

**Industry, Innovation and Technology:
A descriptive study of the Regional Innovation System in the Metropolitan
Region of Grenoble**



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Acronyms.

CEA: Comité à l'Energie Atomique or Committee of the Atomic Energy.

INP: Institut Polytechnique de Grenoble or Grenoble Institute of Technology.

GMR: Grenoble Metropolitan Region

UGA: Université Grenoble Alpes

ARAR: Auvergne Rhone Alpes Region

SRESRI: Schema Regional de l'Enseignement Supérieur, de la Recherche et de l'Innovation or in English, Scheme for Higher Education, Research and Innovation.

SRDEEI: Schema regional de Développement Economique, d'Innovation et d'Internationalisation or in English, Scheme for Economic development, Innovation and internationalisation.

Abstract

Since the 1990's, academic research has highlighted the systemic and interactive character of innovation processes, as well as its links to the local level (Fiore, Grisorio, Prota, 2011). More and more, Innovation seems to be the 'main instrument for improving and ensuring competitiveness to enterprises and growth opportunities to local economies' (Fiore, Grisorio, Prota, 2011). Stemming from this realisation, the concept of a Regional Innovation System (RIS) was conceptualized in the 1990's, 'as a set of actors, such as firms, organisations and institutions, that interact in the generation, diffusion and use of new - and economically useful - knowledge in the production process' (Fischer, Diez, Snickars, 2013).

The RIS concept therefore helps analyse the mechanisms and processes of innovation at the local level, primarily focusing on the network of actors that interlink to produce innovations in a region. It also allows for a greater role for public and political bodies; as their actions often not only facilitate the network of actors but help it grow, aiding in the coordination of economic activity to help the region reach its full economic and innovative potential.

In this paper, we will examine the structure of one highly successful and well-functioning region, the Metropolitan region of Grenoble in France, which has been posited as the 'French Silicon Valley' (AEPI, 2017), as well as being ranked by the European Commission as the second European capital of innovation (EC, 2014). By studying the organisation of the region, we provide an accurate and up to date description of the current state of Grenoble's innovation system, which aids in our understanding of the mechanisms and factors that drive innovation in the Regional Innovation System (RIS) of Grenoble.

The main focus of this research will be the description of the vast array of actors that constitute the RIS of Grenoble. Actors will be classified into three categories, the economic actors, the academic actors, and the local government actors.

This paper has seven chapters. First, the **Motivation Chapter**, where we explore the reasons why this research will be conducted. Second, the **Problem Statement and Research Question Chapter**, where we outline the nature of the problem we attempt to solve, and outline the specific question of research. Third, the **Definitions Chapter**, where we state and explain the exact meanings of key terms of reference used throughout the thesis. Fourth, the **Literature Review Chapter**, where we first provide an awareness of the greater academic background this thesis exists within. Fifth, the **Methodological Framework Chapter**, where we outline how this thesis plans to answer the research question, including the research methodology adopted, how data will be collected, and how data will be used. Sixth, the **Description Chapter**, where we analyse the data we have collected and explain the findings of the research, and setting out the description that answers the thesis' research question. Seventh, the **Conclusions Chapter**, where we observe the results of the thesis, and come to balanced conclusions about the outcome of the research.

Chapter 1. Motivation

The intention of this thesis is to study the metropolitan region of Grenoble, and describe its well-functioning economic environment. Grenoble has been chosen as the focus of this thesis not only as it is the economic centre of the region of Isère, which hosts more than 1.2 million inhabitants, and is the 6th largest district in terms of the GDP of France (out of 97 in metropolitan France), but also because, Isère is often presented as the 'French Silicon Valley'. It is known colloquially as a highly significant center for research and development in France, as it has a dramatically high patent creation ratio of 7.5 per 10,000 inhabitants (AEPI, 2016). For comparison, Paris has a ratio of 3.9 (AEPI, 2016). As a city, Grenoble was chosen in 2013 as the world's 5th most inventive city (Forbes, 2013) and one of the top 3 most innovative cities in Europe (European Commission, 2014). The obvious economic and innovative success from which Grenoble benefits constitutes an excellent basis for a research on Regional Innovation Systems. Adding to this, in 2016 the region of Auvergne-Rhone-Alpes, containing the Metropolitan Region of Grenoble, has been impacted by the 2015 restructuring of the organisation of French regions and regional political powers. (GOVFR, 2017) A primary part of the restructuring policy was to launch a new and ambitious scheme for the Auvergne Rhone Alpes' 'Higher Education, Research and Innovation', the SRESRI (ARA Council, 2017). This scheme is an example of the extent of the interconnected nature of the actors of the region; local government, economic and academic, as well as the primacy of place that is given to innovation in the region.

The focus of the new SRESRI scheme is on the reinforcement of the contribution of region's education/academic actors onwards, from the educational sector to the research sector, and then to the socio-economic development of the territory. Students and their families, firms (especially SMEs), and the diverse levels of local government that constitute the administration of the Auvergne-Rhone-Alpes region, are considered the main actors, and its goals are achieved taking these into account, using three different methods (ARA, 2017). First the scheme aims to ensure and amplify the excellence of the three academic poles of the regions: Lyon-Saint Etienne, Clermont Ferrant, and Grenoble, because the quality of the higher education these poles constitute is, 'an indispensable asset to reinforce the competitiveness of the economic fabric of the region. Second, the scheme aims to favour educational and scientific excellence, as it is key for the regions visibility and efficiency, as well as the creation of new economic opportunities. The third and final goal has two interlinked branches. First the recognition of the need to promote human capital mobility, and second, to create an academic curriculum that fits the needs expressed by the economic actors of the region; which by matching the skill sets of workers to the needs of industry will, in the long run, promote innovation and economic development within the region. Putting all these actors in the perspective of these newly developed objectives for the region is an excellent basis to try to examine and understand the importance these interconnections, and their robustness within the Metropolitan Region of Grenoble. The motivation for the research is therefore clear. By describing the RIS of the Metropolitan Region of Grenoble this thesis forms a basis point from which further research may begin. This thesis fills the identified knowledge gap about the structure of the regional RIS, and thus allows understanding of the specific composition of the RIS's contents, its features, characteristics and actors.

Chapter 2. Problem Statement and Research Question

2.1. Problem Outline and research question

Schumpeter first theorised the importance of innovation (and entrepreneurship) in economic growth during the first half of the 20th century, as part of his work, the Theory of Economic Development. (Schumpeter, 1934). Many have argued since that innovation, as it is at the heart of technological change, is “the primary engine of economic development” (Fischer, Diez, Snickars, 2013).

Recent studies have shown that the regional context is a key level at which innovative capacity is shaped and economic processes are coordinated (Cooke, 2004). As a result, the concept of innovation being associated to a specific region or local context has benefited from more and more academic attention, and it has become increasingly recognized that crucial elements of the process of innovation occur at the regional level, since it is the where economic interaction and innovation occurs (Storper, 1997).

Because of this, economic dynamism and development of a territory can be partially attributed to the extent of innovation in the territory, a fact which local and regional political structures, due to their responsibility to incentivise economic development within their jurisdictions, have not been blind to, playing a major role in securing the innovative capacities of their territory, by developing appropriate policies and recommendations. (Doloreux & Parto, 2004).

Over the years, studies have developed several theoretical concepts regarding the mechanisms of incentivisation of innovation in local contexts. Amongst this multitude of approaches, the concept of the Regional Innovation System (RIS) is particularly interesting, as it captures the interactive character of innovation, associating innovation with interactions between the actors of the local economy. The reasoning for this theory lies on the idea that the economic performance of a local area depends not only on how different businesses perform, but also on how they interact with each other, as well as with the public sector, in knowledge creation and diffusion. This approach allows for a significantly in-depth reflection on the role to be played by all the actors of the system, and is therefore a shift away from a more traditional “firm centred” perspective of innovation (Fiore, Grisorio, Prota, 2011).

Theorized in the 1990's the concept of Regional Innovation System (RIS) has become increasingly popular amongst academics and policy makers and a fair number of studies have undertaken the task apply this framework to some specific environment, with the aim to analyse the mechanisms of innovation present there. Yet regarding the Metropolitan Region of Grenoble, no piece of academic work has offered an extensive description of the area, a necessary step for understanding the RIS of the territory. This is the problem that this thesis will attempt to answer, by providing a detailed descriptive study of the region, and filling an identified knowledge gap. The RIS of the Metropolitan Region of Grenoble will be described, focusing on the RIS's major features, characteristics and actors, and as such adopting a descriptive research design. The specific question of research is:

What are the major features and characteristics of the Regional Innovation System of the Metropolitan Region of Grenoble?

Chapter 3. Definitions

In this chapter, we will define the two terms that constitute the basis for the term Regional Innovation System: **Innovation, and systems of innovation**. Later, the concept of Regional System of Innovation is conceptualised and defined in the last section of this chapter. Finally, potential characteristics that are said to stimulate innovation in a RIS will be outlined.

3.1. Innovation Definition

To define innovation, we begin by asserting the terms similarity to change. However, innovation is differentiated as it may involve a wide range of different types of change depending on the organization's resources, capabilities, strategies, and requirements. Common types of innovation relate to new products, materials, new processes, new services, and new organizational forms (Baregheh, Rowley, Sambrook, 2009).

Innovation is therefore at the heart of technological development and is often recognised as a primary factor of economic growth. Innovation is a process that depends essentially upon the accumulation, development and diffusion of a wide variety of relevant knowledge (Fischer, Diez, Snickars, 2013). However, innovation as a term encompasses a large range of changes and phenomena. Bienayme (1986), for example, distinguishes between; a) product innovations; b) innovations destined to resolve, circumvent or eliminate a technical difficulty in manufacture or to improve services; c) innovations for the purpose of saving inputs (e.g. energy conservation, automation), and d) innovations to improve the working conditions. Following recent work on innovation and its mechanisms, it is increasingly recognised that innovation has an interactive nature and comes from the interplay between firms, political organisations and academic institutions. As such the dictionary definition of the root word, 'innovate' is highly apt, to 'make changes in something established, especially by introducing new methods, ideas, or products' (OED, 2017), and as such innovation is the process by which actors innovate.

3.2. Systems of Innovation

A system of Innovation is helpfully defined by the World Bank, providing a broad definition. A System of innovation is, "the organisations, enterprises and individuals that demand and supply knowledge and technologies, and the policies, rules and mechanisms which affect the way different agents interact to share, access, exchange, and use knowledge". Fischer, Diez and Snickars (2013) offer a similar definition, stating simply that a system of innovation is "a set of actors, such as firms, organisations and institutions that interact in the generation, diffusion and use of new, and economically useful, knowledge in the production process." Important to note therefore, is that the concept of systems of innovation is largely an abstracted concept, the result of the sum of a set of parts, rather than individual quantifiable objects or entities (Madukwe & Obiora, 2012). This means therefore that a system of innovation analysis can be applied to almost any unit of territory, from the most local to the transnational.

Understanding systems of innovation therefore relies on the realisation that innovation is an evolutionary, interactive and social process (Edquist, 2004). It stimulates and is stimulated by various actors and relationships within a specific setting. In order for companies to maintain or develop

competitive advantages, they must improve their innovative capacities and develop partnerships and cooperative relationships with diverse actors of their local context, be that other firms, academic institutions, political organisations (De Oliveira et al., 2017). A system of innovation therefore breeds innovation, sometimes by the incentive of competition, sometimes by cooperation an interaction among participants, spreading learning, knowledge and best practices, establishing partnerships for cooperation and collaboration, and facilitating communication and knowledge exchanges between the multiple institutional actors (De Oliveira, et al., 2017).

The difference in understanding therefore between systems of innovation, and RIS, is the application of the topic to a specific geographical location, which when combined with the Regional Studies literature occurs.

3.3. Regional Innovation System Definition and Conceptualisation.

The concept of Regional innovation systems comes from the system of innovation literature and associated concepts. It stems from the realisation that innovation is an interactive and interdisciplinary process reliant on interconnections between actors of local settings, and crucially not a national setting. Actors in a regional system of innovation may encompass actors from very different fields, organisations, spheres. The large increase in studies on RIS in recent years still however has not included agreement on a common definition of an RIS, although many different perspectives have been taken. In this paper, we will examine only two definitions.

First, Doloreux (2003) writes “a RIS can be understood as a set of interacting private and public interests, formal institutions and other organizations that function according to organizational and institutional arrangements and relationships conducive to the generation, use and dissemination of knowledge” (Doloreux, 2003). In other words, a regional innovation system is characterized by cooperation in innovation activities, between firm’s knowledge generating and diffusing organizations, and the innovation-supportive culture that enables both firms and systems to evolve over time. (Doloreux & Parto, 2004).

Second, a decade later, Fischer, Diez, Snickars (2013) also attempt to provide a similarly general definition of Regional Innovation Systems stating, ‘a system of innovation may be thought of as a set of actors, such as firms, organisations and institutions, that interact in the generation, diffusion and use of new -and economically useful - knowledge in the production process’. Both definitions provided by Doloreux (2003) and Fischer, Diez, Snickars (2013) allow us to have a good understanding of the RIS concept and what it may encompass. Without using these two terms interchangeably, it seems appropriate to say that the two definitions given are non-contradictory, and as such it is possible to state that both definitions are legitimate in defining RIS.

3.4. Characteristics

Throughout the years of analysis of this phenomenon, authors have identified potential characteristics that may impact positively on the emergence and sustenance of a Regional Innovation System. For the sake of this essay, we choose to follow the list of characteristics produced by the authors Fiore, Grisorio, Prota (2011) that are listed as follow:

1. The presence of high-technologies industries potentially oriented towards international markets.
2. The presence of relationships between firms and knowledge centres (Universities, laboratories...).
3. A specialized labour market and labour force, with readily available, highly skilled human capital.
4. The presence of a local tradition of cooperation and entrepreneurial approaches.
5. Supporting agencies and organizations
6. The presence of social capital, defined as shared norms, values and trust, which facilitate relationships and mutual understanding and learning and financial capacity.

These characteristics have been identified as present in a large variety of successful RISs, by research conducted by authors in the past. Importantly they do not constitute a set of characteristics that are necessary causes for a region to be successful at innovation in its territory, but are instead a list of sufficient causes, of which having multiple present simply improves the chances of a successful RIS.

These factors will be used to structure our conclusion chapter as they provide a structured and brief way to directly answer the research question.

Chapter 4. Literature review

This chapter contains a survey of the relevant literature on topics pertinent to the research goals, whilst at the same time, outlining and justifying the theoretical approach that will be taken. The aim of the literature review is therefore threefold. First, we present the reader with some historical background regarding the key development phases of Grenoble. Second, we examine in the literature the role of academic actors in a RIS, and the importance of their links with business. Third, we highlight the role of local and regional government within a RIS, and the policies that are said to favour innovation.

4.1. The case of Grenoble, previous studies and analysis

In this section, we will review the previous work that has focused on the Metropolitan Region of Grenoble. Five different texts are used for reference in this section, so we can provide the reader with relevant historical background, as well as making a specific focus on comparisons between the descriptions of Grenoble that were done on small parts of Grenoble's RIS in the early 2000's and our more up to date and expansive description of Grenoble in 2017.

Grenoble, was at beginning of the 19th century, a small industrial town with two main industries: paper and glove making industries. It was the discovery of Hydro-electric power that is said to be at the origins of Grenoble as a major industrial centre (Januel, 2007), as the discovery of this energy and the resources of the region that triggered the collaboration between nascent local companies and the academic sphere of Grenoble. Michel Soutif, President of Joseph Fournier University in Grenoble, sees the historic development of Grenoble in four phases, starting in 1948 (Soutif, 2005). This organisation in different periods helps the reader by offering the context in which Grenoble city developed.

The first period as thought of by Soutif (2005), starts around 1850 and ends in 1900. It is characterised by the discovery of hydroelectricity. From 1848, the papermaking industry started to develop in the region and helped to galvanize the economy of the city. Paper making required a great source of energy, as well as raw materials. These two crucial aspects of paper making industry were present in the local setting of Grenoble; as wood could be extracted from the Alpines forests, whilst the energy needed could be produced through the hydro power of water falls of the region. Aristide Bergès, a famous French engineer, discovered the hydraulic potential of the region and installed there a paper pulp factory. De Bernardy (1999) argues that it is this discovery of the hydroelectric power in 1869 by Bergès that will trigger the economic development of Grenoble. In 1902 a "hydroelectric power" congress was held in the region, which gathered industrialists, politicians, scientists and engineers, and is a landmark for the collaboration between the businesses and the academics of the region.

