management of public funding.

In the Italian case, formal consultations with key stakeholders are performed on a regular basis, however their involvement is still partial and has only limited influence on policy making (European Commission, 2006). Indeed, as suggested by one of our experts (INTERVIEWE 4) the inability of national policy makers to coordinate different actors, and the lack of long-term political vision, make decision makers prisoners of actors (e.g. business or powerful research centres) supporting their specific interests. Nowadays, there is a lower tendency toward the dialogue between ministers and R&I performers and if that is strictly needed, these practices are kept at the institutional level.

Contrary to the French case, the Italian R&I system is characterized by an endemic fragmentation in the representation of R&I interests on both the public and the private side. Indeed, as suggested by our interviewees (INTERVIEWEES 8-4) universities, together with PROs, do not manage to represent a dynamic actor in R&I policy making, there were some important research centres but overall, they weren't powerful enough to guide the design of a policy and to be a stable interlocutor of the government.

The panorama on the side of the industrial and business actors seems to reflect a similar endemic fragmentation, as well as a greater similarity among our two cases. In the Italian case the representation of the industrial world hinge upon the General Confederation of Italian Industry (Confindustria), an association with voluntary membership, representing companies, their values and interests, at the institutional level. Nowadays this organization is facing some consistent challenges in terms of representativeness (INTERVIEWEES 8-11). There seems to be a widespread perception

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122 As argued by one of the experts we interviewed (INTERVIEWE 13): *"it is necessary to understand that in France universities didn't use to be relevant institutions. Differently from other countries, the executive élites are not trained within universities. This is historically related with French Revolution, at that time universities were related with the church. Since the revolution was anticlerical, we have created new élites detached from the church, with the creation of the Grandes Écoles; which has been enhanced during the Napoleon era, and in 1945 with the creation of ENA. Therefore, French bourgeoisie trains their children in the Grandes Écoles, not at universities. In these institutions the goal is not to "learn to do" but to "learn to learn", therefore French élites tend to be quite detached form research and science (with the exception of some highly-research intense Grandes Écoles institution e.g. École Normale Supérieure or École Polytechnique)".*

regarding the increasing incapacity of Confindustria to catch the requests of big enterprises in the field of R&I, which has been somehow translated into a greater attention towards the needs of SMEs and a greater autonomy of bigger enterprises in their innovation-related investments. All of that is also reflected by the fact that when designing policy, in addition to the dialogue with Confindustria, ministers organizes also one-to-one meetings with representatives of big enterprises (INTERVIEWE 5). Similarly, in the French case, interest representation from the business world is organized around the MEDEF, the largest employer's federation in the country. This organisation mainly represents SMEs because, "big enterprises tend to run their business autonomously" (INTERVIEWE 20). Indeed, these actors can rely on the lobbying of the MEDEF as a forerunner but, as for the Italian case, they can also interact personally with the Ministry[123]. Consequently, in both cases, business interests' representation is organised according to specific organisations, but the overall decision-making structure is biased towards the direct intermediation strategies adopted for dialoguing with big enterprises.

9.5.1 Intermediary agency VS ministerial intermediation

The creation of an intermediary agency, represents a strategy to externalise the management of specific governing tasks in the effort to fulfil greater neutrality and professionalism. The French case has extensively developed this approach in order to design, and implement, its R&I instrument mixes. One examples of this practice is the National Agency for Research. It was established in 2005, with administrative and financial decision-making autonomy, under the supervision of the Minister of Higher Education and Research[124]. Its mission concerned the funding of research performers, according to the thematic priorities identified by the government. The expression of concerns from the research community (and the protests of researchers as discussed Chapter 6) regarding its power to establish thematic priorities for French public research, paved the way for some changes in its governance, with the introduction of the "Alliances[125]" in 2010. Despite the initial inflow of funds, and the organizational flexibility provided in the design of thematic priorities, the ANR has struggled to find its position in the French R&I system that according to the OECD (2014) remains sensibly weighted towards PROs.

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123 As we described in Chapter 6 with the example of the tax credit for research (*crédit d'impôt recherche*).

