AALBORG UNIVERSITY
DENMARK

Aalborg University
School of Business and Economics

MASTER THESIS

Regional Innovation System and Innovation Policy:

"Metropolitan Region of Santiago – Case study"

Francesco Olivier Escudero (20170156)

Fall Semester 2018

M.Sc. Economics and Business Administration
MIKE-B

Supervisor: Professor Yariv Taran

ABSTRACT

This research studies the development of the regional innovation policy in the Metropolitan Region of Santiago, Chile, and its Regional Innovation System. The author has seen the need to carry out this research due to the incongruence between the potential of this region for the generation of innovation and the results that it shows. This document focuses on the first regional innovation strategy (2012-2016) developed in the region, in terms of its objectives, design and implementation. Continuing with an analysis of the configuration of its regional innovation system according to The Triple Helix Model. Finally, recommendations are provided to improve the implementation and effectiveness of it. The data collected were compared with the theory and other studies on these subjects, trying to avoid the author's bias. The conclusions of this research show a weak regional institutional configuration, which ended up causing a partial failure during the implementation of the regional innovation strategy, however, the strategy showed that it was intended to go in the right direction in terms of what the literature has shown about innovation at a regional level in developing economies.

Keywords: Regional Innovation System, Innovation Policy, Innovation Policy Instruments, Triple Helix Model, Innovation, Metropolitan Region of Santiago.

ACKNOWLEDGEMENTS

I would like to thank my supervisor, Professor Yariv Taran, for the constant guidance throughout the research and writing process of this thesis. He supported me while still allowing me to carry out the investigation as freely as possible.

I would also like to thank all the staff members of Aalborg University for these two wonderful years studying in Denmark.

Table of Contents:

List of Figures:

1 - INTRODUCTION:

Chile is according to several studies and publications, ranked as one of the best countries within the Latin American region to do businesses (FORBES, 2017; World Bank Group, 2018). The stable political climate present in Chile, together with strong financial institutions, effective public institutions, and a stable macroeconomic environment have situated Chilean economy as the most competitive within the region (World Economic Forum, 2015).

Santiago, capital of Chile, has a population of seven million people, representing close to 40% of Chile´s population (INE, 2017). The city holds almost every international company in the country, not the ones related with mining, also Start-Up Chile, a business accelerator promoted by the government, aiming to generate new businesses and increase the innovation, this initiative had more than 2,400 applications in 2015 (Inc., 2016). In addition, the 54.9% of R&D expenditures are made in Santiago (Gobierno Regional Metropolitano de Santiago, 2014), also the top universities and the research centers within the country are located in Santiago. All these facts situated this region as one of the most promising in Latin America for the generation of new businesses and innovations. However, statistics show something different. The Global Talent Competitiveness Index (GTCI), developed by INSEAD together with The ADECCO Group, provided interesting numbers regarding entrepreneurship, and local business environment in Chile in 2018. The GTCI situate Chile in the global position Nº33, and Nº1 within Latin America. However, in the categories: "*ease of doing business"* Chile goes down to the position Nº53, *"clusters development"* (Nº85), R&D expenditure (Nº65), International Students (Nº86) e.g (GTCI, 2018). At the same time, 8 out of 10 new businesses fail within the country according to data from The Global Entrepreneurship Monitor (GEM), the world´s foremost study of entrepreneurship, which is a trusted resource used by UN, World Bank, OECD among others. Something seems not to be working inside the Metropolitan Region of Santiago´s Regional Innovation System, and how innovation has been approached by the central, and local governments.

Following, a description of Chile and the Metropolitan Region of Santiago is presented to continue with the problem that this research addresses.

1.1 Chile:

Chile is a country located in the west coast of South America. With a population of 17,8 million is number 6 in the region (OECD, 2018). This country is the second largest in the world (north to south) after Brazil, with a longitude of 4,300 Km and only 350 km wide (INE, 2017).

The geography of Chile has an impact on how its population and the industries are divided. 15 regions make up Chilean territory, as is shown in the picture, from all of them (I to XV, making an exception with RM), "*Región Metropolitana de Santiago*" (metropolitan region of Santiago) represents the smaller according to its surface, which is just 2% of the Chilean territory (BCN, 2018), however, with 7,112,080 habitants, is the one with the biggest population (40% of the total), having a density of 461,77 inhabitants per km2 (BCN, 2018).

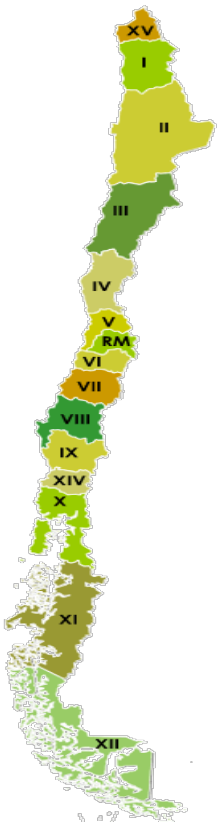

Figure 1: Chilean territory
Source: www.escolares.net

Centralization has been a problem in Chile for a long time, the inequality in the allocation of public resources, added to how most of the MNCs locate its offices in Santiago, have been creating an atmosphere where most young people need to move to the capital to study and develop their professional careers.

Regarding economic aspects of Chile, with a GDP per capita of 24,013 US$ (OECD, 2018) is the number 1 within the region, situated almost at the level of Croatia and Russia. Its main exports are metals and mineral products, mostly copper and derivate of it, representing 51% of the total exports in 2016 (OEC, 2016). As we can appreciate in figure nº2, following minerals, vegetal (12%) and animal products (9,5%) are the biggest exports after them. The light blue square in the right corner below, represent machinery (technological industry within it), and was just 1,4% of the total exports in 2016. Chilean economy relies almost entirely on its natural resources, being a country which exports raw materials without added value, and imports a variety of products which incorporate them.

Chile´s exports divided by sector in 2016:

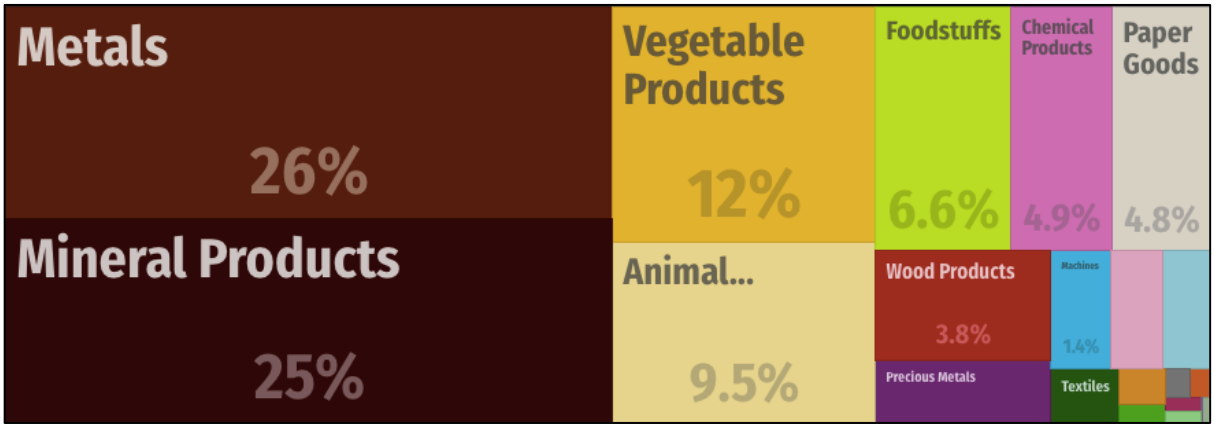

Figure 2: Retrieve from The Observatory of Economic Complexity (OEC), 2016.

The country invested 0,384% of its GDP in R&D in 2015 (World Bank, 2018). This number situates Chile in the fourth position in the region, after Brazil (1,16%), Argentina (0,58%) and Ecuador (0,44%). At the same time, all these numbers are far away from countries like Denmark (3,01%), Sweden (3,26%) or Finland (2,90%), which are close or over the 3% (World Bank, 2018). The global position of Chile regarding this topic is nº65 (GTCI, 2018).

Research and Development Expenditure (% of GDP):

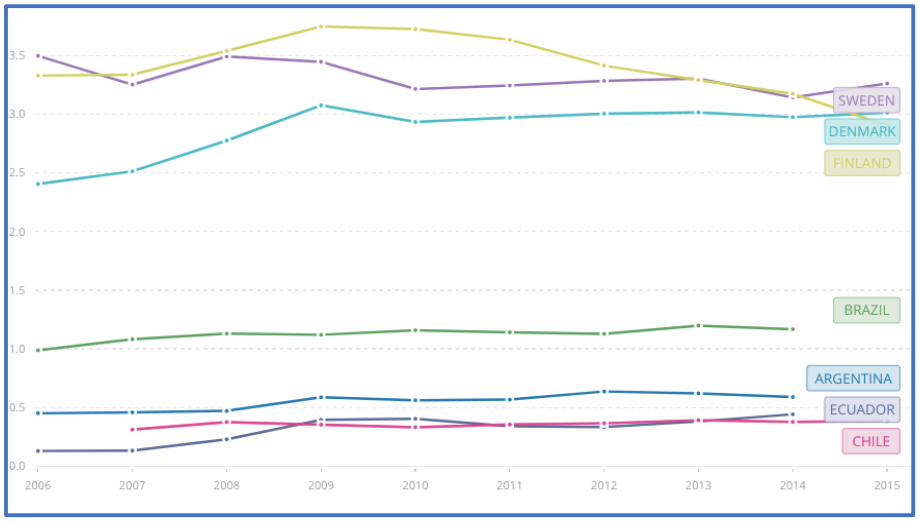

Figure 3: Own illustration using data tool from The World Bank (2018).

To conclude with this brief description of Chile. According to several studies and publications, ranked as one of the best countries within the Latin American region to do businesses (FORBES, 2017; World Bank Group, 2018). The stable political climate present in Chile, together with strong financial institutions, effective public institutions, and a stable

macroeconomic environment have situated Chilean economy as the most competitive within the region (World Economic Forum, 2015).

1.2 The Metropolitan Region of Santiago:

Santiago is the capital of Chile; this city represents the metropolitan region of Santiago almost in its totality. Santiago city holds the headquarters of the Executive Branch, also the highest instance of the Judiciary. In addition, agglomerates a significant proportion of companies and industries in the country. This region concentrates 44% of the goods and services production of the country (Gobierno Regional Metropolitano de Santiago, 2018). this section goes deeper in metropolitan region´s geography, political organization, educational institutions, among others.

Metropolitan Region of Santiago (MRS) is divided into 52 different communes. 34 are in urban areas and only 18 in rural. The region is composed of six provinces: Santiago, Cordillera, Talagante, Maipo, Chacabuco, and Melipilla. According with the department of agriculture of Chile, the MRS has an area of 150,000 hectares of intensive production, being the main producer of vegetables in Chile (27%) and the third in terms of fruit production (Gobierno Regional Metropolitano de Santiago, 2018).

Figure 4:Communes of the Metropolitan Region
Source: Retrieved from www.gobiernosantiago.cl

Santiago, paint in light blue in the picture, is the main area where this research is developed, concentrates 32 communes (all in urban areas). In addition, is the only one which doesn't have a governor, but a delegate.

Regarding the economic activity, the composition of the GDP by economic sector of MRS shows that financial services (34.9%) represent the biggest area. Then, trade (15.1%),

professional services (13%) and manufacture industry (11.6%) (Gobierno Regional Metropolitano de Santiago, 2014). The city holds almost every international company in the country (not the ones related with mining).

Continuing with educational institutions in Santiago, the city has 24 private universities, 5 state universities, 27 professional institutes, and 19 technical training centers (Ministerio de Educacion, 2018). Also Start-Up Chile, a business accelerator promoted by the government, aiming to generate new businesses and increase the innovation, this initiative had more than 2,400 applications in 2015 (Inc., 2016).

To conclude, and to understand the relevance of MRS. The 70.9% of R&D expenditures were made in Santiago in 2016 (Ministerio de Economía, Fomento y Turismo, 2018).

1.3 Problem Statement and Research Questions:

The data, numbers, and rankings presented before are not in concordance with all the expectations put in the Metropolitan Region of Santiago. The mentioned effectiveness of its public institutions seems not to be represented in the generation and promotion of innovation in the region.