The second period of time starts from 1900, and lasts until the 1950's. It represents a period of massive industrial growth in Grenoble. During this phase, numerous firms of different sectors were blooming in the valleys around Grenoble, and much infrastructure was built in the area. At the beginning of the twentieth century, De Bernardy (1999) states that the development of manufacturing industry was the driving force behind research and training activities. As an example, in 1920, Paul Louis Merlin and Gaston Gerin founded the company Schneider Electric; which today is one of the strongest economic actors of the Grenoble region. Quickly, the two founders decided to develop laboratories within the

company, where product trials and quality controls were conducted. Through the years, these laboratories will observe a change in their activities and objectives, as they will develop into R&D laboratories, and as such focus on developing new products, new applications, and new materials.

Similarly, other large electrochemical and electrometallurgy companies of the time could be characterised by their interests in developing robust research services: laboratories where created not only for the activities of control and trials, but for the conception of new products and processes or for the reflection upon the improvement of former products. This shows that as early as the first half of the 20th century, we observe in Grenoble the emergence of collaborative relationships between two different sets of actors, academic and economic and that the development of firms was a driving force behind the development of “research and training activities”(De Bernardy, 1999).

As a sign of the growing importance of the collaboration between businesses and scientists of the time, the first academic classes on industrial electricity were given in 1892, under the pressure of the municipality, which had already recognised its role in promoting local innovation. In 1902, the Polytechnic Institute of Grenoble was set up. Under the direction of Louis Barbillon, the Institute offered classes and disciplines that were closely aligned with the industrial specialities of the region, as Grenoble was always in dire need of more specialist engineers. This element shows the importance given to ensuring that there is a match between the competences offered at universities and the competencies needed in the economic environment, even at this early stage of Grenoble’s economic development.

The third era studied by Soutif (2005) covers the period from 1950 to 2000. During World War II, many researchers came to Grenoble, as it was one of the major cities of the Free zone (until 1942). This resulted in the doubling of the number of physicians in Grenoble (Soutif, 2005), many of which, after the war, decided to stay in the city. Grenoble thus benefited from their knowledge and networks, assisting the delocalisation of many research centres to Grenoble from Paris. It was during this period that two famous figures, Louis Néel, a physician, and his assistant, Louis Weil, arrived in Grenoble. In 1955, the “Centre d’études nucléaires” (currently the CEA), that was responsible for nuclear research in France, decided to create a new research centre in province. On the back of this diversification of R&D activities, the amount of research in the city increased dramatically in the 70’s, notably within the cutting edge field of microelectronics and informatics.

The last classification of time by Soutif begins in 2000 and is ongoing; this means that; because Soutif produced his paper on Grenoble in 2005, he was only able to give a succinct description of the period. Thus, to be able to bring more substantive content, we will examine other pieces of work to fleshout this section. The first paper of interest to us describing this period is by De Bernardy in 1999, focuses on the study of “co-operation and community in Grenoble”. In this paper he reviews the “evolution of high technology firms and industries” from the mid-19th century to late 1990’s. In doing so, De Bernardy attempts to shed a light on why and how this region was able to adapt to change through the years that caused collapse in the economies of other regions (De Bernardy, 1999). Similarly to Soutif (2005), De Bernardy choses to highlight Grenoble key phases of development and the relationships between firms and public sector research institutes and laboratories, that seem to be “natural and reciprocal nurturing process for both kinds of activities” in the region.

What is interesting to capture from this paper is the state of the RIS of Grenoble in the 1990's, and to compare it to Grenoble's current RIS. As an example, De Bernardy takes a technological park ZIRST, created in 1972, as a central feature of the "evolution of a new productive economy" in Grenoble. ZIRST was at the time of the study, composed of 240 innovative firms and contained 5,500 employees. Nowadays, the ZIRST park is called Innovallé (innovative-valley) and has grown to welcome more than 362 companies and employs 11,174 individuals, mainly focused on the communications and information technology sectors. Interestingly, in this paper we note the importance played by the local government in facilitating the creation of SME's.

Another key organisation studied by De Bernardy is the AUG, Alliance-Université-Grenoble. This organisation was set up in 1947 as a tool to contribute to the development of exchanges between universities and the business world. It is still active today, and works in collaboration with the actors of the RIS of Grenoble. It plays a significant role in making sure that the needs for skills and competencies from the economic actors in the region are well understood by the academic world that provides much of the training offered to the region's workforce. We may state therefore, that Grenoble from the time frame De Bernardy wrote in, seemed to have already developed a solid and dynamic innovation system, providing local SMEs with a range of networking relationships, opportunities and psychological benefits. This conclusion seems to still hold true today. However, the ecosystem of Grenoble has changed a lot in addition to this, and many clusters and much additional joint infrastructure has been created after this paper was written, amplifying its conclusions.

The second descriptive source of relevance to a post 2000 description of the RIS of Grenoble is by Lauwton Smith, who in 2003 conducted a comparative study of Grenoble and Oxford, with a specific focus on the role of universities and national laboratories as "territorial actors". Starting with a definition of Innovation Systems and Regional Innovation System, as this thesis does, displaying how these terms were already popular in the early 2000's; he attempted to explain "how technological advance occurs in various locations". This comparative study is different from the ones realised by De Bernardy (1999) and Januel (2007) as it takes a different approach to the study of the ecosystem of Grenoble not mapping out the actors present but by examining different set of policies and characteristics applicable to the region, opposing them to the policies present in Oxford. These policies and characteristics of Grenoble and Oxford that were studied include the level of government funding, the rules on Intellectual Property, the systems of governance, and the major sectors of activity.

These previous studies are of particular interest of us, as they help to capture some of the characteristics of the ecosystem of Grenoble. For instance we see immediate applications in this study, as the characteristics built around the systems of governance in the region, and the major sectors of activities in the region will be used in the description of the Metropolitan Region of Grenoble, and updated with some more modern data. It is highly interesting to perceive the difference between an ecosystem such as Oxford in comparison to Grenoble; as Grenoble, seems to be doing better in many of the criteria, despite Oxford Universities excellent worldwide reputation. For instance, the UK at the time had half the number of scientists than France (Lawton Smith, 2003). Adding to this, a major difference between the two cities lay in their manufacturing base, as "in Oxfordshire until recently this has been low tech – cars,

blankets and food – while in Grenoble manufacturing has long been high-tech (energy, electrical engineering)”.

Other comparative studies have been conducted with Grenoble as the unit of analysis. Robinson, Rip and Mangematin, in 2007 did a comparative study between Grenoble and Twente in the Netherlands, focused on technological agglomeration, and clusters in nanotechnologies. Indeed, at the time, the nano-micro electronics sector of Grenoble had developed dramatically, and competitiveness clusters of international influence such as Minatec had been implemented, greatly participating in Grenoble’s reputation in the field. Minatec, is a regional cluster that encompasses several entities, including both applied and theoretical research institutes, a university, and incubation/technology transfer facilities. In focusing on the cluster of Minatec in Grenoble, the authors highlight the Grenoble Metropolitan Region’s capacity to make firms, knowledge institutes and public government bodies to converge, and form collaborative links.

Finardi (2013), also makes a similar study, focusing on MINATEC, and the sectors of nanotechnologies and micro technologies in Grenoble. He writes that MINATEC, designed to take advantage of the interactions between all the actors of the field, turned to its advantage the proximity of the actors in Grenoble’s clusters, promoting knowledge and technological flows, whilst fostering the growth of the involved actors. MINATEC thus excelled in its intended role as a mechanism and tool to generate innovation in the region, as well as economic growth. It highlights the deep tradition in the Grenoble Metropolitan Region of collaboration between all actors of different fields, with different skills; and it also shows, that such a structure, adds as intended, innovative capacity to the region. Finardi (2013), taking a more contemporary approach to the ecosystem of Grenoble, being one of the most recent papers on issues surrounding the Metropolitan Region’s RIS, builds on the paper of Robinson, Rip and Mangematin (2007), and allows us to grasp the significance of what just one of Grenoble’s major cluster represents to both France, Europe and in the rest of the world.

In this section, we have summarized different texts that use Grenoble as the focus for their studies. Some of these texts, were written more than 20 years ago, and although the information they contain might seem less relevant now for a description of Grenoble’s ecosystem, they still contain many pieces of relevant information, and allow us to see how the Metropolitan Region of Grenoble has developed since the 1990’s. Adding to this, some texts, give us some precious historical indications on the development of Grenoble’s ecosystem, which helps explain why and how collaboration is today at the heart of Grenoble’s DNA.

4.2. Universities as key actors in a RIS

In the RIS literature, universities and research centres are seen as key players in the development of a specific regional setting, as the traditional epicentre of knowledge production and diffusion. This academic knowledge is beneficial to technological change, innovation and growth (Lööf & Broström, 2008) and universities are seen as the main producers of “new knowledge” which contributes to the development, innovation and competitiveness of companies, regions and countries (Govind & Küttim, 2017). Thus, it seems imperative to investigate the extent to which universities and associated institutes can impact the emergence of a RIS and its sustenance.

The most important role of universities regarding innovation comes from their importance in knowledge production and diffusion, which impacts the capacity of a territory to attract and retain high value added activities and talented labour (Florida, 2005). But the extent to which universities and research institutes impact the RIS goes beyond this primary function. Charles (2006) highlighted this in his work and listed three additional aspects regarding the role of universities in a RIS: the creation and commodification of knowledge, the training of the labour force and human capital, and the development of a social capital that favours networking and collaboration between the actors of a territory; to finally impact the level of innovation of the region.

First and foremost, according to Charles (2006) universities impact a RIS by using knowledge as a commodity (Caffentzis, 2008, Baldini, Grimaldi, & Sobrero, 2006). When academics make breakthrough discoveries or have some highly conclusive research results, this new knowledge may then be commodified, i.e. a patent can be applied to it, to protect the rights of the researcher over these results and findings. Charles (2006) highlights the importance for a research institute to protect and “exert control over intellectual property (IP)” as some findings and results may represent significant future income, renowned as well as other beneficial gains. Most universities have massively increased their activities in this area, and a number of mechanisms and policies have been developed to enhance the commercialisation process, including the support for spin-off firms (Charles & Conway, 2001).

Secondly, Charles (2006) points out that an important role of universities in a promoting innovation lies in the training and formation of students, mature or young; and to ensure that the workforce has the appropriate training available to update continually their skills. The role of universities as the primary vehicle of education has undergone a lot of changes; such as the use of new technologies, changes in the demographics of students and changes in the needs and expectations of these students. Thus, universities and training centres had to prove themselves adaptive to change and update their courses to attract students, and ensure they had appropriate skills for the job market. In doing this, universities have succeeded in remaining a major actor in local economic development. It can be noticed that the presence of a highly skilled human capital remains one of the characteristics of a RIS as described by Fiore, Grisorio, Prota (2011) and described in the section 3.2.1.

The third role of universities and training centres on an RIS, highlighted by Charles (2006), has a less direct nature than the two previous arguments presented, as it relates to the creation of both “social”, and “cultural” capital. Social capital is a common theme in the RIS literature, as it is argued to be a crucial characteristic for the emergence of a RIS (Doloreux & Parto, 2004, Fiore, Grisorio, Prota, 2011, Rutten & Boekema, 2007). Social capital can be understood as a set of values and norms that will impact the process of knowledge diffusion and learning within a region, and finally will impact the level of innovation (Doloreux & Parto, 2004). Social capital is an ‘intangible asset’ that impacts the network function of a regional system of innovation (Rutten & Boekema, 2007), based upon degree of trust between the institutions and actors of the territory has a great impact on the level of innovation (Charles, 2006).

In this argument, universities are shown as institutions that drive a form of “civic culture”, to be adopted by the different actors of the local setting. This civic culture, may be understood as “norms of reciprocity and networks of civic engagement” (Putnam, Leonardi, Nanetti, 1992). It is a key factor in developing and

maintaining sets of collaborative relationships and stable connections between the actors of the system of an RIS. Universities are by tradition “civic” institutions, as they play a role in the emergence and development of the cultural and political determinants of socio-economic success. (Charles, 2006), and thus produced both social and cultural capital that makes collaborative relationships possible in an RIS.

4.2.1. Universities and firms linkages: what impacts in a Regional Innovation System?

To take a critical approach to Charles’ work (2006), it seems to omit the role of universities when collaborating with businesses. Indeed previous research has shown that there is a positive link between strong collaborative relationships between firms and universities, and the level of innovation within the firm (Bascavusoglu-Moreau & Hughes, 2014, Caloghirou et al. 2001). A technology transfer from universities to firms is defined by Etzkowitz (1998) as the process of a product originating within a university, but that is commodified by a firm it is in collaboration with. Universities thus, by working with private enterprise, promote innovation in an RIS, play a major role in the innovative system.

This definition of technology transfer reflects the current understanding that we have of firm- university relationships; that the university is a source of knowledge, which is then later transferred to a firm. Broström & Lööf, (2008) found that there are two major benefits to collaborative relationships between firms and universities.

First, such collaboration gives firms increased capabilities to learn and to innovate (Broström & Lööf, 2008), as it has been shown that a firms motivation for collaboration with universities or other research centres is linked closely to the need to access additional research activities, personnel and results, from the university/research centre (Hall et al., 2000). A collaborative relationship with a university gives a firm the opportunity to access new knowledge, to use breakthrough results for anticipatory research and to benefit from the expertise of academic human resources. For a firm to be able to take advantage of these resources and knowledge available, it needs to have “absorptive capacity”, which allows the firm to identify and exploit the knowledge produced (Broström & Lööf, 2008), which again, strong cooperative bonds and good communication between the agents of this relation can aid to build this capacity.

Secondly, Broström & Lööf (2008) found that collaboration allows firms to manage their costs and risks in a more efficient manner, notably by outsourcing R&D activities to other actors they collaborate with. Outsourcing indeed, seems to be increasingly common and the rational choice for firm in the area of R&D (Gerybadze & Reger, 1999), as it may reduce costs and risks. Such a decision may also be a way to avoid the risk of building competences in a specific field that could be prove not to be lucrative latter on.

To conclude, in the previous studies, it has been said that universities and research centres have an impact on the innovative capacity of a firm, in the sense that they increase the resources and knowledge available. These new resources available should help firms to be more adaptive. However, the study of Broström & Lööf (2008) shows that the major benefits of these firm-university relationships are of an indirect nature.

4.3. The role of public bodies and local governments in a RIS.

The presence of these academic and economic actors, is not considered in the literature to be enough to favour innovation, as innovation supportive policies that would favour the emergence of such an environment are crucial, helping to overcome market failures, and to promote collaborative behaviours and relationships between the actors of the local setting (Fiore, Grisorio & Prota, 2011). This is traditionally seen as the role of public bodies and local government, as they have the authority to promote this necessary collaboration and innovation in a regional setting. In this section, we present a set of public policies that are considered to enable the actors of the region to be more innovative and to favour innovation processes.

4.3.1. Major public policies that should facilitate innovation.

According to Fiore, Grisorio & Prota (2011), public policies and public bodies should first focus on implementing policies that facilitate the creation of clusters, as firms agglomerated in a specific setting have been proven to have more options and opportunities of reaching their goals and of doing well on the international market (Andersson et al., 2004). Co-operation has proved to be the key factor for clusters to be successful and to keep their competitive advantages (Porter, 1998). Because clusters are major actors of innovation in the RIS literature, it is importance that the local governments create an environment that encourages the agglomeration of firms as well as their cooperation through network (Cooke et al., 1997).

Secondly, firms should be convinced to have collaborative linkages with knowledge institutes as well as with other firms, as these relationships produce many benefits (direct and indirect) for both sets of actors, and in the long run, enhance the productivity and economic development of the region. Because it is inevitable to have competition between firms of the same industry or sector, it is crucial that local government institutions put in place policies that favour collaboration and trust between all the actors of the system.

Thirdly, public policies should be focused on pushing training centres and universities in offering classes and skills that match the local economic needs in terms of skills required. This argument follows the one made by Charles (2006) in the section 4.2., that the role of universities has changed a lot in the recent years, introducing other functions to their more traditional roles of teaching and researching.

A fourth type of public policy that should be put in place concerns the implementation of incentives for researchers to register their patents, and for the creation of Spin-offs (Fiore, Grisorio & Prota, 2011). Spin-offs are newly developed companies that are exploiting the findings of a research group from a knowledge institute. These types of firms are often the first to exploit new results and new technologies (Christensen, 1997); and they have a key role in the innovation chain. The role of Spin-offs in a Regional innovation system is well-documented (Smith et al. 2014, Saxenian, 1996, Harrison & Leitch 2010). The argument made that public bodies should encourage researchers to patent their inventions comes from the fact that these inventions and findings may dramatically enhance a regions economic growth. However, academic research needs help to reach the commercialisation stage and this is the reason why officials and public bodies need to reflect upon ways to facilitate the patenting of inventions.