124 The agency took over the support actions previously financed through the FRT and FNS; subsidizing basic and applied research undertaken by public research organizations, universities and SMEs; as well as some direct institutional funding to research laboratories (Arnold, 2007; Lepori et al., 2017).

125 These were coordination institutions bringing together different public stakeholders in a given research domain to enhance coordination (Zaparucha, 2010); they took part at the programming of agency and played a role in the priority setting exercise.

In the field of the valorisation of research for the industrial system, and more broadly public support to SMEs, a public agency was in place since 1967: the ANVAR. Its activities were combined with a specialised financial institution (SOFARIS), which managed CDC[126] guarantee fund for the development of SMEs. In 2005, almost in co-occurrence with the creation of competitive clusters, these agencies were merged into a unique organization OSEO, a holding company owned by the state mainly reporting to the MINEFI.

This agency rationalised the structure of innovation support for SMEs, and it became the main operator in charge of managing and implementing the measures established by the government (European Commission, 2005a). Its nature has been evolving over time, first with the absorption of the industrial innovation agency (2008), then it was in turn incorporated (in 2013) within BPI France (a public investment bank financing innovation activity through a different portfolio of actions).

Differently, the Italian case doesn't envisage any specialized agency. There have been some attempts to establish specific actors with similar competences[127], but their role has always been marginal, also because of their short life.

National R&I policies are steered directly by different ministers involved, under the supervision of the parliament. Consequently, there seem to be a high degree of dependency upon the political volatility, and the frequent cabinet reshuffles, characterizing the national political system at large.

There used to be a quasi-agency actor in the public research sector, the National Research Council (CNR), which played a double function, as both a research funder and performer. It managed the administration, and selection, of research projects financing free grants devoted to individual researchers, while carrying out its own research activities through strategic projects.

With the establishment of the Minister of University and Research in 1989, and the implementation of the Bassanini reform[128], the instrument mix was reorganised with the aim of recentralising responsibilities for project funding in the hands of the MIUR, together with a re-organisation of the existent public research institutions. Consequently, the CNR went through a consistent administrative reorganisation process, and its coordination functions were progressively moved to the MIUR. Despite the contrasting views (also among our interviewees) regarding the titularity, and the effectiveness of CNR activities, there is a widespread agreement concerning the empty space left by this reform, which didn't provide any other actor able to represent a unified political responsibility centre to whom different stakeholder could raise their claims and suggestions (INTERVIEWEES 7-10-9).

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[126]The Caisse des Dépôts et Consignations (Deposits and Consignments Fund) is a state bank which funds companies and it is heavily involved in innovation and SMEs financing (OECD,2014).
[127] Like Sviluppo Italia and the National Agency for the Diffusion of Technologies for Innovation.
[128] Ministerial Decree MIUR 593/00

Overall, the structure of interest intermediation between decision-makers and R&I performers were quite fragmented in both our two cases. In the Italian case, on the one hand policy makers seems to be loosely attracted by R&I themes, both for their political ambitions and as a strategy for national economic development. While, on the other hand, R&I performers seemed to be unable to raise their voice in attempting to influence policy making process. In the French case, the landscape of R&I performers was highly disjointed. Nevertheless, despite the great divide between public R&I performers, these actors have been able first to mobilise their resources to slow down the creation of the ANR, and then to mould the characteristics of the newly born agency at their favour.

In the case of private R&I performers, for both countries, interests' representation is organised according to specific organisations, but the overall decision-making structure tend to be biased towards the direct intermediation strategies adopted for dialoguing with big enterprises. Those actors seemed to have a bargaining power by exception, according to the different political attitudes of elected politicians, and more specifically on the basis of their openness towards the business world.

For what concerns the characteristics of the resulting policy mix our expectations were not confirmed, as demonstrated in the French case by the decreasing powers of ANR after the internal lobby of R&I performers, and the more generalised low automatic and permissive attitudes both countries have shown towards private R&I performers. Nevertheless, it is relevant to highlight an important process characterising the relationship policy makers are building with target population.