The first *regional innovation strategy* developed between 2012 and 2016 in the Metropolitan Region of Santiago presents an opportunity to point out gaps in its Innovation Policy (*objectives, design, and implementation*) and the chance to re-think how the central and local government are doing it regarding entrepreneurship and promotion of innovation within the Metropolitan Region of Santiago, and how the interaction between Government, Industry, and Universities have been developed so far.

Aiming to study the current Innovation Policy and Regional Innovation System efectiviness in the Metropolitan Region of Santiago, this research will try to answer the following research question:

What is the current regional innovation policy within the Metropolitan Region of Santiago, and how efficient are its implementation activities in the region (level and quality of interaction between Industry, Government and University)?

And to provide suggestions and point out the main areas where MRS´ innovation policy needs to be improved, will try to answer the following research question:

What additional initiatives, in view of theory, could be made to apply more efficiently the current innovation policy in the region, and improve it even further ?

In the methodology is presented the research design, which explains how these two research questions are going to be addressed, and which methods are going to be used.

STRUCTURE OF THE PAPER:

This document begins with an introduction to the current situation of the Metropolitan Region of Santiago regarding innovation **(Part 1)**. The description of Chile **(1.1)** and the MRS **(1.2)** give a context to the reader, before he goes to the statement of the problem and the formulation of the research questions **(1.3)**.

Continuing, the research methodology is presented **(Part 2)**. In this section, the assumptions about the philosophy of science **(2.1-2.3)** are explained, together with the research design **(2.4)**, which explains the choice of a case study, the data collection, data analysis, the limitation of the investigation, and the validity and reliability of it.

Subsequently, the description of the literature **(Part 3)** builds the academic foundations of the document. The use of the theories behind the Regional Innovation Systems and the Innovation Policy provide an analytical framework for this research.

The analysis of the case study **(Part 4)** begins with a description of the local institutional configuration of the region **(4.1)** and the main actors of its regional innovation system **(4.2)**. Subsequently, the analysis of R & D expenditures **(4.3)** within the country and the region provides the reader with an introduction to the description of the regional innovation strategy of the Metropolitan Region of Santiago **(4.3)** and the analysis of its objectives, design, and implementation **(4.4)**, which are used to answer the first research question.

This section concludes with an analysis of the innovation policy instruments used and neglected by the regional innovation strategy **(4.6)**. This analysis is used to answer the second research question.

The last part of this document **(Part 5)** presents final conclusions about the entire investigation and offers future perspectives for other researchers on the same subject of study.

2 - METHODOLOGY:

In this chapter, following the “four levels of understanding” proposed by John Kuada (2012), the perception of the paradigms of the author and the philosophical vision used to carry out this investigation will be explained. In addition, the elaboration of a research design provides a logical sequence of activities. This allows readers to better understand the connection between the research questions, the approach used, the assumptions underlying your approach, how data is gathered and researched, and the results and conclusions of the research (Kuada, 2012).

Structure and Levels of Discussion in a Methodological Chapter:

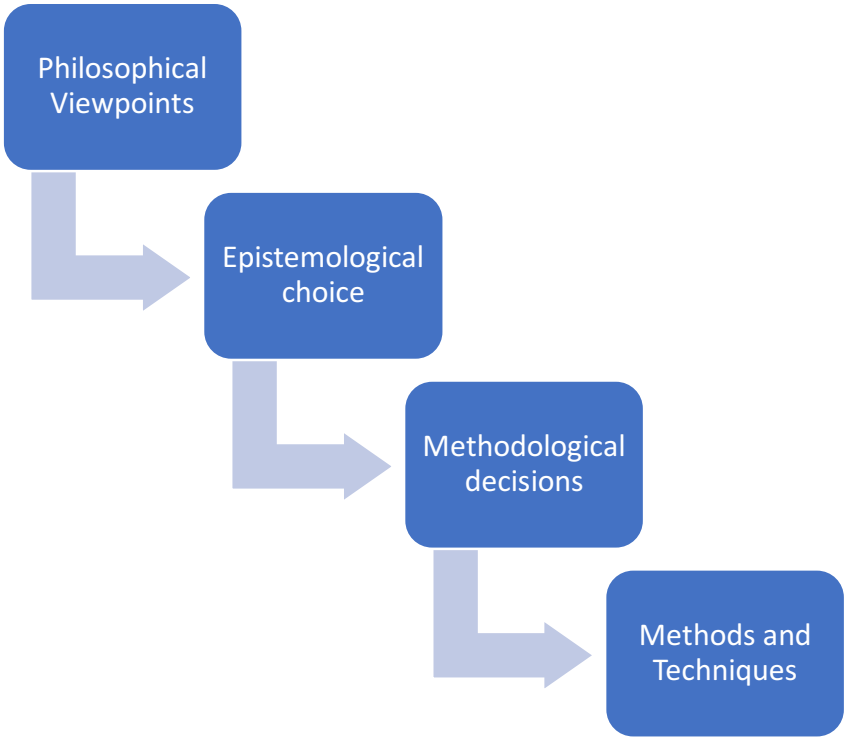

Figure 5:

Note: Adapted from Kuada (2012)

2.1 Level 1: Philosophical and Theoretical level

Ontology aims to give an answer to the question of what reality is. This concept is related to the researchers' point of view about how human beings and the environment are related. Depending on which vision the researcher has, will determine what you will consider as a truth and how the knowledge about it should be assimilated (Kuada, 2012, p.59).
There are two broad approaches on how researches understand the relationship pointed before, objectivists and subjectivists:

- ***Objectivists****:*
  Under this vision, researches perceive the reality externally to human beings and their interactions. The phenomenon exists by itself, and individuals' perception doesn't determine any aspect of it.
- ***Subjectivists****:*
  The reality here is socially-constructed, this means reality relies on different points of view and is not the same for all the individuals and depend on previous experiences and knowledge from each of them.

2.2 Level 2: Epistemological choice

Epistemology describes and try to explain the nature of knowledge and the means of knowing, (Kuada 2012, p.59). At the same time, the reliability of knowledge within the area of research.

- ***Positivism***: Puts attention on causal relationships between "actors" within a social world, and seeks to explain and predict what is happening in this world. Positivist researchers study situations as external observant, and can study the constituents' parts of a phenomenon to comprehend the whole situation (Kuada, 2012, p. 73).
- ***interpretivism***: Social world is constructed by the society and its participants, and can only be understood from the different points of view of the individuals involved in the social phenomena under study (Kuada, 2012, p.73).

2.3 Level 3: Methodological Approach

Here a description of the reasons for the choice of certain methods to conduct the research are explained (Kuada, 2012, p. 59).
There are three main different approaches regarding methodology and the principles which the research will follow during the research process.

- **Deductive approach**: This approach, is often used in scientific research and contain the development of a theory which is tested during the research. In addition, a deductive approach aims to find causal relationships between variables, and with this information generate a general answer for the research question (Saunders, Lewis, & Thornhill, 2015). This approach collect large amounts of quantitative data, and apply several controls to ensure validity of data. Finally, the researcher is independent of what is being studied.
- **Inductive approach**: Opposite to deductive approach, inductive aim to gain an understanding of the meaning humans involved to the event studied. In addition, with this approach, theory follows data, a shorter number of data makes more sense than a larger amount. This approach collect qualitative data. Finally, researchers using this approach, are less worry about find a general answer to their research question (Saunders, Lewis, & Thornhill, 2015).
- **Abductive approach**: This approach allows researchers to mix both (deductive and inductive) during the study, this could provide a better picture of the analyzed data, since goes from theory to data and vice versa. According to Eriksson & Lindström (1997), abduction could be capable of create a new way of thinking, which may lead to new insights and discover meaningful connections within studied topic.

The first three levels explained before are applied to this research and described below, to continue in next subsection (**2.4**) with the research design.

According to author´s vision, a subjectivist approach is the closest one to how he sees reality. The author truly believes that reality is socially-constructed, and as is mentioned before, relies on different points of view. Each person has a different opinion or vision about a topic, according to its previous experience and own knowledge. However, different situations require different approaches and choose only one vision in practice looks like unreal for author´s beliefs, and this way of thinking leads to pragmatism, which agrees in combine different views or not to find the best answer for the research questions.

Regarding the epistemology choice, the author believes how different points of view among actors in social phenomena are valuable and contribute to scientific research. At the same time, more than predict and create an extended explanation, this research focuses more on creating a general understanding of a concept (RIS, Innovation policy and its application in emerging economies). This research uses different perspectives to analyse the function of the different actors of Regional Innovation System. The author considers that both, subjective meanings and the external observable phenomena could provide knowledge and tools to interpreter the data in a better way.

An abductive approach will be used in this research, qualitative data is an important part of this research. However, quantitative data was also used to complement the analysis of this case-study.

2.4 Research Design

Continuing, the methods and techniques used during this research are explained. Topics include the election of a case-study and its limitations, the process of data gathering, limitations of the research in general, and the validity and realiability of it.

2.4.1 Case-Study:

The election of a case-study was more than to get a general answer or theory, to understand and address an exploratory research question of a contemporary event in a specific area (Yin, 2013). Yin points out that single case-studies often are questioned by their lack of rigor. The sources where the author gathers most of the data and the studies which are used to compare the findings aim to fill this rigor´s concern. The second concern is about generalization, which was not the objective of this research. A multi-case study could be better to compare findings

and get conclusions about them, however, using only one case-study gives to the researcher a deeper analysis of the innovation policy within the Metropolitan Region of Santiago. Furthermore, the comparison of findings with different studies conducted in developing economies and even in Chile, together with theoretical frameworks, was useful to validate author´s conclusions. Also, the first research question can be related to a descriptive case-study, due to the intent of it to describe the innovation policy in the MRS, and the effects of it in the region. The second research question is more connected with an explanatory case-study, given to the usage of pattern-matching with theory.

2.4.2 Data Analysis:

The analytical strategy used during this investigation is the development of a description of the case (Yin, 2013). The case study presented was organized in a descriptive framework. This framework came from an initial literature review, where ideas about topics of interest were found.

The descriptive framework begins first, with the analysis of the Innovation Policy in terms of objectives, design and implementation. Second, the use of the triple helix model and regional innovation systems. Third, the taxonomy of innovation policy instruments. These three frameworks help create a strategy for analysing the data collected and then create a description of the case study.

2.4.3 Data Gathering:

This research used both qualitative and quantitative methods in the process of the gathering of data. Many reasons can be behind the election of mixed methods could help to reduce the disadvantages of using only one of them (Walker, 2001; Blake, 1989). Quantitative data were used to study the composition of Chile´s GDP, in addition, Chilean economy in general. Furthermore, quantitative data regarding Santiago´s economic activities and its productive sectors. Also, quantitative data was used to analyze the R&D expenditures from Chile and compare it with other developing and developed economies. At the same time, to understand the structure of this expenditure by region, which was important to comprehend the relevance of the Metropolitan Region of Santiago.

Qualitative data was necessary to obtain information and insights about the Metropolitan Region of Santiago´s regional innovation system, its actors and relationship between them. Also to study MRS´s regional innovation strategy and its results, which were a mix of qualitative and quantitative data.

During this research was used primary data from MRS´s regional innovation strategy, which is a legal document issued by the regional government (GORE), which explains its diagnostic of the current situation in the region regarding innovation, the policy in general, the action plans, the measures, the programs, among others.

Gathering of secondary data was retrieved from worldwide organizations such as, OECD, The World Bank, e.g. Also from public institutions from Chile like, MRS´s regional government, Ministry of economy, Ministry of education, CORFO, CONICYT, e.g. The obtention of secondary data from this kind of sources provided reliability to this research and its conclusions, due to their local, and global recognition.

2.4.4 Limitations:

The limitations during this investigation were mainly related to the lack of information on the evaluation and the results of the regional innovation strategy. There was not an official evaluation after the whole period comprehended for the execution of this strategy (2012-2016). The evaluation which was used in this research to analyze its results was conducted during 2015 and was the last one. In addition, the number of studies about RIS and innovation policy in developing economies are not that extent and find studies to compare the insights obtained during this research was not a smooth process.

The use of the virtual library of Aalborg University was a real help to obtain documents and studies necessary for the development of this research.