The fifth type of policy that should favour innovation focuses on facilitating the creation of New Innovative Firms. In an innovation system, the financial sector is of strategic importance, especially in the starting phase (Cooke et al., 1997). However, it is of common sense to notice that when it comes to new product and ideas, the risk for lenders is great as there is a lot of uncertainty regarding the product. This makes the process of setting up innovative firms difficult. Thus, government bodies could facilitate financing for newly innovative firms. For instance, they could aid in “ensuring exit mechanisms for investors, constructing a network of technology-transfer offices and already-existing business angels to help generate deal flows and spread best practices; ensuring publicly supported co-investment schemes to encourage private investments” (Fiore, Grisorio & Prota, 2011).

A sixth set of public policies that should be implemented concerns the circulation and mobility of skilled labour and is sometimes referred to as policies that “ease the brain circulation” instead of trying to slow it down or stop it. Human capital as key resource in the economic development of a region is widely acknowledged. Highly skilled workers contribute to the creation a diffusion of knowledge (Fiore, Grisorio & Prota, 2011). Attracting these workers should be a priority for the public bodies in charge of the economic development of the region as these migrants can contribute to innovation related activities, in particular, patent applications and the creation of engineering and technology firms (Wadhwa et al., 2007a, 2007b). Adding to this, capturing the flow of these migrants may influence the flow of knowledge in the region.

4.3.2. Innovation Focused Agencies

Such policies, as detailed above, require a regional organisation with political or institutional powers to be implemented properly, especially if they are to be tailored to specificities of a local area. Innovation agencies, or regional development agencies, are set up with the intention to promote innovation-focused policies within their territory. They have developed responsibility for the economic development of their attached territory, with the specific tasks of implementing tailored policies favouring economic development, encouraging international firms to settle, and ensuring cooperation between the firms and universities. Such innovation agencies may be crucial in the case of transitional or industrial regions, so they may gain in adaptive and innovative capacity. They provide regions with the ability to develop the fine-grained public policies needed to address perceived “system failures” and support an active role for the regional government (Cooke & Morgan, 2000).

Fiore, Grisorio, Prota, (2011) underline three ways in which economic development agencies may encourage innovation on their territory. First, they encourage learning and innovation cultures, as well as the reinforcement of social capital by the promotion of cooperative relations and dialogue, which lowers uncertainty and information costs for other actors in the RIS. (Fiore, Grisorio, Prota, 2011). Second, regional agencies can contribute to the establishment of an “adequate” balance between collaboration and competition among local businesses, hence facilitating the learning process, necessary for well functioning RIS (North, 1995). Third, they help the territory to develop some adaptive capacity, highlighting the willingness and capacity of local actors to adopt and re-use new knowledge quickly, to then engage in creative activities (Fiore, Grisorio, Prota, 2011).

These regional governmental agencies have a central role in enhancing regional partnerships and social

capital, notably thanks to their proximity and knowledge to local arrangements and particularities, as well as their privileged relationships with private and public actors that are in charge of innovation promotion processes. Adding to this, public policies and public bodies may also work at the prospection of new economic factors that could enhance the economic development of the region. They act as the bridge between the actors of the RIS and the institutional frame in which they are set; making sure that actors have a shared vision and act together towards it (Fiore, Grisorio, Prota, 2011).

The economic development of a particular region, whatever the scale, is the responsibility of different levels of governance and governments. In the case of the Metropolitan Region of Grenoble, we argue that it is the responsibility of Auvergne-Rhône-Alpes Council, of the District of Isère Council, and finally, at the closest scale, of the Metropolitan Region Council to provide an environment favourable for economic opportunities and innovation. There is a large variety of possible types of innovation agencies, which in some countries perform a national function, as they are in charge of designing and implementing policies at the national level. In our case, there is one Metropolitan region agency that is in charge of the promotion of economic development in the Metropolitan Region of Grenoble, the “Agence économique pour le développement de l’Isère” (AEPI).

Chapter 5. Methodological Framework.

In this section, we will explain from a methodological position how this thesis addresses the research question. We explain how the research will be conducted, what sources will be used, as well as provide justifications for the methodological decisions that have been taken. First we begin with a brief discussion of how RIS research has been conducted in the past, and explain how that has influenced this thesis. Second we explain both how the research will be conducted, as well as providing justifications for why.

5.1. How RISs are studied in the literature.

Doloreux and Parto (2004) identify two ways to look at Regional Innovation Systems. The first way is based on comparative empirical studies of different regions around the world, aiming to highlight sets of criteria that could potentially trigger innovation in the regional level. Comparative studies are used like this to help understand the creation and function of RISs, with a particular focus on isolating the desirable attributes and mechanisms that produce innovation and drive competitiveness. When these attributes are identified, public policies can thus be adapted based on the comparative formats conclusions (Doloreux & Parto, 2004).

The second way of looking at RIS's, is to observe a single case study in depth, with the aim to determine the extent to which the case study system fits within the concept of a Regional Innovation System. Such studies allow examination of the specific relationships between the actors of a system, and to capture the mechanisms of innovation at a local level. Going further, this approach helps academics to map and highlight the bonds and links between the different actors within a regional innovation system. Highlighting these relationships and the different mechanisms at play serves to represent the multitude of possibilities to generate innovation on a local level, underlining the various forms that a RIS may take, the potential for development of a rural or transitional region into a highly innovative one, or the potential variety of policies that may reinforce the innovative capacity of a region.

For the sake of this research, we will follow the second methodological approach suggested previously, as the scope of this study is to describe the main features and characteristics of the RIS of Grenoble, presumed to be involved in fostering innovation on the territory, which naturally lends itself to this single study approach. This research goal necessitates therefore an in-depth examination of the actors, policies and economic figures in this region, and this has not been done before. The scope and the research constraints of a master's thesis do not allow for a further comparative aspect of the research to be added. This thesis may however form the basis for further research that adopts such a comparative strategy.

5.2. Methods available and research strategy

To fulfil the research goal, and describe the RIS of Grenoble, we will conduct a document analysis. In doing this, we draw from the Literature Review and Theoretical Framework Chapter that demonstrates that there are three categories of actors that have a role in breeding innovation processes in the regional setting, the economic actors, the academic and research actors, and the local government actors. This research will thus be divided in three sections, each one representing one category of actors of the local setting.

This research is primarily composed of analysis of secondary sources. A secondary data analysis, the first part of this research, may be qualified in the broadest sense as an “Analysis of data collected by someone else” (Boslaugh, 2007) meaning the information and data may come from many types of sources; government datasets, universities records, authors websites, laboratory reviews and publications. Performing a secondary analysis when trying to identify the major actors of the RIS of Grenoble will help us understand how and where innovation processes happen. In many cases, this data is available to the public at large, and therefore is easily accessible. Adding to this, several authors have studied the region of Grenoble and its local economic development, whether it was for case studies or in comparative studies, these have been previously discussed in the literature review (Lawton Smith, 2003; Bernardy, 1999; Finardi, 2013). By performing this type of analysis we will also be able to observe strategically important documents with critical economic information produced by local government bodies and economic agencies. However, it is important to notice that some of the information gathered in these previous studies needs to be updated to fit the change of the RIS over time.

Chapter 6 Description of the RIS of Grenoble.

6.1. The structure of the Metropolitan Region of Grenoble, and its regional context.

In this section, we will map out the important actors of the innovation system of Grenoble. Through a desk study of a variety of documents, produced by different organisations, we are able to collect important information about their characteristics and features, and thus answer our research question.

In this section, we will first give some basic information on Grenoble, the district it belongs within, Isère, and the region it belongs within, Auvergne-Rhone-Alpes (ARA). Second, we provide a description of the economic actors of the region, the major industries that constitute the economic environment of Grenoble, and provide some relevant figures regarding Grenoble's economic activities. Third, a similar approach to the academic actors is taken, describing the key academic actors, comprising of the universities, schools and research centres of the region, and providing key information on the sector as a whole. Fourth, we describe the political actors that frame the environment in which all the actors evolve, making a specific focus will be made on the Grenoble-Isère Economic development agency (AEPI), as it's purview includes innovation in the region, since it is in charge of promoting the regions "investment and economic development" (AEPI, 2016).

6.1.1. Grenoble, and its regional context: Auvergne Rhone Alpes.

In this section, some basic indicators are given to help the reader better understand the environment in which context Grenoble as a city and its metropolitan region have evolved. The Metropolitan Region of Grenoble, is the economic capital of the district of Isère. The District of Isère, is in turn contained within one of the twenty three French Metropolitan Regions, Auvergne-Rhone-Alpes. The Auvergne-Rhône-Alpes region is home to some 7,937,000 inhabitants. It is 69.711 km², which for context is 12.8% of the French Metropolitan area. (INSEE, 2016). Between 2008 and 2015, Auvergne-Rhone-Alpes' population increased by 0.8%; whilst the rest of France's population increased by 0.5%. (INSEE, 2015).

Figure 1: Auvergne-Rhone-Alpes, amongst the other French metropolitan region. (AEPI, 2017)



Figure 2. Auvergne-Rhone-Alpes’ districts.

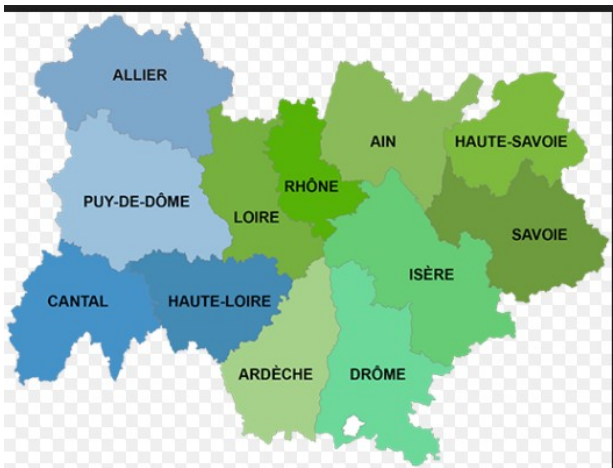


Figure 3. 10 largest cities in the Auvergne-Rhone-Alpes region by population size (2013, latest available data, (AEPI, 2016)

City name	District/ Province	Inhabitants
Lyon	Rhone	2,237,676
Grenoble	Isère	684,398
Saint-Etienne	Loire	515,240
Clermont-Ferrand	Puy-de-Dome	300,200
Genève Annemasse	Haute Savoie	225,173
Annecy	Haute-Savoie	220,118
Chambéry	Savoie	175,751
Valence	Drome	124,197
Bourg-en Bresse	Ain	113,214
Vienne	Isère	107,132

The rate of employment in the region is of 65.7% comparing with 63.7% for metropolitan France (AEPI, 2016). The unemployment rate of the region is 8.8%, compared to the Metropolitan France average of 9.9%. The region houses 305,000 students, and the expenditure on R&D reached 6.6 billion in Auvergne-Rhone-Alpes (Figures from 2014), representing 13.8% of the national total, and 2.7% of the regions GDP. Auvergne-Rhone-Alpes has the fourth most the number of patents in the European Union. Auvergne-Rhone-Alpes is the second largest French region, and fourth largest European region, in terms of GDP. It benefits from a robust industrial base, a well-developed tertiary sector, and strong tourism assets. (AEPI, 2017)

The GDP of the Auvergne-Rhone-Alpes Region for 2013 was 241,093 billion euros, and 30,988 euros per capita (CCI, 2016). It represented 11.6% of French GDP. The partition of the workforce between the sectors of activity in the Auvergne-Rhone-Alpes region may be found bellow in Figure 4, as well as a comparison with the rest of Metropolitan France.

Figure 4: Partition of the worforce in Auvergne Rhone Alpes Region (CCI,2017).

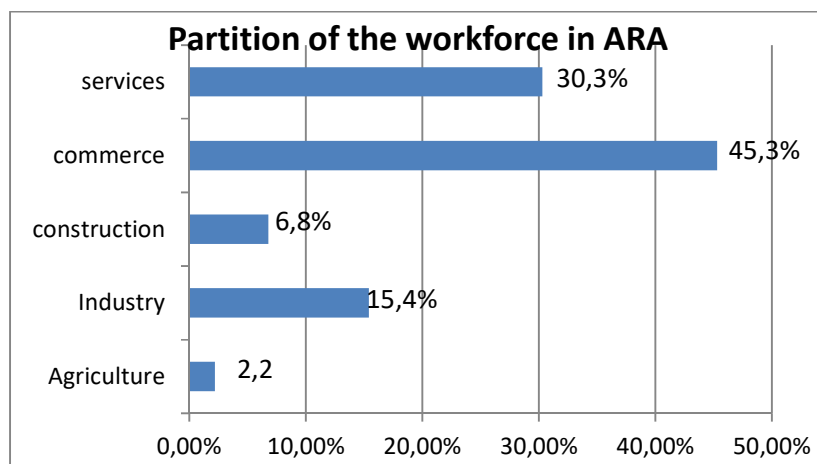
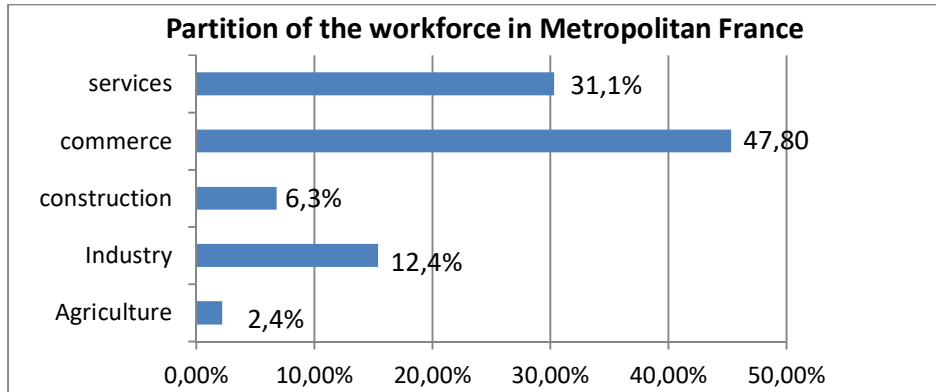


Figure 5: Partition of the workforce in Metropolitan France (CCI, 2017).



The main sectors of activity in the ARA Region are: Machining, Digital Technologies, Electronic Component Manufacture and Design, Energy, Pharma and Medical Technologies, Tyre Manufacturing and Design, Plastics Processing, and Eco-Technologies. Many of these are found in the Grenoble Metropolitan Region.

Finally to place the region within its international context, it is interesting to visualize the countries with which Rhone Alpes has commercial ties. The top 5 exports and import destinations of Auvergne-Rhones-Alpes are listed below by the AEPI (2017) using figures of the Directorate-General of Customs and Indirect Taxes (2015).

Figure 6: Top 5 export destinations for the region Auvergne-Rhone-Alpes. (AEPI, 2017)

Country	Auvergne-Rhones Alpes	Share of exports	ARA/France %
Germany	8,279 million Euros	14,7%	11,6%
Italy	5.493 million euros	9,8%	17,2%
Spain	4,730 million euros	8,4%	14,6%
UK	3980 million euros	7,1%	12,6%
USA	3850 million euros	6,8%	11,8%

Figure 7: Top 5 import destination of the region Auvergne-Rhone-Alpes. (AEPI, 2017)

Country	Auvergne-Rhone-Alpes	Share/total of import (%)	ARA/France %
Germany	9,368 million euros	17,2	10,8
Italy	7,123 million euros	13,1	18,9
China	5,291 million euros	9,7	11,3
Spain	3,095 million euros	5,7	9,8
USA	3004 million euros	5,7	8,6

The region Auvergne-Rhone-Alpes is composed of 12 Districts or “Départements” in French. The unit of analysis of this paper is the Metropolitan Region of Grenoble, which is the economic and political capital of Isère. The Isère District, houses of a population of 1.3 million and is home to 500,000 jobs. The Metropolitan Region of Grenoble, is populated by 759,000 inhabitants. It counts 67,500 students as residents, from which 15.4% of them are foreigners (AEPI, 2017). The Grenoble Metropolitan Region has a workforce of 499,000 individuals, and houses more than 460 enterprises utilising foreign capital investment, representing some 41,200 jobs. (AEPI, 2016)

6.2. The major economic actors and statistics of regional economic development.

Figures have shown that Grenoble benefits from a strong economic environment, and is innovative and adaptive. The city and its metropolitan region count many students, researchers, investors, natives and foreign firms as residents. In the sections below, we examine the major economic actors in the Grenoble Metropolitan Region, as it allows us to understand what the economic development of Grenoble is made of. Understanding the economic environment of Grenoble allows us to perceive its innovative capacity, and economic potential. Thus, after highlighting the major industries taking place in Grenoble, we examine the major competitiveness poles and clusters that favour innovative processes, by gathering specific and well-delimited information about the location’s multidisciplinary actors, portrayed theme by theme.