In the French case, following on from the creation of BPI France and the inclusion of ANR as one of the main operators of the Investment for the future program, policy makers have consistently modified their approach towards R&I funding. Indeed, they are increasingly converging toward a "public holding model" (Eparvier et al., 2011) where, through the provision of different funds, the central administration detained financial stakes in innovation organizations, without the cost associated with their management. Examples like the Technological Transfer Acceleration companies (SAAT) and France Brevet (in the Investment for the Future Program); or the SME pact and the Small business act (among the interventions for SMEs supporting public procurement) suggest how public actors have changed their narrative towards R&I performers. Of course, we cannot directly connect these experiences with the presence of intermediary agencies; nevertheless, it is plausible to hypothesis that since the management of (differently powerful) R&I performers' interest was delegated to specific organisations, decision-makers have started to externalise administrative and management costs, while focusing on the administration of their "assets" across different innovation bodies.

Differently, as we have seen, Italy didn't develop any intermediary agency to administer its interactions with R&I performers. Nonetheless, the country was heavily exposed to uncertainties

related with monitoring and implementation processes, and more generally by the cumbersome nature of the bureaucratic system (Potì & Reale, 2011). Another critical problem of Italian R&I policy was the implementation of different measures; in many occasions innovative policy tools, could not be effectively implemented because of the lack of resources, or delays in their availability (European Commission, 2004b, p. 11). Indeed, from the beginning of 2000s (specifically with Berlusconi II cabinet) policy makers started to increasingly rely on the collaboration of private banks in the financing of innovation. The introduction of a credit system based on banks, was manly aimed at easing the planning of resources for investments in innovation by enterprises, but it didn't express any specific policy goal in terms of R&I strategy (Gallo and Silva, 2006). Private banks provided finance to enterprises (mainly SMEs) and basically public actors participated to back up with public guarantees loans or cash advances to business actors. In this pattern, instead of behaving as shareholders, policy makers became the bearer of the risks related with R&I investments, but they were cut off from future benefits produced by the firm they supported. Basically, the private banking system provided available credits to R&I performers, overcoming the sluggishness related with the public management of these funds; while policy makers were bearing the costs of the possible related failures.

To conclude, our expectations regarding the influence that the type of interest intermediation strategy has on the characteristics of the instrument mix have not been fully confirmed by our data. Indeed we expected that the higher the capacity of target population to nullify or alter the policy process, and the more severe the institutional fragmentation is, the more likely it will be to have more permissive (less coercive shapes) instruments and a greater R&I performers' power in the management of their activation (more automatic delivery structure).

Both cases display a high degree of fragmentation with respect to the organisation of ministerial policy responsibilities; while, French R&I performers demonstrate a greater ability to interfere with the national R&I policy making compared to their Italian counterpart. And both policy mixes are unbalanced in favour of low and medium (rather than automatic) instrument delivery structures. While, for what concerns the distribution of instrument shapes, only France, with its higher coercive attitudes, displays some similarities with our expectations.

Therefore, despite the coordination problems ministers are facing, these issues do not seem to influence policy makers' capacity to provide a consistent mandate to their intermediary agencies (in the French case). Differently, this issue seems to be more prominent in the Italian case, which suffers from both institutional and target population fragmentation in interest representation strategies.

Moreover, the greater activism of French R&I performers, differently from what hypothesised, has been matched with a greater coercive attitude from policy makers, as suggested by the centralisation

of intermediation powers in the hands of the CGI. Differently, for the Italian case, the atomisation of R&I performers' interest, and incapacity to design a long-term ministerial strategy, is directly portrayed by the fragmented evolution of national R&I policy mix and the characterising one-off intervention nature.

9.6 Final Remarks

In this research we were interested in understanding the political dynamics that stand behind policy instrument selection process in the research and innovation sector. We investigated how the interactions between differently motivated actors involved in the governance of R&I, including knowledge producers and developers, public and private actors, together with policy makers influenced R&I policy instrument selection. The analysis illustrated the way governments design more ambitious policy mixes aimed at solving the complex, and cross-sectorial in nature, social challenges contemporary societies are facing. It was focused on providing both theoretical and empirical contributions to support an explanation on how policy instruments are effectively selected from the perspective of the actors making the decision. This also represents an interesting addition to the scholarly understanding of how the holistic nature of many R&I policy issues maps out governance arrangements where actors become interdependent on the basis of the exchange of resources.