2.4.5 Validity and Reliability:

According to Yin (2009), four criteria need to be respected when using a case-study analysis. This to ensure the quality, validity, and reliability of the research:

- **Construct validity**: Achieved through the use of different sources of evidence. (official documents from the local and central governments, published academic articles,

online documents), and the establishment of a chain of evidence (data collected was selected and reported, trying no to distort any of it). This research focused on certain topics chosen from theory. And from the comparison of them with the data collected, conclusions were made.

- **Internal validity**: inferences´ validity was made by considering other possibilities in every situation, and trying to analyze if the evidence was convergent.
- **External validity**: reached through the utilization of theory to evaluate the data of this single case-study.
- **Reliability**: the methods and structure of the research aimed to be the clearest and objective, trying to avoid the author´s bias, and making the study replicable to other researchers.

Continuing, the theoretical overview builds the academic basis of this document and provides the analytical framework used during this investigation to analyze the data collected in the chosen case study.

3 - THEORETICAL OVERVIEW:

During this section, the literature that is relevant to answer both research questions will be explained, trying to give the reader an understanding of the main issues addressed during this research paper. The subsections follow the next order:

- The concept of innovation
- Innovation research
- Regional Systems of Innovation (RIS)
- The Triple Helix Model
- Innovation policy

Using this literature will be helpful to create a framework which will be used to analyse the case example explained in the following sections.

3.1 The concept of Innovation:

The Regional Innovation System idea presents a perspective about generation of innovation through the contribution of knowledge from its subsystems and put importance on the spillovers from the linkages between them (Almeida, Santos, & Rui Silva, 2015). The RIS concept, stress the necessity of collaboration and networking to produce innovation, however there are several definitions for the concept of "innovation" and it's important to state which one is used during this research, by doing this, we will be able to understand what is the rationale behind these systems.

Consider an invention, which is just the idea, like an innovation is a mistake. To be considered as an innovation, this idea must at least be tried to carry out and be transformed in a product or service, which will be used in practice. At the same time, numerous skills are necessary to generate an innovation, together with a demand for this product or service and a space in the market to commercialize it. Usually these conditions are not met, most of the time, for example, there is a gap between the moment where the idea is generated and when the "inventor" can put it in practice, this can due to a lack of conditions to produce the product or service at that time, or because there are factors that are been missing (Fagerberg, 2013). Fagerberg explains, although Leonardo Da Vinci created a lot of drafts about flying machines, he couldn´t produce them because he didn't have access to the correct materials, production techniques and a proper power source, this is a clear example of this "gap" between the generation of the idea and when is put in practice.

Innovation, following a system approach, is a result of complex, cumulative and interactive knowledge, where numerous actors are involved. The old approach to innovation as a linear process is not valid anymore, and this new one has implications regarding innovation policies. Institutions nowadays must promote and support the circulation of knowledge and generation of linkages between the actors within innovation systems to generate innovations (Asheim, Grillitsch, & Trippl, 2015).

Now that the concept of "innovation" was briefly explained, the following section will give a short resume of how innovation research started, to continue with an explanation of regional systems of innovation.

3.2 Innovation research:

Innovation research didn't start twenty or thirty years ago, but centuries. Lundvall in his paperwork "Innovation System Research: Where it came from and where it might go" gives a short review about how different economist contributed to the understanding of innovation systems, which is important to comprehend the importance of innovation regarding economic development.

Adam Smith (as cited in Lundvall, 2007, p. 6), for example, intuited two modes of innovation in "Wealth of Nations", one of his classic works, Smith explains how improvements in machinery were developed by workmen trying to find an easier way of performing their jobs. He gives an example about how a labourer who oversaw open and shut the communication between the boiler and the cylinder of an engine, had an idea of using a string to automate the process, one of the greatest improvements made to this machine. This type of innovation would represent a DUI-mode of learning (Doing-Using-Interacting) a term further explained by Berg Jensen, Johnson, Lorenz and Lundvall in the book "*The learning economy and economics of hope"* (Berg Jensen, Johnson, Lorenz, & Lundvall, 2016).

In addition, Smith says that not all the improvements to machinery are developed by the people who use them, several of them have been made by the inventors of the machinery, or "*men of speculation*", which are men who don't do anything but analyse everything in order to combine existent objects aiming to create something new. These men are divided into different branches, putting their attention to a specific area, which at the end increase the quantity of science (as cited in Lundvall, 2007, p. 6), this explanation is related with STI-mode of learning (scientific, technologic based innovation).

Like Adam Smith, but from another perspective, Friedrich List argue that a government intervention is necessary to "catch up" leading economies, he created an agenda with suggestions about building of infrastructure that could provide technical advances. He also referred to "mental capital" as the most important type of capital for develop of economies (Lundvall, 2007).

To conclude this historical review, Joseph Schumpeter, appears as the architect of modern innovation theory. There is a division between Schumpeter´s work according to which is the motor of innovation (Fagerberg, 2013), which led scholars to talk about two main currents:

- **Schumpeter Mark I:**

  Based on *Theory of economic development* (Schumpeter, The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest and the Business Cycle, 1934), sees individual entrepreneurs as the motor of innovation, they introduce innovations in markets which lead to the creation of companies. These first-starters are followed by imitators, and the earnings created by the first mover is spread among all of them.

- **Schumpeter Mark II:**

  Based on *Capitalism, Socialism and Democracy* (Schumpeter, 1942), Schumpeter argues that the main sources of innovation are R&D teams from big companies searching for new solutions to technological challenges.

Now that the concept of innovation and the origins of innovation systems research have been described, I will explain the regional innovation system, to use it as an analytical framework for the case-study.

3.3 Regional Innovation System:

The regional innovation system (RIS) concept was first introduced in the 90s, with Philip Cooke like one of his founders (Cooke, 1992; Cooke & Morgan, 1998). The regional system of innovation is a system which combines different actors (companies and organizations) which are part of the process of interactive learning, all this embedded in the institutional environment of one region. The structure of the RIS includes institutional, technical and economic components. There are notions of RIS as a set of companies together with universities or educational institutions, business associations, financial institutions, and others, all these like a part of clusters (Asheim & Isaksen, 2002). Using this approach makes easier to trace the timeline of the creation of the RIS, from the start of small clusters to the generation of a system which put all these together through networks. However, RIS is a more complex territorial and social system (Mikhaylova, 2015), and needs a model that consider its specific features.

To define the relationship between NIS and RIS regarding their scales, there are two main approaches (Doloreux & Parto, 2004):

- The first approach, explains that Regional Innovation Systems are being seen as subsystems of the National Innovation Systems
- The second approach uses the concept of region as an area which has no clear boundaries. This characteristic gives us the faculty to consider regions (mega, macro, micro) by different sizes. This one scale the RIS according the particular research which is developing.

This research uses RIS approach over NIS, partly because of the big differences between the Metropolitan Region of Santiago, which has almost half of the population of the country, and the rest of regions in the country. Using NSI could lead to a misunderstanding of the results of the research, creating the idea in the reader of Chile as partially equal in all of its regions. Use a regional level, according to Howells (1999) can be justified by three main arguments. First, the regional governance structure, regarding legal, institutional and constitutional arrangements as well as administrative set-up. Second, long-term development of industry specialization within regions. Third, differences regarding industrial structure and innovative performance of regions. RIS approach, aslo underline the importance of geographical proximity to create interactive learning and generate transfers of knowledge. Part of the knowledge is tacit, which makes it harder to transfer over distance.

Regional innovation systems present two sub-systems:

- **Knowledge exploration**: this one contains universities, research organizations, education organizations, among others. Within this sub-system, the exploration and generation of new knowledge is made.
- **Knowledge exploitation**: this sub-system is related to companies (can be organized in clusters), which are engaged in the exploitation of innovations.

To conclude with the first part of RIS review, some regions are more sutiable to generate radical innovations and others to create incremental ones. By one hand, *Institutional RIS* (IRIS), promote incremental innovations within traditional areas of the market. In this type of

RIS, is usual to see an important public investment in R&D, supporting regulatory and institutional frameworks, and long-term vision of investment by privates. By another hand, *entrepreneurial RIS* (ERIS), promote radical innovations due to their dynamism, venture capital short-term investments, and a important market demand (Cooke P. , 2004). ERISs are more common in liberal market economies and IRISs in coordinated market economies.

3.4 Modeling Regional Innovation System:

To model the regional innovation system which will be studied during this research, I will use "The Triple Helix" model of innovation, a model created during the 90s by Etzkowitz (1993) and Etzowitz & Leydesdorff (1995). The Triple Helix mode is popular around Nordic countries and was present during the author´ studies at Aalborg University, Denmark.

This model presents the rationale of University-Industry-Government interactions and from different interactions between several actors situated in the three different areas of this system, which will contribute to regional (in this case) economic growth, through an increase in innovation and venture creation (Brännaback, Carsrud, Krueger, & Elfving, 2008).

Following the systems theory (Edquist, 2005 in Ranga & Etzkowitz, 2013), we can define a system as a set of three different parts:

- **Components**: divided into three big institutional spheres: University (Academia), Industry, and Government. Each of them presenting several actors (Ranga & Etzkowitz, 2013).
- **Relationships between components**: networking, colloboration, collaborative leadership, substitution and conflict moderation (Ranga & Etzkowitz, 2013).
- **Functions**: activities particularly to the "Triple Helix Spaces": Knowledge, Innovation and Consensus Spaces (Ranga & Etzkowitz, 2013).

The Triple Helix model provides a structure which will help during this research to find relevant actors (components) within Santiago´s regional innovation system. In addition, through this model is easier to assess the interactions and relations between them.

Triple Helix Model configurations:

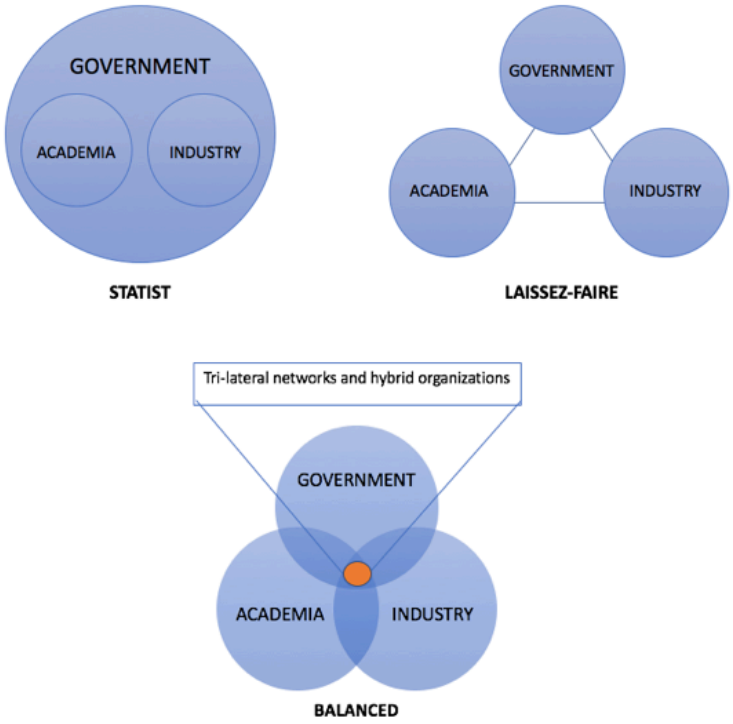

Figure 6:

Source: Adapted from Etzkowitz & Leydesdorff (2000)

There are three different configurations for the Triple Helix model, balanced configuration is the one which, according to Etzkowitz et al., (2005) is the most effective to generate and improve the innovation within the economy. The overlaps areas presented in this configuration, are the best to generate innovation through hybrids organizations, which synthesize elements from the different areas (university, industry, government) of the model (Etzkowitz, Almeida, & Carvalho de Mello, 2005).

The other two configurations have another focus and approach about the role of each of the three areas of the Triple Helix model. First, statist situates government as the guardian among industry and university, and these two as subsidiary units of it. Second, laissez-faire, put apart the three areas of the system, using intermediaries between them.

3.5 Innovation policy:

Policy-makers have become concerned about how economic performance is directly related with innovation, and how is the solution to different challenges that arise (Edler & Fagerberg, 2017). "*Innovation policy*" is a popular concept these days and is largely used between nations from all over the world, starting to restructure how countries allocate its resources.