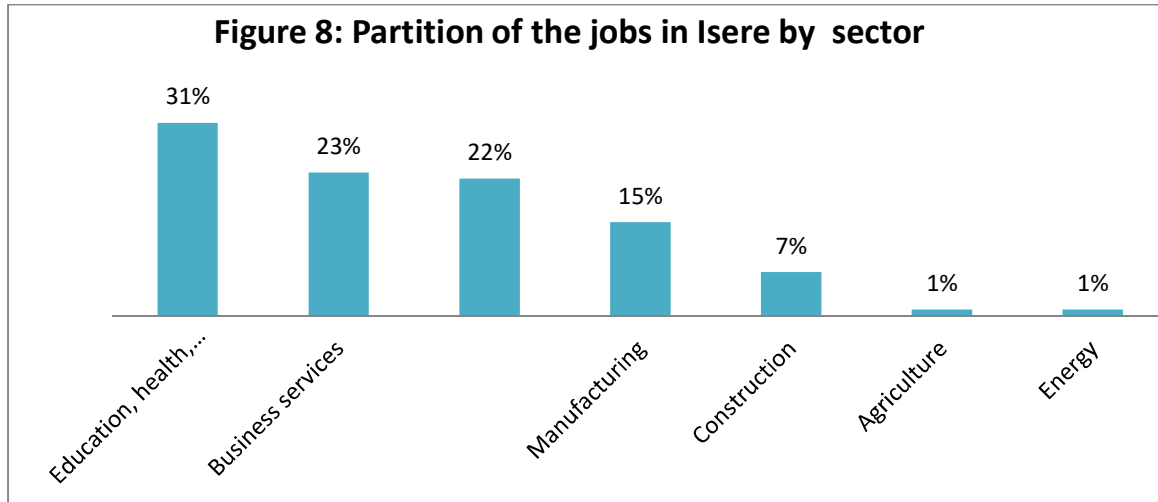
Grenoble and its metropolitan region house many competitiveness clusters and competitiveness poles. These two concepts, although closely related, have strictly different meanings when applied to the French system. Competitiveness poles were created in 2004 all around France, as an initiative of the government in an attempt by the French government to launch a new set of industrial policies, aimed at enhancing regional and national growth. Competitiveness poles are formal organisations that bring together, in a specific and well-defined territory, actors of the academic sphere, large companies, SME’s, training and research centres and actors of the local and regional government. The purpose of the multidisciplinary and multi-level organisation of these poles is to stimulate innovation by encouraging collaborative research and development projects, and synergies between different actors (AEPI, 2016). In Grenoble, the four major competitiveness poles are: Minalogic, LyonBiopole, Tenerrdis, and Axelera. Each one of these poles represents an area that Grenoble is excellent in. They will be the object of a more detailed examination later on.

6.2.1. The major sectors of activity of the region.

Looking closer at the different economic environments of the district of Isère, from which Grenoble is the economic capital, we observe that it benefits from a well-diversified basis of industries and research areas including: mathematics, physics, engineering sciences, micro and nano-technologies, and green technologies (CCI, 2017).

Adding to this, Isère is the premier French industrial district, with 15% of its population employed in manufacturing, which represents a total of 73,600 jobs in the region (AEPI, 2016; INSEE, 2016). For comparison, in the rest of France, the average rate of the population employed in the manufacturing sector is 11%.

Figure 8. Partition of Jobs in Isère by Sector.



The workforce of the Isère district is composed of 499,000 individuals. Jobs are divided as follows. There are 155,000 jobs in the education, health, social and administration sectors (31%). Business services jobs constitute up to 113,300 jobs out of the total workforce (23%). The third largest sector is the commercial services, constituting 112,200 jobs and 22% of the workforce. Manufacturing jobs, as stated earlier, add up to 15% of the workforce, with 73,600 jobs. The construction sector represents in total 7% of the workforce, with 33,800 jobs. Finally, the last two sectors, energy and agriculture, represent respectively 6,100 and 5,000 jobs, with each of these sectors representing roughly 1% of the workforce. (AEPI, 2017).

Amongst the manufacturing sector, there are four majors branches of activities that can be identified in the region of Grenoble as “poles of excellence”; meaning they are sectors in which Grenoble is well known for having exceptional knowledge, highly skilled labour, and infrastructure. These sectors of industry can be listed as follow: Digital technologies (1), Med-tech (technologies applied to health) and biotechnologies (2), new energy technologies (3) and chemicals and cleantech (4).

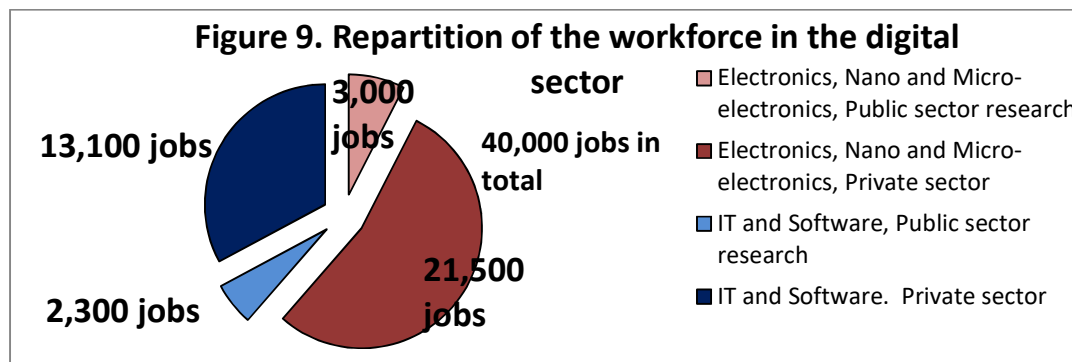
6.2.1.1. Digital technologies.

The first sector of activity in Grenoble gathers activities linked to digital technologies. This sector represents in itself 40,000 jobs and 6,800 students (AEPI, 2017). In this sector, there are two major branches: Electronics, micro-and Nano-electronics sector, as well as the IT and Software sector.

The sector of Electronics, micro-and Nano-electronics represents 24,500 jobs, from which 21,500 come from private companies, with 3,000 individuals employed through government funded research. Since 2002, 13 billion euros were invested in this sector. Grenoble’s metropolitan region is home to one-third of France’s electronic component manufacturing jobs (AEPI, 2017). The main companies operating in the Isère District in this sector specifically are the following: STMicroelectronics, Soitec, e2v, Sofradir, Ulis, Trixell, Thales Electron Devices, Thales Avionics, ARM, ASML, Applied Materials, Tokyo Electron, Mentor Graphics, Synopsys, Cadence Design Systems, Air Liquide Electronic Systems, Lam Research, Tronics,

Dolphin Integration, Intel Corp, Radiall, InvenSense, Entegris, 40-30 and Apix.

The IT and Software sector represents in total 15,400 jobs. 13,100 in the private sector and 2,300 in government funded research. (AEPI, 2017). Grenoble, is a hub for research and development in hardware-software convergence. One-fourth of jobs in this sector are in R&D (public and private sectors combined). The main companies operating in Isère in this sector are: HPE-HP Inc, Atos/Bull, Capgemini, Xerox, Oracle, Orange L@bs, Salesforce.com, Business&Decision Eolas, Open, Autodesk, The Mathworks, Ericsson, Comsol, Forgerock, Criteo, Esri, Photoweb, Kelkoo, Spartoo, Bonitasoft, CGI and Persistent Systems.

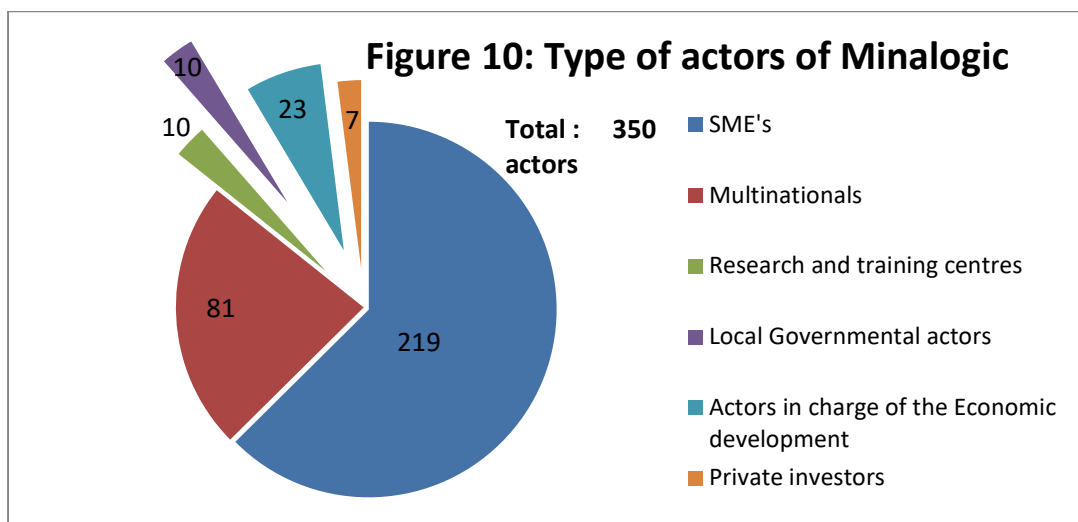


We observe that out of 40,000 jobs in the digital sector, the number of employees doing government funded research is of about 5,300 jobs out of 40,000 jobs, thus it represents 13.25%. We do not have the figures for research conducted within the private sector. However we do know that for the IT and Software sector, one-fourth of jobs are in R&D, public and private sectors combined (AEPI, 2017).

In the field of digital technologies, various projects have been set up in Grenoble and are now recognised as of international influence. To name few initiatives: the competitiveness pole Minalogic, the project GIANT, and the partnership Grenoble-Dresde.

Minalogic, is a competitiveness pole of international influence that was created in 2005. It is specialised in digital technologies and more precisely in Micro-electronics, Nano-electronics, Photonics and Software technologies. It produces technologies, products and services that relate to various industrial sectors ranging from IT to Health technologies to Energy.

Minalogic comprises more than 350 actors from various fields. Amongst these actors, 300 are companies, from which 73% are start-ups and SME's. There are 10 research and training centres, along with again 10 local political entities and municipalities. 23 participating organisations have an "economic development role", and 7 actors are private investors (See figure 4). Since its creation in 2005, Minalogic counts 519 projects finalised, out of which 176 were patented and 56 products were commercialised or are in the process of being so. Adding to this, 686 pieces of research were published, from which one third was written for an international audience. Since 2005, 706 jobs were created in the pole, to now reach a workforce of 2,900 individuals. The total R&D expenditures is 2.1 billion euros since 2005. In 2015, the revenue for the pole was of 3.6 billion euros (Minalogic, 2017).



Regarding governance, Minalogic benefits from a multi-level, multi-disciplinary model, as it gathers a large variety of actors, from different spheres, including private companies, local government, research centres, and laboratories. The Administrative Council is in charge of the governance and future orientation of the competitiveness pole. There are 16 members in this council, representing the SME's, the multinationals, municipalities, research and training centres involved in the activities of the pole. The represented members listed as follow: STMicroelectronics, Schneider electric, Araymond, Eveon, Bidul & Co, Automation Square, Ireis, Hardis Group, Orange. For the training centres and laboratories present in the pole, the representatives are the INPG, Grenoble Université Alpes, Inria, CEA, INSA and the université Jean Monnet of Saint Etienne. The departmental council of Isère is the main actor representing the political sphere.

Another important organ in the governance of the pole is the SME's board, which is in charge of representing the interests of the SME's in the pole to the Administrative council.

There are 8 members in this board the CEO's of the SME's of: Alpwise, Evéneon, Bidul&Co, CIO Systèmes EMbarqués, Iris, Automation Square, Tiempo, Tronic Microsystems.

6.2.1.2. Med technologies, Biotechnologies and healthcare.

Med-technologies (technologies applied to health) and Healthcare is another sector that drives the economy of Grenoble. It represents 10,900 jobs for the region, with 8,600 individuals employed in the private sector, and 2,300 individuals employed by publicly funded research. Adding to this, 9,000 individuals are studying in this field. (CCI, 2017). An interesting point to notice is that this sector is highly job-creating, as over the last 15 years, it has created more than 3,200 jobs in the region (AEPI, 2017). Highly innovative, this sector is also attractive to investors, both national and foreign; over 26 million euros were raised in 2016 (AEPI, 2017).

There are many companies operating in Isère in this sector, listed as follows: bioMérieux, Roche, BD, GE Healthcare, Medtronic, Trixell, Fluoptics, InvenSense, Wright (formerly Tornier), Eveon, Endocontrol,

Genostar, Technidata, Maatel, Fresenius, Patheon, Skyepharma, ARaymondLife, Biomatech, Aryballe, Synapcell, UroMems, Irllynx, Avalun, Surgivisio, Cytoo, Equitime, Alpao, Koelis, Kayentis, Sublimed and BGene... (AEPI, 2017).

In Grenoble, innovation centres and international projects have been organised surrounding the sector of Med-technologies and health. Two major competitiveness poles have activities in Grenoble: LyonBiopole, and Medicalps. Lyonbiopole mostly is a regional competitiveness pole with most of its facilities in Lyon, but has collaborative links with research centres of Grenoble: Institute for Advanced Biosciences, and The Institute of Structural Biology. LyonBiopole has four main strategic axes: Human medicine, veterinary medicine; in vitro diagnostics and medical devices and technologies. It offers support in various ways: to facilitate innovation, support SME's development, and to offer a high-level of research infrastructure. It has 6 founding members, from which 4 are internationally renowned in the industry: Sanofi Pasteur, bioMérieux, Boehringer Ingelheim Animal Health, and Becton Dickinson. The two last members are the CEA and the Fondation Mérieux (a foundation dedicated to fighting infectious diseases). The Governance board is composed of Sanofi Pasteur, Hospices civil de Lyon, Voxcan, Mérieux, Leti, Cellipse, Boehringer Ingelheim Animal health, Becton Dickinson, and Inserm.

In total, this pole currently has some 200 members, from which 180 are innovative companies, and 14 are research and clinical centres. The major players being ENS, INSA, INRIA, Ecole centrale de Lyon, CNRS, INSERM, EM Lyon, Grenoble Ecole de management. Regarding the academic actors, Université Saint Etienne and Université Lyon 1 Claude Bernard are partners of this pole. Adding to these actors, we observe that within the competitiveness pole, many competitive clusters can be found; to name few: I-care, Medicalps, and Le clara.

Medicalps is the major health technology related cluster in Grenoble, specializing in innovative health technologies. Since 2000, the cluster gathers and represents a network of local enterprises from the biotechnologies and medical technologies spheres. With a governance system composed in majority by private actors, the leading part of Medicalps is mostly taken by the entrepreneurs themselves. The programs of Medicalps serve to improve the growth and visibility of businesses involved in health technologies in Isère. It promotes the attractiveness of the territory to help it shine on the international level.

The cluster benefits from the robust support of local municipalities, research institutes, universities, and even clinical institutes like Grenoble Hospital. The cluster mobilises all these actors around one common objective, to accelerate the development of start-ups and firms in the territory, and to facilitate the access to national and international markets. Medicalps has 70 members and 75 international and European partners.

6.2.1.3. The New Energy Technologies Sector.

The third major sector of activity in Grenoble concerns New Energy Technologies. This sector represents more than 15,000 jobs and 1,200 students. Amongst the 15,000 individuals working in the field, 13,000 work in private companies, whilst 2,000 individuals are conducting government funded research (AEPI, 2017).

The main companies operating and involved in this sector of industry in the region are: Air Liquide, Schneider Electric, Artelia, Enerbee, GE Renewable Energy, Atos Worldgrid, Eaton, ZIV, EDF ENR PWT, Symbio, McPhy, Siemens, Sylfen, Andritz Hydro, HydroQuest, and Paxitech.