In order to make sense of these dynamics, we theorised an R&I policy instrument typology able to provide information on both the different ways social control is exercised (instrument shape) and on the type of governing arrangements coming together with instruments (delivery structure).

As demonstrated by the results of the comparative case study of France and Italy, similarities in the way governments use their legitimate power to shape public action (instrument families Figure 9.2), can actually hold substantial internal differences in the relationships between policy makers and target population (as demonstrated in Figure 9.3 and 9.4) these activate.

Indeed, both our two cases have the necessary R&I instrumentation at their disposals, but they are not equally able to make use of them at their advantage. The Italian case suffers from an inherent fragmentation and duplication of instruments, and actors tend to follow a short-term logic of layering for change through the design of one-off interventions. While, France shows a more consistent "layering for equilibrium" behaviour. Indeed, experiences like the evolution of the Research Tax Credit (*Crédit Impôt Recherche*) and the Incubator and Technology Transfer Organisations (see Chapter 4), suggest how actors chase their goals through the stratification of multiple (often similar) instruments. Those results further support the theoretical and empirical capacity of our instrument typology, which is actually able to provide insights on the constitutive differences embedded in

instruments shapes and delivery structures. Indeed, from an empirical perspective, it is not enough to look at the types of instruments selected (families), but it is necessary to have a grasp on their capacity to induce a specific behaviour while addressing the right target. Policy instruments containing similar coercive principles, can be actually applied in different ways (Vedung, 1998), because in addition to social control each tools embed a particular way of exercising it (Kassim and Le Galès, 2010; Lascoumes and Le Gales, 2007). Indeed, as demonstrated throughout our analysis, the choice and also the particular way in which instruments are structured and assembled reflect the interaction between decision makers and the political clientele of the policy.

Along our analysis we also investigated how innovation represents a special investment in long-term intangible assets that will (likely) generate profits in the future. Therefore, the way it is different from regular investments in tangible assets, such as capital expenditures, because of its longer time horizon and higher risk (Bhattacharya et al., 2017, p. 2). Consequently, when making these choices a political strategy is needed, because the investment made today will produce results tomorrow. Indeed, if policy makers do not construct a vision, some expectations regarding what they want to achieve through R&I policy, they might fall in the trap of creating structures in which bureaucracy derives its *raison d'être* only from the administration of subsidies, leaving apart the willingness to pursue a broader national strategy for development. Similarly, also R&I performers will struggle to foster their business, given the high volatility related with the lack of a political leadership. Such differences are evident among our two cases, with France repeatedly trying to re-centralize decision making powers, at the expenses of a broader dialogue with its national R&I performers; while Italy seems to be stuck in the grip between some attempts to design a national strategy and a more general tendency to satisfy the short-term priorities of different political constituencies. Therefore, in both cases, despite some specific national dynamics, policy makers did struggle to find an equilibrium with the recipient of their policies and moments for dialogue seem to be consistently decreasing in number. However, the different forms of stabilisation among these actors are closely dependent on the dynamics characterising the different national systems; hence, on the preferences, the perception of preferences and the strategies of the actors involved, and how these relations are institutionalised (Van der Meulen, 1998a).

The national organisation of ministerial responsibilities in R&I does not ease this process; indeed, both our cases followed an external specialisation strategy which implicated a profound divide characterising both the framing of R&I issues and the interactions between their respective constituencies. Despite similar efforts in the design of coordinated R&I policy mixes across the ministries with joint responsibilities in this field, the fact of belonging to a specific institution with its embedded values, identities and attitudes consistently influenced the capacity of different actors

to design R&I policy mixes encompassing different sectorial policy responsibilities. Therefore, the siloed approach characterising many public administrations (Christensen et al., 2014; Pencheva et al., 2018), as well as the classic departmentalised structure of formal policy making institutions (Pelkonen et al., 2008), is still predominant over the attempts to jointly design more ambitious policy mixes aimed at tackling the cross-sector nature of Grand Societal Challenges.