The term began to become popular during the mid-1990s, however not because a policy didn´t have the label "innovation" means that were not policies impacting innovation since earlier years. In the figure below, we can see how "innovation policy" had a boost around 1995, but innovation had been becoming popular since the early 60s, which supports the idea about how policies have been affecting innovation for a long time.

Frequency of terms "innovation" and "innovation policy" according to Google:

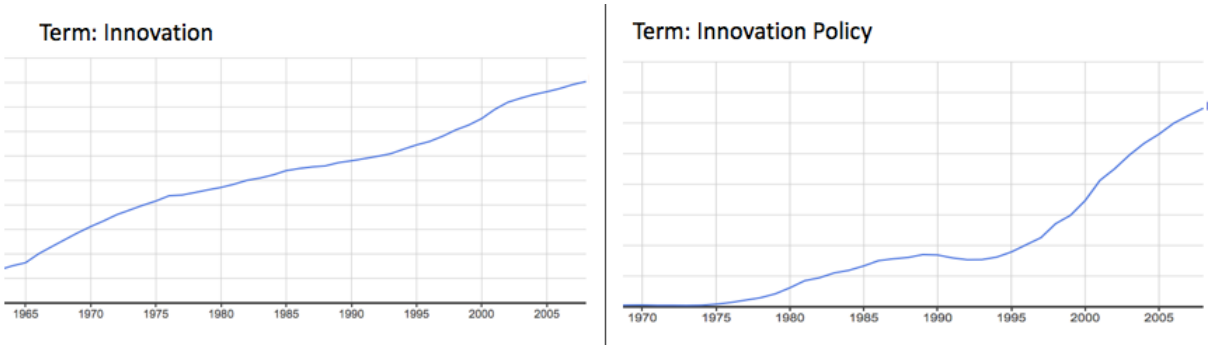

Figure 7:
Source: Retrieved from GoogleNgrams https://books.google.com/ngrams

Innovations represent an asset for economic development not only by themselves but its following exploitation in the economy. Under this point of view, innovation policy needs to put effort on the generation of new solutions/ideas, but also in their exploitation, diffusion, and reactions back and forth during the whole innovation process (Edler & Fagerberg, 2017).

A different perspective on innovation, lead to different perspectives on innovation policy. By one hand, a narrow one will see innovation as only an invention or creation of something "new". By the other hand, a broader will take in count the whole innovation process, from the creation to the implementation and diffusion (Edler & Fagerberg, 2017). These two perspectives, in addition to the question if the analysis of innovation policy, should include or not policies that influence indirectly innovation, provide us a distinction between three types of innovation policy

- **Mission-oriented policies**: this type provide solutions to specific challenges that are part of different political agendas, these solutions should work in practice so policy-makers need to consider the whole innovation process during their design and implementation (Edler & Fagerberg, 2017).
- **Invention-oriented policies**: they follow a narrower vision, putting its focus on the first step of the innovation process (R&D/invention), leaving the responsibility of the exploitation and diffusion of innovations to the market (Edler & Fagerberg, 2017).
- **System-oriented policies**: this type of policy is the newest one, and put its focus on *system-level* features. They concern about the level and quality of interaction between different parts of a system to generate innovations (Edler & Fagerberg, 2017). System-oriented policies are related with NIS and RIS approaches, which are the ones used during this research.

To assist policy-makers, several typologies of instruments which clarify what are the goals of the different innovation policies have been developed. *Edler et al. (2016)* created the typology which is shown in the figure nº8, and gives us an explanation about 15 different instruments and if they are oriented to the innovation supply (or demand) part, and which are its main goals. These instruments could be helpful to analyse the policies created in Santiago so far, and to evaluate which goals are missing and the best way to approach them. The most common instrument used by many countries is subsidies to R&D expenditures in firms (Nº1 in the table), as the main element of innovation policy, but even if these can have a positive effect on innovation investments, the societal effects on productivity and jobs are less evident (Edler & Fagerberg, 2017), and this is a reason why countries cannot rely only on this type of innovation policy. A policy mix is necessary to find solutions of challenges which are at the top of political agendas.

Taxonomy of innovation policy instruments:

	Overall orientation		Goals						
Innovation policy instruments	Supply	Demand	Increase R&D	Skills	Access to expertise	Improve systemic capability, comple-mentarity	Enhance demand for inno-vation	Improve frame-work	Improve discourse
1 Fiscal incentives for R&D	●●●		●●●	●○○					
2 Direct support to firm R&D and innovation	●●●		●●●						
3 Policies for training and skills	●●●			●●●					
4 Entrepreneurship policy	●●●				●●●				
5 Technical services and advice	●●●				●●●				
6 Cluster policy	●●●					●●●			
7 Policies to support collaboration	●●●		●○○		●○○	●●●			
8 Innovation network policies	●●●					●●●			
9 Private demand for innovation		●●●					●●●		
10 Public procurement policies		●●●	●●○				●●●		
11 Pre-commercial procurement	●○○	●●●	●●○				●●●		
12 Innovation inducement prizes	●●○	●●○	●●○				●●○		
13 Standards	●●○	●●○					●○○	●●●	
14 Regulation	●●○	●●○					●○○	●●●	
15 Technology foresight	●●○	●●○							●●●

Figure 8:
Source: Retrieved from "Innovation policy: what, why and how" (2017), Edler.J and Fagerberg.J.
*Note: black dots indicate overall orientation´s relevance – *** = Major relevance*

3.5.1 Innovation policy in emerging economies, R&D-related FDI as a tool:

Since the early 2000s, multinational enterprises (MNEs) have been investing in R&D within emerging economies, locating its centers in regions like Asia and Latin America. This strategy raised the attention of policy-makers on the impact of R&D-related foreign direct investment (FDI) in emerging economies (Guimón et al., 2018). R&D-related FDI could have effects on developing countries in terms of how local firms could improve its technological capabilities by interacting with innovative MNEs.

Latin America´s liberal policies perused during the 90s under Washington Consensus weren't fruitful at using FDI as a tool to generate a capabilities accumulation (Cimoli, Dosi, & Stiglitz, 2009). This situation changed the focus on how Latin American countries approach FDI, putting more attention on quality than quantity. Nowadays public intervention shouldn't only maximize FDI inflows but attract the kind of FDI could be more effective in gaining new knowledge and at the same time diversifying the economy (Guimón et al., 2018).

R&D-related FDI is especially important for emerging economies, through them, they can be able to participate in *global innovation networks* (due the internationalization of R&D). At the same time, close technology gaps and accelerating catching-up, and address failures from its NIS or RIS. However, attract FDI is not enough, this process requires an effort from host countries of improving the local´ set-up (local supplier networks, scientific infrastructures, universities, institutions and human capital). Studies have proven that benefits from R&D-related FDI increase when local firms and public research organizations work together with MNEs in innovation, creating knowledge-intensive linkages (Guimón & Salazar-Elena, 2015). This point out the importance of engaging FDI in R&D projects in cooperation with local actors. In addition, *spillovers*, in its different forms (informal and formal, organizational, technological, tacit and codified, human capital effects, etc.) could be found in these interactions.

To continue analysing how emerging economies could take advantage of R&D-related FDI, it is needed to define *absorptive capacity*, which is the ability of firms or countries to obtain, assimilate and exploit knowledge, which was developed outside the firm or country (Cohen & Levinthal, 1990). Build knowledge-intensive linkages between local actors and foreign investors, is nonsense if local actors and the host country are not able to integrate and exploit the "new knowledge", due to a lack of research infrastructures, innovative firms or high-quality human capital, which are immersed in the absorptive capacity concept. Emerging economies need to develop a certain level of absorptive capacity in order to attract R&D-related FDI. Which is, in most of the cases, through policies which affect directly or indirectly, these gaps.

The analysis of the Metropolitan Region of Santiago begins in the next section **(4)**. Here its Regional Innovation System and Regional Innovation Strategy are studied using the theoretical overview presented earlier.

4 - Metropolitan Region of Santiago – Case analysis:

During this section, Santiago´s Regional Innovation System and its Innovation Policy will be analysed. This section begins with a description of MRS´s RIS and its actors (**4.1**), this makes easier to understand the role of each of them in the regional innovation strategy. In addition, is presented a brief description of Chile´s R&D expenditures structure (**4.2**) to put this region in a context within the country.

Section **4.4** is a description of MRS´S Regional Innovation Policy and its main challenges. Section **4.5** presents an analysis of the strategy (objectives, design, implementation), and the RIS´ Triple Helix configuration. These will be used to answer the first research question. Aiming to answer the second research question, section **4.6** analyse the innovation policy instruments and goals of the regional innovation strategy.

The methods of analysis and more information are provided at the beginning of each section.

4.1 Metropolitan Region of Santiago´s Regional Innovation System:

The metropolitan region of Santiago has a system of regional innovation which is presented below, dividing the different actors of the system into three different spheres (Government, Industry, and Academia) following the Triple Helix Model. Also, a description of the most relevant actors and their functions within the regional innovation system is provided.

4.1.1 Chile´s institutional set up:

The Chilean system of innovation is headed by the Presidency of the Republic, which is advised by The National Innovation Council for Competitiveness (CNIC). This council proposes general guidelines for the development of a national innovation strategy. These guidelines are evaluated by a committee of Ministers for Innovation, which define national policies on science, technology, and innovation. These three entities constitute the main political instances of the Chilean innovation system.

The three actors mentioned before are part indirectly of MRS´S RIS, due to its empowerment regarding innovation strategies in the different regions of the country. At the same time, all the Ministries have a participation in the regional innovation system, however, the Ministries

of Education and Economy have a leading role. The first one through The National Commission for Scientific and Technological Research (CONICYT). The second one through The Production Development Corporation (CORFO).

Is important to clarify how most of science, research, entrepreneurship, and innovation initiatives are financed in the regions of Chile. Since 2006, there is a public fund which mission is to increase Chile´s competitiveness in a manner consistent with the National Innovation Policy (Ministerio de Economía, Fomento y Turismo, 2010). The Innovation Fund for Competitiveness (FIC) puts in order the other public programs in the field of innovation. The FIC distributes 25% of its resources to different Regional Governments (GORE), and 75% to different beneficiaries through public agencies such as CORFO, CONICYT, FIA, ICM, among others. During the following sections a description of different policies applied in the MRS, and how some of these agencies and other actors used FIC´s resources.

4.2 Metropolitan Region of Santiago´ RIS actors:

4.2.1 GOVERNMENT:

The main actors of the Government sphere of Metropolitan Region of Santiago´s regional innovation system are:

1. <u>Present at national and regional level:</u>

- **Presidency of the Republic.**

- **National Innovation Council for Competitiveness (CNIC):**
  President, seventeen councillors, four representatives of the public sector (Ministers of Finance, Education, Agriculture and Economy), and six permanent guests (the President of CONICYT, the Executive Vice President of CORFO, the Executive Director of the FIA, the Chief of the Innovation Division of the Ministry of Economy, the Manager of Entrepreneurship and Innovation of CORFO, and the Executive Secretary of the CNIC) (Gobierno Santiago, 2018).

- **Committee of Ministers for Innovation:**

  Composed by the Ministers of Finance, Foreign Affairs, Education, Public Works, Transport and Telecommunications, Agriculture, and Economy. This last one act as headmaster of it (Gobierno Santiago, 2018).

- **National Commission for Scientific and Technological Research (CONICYT):**

  Autonomous corporation, designed to advise the President of the Republic in the planning of scientific and technological development. It is administratively related to the Government through the Ministry of Education, and It has three main objectives. First, strengthen the country's scientific and technological base. Second, promote the formation of advanced human capital. Third promote a scientific and technological culture in the population (CONICYT, 2018). All this in coherence with the national and regional innovation strategies.

- **Corporation for the Promotion of Production (CORFO):**

  CORFO is an executing agency for the policies of the government of Chile in the field of entrepreneurship and innovation. Its mission is to promote entrepreneurship and innovation to improve Chile's productivity and achieve world leadership positions in terms of competitiveness (CORFO, 2018). It is administratively related to the Government through the Ministry of Economy, Development and Tourism.

- **ProChile:**

  Institution of the Ministry of Foreign Affairs responsible for the promotion of the exportable supply of Chilean goods and services, and to contribute to the diffusion of foreign investment and the promotion of tourism (ProChile, 2018).