Grenoble is the home of a major competitiveness cluster in this sector, Tenerrdis. This pole aims to “bolster the competitiveness of emerging New Energy Technology industries through innovation.” (Tenerrdis, 2017). At its creation, 2 billion euros were invested, from which 805 million euros were publicly financed. Since then, Tenerrdis has certified 603 research projects. It has 217 members, 60% of which are SMEs (AEPI, 2017). The main goals of the pole are to help new energy companies to “expand their footprint in the global carbon-free energy market.” (Tenerrdis, 2017). Tenerrdis has three main strategies. First, to facilitate collaborative innovative projects that help cluster members expand their businesses, second, to provide opportunities for small- to mid-sized businesses in existing New Energy Technology industries, and third, to promote the cluster’s members and technological expertise internationally (Tenerrdis, 2017).

Tenerrdis is composed of 5 major programs with the intent to develop a diversified energy offer for the future, with applications to different markets. The first program of the pole focuses on solar energy applied to buildings, to improve the efficiency of the energy management, using solar and thermal energy. The second program consists in studying, at different scales, the efficiency of energy distribution networks, taking into account the newfound ability of customers to sell electricity production back to ‘the grid’. The third programme focuses on Biomass production, the production of fuel, electricity, and hydrogen out of wood reserves. The fourth program surrounds the production of hydrogen, and fuel cells. The idea being to develop green transportation means powered by hydrogen, whilst producing hydrogen from renewable energies (electrolysis, biomass gas). The last program is focused on hydraulic power, aiming to increase the efficiency of the equipment, and improve the management of water resources, whilst promote new concepts for machinery and turbines.

In 2013, the partition of the number of project according to the 5 programs was as follows:

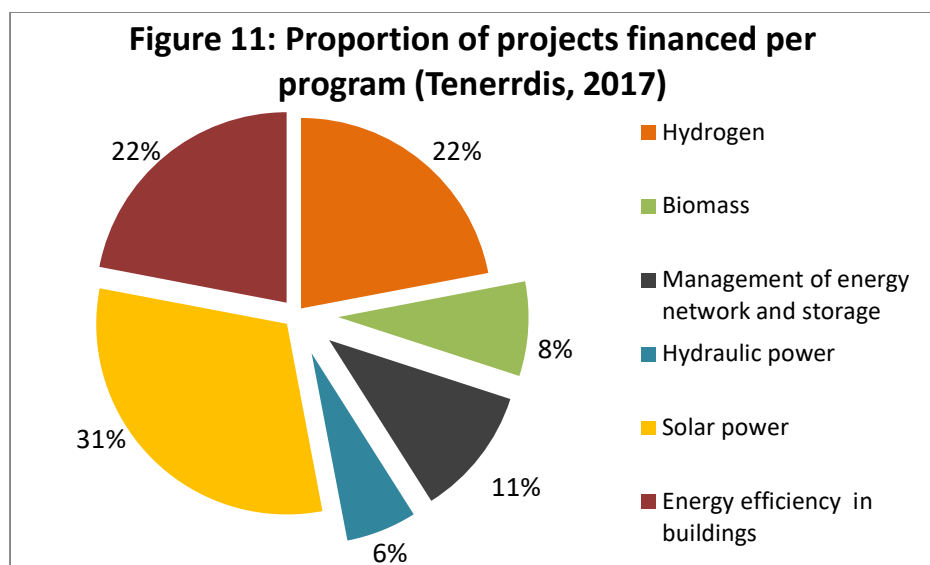


Figure 5 shows the proportion of the projects financed in function of the 5 programs of the pole. 22% of the total of the projects were on Hydrogen power. 8% of the projects focused on biomass power projects. 11% of the total projects focused on the management of energy network and storage. Hydraulic power focused projects represent 6% of the total projects. Solar power projects themselves represent 31% of the total projects, whilst energy efficiency applied to buildings projects represented 22% of the total quantity of projects of the pole. (Tenerrdis, 2017).

The governance of the pole is shared between different members, made up by six businesses from new energy technology sector; Alstom Power Environment, CIAT, GDF Suez, MGE UPS SYSTEMS, Tenesol, and Thales. Three research and academic centres; the CEA, the INPG, and the Savoie University. And finally, by one political actor, which represents the Auvergne Rhone Alpes Council. In total, this pole represents more than 100,000 jobs in the Auvergne Rhone-Alpes region, and counts major international players: notably Schneider Electric, Alstom, MGE, Photowatt, Tenesol, Gaz de France, SUEZ. Some of these companies are active in other clusters and competitiveness poles and clusters because of their diverse businesses interests. (Tenerrdis, 2017)

6.2.1.4. Chemicals and Clean-tech.

The fourth major sector of activity in the Grenoble Metropolitan Region focuses on chemicals and clean-tech (Eco materials). It represents more than 12,700 jobs for Grenoble, shared between 11,400 individuals employed in the private sector, and 1,300 jobs in government funded research, specifically focused on research associated with chemicals in clean-tech. Adding to this, 80% of France's private-sector research into eco-construction, materials, and processes take place the region. Already more than one billion euros has been invested in this sector between 2012 and 2017 (AEPI, 2017).

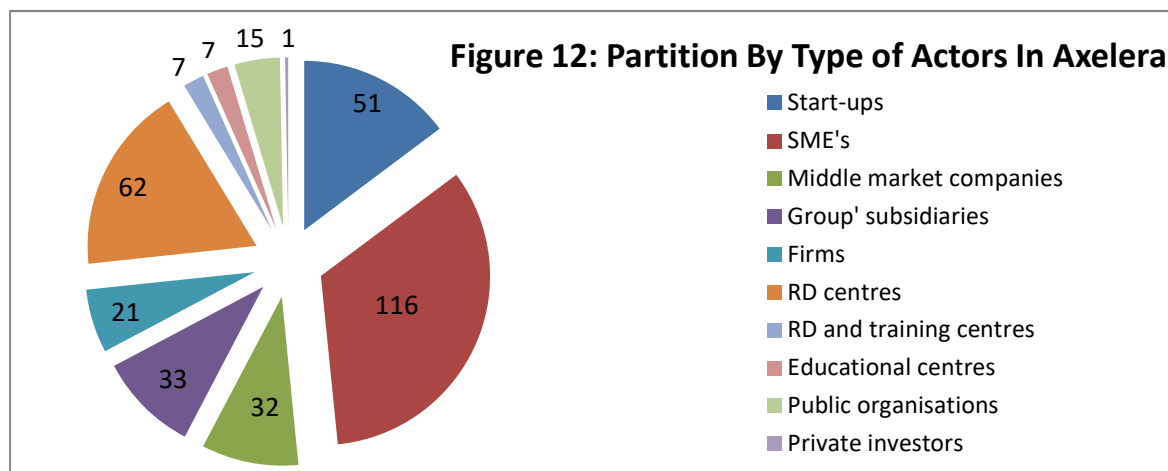
The major businesses of this sector in the region are: Arkema, Air Liquide, Adisseo, Vencorex, Hexcel, Solvay, Bluestar Silicones, Tera Environnement, Ethera, Ecoat, Tredi (groupe Seché Environnement), Kerneos, Parexlanko, Serge Ferrari, Xella, Areva, Novacap, Evonik, Ryb, Artelia, Labaronne Citaf, Recupyl, Wessling, Vicat, and Lafarge (AEPI, 2017).

Adding to this, Grenoble is home to a competitiveness cluster of international influence in the sector of chemical and environmental industries Axelera. Created in 2004, the pole has 6 founding members, mixing enterprises and research centres which include, the National Centre for Scientific Research (CNRS), Engins, IFP Energies nouvelles, Solvay, and SUEZ. It is supported by three of local and regional political bodies of the region: the Auvergne-Rhones-Alpes council, and the Metropolitan councils of Lyon and Grenoble. The pole produced 290 R&D projects certified for total spending of €800m. It is constituted of 337 members, half of which are SMEs (Axelera, 2017) (See figure 6).

This pole focuses on 5 specific strategic axes surrounding chemicals and clean-tech industry products: Renewable raw materials, Eco-efficient factories, materials and products for industries, Recyclable and recyclability as well as preservation and restauration of natural and urban spaces. It also gathers many competencies, such as the fabrication of new materials, services to industries (energy efficiency, regulations), services regarding environmental issues, and laboratories specialised in chemistry.

Axelera, has also allowed the creation of 6 technological platforms, such as Axel'One and Provademse. Axel'One is collaborative platform dedicated to chemistry and innovation in materials. The main goal of the platform is to favour collaboration between different actors. It has two specific focuses: materials and innovative processes. Provademse is also thought of as a collaborative platform where actors think together about a more durable management of waste, water resources, raw materials and energies. It is constituted by both public research centres and private enterprises, and has clients and projects all around the world. Both of these platforms show the innovative capacity of the competitive pole and its capacity to bring actors together around a common project.

The 345 members of the pole Axelera may be partitioned in the figure 12 as follow:



Ranked amongst the most highly performing poles by the French State in 2012, and labelled Gold by the European Union in 2014 and 2016, the pole Axelera has definitely triggered an innovative dynamic in the territory. (Axelera, 2017)

6.2.2. The multinationals that drive local economic growth.

In the previous section, we have identified a comprehensive list of the major sectors of activities that comprise the RIS in Grenoble. Within this, we observed the constitution of the four major competitiveness poles and clusters that through the links within the clusters/poles are said to promote and favour innovation in the regional setting of Grenoble. In addition to this, there are also many large multinational corporations that exist within the RIS of Grenoble and that impact the local economy. These multinationals that are listed below as drivers of the local economy were compiled by the AEPI, the Grenoble Isère Innovation Agency.

Figure 13. Top 10 companies in Grenoble Metropolitan Region by number of employees (AEPI, 2017).

Companies	Sector of industry	NB of employees.
STMicroelectronics	Microelectronics	6000 to 7000 employees
Schneider Electric	Energy Management	5000 to 6000 employees.
EDF	Energy	2000 to 3000 employees.
HPE HP INC	IT	1500 to 2000 employees.
Caterpillar	Construction equipment	1500 to 2000 employees.
BD	Medical Technologies	1500 to 2000 employees
Atos-Bull	IT	900 to 1000 employees.
GE Renewable Energy	Hydraulic turbines	900 to 1000 employees.
Capgemini/Sogeti	IT	900 to 1000 employees.
Air Liquide	Industrial Gaz	900 to 1000 employees.
Soitec	Microelectronics	800 to 900 employees.
ARaymond	Fastening/assembly solutions	800 to 900 employees.
Calor	Household appliance	800 to 900 employees.

Figure 14: Top 10 companies in the District of Isère with foreign capital investment (AEPI, 2017).

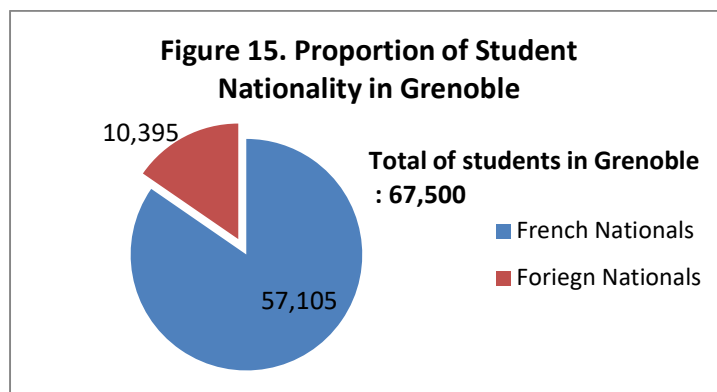
Companies	Nationality	Sector	Nb of employees
STmicroelectronics	France/Italy	Microelectronics	6 000- 7 000
HP INC - HPE - DXC TECHNOLOGY	USA	IT	1 500-2 000
Caterpillar	USA	Construction equipment	1 500-2 000
BD	USA	Medical Technologies	1 500-2 000
GE Renewable Energy	USA	Hydraulic turbines	900-1 000
Rcohe Diagnostics	Switzerland	Medical diagnostic technologies	700-800
Tecumseh Europe	USA	Refrigerant equipments	700-800
Porcher Groupe	United Kingdom	Textile technology	500-600
Rolls Royce Civil Nuclear	United Kingdom	Civil Nuclear Controlling Equipments	500-600
Vencorex	Thaïlande/Sweden	Chemistry	500-600

We have seen in this section that the Metropolitan Region of Grenoble is the economic heart of the Isère District, and the second largest town of the Auvergne-Rhone-Alpes region after Lyon. It benefits from a diverse base of successful industries, whether they are high-tech or manufacturing. The four sectors of excellence that drive the region are: Med-technologies and Bio-technologies, Clean-tech and Eco-Materials, New Energy Technologies, and finally digital technologies with a specific focus on IT and Software as well as Electronic-nanotechnologies and Micro-technologies. Grenoble has four competitiveness poles of international influence, which showcase Grenoble's involvement in research and innovation: Minalogic, Tenerrdis, Lyonbiopole and Axelera. Grenoble thus has a robust industrial setting, reliant on various industries and sectors, as well as research, and on the academic actors that train the future highly skilled workforce of the region/district.

6.3. The academic actors of the region, and complementary statistics.

In this section, we will examine the academic and research characteristics of the RIS of Grenoble. These academic actors fill two roles within the RIS. First, they provide the research capabilities that so many of Grenoble's successful economic actors are dependent on, utilising resources, which are in many cases provided by the private sector, effectively to produce technological advances that spur innovation. Second, the academic actors train the workforce of the region, adding skills, knowledge and human capital that many economic actors are reliant upon for their activities.

The Isère District, benefits from a young and educated population, with education levels significantly above the national average. For instance, 31% of the population over the age of 15 has completed at least two years of higher education, whilst the rate is of 27% for all of France (CCI, 2017). Looking at Grenoble specifically, it counts 67,500 students, from which 15.4% of them are foreigners (AEPI, 2017) (see Figure 15). For the rest of France, on average, only 14.5% of students are foreign born. Adding to this figure, 45% of the PHD students of Grenoble are foreigners. Training is also orientated mostly towards the sciences, although academic actors in Grenoble still offer many degrees in different sectors. Some 41% of students are enrolled in science programs, especially in fundamental science and engineering (AEPI, 2017).



To better understand the academic structure of the Metropolitan region of Grenoble, it is important to go into detail when looking at the actors of the academic sphere, and the number of students enrolled. The major academic group of academies of the regional setting is the "Communauté Université Grenoble

Alpes" (COMUE). The COMUE was created by decree on the 31th of Decembre, 2014, and gathers different universities into one name (the members of the community still remain independent from one another). There are different 4 major members that constitute the Community of Université Grenoble Alpes (COMUE), and additionally 7 associated establishments. As a community of universities and institutes, it comprises establishment that may not be localised within the District of Isère, which make the calculation complicated. Indeed, the University of Savoie, a member of the community, gathers thousands of students, but does not belong to Isère, but to the Savoie District. Thus, we must be careful when calculating the number of students of the COMUE institutions within Grenoble and Isère. For the sake of this study, we will still examine the Savoie University, as an actor of the COMUE. The COMUE comprises in total around 62,000 students (UGA, 2017), when in total 67,500 students are located in establishment in Grenoble. Some of the members and associated establishments of the COMUE are research centres, whilst some are training institutes, because some of these associated members are research institutes, they will be detailed in another section dedicated to Research activities in Grenoble.

The first member of this community is the Université Grenoble Alpes (UGA). This newly founded university is actually the gathering of three previous independent structures: Université Joseph Fourier, Université Pierre-Mendès France, Université Stendhal. Nowadays, the total student population of the newly combined structure has reached 45,000 students in 2016 (UGA, 2017). The UGA is mainly in Grenoble but it also has a delocalised campus in the city of Valence in the Drome District. This university offers classes surrounding the sciences, technology and health, human and social sciences, literature, foreign languages, language sciences, the arts, and communication. Université Grenoble Alpes was ranked 6th in France, 20th in Europe and 93rd worldwide in 2016 by Thomson Reuters university ranking scale, which "aims to identify the institutions which contributes the most to scientific and technological advancement" (UGA, 2016).

The second major member of the COMUE is the CNRS, the National Centre for Scientific Research. The CNRS research centre of Grenoble is part of a whole network of research units present in all around France, gathering nationally more than 33,000 individuals. Grenoble, benefits from an important unit of research belonging to this CNRS network of research units, thus it will be described below in the section of research activities in Grenoble.

The third major member of this community is INRIA, the National Institute for Research in Computer Science Automation. It 2,400 members from 102 different countries and has many research units around France, and one in Grenoble. It will be detailed further on in the section on research activities in Grenoble.