The governance of R&I policies represents an extremely complex arena for policy making, exactly because the resources needed for instrument activation are increasingly dependent upon the participation of different actors, and the assets they can mobilize (Béland and Howlett, 2016; Capano and Lippi, 2017; Flanagan et al., 2011; Majone, 1976). Indeed, R&I performers do benefit of public funding for their activities, but on the other hand, also policy makers benefit from the results of the same activities. Therefore, the tension for power between policy-makers and R&I performers is persistent in the sector, especially for what concerns the identification of those actors who will have the legitimacy, and power, to determine national R&I investment decisions, and whether those choices should be driven by market needs *versus* scientific considerations.

Consequently, stakeholders' support, or legitimacy, for the behavioural change proposed by a new instrument become a relevant asset for fuelling the policy design process, while pursuing the successful implementation of different policy instruments. Ans, as confirmed by our analysis, their role become even more important in policy making contexts characterised by high level of institutional fragmentation.

All of that suggests how in R&I policy design practices, it has increasingly become necessary to consider how governments are not anymore simply, and unilaterally authoritative, but they are instead dependent upon the action, acquiescence or support of others, which they do not directly control (Bressers and O'toole, 1998; Gassler et al., 2008; Goetz, 2008; Kattel and Mazzucato, 2018; Nauwelaers and Wintjes, 2008; Salamon, 2002a). On the other hand, looking at the heterogenous characteristics of R&I performers, and at the different intermediation strategies undertaken by our two cases, some reflections are needed. First of all, the permeability of the policy design process for R&I performers is not given by default, but it is rather dependent upon their capacity to behave as a constituency. Indeed, the successful cases in which target populations did manage to raise their claims were related with either their ability to design a well- structured national strategy for action, or their capacity to mobilize resources perceived as essential, or however highly valuable, from policy-makers' perspective. Secondly, it is misleading to equate the participation of intermediary agency in the policy making process with a less coercive attitude of policy-makers. Indeed, as demonstrated in the French case, the introduction of this type of agent within the national R&I governance represented

a strategy to recentralise power, which didn't nullify the authority of policy-makers to steer decision making process at their favour.

To conclude, R&I policies do actually design highly complex governance arrangements, where actors and recipients of different (formerly detached) policy sectors interact. However, the barriers that hinder actors' coordination in this sector seem follow the features characterizing decision-making process in the classic sectors of government responsibilities. Like, for example, the presence of relatively stable groups of actors and institutions; their associated interests, representation practices and perceptions of the problems (Candel and Biesbroek, 2016). Therefore, we believe that, in analysing policy sectors standing at the cross road of different policy responsibilities the adoption of an actor perspective, together with a profound understanding of the dynamics characterising each specific policy responsibility is needed.

9.7 Policy implications and issues for future research

Following on from the results of our analysis, some policy implications are suggested.

In our investigation, especially during the data collection process, we observed a consistent gap between the scholarly theorisation of innovation process and the attitudes of policy makers and R&I stakeholders. This divide concerned two main practices in R&I policy making, the first refers to the perceptions over the mechanisms driving innovation. Indeed, across our empirical analysis of R&I policy design in France and Italy, it emerged a quite consolidated and generalised "linear view" of innovation among policy makers. These findings clash with the some of the theoretical approaches adopted in the current literature for explaining co-evolution of R&I policy change. Specifically (Mytelka and Smith, 2002), through a diachronic analysis of the innovation theories and ideas from 1970s to 1990s, argue that a clear connection between policy and theory does exists. Indeed, according to the authors, the theories and the actual policy-making practices in the R&I coevolve; this is a process of interactive learning, in which a social science field, and a policy arena, have been jointly and interactively shaped (p. 1468).

Throughout our research, we actually highlight how policy makers tend to aim for applying the latest scholarly theories in their policy making practices (as also discussed with respect to the concept of Grand Societal Challenges), but they ultimately fail in adopting them; falling back into consolidated linear views of innovation process. Indeed, since our analysis was focused on adopting an actor perspective to understand the capacity of different governments to get things done, we are confident to state that policy makers tend to make use of the narratives related with the latest developments in the field of innovation research. However, once they have to agree upon how to coordinate their action internally (e.g. among ministers with shared R&I competences) and externally (e.g. in their