- **Millennium Scientific Initiative (ICM):**

  Funds and supports research centers of excellence in the areas of Social Sciences and Natural Sciences. The Millennium Centers are awarded through public competitions by a committee of high-level international researchers (ICM, 2018). This is a program of the Ministry of Economy, Development and Tourism of Chile.

- **The Innovation Fund for Competitiveness (FIC).**

2. Present at regional level:

- **Regional Government (GORE):**

  The Regional Government is an autonomous body responsible for the administration of the region, is concerned with the harmonious and equitable development of the territory. Its main task is the planning and preparation of projects that promote the economic, social and cultural development of the Metropolitan Region of Santiago, considering the preservation and improvement of the environment and the participation of the community (Gobierno Santiago, 2018). GORE maintains a relationship with the national Government and its various institutions present within the region to coordinate the planning and executing of programs and projects. At the same time, this institution has a low autonomy with respect to investment decisions and policies on issues of regional economic development. Supporting itself mainly in the central Government (Planas & Fernández de Lucio, 2018).

  This institution has three divisions: Administration and Finance Division (DAF), Division of Analysis and Control of Management (IVAC), Division of Planning and Development (DIPLADE).

4.2.2 ACADEMIA:

In Chile, the educational institutions which are recognized by the Ministry of Education are named autonomous. If they qualify as *autonomous*, the institutions can also be *accredited*, they need to apply for an evaluation conducted by the Ministry, which verifies the institutions' quality of the infrastructure, study plans, careers, among others.

According to data from the Ministry of Education of Chile (2018), the number of educational institutions in the Metropolitan Region of Santiago are:

- **19 Technical Training Centers**:
  - 15 autonomous.
  - 5 accredited.

- **27 Professional Institutes:**
  - 22 autonomous.
  - 15 accredited.
- **5 State Universities:**
  - All autonomous and accredited.
- **24 Private Universities:**
  - 23 autonomous.
  - 18 accredited.

The number of universities that carry out R + D + i is 10. In addition, 21 offer master's programs and only 9 doctorate programs. In the region, there are also 19 research centers supported by CONICYT (Ministerio de Educación, CONICYT, 2018).

Two Chilean universities (PUC, Universidad de Chile) are part of the best universities in the whole region, and have a presence in international rankings, providing high-quality engineers within the MRS. In addition, the city has top business schools oriented to entrepreneurship and innovation. Universidad Adolfo Ibañeez, and Universidad del Desarrollo (America Economía, 2017).

4.2.3 INDUSTRY:

According to the Chilean internal tax service (SII), were 462,260 companies in the Metropolitan Region of Santiago in 2016. This number represents almost the 50% of the total number of companies in Chile (SII, 2016). At the same time, there are 5,5 millions of dependent works in the MRS, which is more than the 60% of the total in the whole country.

In the following table, we can see which sectors concentrate the biggest numbers of companies within the MRS.

During the following section, there is a description about how and who finance and execute R&D in the MRS. For example, Industry executes 39% of the spend in R&D, and receives only a 12% of funding from the Government (figure nº11).

Number of Companies by Sector in The Metropolitan Region of Santiago:

INDUSTRY	Nº of companies
WHOLESALE AND MINOR COMMERCE, REP. VEH.AUTOMOTORS / DOMESTIC SENSES	148,279
REAL ESTATE, BUSINESS AND RENTAL ACTIVITIES	75,874
FINANCIAL INTERMEDIATION	44,936
TRANSPORTATION, STORAGE AND COMMUNICATIONS	42,172
CONSTRUCTION	35,241
NON-METALLIC MANUFACTURING INDUSTRIES	24,386
OTHER ACTIVITIES OF COMMUNITY, SOCIAL AND PERSONAL SERVICES	20,288
METAL MANUFACTURING INDUSTRIES	17,716
HOTELS AND RESTAURANTS	16,416
AGRICULTURE, LIVESTOCK, HUNTING AND FORESTRY	15,872
SOCIAL AND HEALTH SERVICES	11,599
TEACHING	4,983
MINING AND QUARRY EXPLOITATION	1,408
SUPPLY OF ELECTRICITY, GAS AND WATER	1,375
NO INFORMATION	739
ADMINISTRATION COUNCIL OF BUILDINGS AND CONDOMINIUMS	582
FISHING	194
ADM. PUBLIC AND DEFENSE, SEG PLANS SOCIAL COMPULSORY AFFILIATION	189
ORGANIZATIONS AND EXTRATERRITORIAL ORGANS	19

Figure 9: Own illustration based on data from SII, 2016.

Concluding with the first part of the analysis, the R&D expenditures within the country and the region introduces the description of the regional innovation strategy of the Metropolitan Region of Santiago to start the analysis of its objectives, design, and implementation, which will be used to answer the first research question.

4.3 R&D Expenditures:

Chile invests around 0,385% of its GDP in R&D (2016). This number is far from the OECD historical average, which is 2,38% (Ministerio de Economía, Fomento y Turismo, 2018). In fact, from all the member of the OECD, Chile is the one with the lowest investment in R&D (as the percentage of the GDP), behind of Mexico (0,53%), Turkey (0,88%) and Greece (0,97%). Israel (4,25%), Korea (4,32%) and Switzerland (3,42%) close the Top 3 (OECD, 2018).

Considering which units execute this spend, companies represent 39%, while 42% the Higher Education Institutions (HEI), 13% executed by the State, and a 6% by Non-Profit Private Institutions (NPPI) (Ministerio de Economía, Fomento y Turismo, 2018).

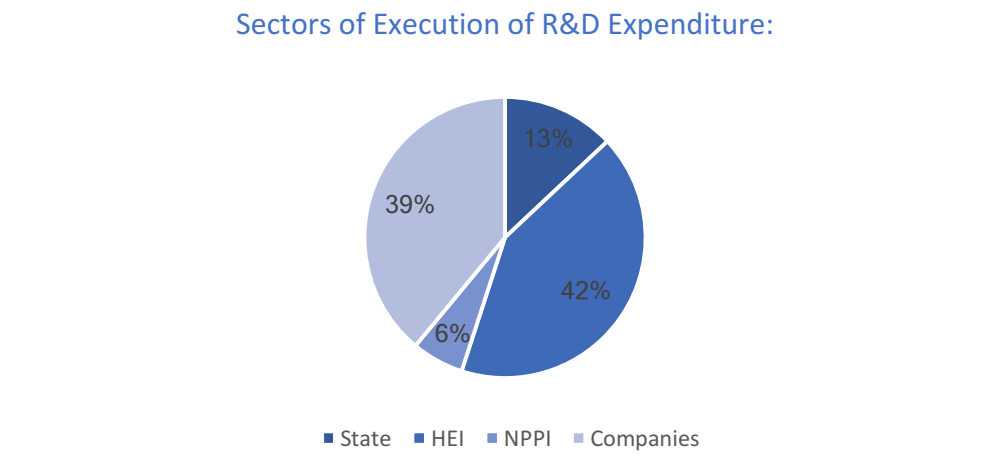

Figure 10: Own illustration based on data from Ministry of Economy, Development, and Tourism (2018)

The funding source for each sector of execution (figure 10) shows, for example, the State finances 98% its expenditure in R&D, 60% of the higher education institutions´ (HEI) expending, 64% of non-profit private institutions (NPPI), and only a 12% of companies´ expenditure. International sources have a minimum impact on R&D sourcing, financing only 1% of State and companies 'expenditures, 3% of HEI, and a 6% of NPPI.

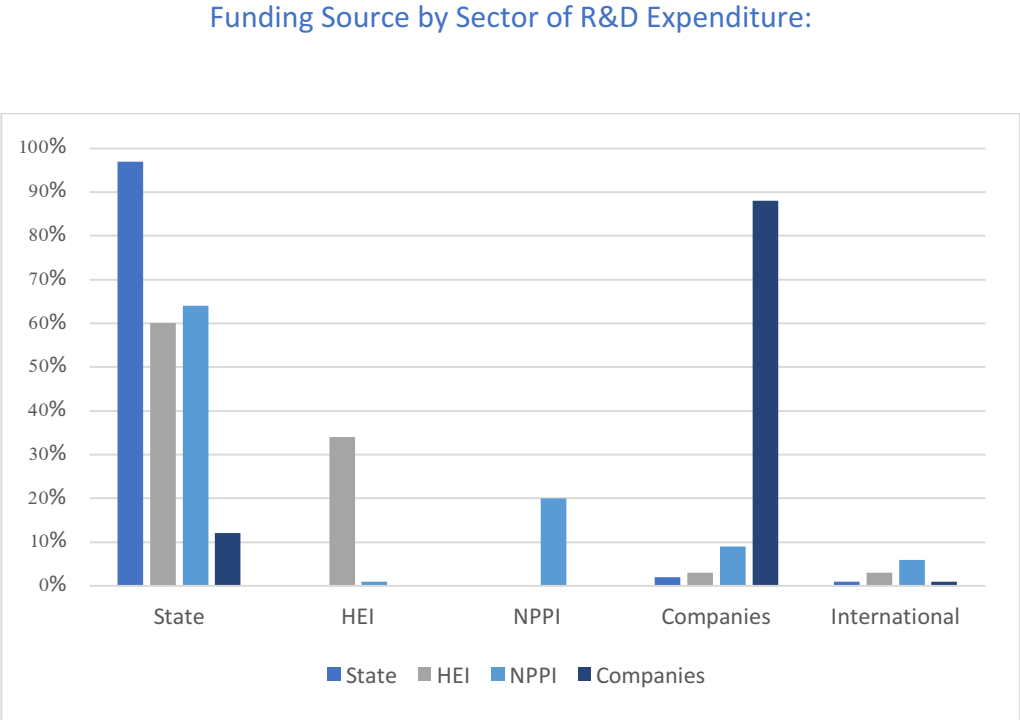

Figure 11: Own illustration based on data from Ministry of Economy, Development, and Tourism (2018)

The percentage of the total investment in the country that is expended in the MRS is: State (66,9%), HEI (66,4%), NPPI (64%), and companies (78,4%) (Ministerio de Economía, Fomento y Turismo, 2018). All these investments represented, as I mentioned before, the 70,9% of the total investment in R&D in the country.

The sector in the economy where companies spend the most in R&D are: exploitation of mines and quarries (15,6%), manufacturing (15,5%), and scientific research and development (12,4%).

Chile also presents every 1,000 workers, only 1,09 researchers (Ministerio de Economía, Fomento y Turismo, 2018). Positioning Chile at the end of the ranking between OECD countries again. OECD´s average is 7,75 (OECD, 2018).

From all this data, Chile is behind in terms of the total amount invested in R&D comparing other countries members of the OECD. The same happens with the number of researchers within the country. At the regional level, the metropolitan region of Santiago holds a big amount of R&D investment. Companies spend almost 80% of the total in MRS and the other units of execution close to 70%. This data is relevant to analyse where the innovation policies are being executed within the country, and if they are in line with the amount invested in the different regions.

Finally, the State finances more than 60% of HEI and NPPI´s R&D expenditures. At the same time, only execute a 13%, which give us the picture of a State which relies on other units to generate innovations, investing more than executing. The 12% invested in companies show a distance between the private and public sector in terms of generation of new technologies and development.

4.4 Metropolitan Regional of Santiago´s current Regional Innovation Strategy:

The regional council of MRS developed the first Regional Innovation Strategy in the history of the region for the period 2012-2016. This strategy aimed to guide the articulation, connection, and promotion of collaboration networks between companies and the components within MRS´s regional innovation system (Gobierno Regional Metropolitano de Santiago, 2018).

The strategy puts focus on small and medium-sized enterprises (SMEs), arguing that SMEs are the ones situated further from innovation than big companies, which have access to information and bigger resources. SMEs, according with the regional council of MRS, need to have access to the worldwide technologic tendencies, and to the innovations that are happening and could add value to its productive or commercial activity.

This stage of the strategy puts effort in these sectors of the economy: Food Industry, Horticultural Industry, Primary Horticulture and Processed Food, Manufacturing, ICT and Platform of Services, Design and Creative Industries, Advanced Services, Tourism and Special Interests (Gobierno Regional Metropolitano de Santiago, 2018).