Finally, the last major member of the COMUE is the Grenoble Institute of Technology (INPG). It is a public technology institute which for the year 2017, welcomed a total of 5,500 students and 800 researchers and teaching fellows (INPG, 2017). This engineering institute gathers six smaller schools of engineering, each one with a scientific speciality: Ensimag, Pagora, Ense3, Phelma, Esisar and Génie industriel. It is strongly dedicated to research and to maintaining links with industries, thus 2,200 students go on industrial internship placements each year (INPG, 2017). Adding to this, INPG has ties with 36 research institutes around France and in Europe and in the world (with collaborative relationships with laboratories in Vietnam, Mexico and China). INPG is also involved in projects developed by different

competitiveness poles such as Minalogic or Tenerrdis (INPG, 2017).

Regarding the associated establishments, their locations represent the difficulty of analysing a sole region in a country as interconnected as France, as often the practical considerations of organisations pay little regard to geographically or politically defined boundaries. Some associated establishments of the University of Grenoble Alpes have delocalised activities in other cities, to a greater or lesser extent. The case of the Université Savoie Mont Blanc is an extreme example, as its activities are located almost entirely in the district of Savoie, a neighbouring district to Isère, whilst still interacting heavily with research activities in Grenoble, as the excellent communications and relatively close distance (roughly a 50 minute drive from Grenoble City centre) of the University Savoie Mont Blanc facilitates this. This university offers training in sciences, technologies, foreign languages, literature, arts, human and social sciences. In 2016, more than 14,329 students were attending classes at this school. The university focuses on three specific poles of activity: Mountain studies, Eco-technologies and mechatronics. It works in close collaboration with major research institutes such as the CNRS, INRA, CEA and CERN. It is also strongly involved with competitiveness pools of the region such as Tenerrdis, Minalogic, Axelera.

Turning to the Institute Sciences Po Grenoble, this is specialised in political science, offering classes in all the branches related to this field of study as well as preparing classes for national civil servant exams. In 2016, 1,800 students attended this school, from which 180 were PHD students.

The ENSAG, the École nationale supérieure d'architecture de Grenoble is the National architectural school of Grenoble. It is a public establishment, created in 1927. It gathered in 2013 around 965 students, from which 20% were foreigners (ENSAG, 2017).

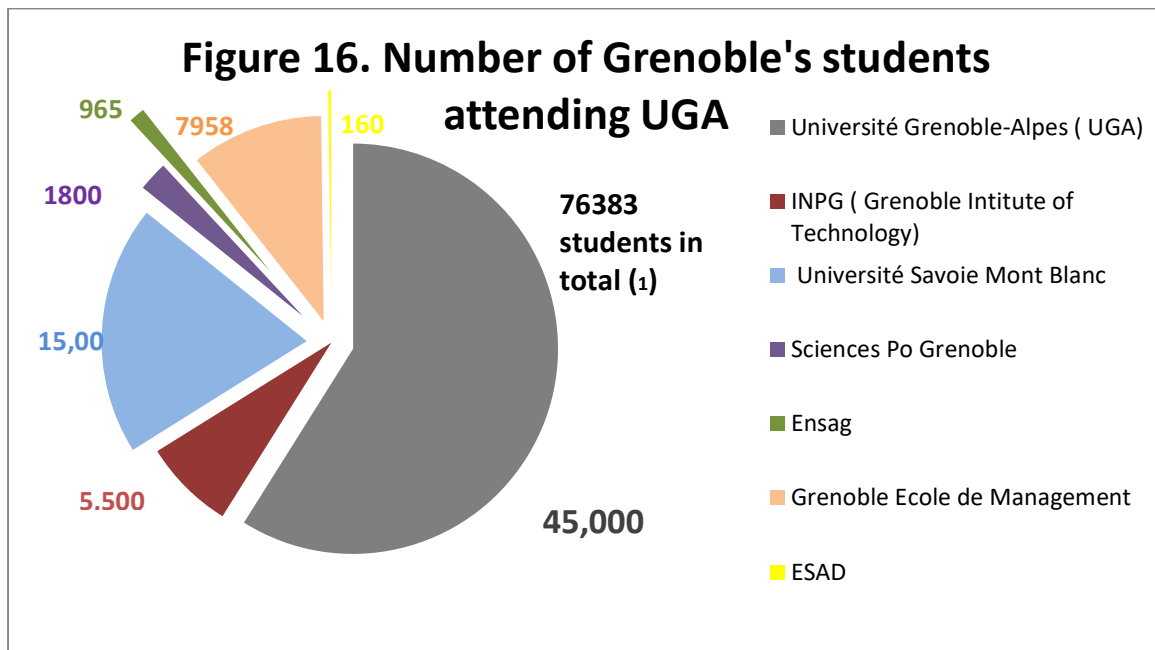
Another associated establishment of the COMUE is the the commissariat à l'Energie Atomique (CEA), an internationally renowned research centre in nuclear energy science with application to health, information and communication. As a major research centre of the RIS of Grenoble, the CEA will be examined later on in the section 6.3.2.

Grenoble Ecole de Management (GEM) also known as Graduate School of Business is another associated establishment of the COMUE. It is a private business and management school that welcomed for the year 2016-2017 about 7958 students (GEM, 2017). It is recognised to be an excellent management school, ranking number 20 in Europe according to the Economist¹ as well as top 50 worldwide (AEPI, 2017).

The ESAD, Ecole Supérieur d'Art et de Design, is specialised in Art and Design. It has two campuses, divided up between Grenoble and Valence, in the District of Drome. It welcomed in 2016-2017 around 160 students.

The National Institute for Research in Environmental and Agricultural Technology (IRSTEA). As one of the major research centres of Grenoble, the IRSTEA will be the object of a more in depth description in the following section on the research activities and institutes in Grenoble.

¹ <http://www.economist.com/whichmba/grenoble-graduate-school-business/2011>



(1) We are aware that there is a discrepancy between the total number of students portrayed in the graph and the number of students given earlier gathered through the different websites of the establishments studied. This result discrepancy might results from various sources: first it could come from a lack of up-to-date data or secondly, be due to rounding error.

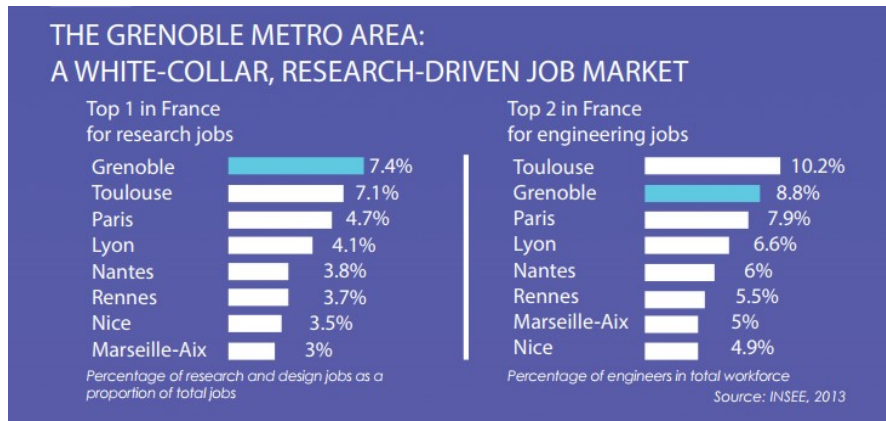
Adding to all this information, Université Grenoble-Alpes the largest members of the COMUE is known the premier “French university outside of Paris with the most PhD students”, with a total of 3,600. For the academic year of 2014-2015, it was calculated that that Grenoble was the region with the highest proportion of students enrolled in PHD programs, with a rate of 6.2% (outside Ile de France). For comparison, Strasbourg, the second ranked academic sector after Grenoble, had a percentage of 4.9% of students enrolled in PHD programs for the academic year 2014-2015 (AEPI, 2017).

6.3.2. Research and laboratories in Grenoble.

In the previous section, we have argued that Grenoble benefits from a solid student base, with excellent universities and schools, ranking well in the quality and quantity of education provided in both the France and European scale, whilst offering various types of diplomas and courses, with a focus on the sciences. In this section, we detail the major laboratories, observatories and research institutes that constitute a significant part of the Regional Innovation System of Grenoble, as Indeed, Research and Development activities, are seen as primary to innovation, and the Grenoble Metropolitan region ranks comparatively well in this matter.

The Metropolitan Region of Grenoble has the highest per capita proportion of jobs in research and development of a metropolitan region in France, followed by the metropolitan region of Toulouse. Grenoble having a rate of 7.4% and Toulouse has 7.1%, see figure 3 (INSEE, 2013).

Figure 17. The Grenoble Metro Area: A white-collar, research driven job market. (AEPI, 2017, INSEE, 2013).



It is also the largest metropolitan region for public research, after Paris (Chambre du commerce et de l'Industrie, 2017). The Isère District is home to 25,000 R&D jobs in total, with 15,000 jobs in government-funded research labs, and 10,000 at private-sector R&D centres. Out of the high level of public research, it is estimated that 200 start-ups were created in 10 years.

The Metropolitan Region of Grenoble is home to a large scientific community, with a significant proportion of foreign-born scientists. It also benefits from research centres of international, European and national influence. Some of these research centres also have large international scientific instruments of research, such as the EMBL (European Molecular Biology Laboratory) and the, ESRF (European Synchrotron Radiation Facility). There is a large variety of both large and small research centres in Grenoble, working in various domains, however, for the sake of this study, we will use a list provided by the AEPI (2017) that highlights the 13 most major research centres present in Grenoble. The majority of these research facilities are part of a “group” or a “network” of research centres with other facilities present in France or all around the Europe.

The first research centre is the European Molecular Biology Laboratory (EMBL). It is specialised in life sciences and has 6 missions: to perform basic research in molecular biology, to train scientists, students and visitors at all levels, to offer vital services to scientists in European Union member states, to develop new instruments and methods, to actively engage in technology transfer and to integrate European life science research. (EMBL, 2017). Research at the EMBL examines all levels of Biology's organisation, from “the molecule to the organism, as well as computational biology, bioinformatics and systems biology” (EMBL, 2017). This research centre is of international influence and has operation on six sites: Grenoble, Heidelberg, Barcelona, Habourg, Rome and EMBL-EBI Hinxton. The research centre in Grenoble is specialised in structural biology. It is constituted of 1,600 employees, with scientists coming from various disciplines: biology, physics, chemistry and computer science.

The second major research facility of the region is the Institut Laue Langevin. It is an international research facility, specialised in neutron science and technology (ILL, 2017). It operates one of the most intense neutron sources in the world and gathers around 1,400 researchers from over 40 different

countries. It is funded and managed by France, Germany, and the United Kingdom, and has 10 other collaborative partners involved in their research projects (Institut Laue Langevin, 2017).

The third research facility is the, European Synchrotron Radiation Facility (ESRF). Inaugurated in September 1994, it has a particle accelerator, and a joint research facility based around this, supported by 22 countries and 9 other associated countries. The project has an annual budget of around 100 million euros, employs over 630 people and is host to more than 7,000 visiting scientists each year (ESRF, 2017). This research centre shares a physical location with other important research centres of the region such as the ILL and the EMBL described above. Every year, about 7000 scientists from 22 partner countries and from around the world travel to Grenoble to use the facilities (ESRF, 2017).

The European Magnetic Field Laboratory gathers the effort of three laboratories in the Netherlands, Germany and France. The mission of this laboratory is to generate highest possible magnetic fields for use of scientific research. It provides pulsed (Toulouse and Dresden) as well as static magnetic fields (Grenoble, Nijmegen).

The fifth research centre, Institut de Radio-Astronomie Millimétrique (IRAM), specialises in radio astronomy. Its overall objective is “to explore the universe and to study its origins and evolution (IRAM, 2017). This research centre was put together by collaboration between France, Germany and Spain. It has facilities in the three countries, with the headquarters in Grenoble. It gathers more than 120 scientists, engineers, technicians and administrative personnel. Adding to this, through the years, the IRAM developed two observatories that are “are prime facilities for radio astronomy and among the most powerful observatories today operating at millimetre wavelengths.” (IRAM, 2017).

The sixth major research centre in Grenoble is the Atomic Energy Commission (CEA). It focuses its research on the development of new technologies in the field of health, information, and communications. It is also a key player in four main areas: defence and security, nuclear and renewable energies, technological research for industry, and fundamental particle research in the physical sciences and life sciences. The CEA gathers 9 research centres in itself, with 16,010 technicians, engineers and researchers in total. On the Grenoble site of the CEA, 4,600 researchers are present (CEA, 2017).

Another important research centre in Grenoble is the National Centre for Snow Studies (CEN). It is a research facility that has the task of surveying the snowpack, of forecasting its evolution and of diffusing relevant information” (CEN, 2017). This research centre studies the snowpack for different applications: avalanche hazard forecasting, role of the snow in the climate system, snow effects on mountainous catchment water resources and river discharges (CEN, 2017).

National Center for Scientific Research (CNRS) is another major research centre that has important activities in Grenoble. Founded in 1939 by governmental decree, it gathers 100 active public and private research structures and was the 6th largest patent filer in France in 2015 (CNRS, 2017). It aims at “carrying out all research capable of advancing knowledge and bringing social, cultural, and economic benefits for society.” (CNRS, 2017). It also has the goal of supporting training, and analysis of the national and international scientific climate its potential for evolution in order to develop national policies (CNRS, 2017). In particular, it undertakes research in the following fields: knowledge, Environment, energy and sustainable development, Nanosciences, nanotechnologies, materials,

Astroparticles. With more than 33,000 individuals working for the CNRS, divided up amongst 1,100 units of research and with a budget of 3.29 billion euros, the CNRS is the premier European centre of research for fundamental particle research (CNRS, 2017). The Grenoble site is part of the “CNRS Alpes” group of research facilities. The CNRS ALPES group of research facilities gathers 2,245 personnel, divided up between researchers, engineers, technicians and administrative staff. The CNRS of Grenoble alone contains 90% of the personnel of the Group Alpes. The principal mission of the Grenoble CNRS centre focuses on condensed matter physics and fluid physics, and the development of innovative technologies.

The Centre for Science and Technology for the Construction Industry (CSTB) has the mission to guarantee the quality and security of buildings and to help innovation in the sector, and to facilitate the access to the market. The CSTB gathers multidisciplinary competencies to help actors of the sector obtain the answers they need in their professional practices (CSTB, 2017). It has four main applications: research and expertise, evaluation, certification and diffusion of knowledge. It gathers 906 collaborative actors and 169 researchers in four sites around France: Champs-sur-Mars, Nantes, Grenoble and Nice.

The National Institute for Agricultural Research (INRA) aims to produce and diffuse agricultural knowledge, by training future scientists in the field, informing public policies, promoting innovation, and helping to shape national and European research strategies. It is the first institute in agriculture in Europe, the second in the world (INRA, 2017). They work in the field of alimentation, agriculture and environment. Their main goals focus on competitiveness, health, sustainable development and the Bio-economy. It gathers in total 8165 permanent staff and 1715 researchers. It has a network of 17 research centres and holds 354 patents. The annual budget for the structure is 881.57 million euros, from which 77% of funds are grants from the French Ministry of Research, and the other 23% come for other sources. The Grenoble centre, gathers 10% of the total number of staff and researchers, and is in size the 3rd largest research centre, with an annual budget is of 80 million euros.

The National Institute for Research in Computer Science and Automation (INRIA) employs 2,600 individuals. Research is gathered around project teams, that bring together researchers from different academic fields. Thanks to this model, Inria “is able to explore original approaches with its partners in industry and academia and provide an efficient response to the multidisciplinary and application challenges of the digital transformation”. It particularly focuses on applications in the fields of: healthcare, transport, energy, communication, security and privacy, smart cities, and factory of the future. It counts 2,400 members from 102 different countries. It is also constituted of research centres all around France: (Paris, Rennes, Sophia Antipolis, Grenoble, Nancy, Bordeaux, Lille and Saclay). Their annual budget is 231 million euros. In Grenoble, the INRIA collaborates with the competitiveness poles of Minalogic and LyonBiopole on various projects.

The National Institute for Health and Medical Research (INSERM) is another of the major research centre that has research facilities of Grenoble. It mainly focuses on healthcare, and on human diseases of all types, from the most common one to the rarest. It was created in 1964 and is government-funded. It is France’s only government funded research institute that focuses only on human health issues. The regional group of Auvergne-Rhone-Alpes gathers 22 structures, 110 teams and 4 research centres: Lyon, Grenoble, Saint Etienne, Clermont Ferrand. The INSERM’s centre of Grenoble is constituted of 2 centres of research in Neuroscience and in Cancerology: The Grenoble Institut des Neurosciences and the Institut

Albert Bonniot. The Institut des Neurosciences employs more than 250 employees conducting research on cancer, Alzheimer's disease, epilepsy, neurovascular disease, schizophrenia, and Parkinson's disease. The Institut Albert Bonniot focuses on "the basic mechanisms that underpin cell and tissue differentiation processes and related pathologies—especially oncogenesis, the formation and development of tumours" (INSERM, 2017).