interaction with stakeholders) they tend to adopt more consolidated linear view of innovation in which the innovation process is mainly seen as a chain of events starting with investments in basic research, leading (possibly) to the development and prototyping of the results of these investments and ultimately to the production and commercialisation of resulting innovations. Ultimately, since R&I policies are said to design complex governance arena for policy making, given the resource dependency on different actors, it is necessary to considerer how the capacity of innovation theory and policy making practices to co-evolve is not only dependent upon decision-makers, but also on R&I performers. Therefore, differently from how portrayed in the current literature, the learning process can also be hampered by the opposition of R&I performers which may not see their interest fully represented by the newest theories on innovation process. Similarly, also the ability of policy makers to promote a specific narrative and policy making practice is linked with their capacity to stay in power and generate consensus over national R&I strategies.

The second important empirical gap we identified from the theory to the effective R&I policy making practices was related with the attitudes of policy makers towards policy instrument selection.

Indeed, when policy-makers design new instruments, they do not always have a clear overview of what has been done before, and of what it is already into force. This often leads to an inconsistent layering of instruments and a related low uptake of these instruments from the recipients, who are lost in the jungle of very similar tools at their disposals. Consequently, we believe that scholarly attention should be devoted to work on identifying a more accurate, and empirically grounded, classification of R&I policy instruments. This exercise will be able to provide a more accessible analytical tool to political actors shaping national Research and Innovation policies, and it will also be beneficial for the scholarly community, who will be able to work within a common framework of analysis and to trace the overtime activity of instruments more easily.

Therefore, we believe that is important to further stress the necessity to work on an integrated theoretical framework on the study of R&I policy instruments. This, as demonstrated by the results of our analysis, should investigate tools, and their selection process from a two-way perspective, where both policy-makers and recipients are considered as actors able to influence the characteristics of public action. Because, similarities in the way governments use their legitimate power to shape public action (instrument families), do actually hold substantial internal differences in the relationships between policy makers and target population these can activate, which we have only been able to grasp thanks to the introduction of instrument shape and delivery structure categories.

Policy instruments containing similar coercive principles, can actually induce behaviours in different ways (Vedung, 1998), because in addition to social control each tools embed a particular way of exercising it (Kassim and Le Galès, 2010; Lascoumes and Le Gales, 2007). Therefore, theories on

R&I policy instruments, and their related classifications into typologies, should be able to grasp not only how governments use their authority to induce specific behaviours on target population, but also the extent to which the way instruments are structured and assembled actually reflects the interaction between decision makers and the political clientele of the policy.

These insights will actually be beneficial for the analysis of policy design process not only in the R&I sectors, but more generally, for complex governance arrangements characterised by cross-sectorial policy issues.

During our analysis we faced some issues regarding the low accessibility of private actors in the data collection process. Our investigation was mainly oriented towards policy formulation process; therefore, we are confident to state that by interviewing policy makers and representative of business organisations we reached the needed data saturation point. Nevertheless, we believe that further researches in this field would consistently benefit of a broader spectrum of data coming from private enterprises. Moreover, given the time frame of analysis, and the limitations related with the management of our research for both cases, we decided to leave out two industrial policies, namely *Industrie du Future* (Industry of the future) for the French case and Industria 4.0 (Industry 4.0) for the Italian case. This choice was mainly driven by the fact that these two policies were going through a formulation process during the period of our data collection. Therefore, given the fact that the numbers of years under investigation was in line with the appropriate time frame for analysing policy change identified by the literature (Sabatier, 1986), and the consistent problems we faced in collecting and translating information over policy instruments, we decided to leave out these two new-born policies. We do not regret our choice, and we rather believe that this decision just paved the way for a (follow-up) comparative analysis of these two policies in the light of the analytical framework developed in the present study, this will surely provide a valuable contribution to the existent literature in the field.

To conclude, we are aware that this study adopted a macro perspective on the analysis of the Research and Innovation policy sector. Our aim was exactly to have an understanding of the national-wide dynamics shaping the design of these policies in two different countries. Therefore, as a future research venue we aim at narrowing down the focus of the analysis to either a specific R&I sector, or better to a regional or local perspective, in order to test the validity of our policy instrument selection framework at a different level of analysis.

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