The Regional Innovation Strategy presented three main big challenges for the metropolitan region of Santiago:

1- Articulate Research, Development and innovation (R&D+I)
2- Increase Productivity for Competitiveness
3- Enhance the Productive Base

The strategic axes of the strategy were divided into four. These respond to the plan of action of the regional innovation strategy. Each of them determines the scope, in what term, and to which agents address. Each of these axes contain different programs (7) and measures (23), which will be described below (objectives, actions, beneficiaries, and expected results). List them will help in the analysis of its effectiveness and to understand what is missing to improve them. The innovation strategy was developed between 2012-2016, and all its programs were supposed to be implemented until 2016.

To achieve some of the objectives of the different programs of the innovation strategy, was used the Innovation Fund for Competitiveness (FIC) as the main source of finance. The FIC is an annual allocation of resources received by the MRS Government to enhance the region´s economic development through research projects that generate knowledge applicable to the productive sector (Gobierno Santiago, 2018). The Regional Innovation Fund for Competitiveness (IFC-R) is executed, first, by specialized public agencies (CORFO, Innova Chile, FIA, CONICYT, etc.), and second, by a public contest addressed to Universities and R&D centers.

Four Strategic Axes of The Regional Innovation Strategy:

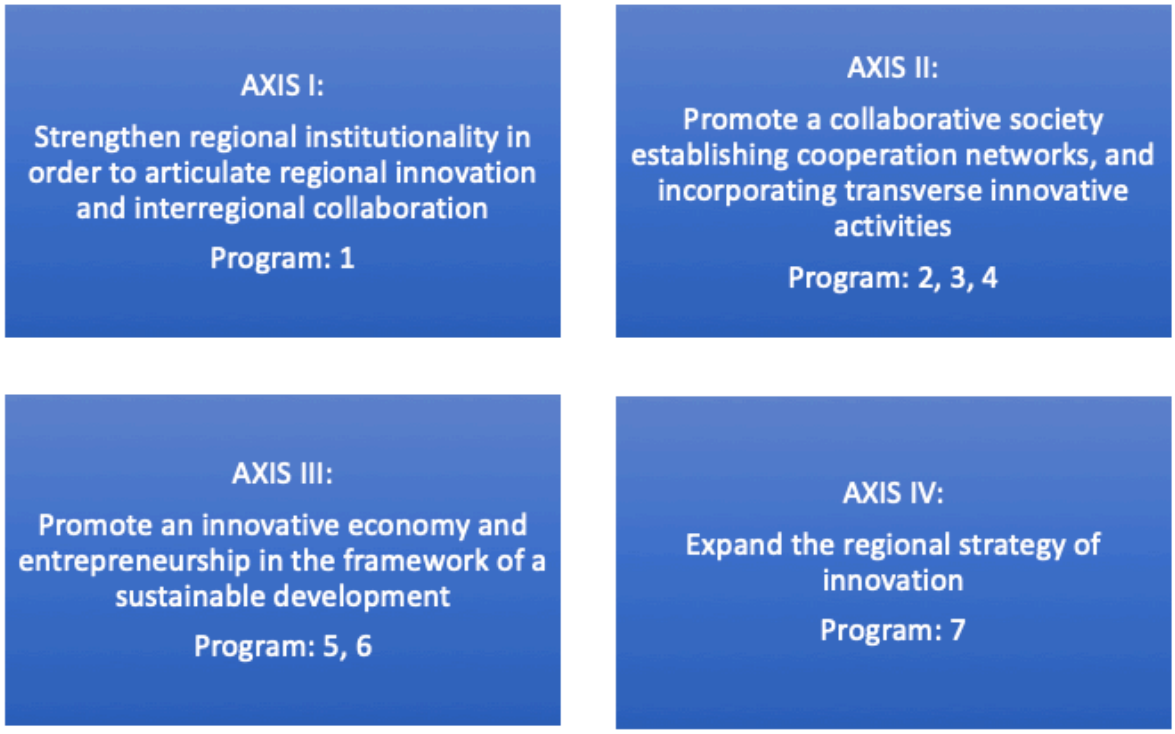

Figure 12: Own illustration based on data from Gobierno Regional Metropolitano, 2018.

Each axis focuses in different parts of MRS´s Regional Innovation System. Axis I, aims to improve it from the Institutional sphere. Axis II and III, focus in the Industry sphere trying to link it with Academia one. Aiming to improve managers and worker's innovation capabilities, and attract and retain talent from universities and research centers. Finally, axis IV approach the Regional Innovation System in its totality, seeking for an extension of the innovative culture in the region, the country, and abroad.

The regional innovation strategy of the MRS will be explained following this structure. First, a brief resume of the objectives of each program (1-7), and measures contained in them. Second, a table with the objectives, actions, beneficiaries, and expected results of each one of the measures of the innovation strategy. Each one of these measures has a colour, which represents the level of achievement of them. Green (totally achieved), Red (not achieved), Light Yellow (partially achieved), Dark Yellow (early stage).

4.4.1 Axes, Programs, and Measures:

Axis I, program nº1:

The objective of this program is to complement regional institutionality needed to articulate a dynamic and collaborative RIS (Gobierno Regional Metropolitano de Santiago, 2018). This program has five different measures which all together help to achieve its objective. **1.1**: Creation of an innovation unit, **1.2**: Creation of an innovation executing unit, **1.3**: Strategic surveillance tools and regional intelligence, **1.4**: Creation of consensus and regional coordination mechanism, **1.5**: Installation and strengthening of capacities.

	Objectives	Actions	Beneficiaries	Expected results
1.1	Having a coordinating body of the regional innovation strategy, which ensures its implementation, continuity and monitoring.	Create a team with 3 professionals. Set goals and expected results.	Regional Government (GORE). Division of planning and development (DIPLADE).	3 trained professionals within 1 innovation unit. Implementation of the strategy.
1.2	Creation of an executor unit of the innovation strategy. Development of a regional instrument specialized in supporting R&D+I.	Study for the design of the legal formula for this executing unit. Entity design (organization chart, functions, resources, etc.	Regional Government (GORE).	1 executing unit of the programs and support measures in the region.

1.3	Have qualified info for making decisions regarding innovation. Dissemination of news, reports, studies, etc. about innovation in the regions.	Agreements with entities to obtain info at the regional level. Creation of an observatory of regional innovation.	Regional Government (GORE) and different entities.	Up-to-date statistics on innovation, periodic newsletters, follow-up reports on the innovation strategy.
1.4	Consolidate the participation of regional actors. Strengthen the coordination of entities and instruments in the region.	Approval by the Regional Council of the Regional Board.	Regional Government (GORE) and related entities.	Legitimate the Regional Board. Promote regional coordination.
1.5	Guarantee the skills and qualifications required for the innovation unit.	Training of the innovation unit. Strengthening actions for regional agents.	Regional government (GORE) and regional agents.	Trained innovation unit. Awareness of the innovation strategy in the region.

Figure 13: Own illustration based on MRS´s Innovation Strategy (2012-2016).

Axis II, program nº2:

This program aim to incentive and support enterprises collaboration regarding innovation projects. (Gobierno Regional Metropolitano de Santiago, 2018). The measures are, **2.1**: Strengthening of innovation and associativity capabilities for horticultural producers, **2.2**: Install project units for the support of innovation, **2.3**: Strengthen of trade associations.

	Objectives	Actions	Beneficiaries	Expected results
2.1	Develop and implement a service which allows improving the capacities of incremental innovation in the horticultural production, and the commercialization of its products.	Design an implementation plan. Strengthen associativity of the sector.	Small agricultural producers. Trade association of producers Hortach.	At least 100 producers receive training for the installation of innovation capabilities.
2.2	Promote innovation management in SMEs and support innovation processes. Encourage associativity among companies for innovation projects. Create and support innovation units in trade associations.	Training of professionals to help trade associations. Create project units for "innovation support in the SMEs"	SMEs. Trade associations.	3 project units in 3 trade associations. 20 qualified professionals. 60 SMEs innovative projects, and 20 of collaboration between companies.
2.3	Expansion of the number of trade associations with the capacity to execute public funding. Strengthen trade associations with less capacity.	Support for participation in collaborative projects. Training of the work units of trade associations.	Trade associations.	10 trade associations trained to act as receiving entities.

Figure 14: Own illustration based on MRS´s Innovation Strategy (2012-2016).

Axis II, program nº3:

The measures of this program aim to support innovation processes and add value to SMEs products. Also, strengthen ICT and Design sectors. (Gobierno Regional Metropolitano de Santiago, 2018). **3.1**: Incorporation of ICT in the sustainable tourism sector, **3.2**: Innovation management for exporters SMEs within gourmet and food with added value sector, **3.3**: Development of ICT tools of high productivity for SMEs within services sector.

	Objectives	Actions	Beneficiaries	Expected results
3.1	Improve competitiveness of companies in the tourism sector. Extend the innovation in the region.	Coordination platform for projects and innovation support plans. Identification and development of tech solutions within tourism sector.	Companies in the tourism sector.	Involvement of at least 100 companies. Development of at least 10 tech solutions. Application of solutions by at least 100 companies.
3.2	Increase capacity of innovation of products and services for exporting SMEs in the food sector (gourmet and condiments).	Working group with companies, Gourmet associations and ProChile.	30 SMEs in the region.	At least 30 SMEs receive a consultancy to install innovation management capabilities.
3.3	Develop and install a high impact ICT tool for the integral improvement of management in SMEs.	Working group with SMEs in the service sector. Development of system and business models.	Companies in the ICT and services sectors.	At least 30 SMEs incorporating ICT tools. Strengthen the associative capacity between tech supply and demand.

Figure 15: Own illustration based on MRS´s Innovation Strategy (2012-2016).

Axis II, program nº4:

The objective of this program is to make visible and accessible the innovation offer to SMEs. In addition, help to promote the rapprochement between the entities offering R&D+I and the SMEs in the Region. Finally, extend this offer to the rest of the country (Gobierno Regional Metropolitano de Santiago, 2018). **4.1**: Platform of management of the technological and knowledge offer for SMEs, **4.2**: Meetings for the collaboration between universities and SMEs, including research centres, **4.3**: Interregional forum for the extension of R&D+I offer to the rest of the country.

	Objectives	Actions	Beneficiaries	Expected results
4.1	Order R&D+I offer, commercialize it, and create a network of suppliers. Agents of technology and knowledge transfer.	Create a catalog with R&D+I offer addressed to SMEs. Create a marketplace of supply and demand of R&D+I.	SMEs.	3 qualified professionals as supply-demand intermediaries. Offer catalog and marketplace. 15 SMEs with transfer projects.
4.2	Make R&D+I offer visible. Bring SMEs closer to the academic field. Bring researchers to the business environment.	Conduct meetings between research groups and companies (sectorial and territorial).	SMEs. Researchers.	12 meetings. Participation of 600 companies. Participation of 20 R&D+I offer entities.
4.3	Make visible the R&D+I offer nationwide. Encourage collaborations between companies and interregional R&D+I offer entities.	Realization of interregional meetings.	SMEs. Researchers.	Realization of 4 meetings. Participation of all Chilean regions.

Figure 16: Own illustration based on MRS´s Innovation Strategy (2012-2016).

Axis III, program nº5:

Increase and extend SMEs innovation processes to make them more competitive Is the objective of this program. Also, obtain tool which contribute the improvement of the innovation in SMEs (Gobierno Regional Metropolitano de Santiago, 2018). This program has three different measures. **5.1**: Integral support system for SMEs to install innovation capabilities (manufacture and services sectors), **5.2**: Support to the funding of the innovation in SMEs, **5.3**: Creation of new innovative SMEs in urban/rural areas.

	Objectives	Actions	Beneficiaries	Expected results
5.1	Improve absorptive innovation capacity of SMEs Identify, promote, and follow innovation projects.	Implementation of an innovation management system to create innovation plans. Implement these plans, development of prototypes.	SMEs in the region (manufacture and services sectors)	100 SMEs with this system. 50 prototypes. 100 businessman trained. 5 trade associations participating.
5.2	Support the finance of innovation in SMEs. Create and adopt financial instruments adapted to SMEs. Venture capital.	Analysis of instruments. Development of venture capital for SMEs.	SMEs	Innovation financing program for SMEs.
5.3	Support the creation of innovative firms. Create a favourable atmosphere for them.	Condition urban spaces which could hold innovative activities.	New companies. Microenterprises.	Proper infrastructure for new companies.