The National Institute for Research in Environmental and Agricultural Technology (IRSTEA) has a budget of 109.5 million euros of which 26% come from "its own resources" (IRSTEA, 2017). 1,100 scientists work in the 9 regional centres of the network and 14 research units combined in 5 locations. It has three main research departments overall: water, eco-technologies and land. The Grenoble research facility of the IRSTEA mainly focuses on conducting research and developing expertise "to improve the knowledge and management of mountain ecosystems, territories and natural hazards". In Grenoble's site, the staff is composed of 220 individuals. The annual budget allocated to the research represents 4.4 million euros.

The previous paragraphs highlighted the number, variety and quality of the research centres and instrument of research present in Grenoble. However, businesses in Grenoble also have their share in the innovation capacity of Grenoble, some of them having private laboratories to conduct research. Private laboratories have a similar goal to the public research centres and laboratories, although we may argue that the aim for companies to develop research activities is to benefit the company that financed the research processes. In Grenoble, the major private laboratories are the following ones: HP, Xerox, Salesforce.com, Siemens, Oracle, Air Liquide, Ahlstrom Paper Group, BD, STMicroelectronics, Schneider Electric, Constellium, Orange L@bs, Atos/Bull, Alstom Hydro, Lafarge, Vicat, Soitec, and bioMérieux (AEPI, 2017).

Finally, Grenoble's academics and scientists have allowed the city to be renowned for its academic excellence and innovative environment. Throughout the years, Scientists of Grenoble have received: 3 Nobel Prizes in Physics, in 1961, 1970 and 1985 thanks to R. Mössbauer, Louis Néel and K. von Klitzing. In 2009 and 2012, two Nobel Prizes in Chemistry were attributed to scientists working within Grenoble's research facilities, respectively Ada Yonath and Venkatraman Ramakrishnan in 2009 and Brain Kobilka in 2012. In 2007, Joseph Sifakis received the Turing Award. In 2008, Claude Lorius received the Blue Planet Prize. In 1985, Philippe Nozières received a Wolf Prize in Physics. In 2014, Rachid Yazami received a Draper Prize and the same year, Alim-Louis Benabib was awarded a Lasker Prize.

6.4 Local Government actors and innovation focused policies.

There are many local government actors that have the task of promoting the economic development of the Metropolitan Region of Grenoble as it is encompassed in the Auvergne Rhone Alpes Region. Innovation and economic development policies are organised and designed at the regional level through two schemes: the SRESRI and the SRDEEI. Once these policies are designed at the regional level, the lower levels of government have the task of applying them in their respective territories and ensuring the policies well-functioning. To help the reader capture how innovation policies are organised in the region of Auvergne Rhone Alpes, we will first provide an overview of the organisation of the political apparatus of France in the context of the NOTRe law. Later, we will present the three major political actors that frame the environment in which Grenoble's economy has evolved, from the most far sighted

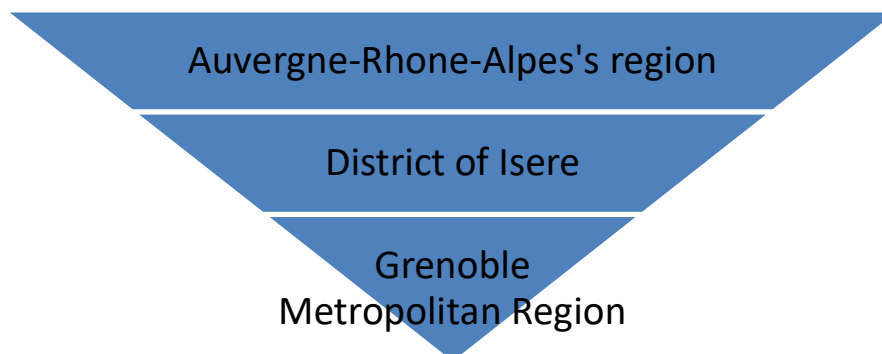
to the most near-sighted: the Auvergne Rhone-Alpes Regional Council, the Isère District Council, and the Metropolitan Council of Grenoble. Adding to this, we will detail the activity of the innovation agency of Grenoble, the AEPI, which is tasked by the District Council with enhancing Grenoble's visibility and attractiveness to foreign investors, researchers and businesses.

6.4.1. The French political organisation and the NOTRe law.

In this section, we present the organisation of the different layers of government of France in the context of the NOTRe law.

From 1956 up to 2016, France was divided up in 27 regions. However, with the recent territorial reform, the Nouvelle Organisation Territoriale de la République (NOTRe), the French regional organisation was changed, with a significant impact on the local government actors in Grenoble's RIS. In effect, some regions were merged together to create a much larger structure, resulting in there being just under half as many regions, leaving a total of 13 regions, and 5 overseas districts. These regions (excluding the overseas districts) are then subdivided into anywhere between 2 and 13 districts. The Auvergne-Rhone-Alpes region, the region of interest for this thesis, has 12 districts, one of which is the Isère District, of which Grenoble is the economic and political capital. Auvergne-Rhone-Alpes is also the 6th largest regional economy in Europe in terms of nominal GDP. Figure 18 is a visualisation of the organisation of the territories within the Auvergne Rhone Alpes region.

Figure 18: Administrative division of the region Auvergne- Rhone Alpes with a focus on Grenoble.



The NOTRe law was an attempt to rationalise the system of French regional organisation, changing it in two ways. First, it transformed the map of France by changing the borders of regions that were established in 1956. Secondly, it changed the partition of “competencies” or “powers” attributed to the different local councils, meaning that some competencies that had previously been attributed to the district level, were shifted to the regional or metropolitan levels, and their respective associated councils. This law had several formal goals, the first being to guarantee the, “solidarity and equality between the different territories”, which in practice meant to allow regions in economic difficulty to be paired with regions doing economically better, and so better spread the benefits of development nationally. The second goal of this new law was to promote transparency in the management of policies between the different local political bodies, and to enhance their financial responsibility.

The NOTRe law therefore had an impact on the institutional and political framework in which Grenoble is

set. As with this law, and the re-organisation of the regions it caused, powers and competencies were re-distributed amongst the local government actors of the region. Economic competencies that previously belonged to the Iseré District Council were passed downwards to the multiple Metropolitan councils, or upwards to the Council of the Region of Auvergne-Rhone-Alpes. This followed a multi-level governance based argument, that some competencies would be more effectively organised at the new larger region level, and others, at the lower metropolitan council level. (SRESRI, 2016).

6.4.2. The regional level of governance and the SRDEEI and SRESRI frameworks.

In this section, we will focus on the policies related to the innovation and economic development that the Auvergne Rhone-Alpes council is in charge of designing, organising and implementing. The policies developed have a large impact on the RIS of the Metropolitan Region of Grenoble, and on the District of Isere which both are encompassed in the ARA region, and are subject to these policies. Thus, observing in detail these regionally designed policies is necessary for the reader to understand what the District level and Metropolitan level of governance are subject to.

Mandated by the central government of France, the Regional Council of Auvergne Rhone-Alpes is in charge of ensuring the continued economic development of the area it represents, so as to improve the well-being of its population. One of the mandated activities of the Regional Council by central government, is the design of two frameworks; the **SRDEEI** and the **SRESRI**, that are then to be applied to all the districts the region is constituted by, meaning in effect the SRDEEI and SRESRI frameworks of the Auvergne Rhone-Alpes Council directly impact the Metropolitan Region of Grenoble. The **SRESRI** is the regional scheme for Higher Education, Research and Innovation Scheme, and the **SRDEEI** is the Regional scheme for economic development, innovation and internationalisation.. Describing these two schemes and their specificities is important as it allows the reader to understand the orientation that the regional council of Auvergne Rhone-Alpes, is taking, and thus Grenoble as it is encompassed in the region Auvergne Rhone Alpes and as such is subject to these schemes. These two schemes will be discussed below as they have a large impact on the RIS of Grenoble, starting with the SRESRI framework.

6.4.2.1 The scheme for Higher Education, Research and Innovation Scheme (SRESRI)

The SRESRI scheme of the Auvergne Rhone Alpes Region is an ambitious scheme that has, as its main goal to reinforce the contribution of regional actors to the socio-economic development of the territory (SRESRI, 2016). Within the SRESRI framework, the regional council has seven main objectives. The first is to ensure the academic excellence of the three major academic and research poles of the region: Lyon-Saint Etienne, Clermont-Ferrant, and Grenoble (out of 15 academic poles in the region). Second, to focus on the development of the smaller academic poles, as it is important not only to support the largest academic poles, policies are set up to make sure all the academies of the regions have the tools they need to offer training of quality. Third, the region wants to be the “Region of students”, and thus attract more of them, by developing activities surrounding student life, including sports facilities, housing, and increasing the amount of cultural and entertainment activities offered in the region. Fourth, the region will maintain its effort to enhance student international mobility, promoting the ERASMUS programme, and other study abroad programmes for students. Fifth, the region aims to allow an easier transfer of young people into the job market, by doubling the number of available apprenticeships, and by

supporting student entrepreneurial activities. Sixth, the region will focus on job creation by promoting collaboration between “enterprises, laboratories and technical centres”. Seventh, it will intervene to «bring closer the world of business and the world of research” through collaboration, developing multi-disciplinary approaches in research and innovation processes (SRESRI, 2017).

6.4.2.2 The SRDEEI framework.

The scheme for economic development, innovation and internationalisation (SRDEEI), is the other scheme relevant to innovation for the Auvergne Rhone-Alpes Region. As the SRDEEI is mandated by central government for each region of France, it is expected that there will be significant deviations between each region’s SRDEEI plans, respecting the unique context of each region. The main aim expressed in the Auvergne Rhone Alpes region (ARAR) **SRDEEI** is to reinforce the competitiveness of the enterprises of the region and to support their development projects to create jobs. To do so, the region sets up three priorities that will be described below.

A First priority; to be “side by side” with entrepreneurs and enterprise creators (SRDEEI, 2017). This first priority of the SRDEEI focuses on promoting entrepreneurship and increasing the number of enterprises created in the region. Whatever the nature of the project is, entrepreneurship, social entrepreneurship and other types of innovative projects, the intention of the SRDEEI scheme is that the region can assist it along its way, providing assistance at different stages of the businesses development with different initiatives. Under the SRDEEI, there is a large range of programs are organised by the region. Three of the most important programs and initiatives organised as part of the SRDEEI scheme are addressed in detail here.

First, an online platform has been set up, where 450 professionals at business creation, each with the objective of offering help, expertise and advice to the new entrepreneurs of the region. The online platform will also allow these future entrepreneurs to identify future partners and suppliers in the region, giving them a ready-made network of supportive contacts. On this project; the region of Auvergne Rhone Alpes will work with the metropolitan regions of Grenoble, Lyon and Saint Etienne to expand this network.

Second, a regional initiative that provides assistance to new firms struggling with product development between the phases of R&D and commercialisation has been put in place, with some scope also being available for help during the post-creation phase to ensure the longevity of struggling enterprises. This initiative was put in place to tackle a major perceived problem of the region, that whilst there was not a lack of initiatives or projects, there was a significantly high failure rate of products before reaching their final stage, identified as being caused by an absence of expertise and businesses facilitators that could help entrepreneurs and researchers commercialise their new products, services or processes. The region, under the SRDEEI scheme, will therefore organise by the end of 2017 several programs to assist starts ups, supporting these new enterprises through the phases of commercial development. Helping them organise the manufacture of their first product, hire skilled workers, and raise funds. The region will also provide financial opportunities through loans and financial tools, that in total aim to support the development of 150 start ups per year. This model was first successfully observed working in the French Tech Program, that helped start-ups find an economic model to help them grow, and as such will now be

increased in scale.

Third, the region will assist specifically the development of SME's by helping to accelerate their growth, through various programs such as, the SME's Plan. It will help SMEs by developing their industrial and environmental performance, the internationalisation of companies' activities by assisting in the export strategy, and securing their implantation in foreign markets.

A second priority: to make the Auvergne Rhone Alpes Region a leading actors in 8 specific sectors of activity. Competition between the different local ecosystems of France and Europe is fierce, thus it is necessary for the ARA region to have a clear vision of its priorities so it can focus its means and funds on specific areas, and as such avoid an over-diversified industrial base which might lead to a loss of competitiveness and attractiveness. There are 8 fields in which the Auvergne Rhone-Alpes Region is said to be "excellent" in, each benefiting from competitiveness poles, clusters and industries with international influence. These are: industry of the future, construction and buildings, digital, health, agriculture, energy, mobility and smart transportation systems, sport and tourism. Briefly, the region has three main axes that it intends to focus upon in its SRDEI, aiming to make the ARA region a European Champion. First, it will increase its support for clusters and competitiveness poles as well as invest strongly in innovative projects from these 8 specific sectors of industry. Second, it will attempt to facilitate increased collaboration between actors of the regional setting, as a way to reduce expenses and favour the knowledge exchange that has helped Grenoble to be successful in the past. Third and finally, it will put together specific plans for agriculture and tourism, as these sectors currently are providing a relatively low return on the investment of the region, despite large amounts of money being spent. Such plans for agriculture and tourism will focus on job creation, durable systems of production and climate change preparation/adaptation.

A third priority; to accelerate the investment dedicated to research instruments and infrastructure in the region. A third priority of the SRDEI is to invest more in the region's instruments of research and infrastructure. The regional government plans to do this by enhancing a sense of "collectiveness" when dealing with the funding and management of research instruments and infrastructure located in the territory. In particular, the region has 5 priorities: First, it will increase its financial aid to enterprises, taking various forms as listed in the first and second priority of the SRDEI scheme. Secondly it will begin to organise jointly with the lower levels of government (Districts, Metropolitan regions) the real estate offers for companies to settle down in the region. Third, the region will prioritise infrastructure investment that is essential to attract investors, firms and individuals to the region, as well as having a specific focus on improving the internationalisation and attractiveness of Lyon- Saint Exupery Airport. Fourth the region will improve its industrial zones, attempting to guarantee their regional and national attractiveness, focusing on making the zones relatively easy for regional and national firms to settle into. Fifth the region will organise better the exchange of information between elected members of the regional, municipal and metropolitan councils, regarding the policies of the region in terms of priorities for the acceleration of investments in research activities.

6.4.3. Examples of initiatives under the SRDEI and SRESRI Schemes

Regarding support for SME's, Starts ups and new innovative firms, the regional council offers a large range of programs of various size and importance. In the following section, we will present the three most major initiatives: **the RDI Booster Project, the Regional Fund for Innovation and the SME's Plan**, each aimed at promoting a spirit of entrepreneurship, at promoting enterprise creation, and at supporting existing SMEs and starts ups.

On the regional level, **the RDI Booster project** is organised in the SRESRI context, it is a regional event that has ramifications for the different districts of the region although is limited in scope, focusing on helping specifically enterprises within the Auvergne-Rhone-Alpes setting. It is mainly based on the realisation that in the development of a product/process/service, the step between R&D and commercialisation is very important, but also very difficult, leading to, without intervention, many failed commercialisation attempts. The objectives are thus to allow enterprises to be able to adapt their products to the market and to commercialise their ideas, accelerating the rate of new product and service creation. Once a promising project is selected, financial support may be provided under the form of subsidies that may reach a maximum of 500,000 euros. This RDI Booster project is specifically designed to finance scientific events of national and international influence, the intervention of international scientists, and business conventions and conferences. In financing all these events and initiatives, the RDI Booster Project wishes to help enterprises in the hardest phases of the development of their product/project/service.

Another regional initiative for innovation is the Regional Fund for Innovation (FRI). It has the main goal of reinforcing the contribution of the actors of public research that support the economic and industrial development of the territory (FRI, 2017). Its funding possibilities start at 20,000 euros and can go up to 700,000 euros per project. It has a very specific focus as it supports projects that associate solely laboratories and enterprises localised in the Auvergne Rhone Alpes region. It is aimed specifically at research projects that involve companies with less than 2,000 workers. To be selected for this program, the project must be the result of collaboration between research institutes and businesses, which must be located within the region.

On the regional level, there is a third plan orientated towards the support of innovation and economic development: **the SME's Plan**. It is funded by the Region of Auvergne Rhone-Alpes to answer the needs of SME's and Micro enterprises. Its main goal is to support the emergence and competitiveness of SME's, via specific actions: to help SME's to grow their projects, to help the differentiation of products and maximise the chances of enterprises to enter the market. It also offers small companies advice and expertise to reinforce the performance of SMEs and helps them to grow their activities. It is organised around 8 axes: strategy, finance, performance, systems of information, commercial/international, environment and human resources. It has 19 programs that allow enterprises to choose the formula that suits them best. In total, this program helps 1,500 enterprises per year and represents a budget of 15 million euros.