Figure 17: Own illustration based on MRS´s Innovation Strategy (2012-2016).

Axis III, program nº6:

This program aim to build the capacities necessary to start innovation processes. In addition, integrate skilled human resources into SMEs, and promote an innovative culture within the region (Gobierno Regional Metropolitano de Santiago, 2018). This program has three different measures. **6.1**: Innovation training for managers, mid-level and workers of SMEs, **6.2**: Attraction, incorporation, and retention of talent, **6.3**: Forum networks for the promotion of an innovative culture.

	Objectives	Actions	Beneficiaries	Expected results
6.1	Create capacities to install innovation processes. Contribute to the relationship between companies.	Identify training needs among SMEs workers. Design and application of a training program.	SMEs workers.	150 companies participating. Validated training program.
6.2	Integrate advanced human capital into SMEs. Attract and retain talent.	Design of a program to integrate this talent (supported to study abroad)	Young talent. SMEs.	60 people incorporated. Validated program.
6.3	Extend the innovation culture in the region.	Design program to diffuse and promote innovation.	MRS actors.	1,200 people participating in different forums.

Figure 18: Own illustration based on MRS´s Innovation Strategy (2012-2016).

Axis IV, program nº7:

The objective of this program is to keep a long-term reflexion about innovation strategy within the region. In addition, integrate traditional and emergent sectors into it. Finally, extend the innovation support to other regions and other countries (Gobierno Regional Metropolitano de Santiago, 2018). This program has three different measures. **7.1**: Integration of new sectors, **7.2**: Extension of innovation to the whole territory, **7.3**: Plan design for the internationalization of R&D+I from the region.

	Objectives	Actions	Beneficiaries	Expected results
7.1	Extend the innovation strategy to new sectors.	Analyse and create strategic propositions to add new sectors.	MRS actors.	Sectoral strategy for the second stage of the innovation strategy.
7.2	Extend the innovation strategy to the whole region.	Analyse and create strategic propositions to add the whole region.	MRS actors.	Regional strategy for the second stage of the innovation strategy.
7.3	Extend the innovation strategy to the other countries.	Design an action plan for the internationalization of innovation.	MRS actors.	Action plan for the internationalization of innovation.

Figure 19: Own illustration based on MRS´s Innovation Strategy (2012-2016).

Continuing, and aiming to answer the first part of the first research question, the general results of the Regional Innovation Strategy are explained briefly, to continue with a description and evaluation of each axis. The analysis is divided into three different points of analysis: objectives, design, and implementation. The first of them aims to compare each axis´ objectives with studies made by other researchers regarding relevant topics. The design is analysed using the table of the taxonomy of innovation policy instruments, which can be found in the literature review, and to make it clear to the reader, at the end of the following subsection, in which all the measures are included. Implementation´s analysis aims to find

what was missing during it, and why this occurred. Furthermore, a conclusion is presented which analyses these three topics for all the Regional Innovation Strategy together. Finally, and to support the answer of the first research question, an analysis of the configuration of the MRS´ RIS is presented, following the Triple-Helix Model. With this model the roles of the actors this Regional Innovation System are explained.

4.5 MRS´s Regional Innovation Strategy results and analysis of its objectives, design, and implementation:

By end of 2015, a first evaluation of the MRS´s innovation strategy was conducted by INFYDE. This consulting firm is worldwide recognized, and put its focus in innovation and competitiveness. They have more than 500 projects around 40 countries, with more than 250 different clients (INFYDE, 2018).

Between 2012-2015, the general results showed 10,273 assistants to events related to FIC-R, these were entrepreneurs, associations, researchers and public agents. At the same time, at least 755 SME´s were directly benefited (capacities, consulting, new products, sales growth, etc.) by FIC-R projects. More than 23 Trade Associations saw their innovation capacities improved. In addition, 60 innovation projects have been defined and formulated as result of FIC-R projects. Finally, regarding public agents, more than 100 also improved their innovation capacities (INFYDE, 2015).

Going in detail about the 23 measures contained in the innovation strategy, 7 of them were fully achieved (green), 10 were partially achieved (yellow), 3 were not achieved (red) and 3 were in early stages (darker yellow).

Continuing, I will analyse if each axis (I-IV) can be considered as good or not regarding its objectives, design, and implementation. Comparing these three topics with Regional Innovation Systems and Innovation Policy theories, which were explained in the theoretical overview, and different studies regarding innovation in developing countries.

4.5.1 AXIS I:

Program nº1:

Objectives:

Axis I aims to strengthen the regional institutionality to articulate innovation and collaboration within the region. This objective considers the lack of connection between the actors of MRS´ regional innovation system, pointing out the necessity of a strong institutional framework able to lead innovation processes and coordinate them. Painuly (2001), did a study about barriers to renewable energy penetration. The study divided barriers into 6 different categories: market failure, market distortions, economic and financial, institutional, technical, and social and cultural. This axis has as objective to break the institutional barriers, which are represented by a lack of professional institutions. Significant amount of research about barriers in developing countries to generate innovations identify institutional, technological and financial barriers as the common ones (Painuly, 2001; Painuly & Fenhann (2002); Reddy & Painuly (2004).

At the same time, this axis understands that is necessary a continuity of innovation processes beyond the political calendars. Overall, this axis comprehends the concept behind Regional Innovation System theory, and how all the actors need to collaborate between them, embedded in a strong and efficient institutional environment, which is according to various authors (Doloreux & Parto, 2005; Asheim, Grillitsch, & Trippl, 2015; Nelson, 2008) a key factor to make regions competitive and to develop RISs. In addition, its objectives are *system-oriented* (Edler & Fagerberg, 2017), considering every part of the system as a key actor within generation of innovation, and the importance of the quality of their interactions.

Design:

The goals of Axis I are: *improve skills, improve systemic capabilities, improve framework*. If we consider the measures under this axis, 1.1 and 1.2 focus on *improving skills and systematic capability*, with the training of professionals abroad to create the innovation unit and executing unit, and at the same time this unit provide guide and training to innovation projects. Also by 1.5, which also aims to strengthen innovation skills of regionals actors, and 1.4 which focus on a regional coordination mechanism. Finally, 1.3 puts attention on improving the gathering of information to take decisions about innovation. The goals of this

axis and its measures were design using a mix of policy instruments which were in line with the objectives of it.

Suaréz-Barraza (2013) in a study of local governments in Spain, shown empirical evidence about how municipal employees from different municipalities got a deeper understanding about innovation capabilities and models by applying improvements activities by stages. The design of the measures part of axis I are in its majority relying on the training of just 3 professionals, and not on a general training on innovation processes for public employees. These three professionals need afterwards to start the guide and training to others. The design under author´s point of view and based on the theory is poor and doesn't show a real process in which the MRS´s institutionality can be improved.

Implementation:

From this program, the only one totally achieved was the creation of an innovation unit (1.1). Three professionals were trained in regional innovation management by the University of Valencia, Spain. This leaded to the creation of the innovation unit, which is currently working within MRS Regional Government (MRS GORE). However, there is not an innovation execute unit (1.2), thus innovation is still been executed by the GORE through public contests with CORFO, FIA and CONICYT, all these agencies at national level (review MRS´RIS actors section for further details about these agencies).

Measures 1.3 and 1.5 were partially achieved. There are up to date statistics regarding innovation, but there are not following reports of the regional innovation strategy. In addition, have been an awareness about innovation, but not a real implication from regional actors.

All the measures of this axis, were developed by the planning and development division (DIPLADE) of the Regional Government (GORE). The fact that only one measure was achieved can be attributed to a lack of capacity of this division, and the Regional Government. However, most of these measures have as objectives the training and improvement of the human capital in these institutions, which is a good signal about how the deficit of capabilities is being approached.

4.5.2 AXIS II:

Program nº2,3,4:

Objectives:

Axis II aims to improve the collaboration of companies between each other, and with other actors of the Regional Innovation System. This axis considered the importance of collaboration for innovation (Cooke, 1992; Cooke & Morgan, 1998) putting as one the objectives, the collaboration between ICT companies and traditional ones. The co-development with external partners relates to the development of higher-level innovations, which are more complex and radical (Hahn, 2014). In addition, ICT industry present R&D characteristics, due to experience a continuous restructuring activities following the changes which internet generated. ICT companies have been developing software-specific competencies, these competences have been linked with new and disruptive technologies. Thus, ICT industry, according to Hahn (2014), should be able to conduct innovation project within cross-industry cooperation.

Axis II understands the global trends regarding the convergence of technologies, which lead to the integration of transversal activities. Furthermore, axis II takes in count the necessity of generate trust to promote these collaborations. At the same time, establishes mechanisms to connect the offer of public instruments with SMEs. And considers the commercialization of innovation, aiming to make R&D offer visible.

Design:

The goals of Axis II are: *Skills*, *Access to expertise, Improvement of systemic capabilities, Enhance demand for innovation, and Improve the discourse.*

Measures 2.1 and 2.2, both aim to improve *innovation skills*, by training local producers and supporting units for the generation of innovative projects. These two measures are focused in the small agricultural producer's trade associations. Five different measures have the goal of *access to expertise*, however, three of them (2.2, 3.2, 3.3) try to do it using technical services and advice as instruments. 4.2 and 4.3 have the same goal, but they try to achieve it by policies to support collaboration. With the goal of *improving systemic capabilities,* 2.3 aims

to make trade associations in receiving entities of public funds for innovation, by improving their capabilities by cooperation.

Three from all the measures, which are part of the MRS´s regional innovation policy, focus on *enhance demand for innovation*. Two of them are part of the axis nº2, 4.1 does it through the creation of a public marketplace for R&D offer, and structuring its production. 4.3, encouraging the collaboration between Industry and Academia, making the R&D offer visible nationwide. With the goal of *improving the discourse*, measures 3.1 and 3.3 focus on the application of technology in two areas of the economy (tourism and ICT), to improve innovation management and processes. In general, the design of this axis mixes several policy instruments, however, program nº3 try to hold three different sectors using just one measure for each of them. The design of these three measures was poor. By one hand, measure 3.2 just involve 30 SMEs, creating a working group with them and generate more than a real impact, a diagnostic of possible opportunities. By another hand, measure 3.3´s goal is to install ICT tools in 30 SMEs in the services sector, but installing doesn't mean that these companies are improving their absorptive capacity or the innovation capabilities of their workers.

Program nº2 focuses on the small agriculture producers, but differently from program nº3, this one was design from first, the installation of innovation capabilities. Second, the promotion of innovation management in SMEs part of this sector, and encourage associativity between them. Third, expand the number of trade associations capable to execute public funding for innovation. The program approaches the agriculture sector different areas which all together create a plan of action and a common goal between all the measures (2.1, 2.2, 2.3) inserted in it. Program nº4, is one of the two programs that put attention on the commercialization of innovation, aiming to make R&D offer visible. At the same time, bring together researchers and SMEs. These two objectives have been further studied in the academic field, and pointed out as an important part of the generation of innovation, and grow of the economy. Liefner & Schiller (2008) explain how Governments in developing countries have been restructuring their higher education systems trying to understand how universities could contribute to a general development and a technological upgrade. Universities contribute with knowledge, by conducting research, training professionals, etc.

Overall the design of axis II has not been too precise about how the plan of action would achieve an improvement on innovation in general. There are too many meetings, without a

clear objective for them. After studying the three programs of this axis, the feeling of not having a structured way of acting and measure the progress makes the axis weak in its design.

Implementation:

Considering the three programs of this axis, only program nº2 was totally achieved. Measure 2.1, 2.2, and 2.3 were executed by public agencies (FIA, Innova Chile), an university, and Fraunhofer Chile, which is a research center. These last two institutions won a public contest through the Innovation Fund for Competitiveness (FIC), which gave them funds to develop projects to achieve the different objectives of the measures. These projects were a success, with more than 14 trade associations strengthening their capacities, and the wiliness to collaborate between them. Also, 104 agriculture producers received training and advice for the installation of innovation capacities. To conclude, 24% of them increased their productivity (INFYDE, 2015).