6.4.4 The District of Isère.

Stepping downwards in scale from the regional organisation of Auvergne-Rhone-Alpes, the District of Isère is the next smallest level of local government that encompasses the Metropolitan Region of Grenoble. Due to the NOTRe law, this region has since 2016 lost many of the powers it used to have that would impact significantly on the RIS of Grenoble, as these have now been passed either up to the Regional level, or down to the Metropolitan level. It does however maintain a purview over three policy areas worth mentioning. First it retains a responsibility for the solidarity and cohesion of the territory, which in practice means the district must ensure that residents in the most fragile and precarious situations are protected and supported. Secondly, the district retains responsibility for the care of school infrastructure and personnel, and of urban transportation, where competencies are shared between the region and the district, dependent on the scale of the infrastructure. Finally, the district council retains power over the management of the district's forests and agriculture. It is not the intention of this thesis to go into any more detail in this section as the district level of governance has such a small impact on the RIS of Grenoble, as virtually all of its relevant powers were redistributed to other levels of governance by the NOTRe law.

6.4.5. The Metropolitan Council.

Metropolitan Regions and their councils have obtained from the NOTRe law economic competencies previously associated with the District councils. They have obtained "economic competencies" in the sense that they now decide the economic orientations of the city, within the framework designed and organised at the regional level (SRESRI and SRDEEI).

In the case of the Metropolitan Region of Grenoble, this territory includes 49 municipalities. The council gathers once per month in a public audience and has 6 deliberative commissions: development and attractiveness, social cohesion, durable territory, resources, mobility, and public services for the environment. In brief, the Metropolitan Council manages the creation of industrial zones of regional and national influence, and plays a role in the governance and economic development of competitiveness poles of the region. It also promotes tourism activities, and supports higher education and research facilities.

Subject to the SRDEEI and SRESRI schemes, the Metropolitan Council of Grenoble shares many responsibilities with the much larger Auvergne Rhone-Alpes Regional Council. However, there is one specific responsibility that falls solely under the Metropolitan Council's purview, incentivisation for implanting companies within the Metropolitan Region of Grenoble. Indeed, it must assist enterprises, starts ups and spin-offs in finding a good location in the territory; and ensure that the real estate offer made by the region is appropriate and attractive. Local government has little to do with the organisation of clusters and do not participate in their running and management. The sole bit of policy that is left to a local government's control, regarding enterprise settlement concerns the provision of a physical location for companies. In the case of cluster creation, local governments may participate by providing or funding the running of buildings and infrastructure, as well as utilities for the future actors of the cluster. A very concrete example may be given with the case of the implantation of the company Hexcel in the District of Isere. Hexcel is the largest producer in the world of high tech chips for the aeronautics

industry. Well established in France and in Europe, the company is now willing to invest 400 million euros in the town of Roussillon in the District of Isere, creating 180 jobs on the long run. Some of the infrastructure and construction work for the activities of Hexcell was at the expense of the Auvergne Rhone Alpes Council and of the Metropolitan Council, totaling about 9 million euros. 72 other sites in France and in the world were selected at first to welcome the firm, but the town of Roussillon finally won the attention of the investors, at the final expense of Newcastle in England, the last city competing to be Hexcel's investment.

Regarding the many competitiveness poles organised in the Metropolitan Region of Grenoble, the local government goes further than only providing infrastructure and a location for future actors. In a competitiveness pole, public authorities are heavily involved all along the way, from the creation of the pole, to the daily-running of the site, to management and strategic decisions. Indeed, this is the main difference between competitiveness poles and clusters: poles are created under the impulse of the state and the local/regional authorities, whilst clusters are created by the will of firms and research institutes alone to gather and collaborate. A competitiveness pole of international influence such as Minalogic, located in Grenoble city itself, has a system of governance shared between actors of the pole and representatives of the local and regional authorities (Please see section 6.2). Because of its importance for the region's competitiveness and innovation capacity, a competitiveness pole often has representatives of the various levels of government: municipalities, metropolitan, district and regional level. These representatives may have many roles, from the promotion of the pole on the international stage, to the prospection of investors and future partners, to the funding of different activities, to the enhancement of collaboration between the actors of the pole.

Another major policy the Metropolitan Council implements concerns the renovation of university buildings and training facilities, as it is key for these universities to be able to compete internationally with the best institutions in the country and in Europe. It also makes it more possible to attract international talent, students, researchers, and investors, by offering them an agreeable environment to live in, with high quality infrastructure for them and their families.

The metropolitan region is also in charge of promoting the spirit of entrepreneurship in its territory, and the creation of enterprises. It does so through various initiatives. One of these initiatives is the 5i forum. It aims at helping projects to find funds as well as an appropriate economic model to help them grow quickly. Since its creation in 1998, it has helped more than 268 projects, leading to the creation of 215 enterprises and 2,100 jobs. Another initiative launched by the Metropolitan Region is the "I create my enterprise" initiative. It aims at structuring the network of actors involved in enterprises creation in the region to facilitate the emergence of new firms and companies. The Metropolitan Council also has set up initiatives and programmes to help start-ups developing their activities and reaching the commercialisation phase. Finally, the Metropolitan council also has initiatives and funds that are meant to assist the enterprises in difficulty by lending them money and providing experts to help improve an enterprises business plan.

The Metropolitan Council has a role in the RIS of Grenoble going beyond facilitating enterprises creation or the settlement of firms on the territory. Indeed, one of Grenoble's Metropolitan Council actual preoccupations is the promotion of the innovative and adaptive capacity of actors of the region and of the RIS of Grenoble. In this regard, it has advertising policies to promote "the marketing of the city" (Lametro, 2017). To design such policies; it relies on other actors of the territory such as universities and their partners (competitiveness poles and state agencies for example) to deliver a coherent and positive message to an international audience. In the end, the major objective is to attract investors, visitors and researchers, and potentially international firms and research units. The metropolitan council also participates in promoting the international standing of Grenoble, by welcoming international visiting delegations, whether they are institutional, scientific or economic actors. This last action is done in collaboration with the AEPI, the Grenoble-Isère economic development agency.

6.4.6. AEPI, the Grenoble-Isère Economic Development Agency.

Created in 1997, the AEPI agency, or the Grenoble Isere Economic Agency in English, has the main role of promoting Grenoble's economic eco system to international actors, to attract investors and businesses and to appeal to researchers. It puts together favourable conditions to detect, attract, and develop actor's activities in Isère, focusing particularly on Grenoble, as it is the regions economic capital, having a substantial effect on the RIS. Over the years, it has contributed to the establishment of 450 firms in the District of Isère, and to the creation of 9,900 jobs (AEPI, 2017).

The AEPI has a position at the crossroads between industries, research and training, as it maintains a strong presence in various structures, including competitiveness poles. It has 3 main roles: first, to provide support and advice for businesses seeking to move to, or grow their activities in Grenoble/the District of Isère. Second, to promote the RIS of Grenoble abroad, by highlighting the excellent economic, business, research and social features of the local setting, generally this is done by sending delegations to the largest business conventions and conferences world wide (USA, Tapei, Japan..), and welcoming international delegations that come to examine the potential of the RIS of Grenoble, including in 2016 the Japanese ambassador, the economic director of Phoenix USA, and in March 2017, the Irish ambassador. Third, to publish economic research and insight on the industrial environment of Grenoble, often concerning the general innovative environment in Grenoble, but also the economic performances of specific industrial sectors. In this function, the AEPI also acts as reference to anyone wishing to obtain official and specific information on any actor constituting the RIS of Grenoble. Finally, the AEPI facilitates connections and collaborative relationships between businesses, institutions and civic leaders (AEPI, 2017).

However, with the NOTRe law and the redistribution of prerogatives and powers between the different layers of governments, many of the prerogatives that were attributed to the AEPI were transferred to the Metropolitan Council of Grenoble. This agency might therefore disappear or transform significantly in the near future. A potential transformation muted is for the AEPI to keep its analytical role of the ecosystem of Grenoble and act as an "economic observatory" producing figures and insights, whilst losing its "promotion" role.

6.5. Challenges faced by Grenoble.

Grenoble and its ecosystem, has showed a robust capacity to innovate. It evolved from a small industrial town focused on solely two industries: glove making and paper industry, to a metropole specialised in high-tech industry and research activities with international influence. Generally therefore, in this description, we have been highlighting the positive side of Grenoble's RIS as by default; we focus on innovation and innovative capacity which is one of Grenoble's major strengths. Our description would therefore be incomplete if we did not make a reflection on some of the disguised weaknesses of the RIS as they do not all directly stem from topics relating to innovation.

First, if we observe the latest macro- economic data the region currently suffers from a slowing down of its economic activity below its trend rate, as well as an increasing rate of unemployment, adding to the fragility of the RIS. (CCI, 2017). Indeed, whilst many of the figures presented throughout the document may be highly encouraging for the RIS, overall, the Metropolitan region lost jobs between 2008-2015. (CCI, 2017).

We observe five other significant challenges that may have contributed to this fragility and the relatively poor economic performance of the Metropolitan Region in recent years, despite the strength of activity in the RIS.

- First, a strong and tough competition, both local and international (LaMetro, 2017). Within France and Europe many districts and metropoles have shown strong innovation capacity, meaning Grenoble is not alone in developing its RIS, and thus has strong competition. In particular the Metropole of Lyon has been a major competitor, as its economy operates in the same high technology sectors as Grenoble, benefits from being a larger city by some margin, and has a more well known name, that aids Lyon's brand recognition significantly.

- Second, whilst Grenoble's unique geographical environment, being built between the mountains Le Vercors, Belledune, and la Chartreuse, is a boon for tourism, on other sectors it may represent a significant problem. The region's air pollution level is significant, acting as a disincentive to investment. The geographic formation of the city, surrounded by mountains, traps pollution from vehicles and industry in the city, reducing air quality so significantly, that during the summer, when the heat and lack of wind compound the geographical pollution problem, Grenoble has some of the worst air quality levels in France. This geographic situation is also a problem for traffic circulation as the lack of space available for transportation infrastructure is limited. This issue was such an environmental and health problem that it pushed the population of Grenoble to elect in 2015 the only Green Party mayor of a city with more than 100,000 inhabitants in France after a campaign focused significantly on this issue. Since then, tackling these two "green" issues has been a priority for the local government, and many policies have been put in place to reduce air and visual pollution, as well as to ease traffic circulation within the city.

- A third challenge for the Metropolitan region of Grenoble relates again to the lack of space in the region for building, as Grenoble's capacity to offer foreign investors and firm's buildings and infrastructure to settle down in is extremely limited (LaMetro, 2017). Indeed, in Grenoble, the real estate offer made by the local government specific to enterprises and research institutes is very limited and quite expensive. Again, this challenge relates exclusively to the metropolitan Council and their

competences, as it is a very local matter. To tackle this issue, as described previously, since 2015 the Metropolitan council has made one of its priorities to improve the available real estate for enterprises on its territory (LaMetro, 2017).

- A fourth challenge that Grenoble has to face relates to its capacity to attract foreign investors (LaMetro, 2017). Whilst in the past Grenoble received many awards for its innovative capacity, there was a significant lack of recognition for these awards, and in general for the innovative profile of the region. The 'French Silicon Valley' in essence seems to suffer from a communication problem, especially in comparison to its American cousin, as there is an obvious lack of visibility of the RIS present in Grenoble. This applies to both national and international level, where there is a lack of communication and marketing to highlight the territory's capacity.

- Finally, and potentially most significantly, the region faces the realisation that the RIS is poor at the commercialisation phase of innovation. This realisation links many of the local government policy initiatives that are mentioned in previous sections, as this problem has been linked to a lack of actors and agents that work specifically in this area, and is a major public policy priority.

Section 7. Conclusion.

In this research paper, we have applied the RIS concept to the Metropolitan Region of Grenoble, answering the research question, *‘What are the major features and characteristics of the actors of the Regional Innovation System of the Metropolitan Region of Grenoble?’*

We have found, after discussion of the definitions and theoretical context necessary to answer the research question, a formidable example of a highly successful Regional Innovation System. The Metropolitan Region of Grenoble not only has some of the world’s premier academics within the region, developing technological advancements, nor just a highly involved local government, organising competitiveness poles and creating an environment that facilitates innovation, but it also is rich with high tech firms and flush with economic capital, that is diversified in a large industrial base often organised in clusters of world leading firms.

To summarise our work, we have first, in the **Definitions and Conceptualisation Section** introduced the concept and definition of a RIS and associated terms, as well as presenting the contextual theoretical debate that rages around several concepts discussed. Second, through the **Literature Review Section**, we have summarized the roles of a variety of actors that normally constitute an RIS splitting them into into three categories: the economic, the academic, and the local government actors, as well as writing about how Grenoble has been described in the past. Third, in the **Description Section** we believe we have exposed the variety of actors present in the RIS of Grenoble by systematically presenting them and their characteristics. We have also presented the relevant policies for promoting innovation organised by the various levels of local governments, and described the academic and research actors contribution to the RIS of Grenoble. Lastly, we have explicitly mapped out the economic actors of the region and provided figures and data outlining their activities.

On a conclusive note, and as a way of structuring a direct answer to our research question, we now return to the list of potential characteristics provided by Fiore, Gristorio and Prota (2011) in part 3.4. These characteristics represent the identified major features of an RIS, and allow us to clarify in a relatively small number of sentences a structured answer to the research question.

First, we observe the characteristic of an RIS that relates to high-tech industries that are orientated to international markets. Such industries have been described as being at the heart of Grenoble’s economic power and innovative capacity. There are four major sectors in which Grenoble is said to be “excellent”, all of which high tech. First, the Digital industry, encompassing nanotechnologies, microtechnologies and electronics in one branch, and IT and software in another branch, second bio tech and med technologies, third new energy technology, and fourth clean-technology. Each one of these sectors exports a large proportion of their production and has succeeded in putting together competitiveness poles and clusters that have international influence.

Second we observe the characteristic of an RIS that relates to the presence of relationships between firms and knowledge centres. This characteristic is visible through various examples, particularly the multiple competitiveness poles and clusters of the region, and through Grenoble’s historical development. Since the discovery of the hydraulic power of the region, academic and economic actors of the region have worked well together, developing strong relationships, and this shows no sign of coming

to an end, as such a large variety of programs either continuing indefinitely or planned to begin shortly.

Third we observe the characteristic of an RIS that relates to the presence of a specialized labour market and labour force, with readily available, highly skilled human capital. This characteristic is demonstrated by the output of skilled labour of Grenoble's successful universities. The labour force has significant levels of human capital that is leveraged by the many industries that depend upon the skilled labour for production. Grenoble has an exceptionally well educated population with more than one inhabitant out of five being a student (AEPI, 2017), whilst PHD students represent 6.2% of the student population.

Fourth we observe the characteristic of an RIS that relates to the presence of a local tradition of cooperation and entrepreneurial approaches. This is visible in the region in two ways: first, through the historical development of Grenoble, as it shows strong collaborative links between the actors of the region since the Region's industrialisation; and second, through the high intensity of the exchanges between the different actors of the RIS, who are increasingly interreliant on one another, as demonstrated by the growth of the many clusters and competitiveness poles of the region.

Fifth we observe the characteristic of an RIS that relates to the presence of supporting agencies and organizations. In this regards, the AEPI is the largest and most obvious actor that fulfils this criteria, as it is directly aimed at fulfilling the supportive agency role. The AEPI has three main roles; first, to provide support and advice to businesses in the region. Second, it is in charge of promoting the RIS of Grenoble abroad, by highlighting the excellent economic, business, research and social features of the local setting. Third, it publishes economic research and insight on the economic environment of Grenoble and acts as reference to anyone wishing to obtain official and specific information on the RIS of Grenoble (AEPI, 2017).

Sixth, we observe the characteristic of an RIS that relates to the presence of social capital. This is the only characteristic that we cannot assuredly perceive through this descriptive study, as social capital is a largely intangible asset, for which a developed empirical claim would be necessary to confirm the presence of. Instead, what we can say is that we have been able to identify strong collaborative links between actors that are said to produce such capital, and as such could say that in all likelihood social capital is probably present.

With this research, we have described the characteristics and features of the RIS of Grenoble. As such, we have outlined the region's major actors, how they link to one another, and how they support each other in facilitating innovation in the Metropolitan Region of Grenoble.

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