From the three measures of program nº3, two were partially achieved (3.1, 3.2), and one (3.3) was in an early stage, so didn't present results yet. Measure 3.1 was developed by two universities, through two different FIC projects. The first one, was developing a methodology to promote innovation in SMEs. The second one, the creation of a platform for the tourist offer in the country. Both were still been executing at the time of the first evaluation. Innova Chile is present again, incorporating new technologies into the gourmet food industry, with the cooperation of 31 restaurants (INFYDE, 2015).

Program nº4 is one of the worst in terms of implementation. 4.1 supposed to be developed by a foundation (Fundación Chile) through the FIC, however, was cancelled due to unspecified reasons. With this, R&D offer is not promoted yet in the region. At the same time, 4.3 supposed to make visible this offer at a national level but didn't achieve its objective. Finally, measure 4.2 didn't present any result yet.

The failure on the implementation of these programs ended up with an R&D offer isolated from the private demand. Furthermore, ICT technologies were poorly incorporated into different sectors of the economy.

4.5.3 AXIS III:

Program nº5,6:

Objectives:

This Axis aims to strengthen the innovative capacity of the region, including its productive, social and cultural aspects. In its objective, the extension of innovative attitudes is a key factor to improve the generation and absorptive capacities of innovation. Is important to remark how this axis recognizes the relevance of absorptive capacities (Cohen & Levinthal, 1990) during innovation processes. The capacity of assimilating and exploit knowledge takes even more importance in emerging countries, where there is not only an institutional gap, but a technological one too. Guimón et al. (2018) during their research about policies to attract R&D related FDI in small emerging countries, pointed out the technological capabilities' gap that exists between local firms in developing countries and MNEs. In addition, the duty from host countries of improving the local´ set-up (local supplier networks, scientific infrastructures, universities, institutions, and human capital).

Together with the culture and training in innovation, axis III considers the formation of an innovative and entrepreneurial economy as third key factor. Putting as objective the incorporation of innovative processes and activities in SMEs.

Finally, the creation of innovative companies is its last objective. Aiming to maximize the commercialization of R&D results. A study conducted by K. Baharudin (2016) about R&D commercialization in Malaysia, showed that funding during the different phases of the commercialization process, together with policies and availability of entrepreneurs could increase the fruitful R&D commercialization. In addition, from this study (which analyses two pharmaceutical innovations), a successful commercialization process could lead to the creation of new innovative businesses (start-ups), a and the expansion of current ones.

Design:

The goals of Axis III are: *Increase R&D, Skills*, *Enhance demand for innovation, and Improve the framework.*

Measure 5.2 is the only one in the whole regional innovation strategy which aims to increase SMEs´ R&D through direct financial support. Also, the development of venture capital in the region for the generation of innovation in firms. Venture capital gives the possibility of

achieving economic growth and job creation. In addition, theory suggests that early stage firms often suffer from credit constraints (Da Rin, Nicodano, & Sembenelli, 2006), which explain measures like 5.2.

Measure 5.1, 6.1, and 6.2 aim to improve skills through training. The first one designed to improve the absorptive capacity of SMEs. As is mentioned before, this capacity is a key factor for firms, to be able to assimilate and exploit knowledge, which was developed outside the firm or country (Cohen & Levinthal, 1990). The second one designed to train SMEs workers in terms of their capacity to install innovation processes, which at a certain level could be understood like an improvement of SMEs absorptive capacity. In the same line, measure 6.2 looking after the same objective, pretends to incorporate skill human capital to SMEs.

With the goal of *enhancing the demand for innovation*, measure 5.1 is the only one in the regional innovation strategy, which puts a focus on prototypes and its development, and define objectives about the number of prototypes that need to be developed during the period contained in this measure. Finally, measure 5.3 aims to improve the framework by creating a proper atmosphere for innovative firms. This measure focuses only on infrastructure.

The design of the programs from axis III has four goals, which are approached with five different policy instruments. The mix of measures approaching different topics as venture capital, and R&D offer makes the measure ambitious on its objectives, however, most of them are a measure to design a plan and not a plan per se.

Implementation:

From axis III, 3 measures were achieved (5.3, 6.1, 6.3), two partially achieved (5.2, 6.2), and one not achieved (5.1).

Program nº5 had the objective of increasing and extend innovation processes in SMEs. Measure 5.1, supposed to improve the absorptive capacity of them, at the end only 12 SMEs were supported, but mostly from products design´s innovation. Also, innovation management tools were not introduced at all, neither trade associations were part of this. This measure was developed by a University of the region. Measure 5,2 generated new ways of funding for SMEs, however there wasn't a new funding program, which was the main objective of it. Finally, measure 5.3 created new smart infrastructures to support innovation (innovation HUB), this initiative benefited 124 companies (INFYDE, 2015).

Program nº6, almost achieved all its objectives, however, measure 6.2 was not executed at all. The integration of skilled human capital is an important part of the process of installation of innovation capacities, and the generation of it. At the same time, attract the talent and retain it results crucial to producing new and valuable knowledge. Measure 6.1 achieved the training of SMEs workers in the whole organizational structure, making all of them part of the innovation process. More than 6,000 participants were part of 100 events regarding this topic (INFYDE, 2015). Measure 6.3, through several forums and diffuse events, got more than 1,200 participants, who were informed about the innovation strategy in the region.

Measure 6.1 was implemented by a University and a public agency (FIA), both worked through two different FIC projects. Measure 6,3 by the regional Government (GORE).

Generally, the objective of build capacities necessaries to start innovation processes was partially completed, the training of SMEs workers was a success, however, is necessary the incorporation of talent from outside of the firms to aggregate new knowledge and point of view to them.

4.5.4 AXIS IV:

Program nº7:

Objectives:

The last axis aims to integrate all the sectors and the territory in a strategic innovation framework. Here are integrated sectors that weren't integrated in the first stage (mining, construction, among others). Also, emergent sectors such as biotechnology and nanotechnology.

This axis take in consideration the differences regarding innovative and technological levels between regions, and the necessity of use different instruments.

Finally, as the ultimate objective, is the internationalization of the innovation strategy when the bases are settled. Guimón et al. (2018) remark how local firms could improve its technological capabilities by interacting with innovative MNEs. The technological catch-up could be faster by the participation of the region in an international innovation network, promoting international collaboration, and the promotion at the international level of Chile´s R&D offer.

Design and Implementation:

The three measures part of axis IV, are plans to elaborate a diagnostic of which sector of the economy need to be incorporated during the next stages of the regional innovation strategy. At the same time, analyse the possibility of extending this strategy to other regions and other countries. Is not possible to evaluate the design of these measures, because their objectives are just the generation of the plan for the diagnostic. There is no data about how is planned to be done. These measure can´t be categorized under policy instruments now, however the extension of the innovation always must be considered as a future goal. The incorporation of other regions and countries would improve the quality and quantity of knowledge present in the Metropolitan Region of Santiago. There was no implementation at the time of the evaluation of this strategy, and was not possible to get access to a more information from official sources respect.

4.5.5 Discussion on the analysis of the Regional Innovation Strategy:

The four axes of the strategy present objectives which are in coherence with the theory and studies regarding innovation policy, and strategies. These approach the three most common barriers that developing countries present to generate innovation (Pinuly, 2001; Painuly & Fenhann, 2002; Reddy & Painuly, 2004). These barriers are *financial*, *institutional* and *technological*.

Financial barriers seem to be more a country-level than a local problem, with Chile at the bottom of the OECD members regarding the percentage of the GDP invested in R&D, which was 0,385% in 2016 **(section 4.3)**. However, from the perspective of a lack of private investment (venture capital, long-term investment in new businesses), the problem is approached by measures 5.2 and 5.3. Venture capital besides promoting innovative activities, also help innovative products or services to be brought faster into the market. Emerging economies seek foreign funds, and specially VCs expertise, which could represent a benefit for local entrepreneurs, but also for local VCs (Hain, Johan, & Wang, 2015). Finally, from the point of view of resources invested to implement the Regional Innovation Strategy, the failures are not directly related with the lack of financial resources, but more with the design and the *execution units* 'capacity to develop them.

To approach the second one, the strengthening of the institutional framework is mentioned in more than one axis, and as an important part of the whole strategy´s objective. Innovation processes require efficient public institutions to promote, develop, and sometimes lead them. A good institutional set-up is a key factor to innovation (Doloreux & Parto, 2005; Asheim, Grillitsch, & Trippl, 2015; Nelson, 2008). Axis I approach the improvement of the human capital in public institutions to increase its capacity regarding innovation processes.

The biggest focus of the Regional Innovation Strategy resulted to be the training and improvement of skills. Which makes sense if we consider that this is the first innovation strategy in the region. The effectiveness of Chilean public institutions mentioned during the introduction ended up being more a characteristic of national-level entities, than regional-level ones.

The technological barrier is approached by a Regional Innovation Strategy that understands the necessity of improving the absorptive capacity (Cohen & Levinthal, 1990) of SMEs, to be able to use the knowledge received from other actors. Aiming to make the technological catch-up faster, the internationalization of the strategy seems to be the right way to get access to international innovation networks, which could create knowledge-intensive linkages, diminishing the technology´s capabilities gap existent in the region. Furthermore, the collaboration between actors of the MRS´S RIS which is the ultimate goal of Regional Innovation Systems is also mentioned in more than one axis. The cooperation between ICT companies and traditional ones was thoughted to create cross-industry innovation projects. As Hahn (2014) mentioned, due to its characteristics, ICT companies are very suitable to conduct innovation projects. The strategy also follows global trends with the convergence of technologies. At the same time, in the future stages of the strategy is declared the integration of strategic sectors of the economy (Mining, Construction), and of new ones (Biotechnology, Nanotechnology), keeping the same action plan.

In resume, the objectives were well thought, they are system-oriented (Edler & Fagerberg, 2017), and they concern about the quality and level of interaction between RIS´s actors.

The design of the Regional Innovation Strategy is not as good as its objectives. The design of the program nº1, for example, relies on an innovation unit composed by only 3 professionals. They, which needed to be trained first, supposed to be in charge of the right implementation and continuation of the strategy. The creation of an innovation unit was a necessity, but the lack of experience of these three professionals, plus the amount of measures and scope of the strategy seems to be a lot of work for a unit of the size proposed in measure 1.1.

The main problem with the design is that which entities were supposed to execute them was not defined together with the design of them, this makes even more important clarity on action plans and deadlines, which didn't happen here. Executing units could have another conception of what needs to be done if the designs and action plans of each measure are not clear enough. This is directly related with that only 7 out of 23 measures were totally achieved.

Another issue regarding the design of the measures, is that a lot of them have as a plan of action, diagnostics, and elaboration of plans as its “action plan”, however, its objectives seems to be unachievable with these action plans. The measures are not too precise about how the objectives want to be achieved. Meetings are a recurrent action plan, but these

“meetings” have a not a real mission. Reading the strategy in detail gives to the reader the feeling that some of the measures remain in the air.

Also, topics, which are pointed out as the main objectives of the strategy, are only mentioned in a few measures. Increase R&D (1), improvement of the framework (2), enhanced the demand for innovation (3) and improvement of systemic capabilities (3).

There is a disbalance about how many measures approach the main goals of the strategy. Most of them focus on training and improvement of skills, however, the improvement of the institutional framework is only truly approached by axis I. This is not in line with the proportion of the strategy´s objectives focused in the improvement of the public institutions.

Regarding the implementation of the measures of the Regional Innovation Strategy, the results were unsatisfactory. This is a result in part of the problems during its design. Program nº1 is a clear example of it, an innovation unit was created, however, there is not an executor unit, which means that all the FIC projects continued to be managed by external agencies (CORFO, FIA, CONICYT). This reduces the level of responsibility of the region and the Regional Government (GORE) regarding the strategy and the approach to achieve the goals of the region in innovation. The non-presence of an entity just responsible for executing innovation policy in the Metropolitan Region of Santiago makes the MRS´ RIS institutional framework weak. Furthermore, the Regional Board was not legitimated, so was not functional during the period in which the strategy was developed. Because of this, there was a lack of evaluation reports for the different programs and measures, resulting in only 7 of them completed. The failure of program nº1 evidenced a lack of capacity of MRS´ public institutions concerning innovation. Following the same idea, several measures supposed to be implemented by Universities, which failed in achieving them. This is the result of a weak selection process by The Innovation Fund for Competitiveness (FIC) about which entities should receive the resources to execute the Regional Innovation Strategy. Also, a problem with the design of the measures, as I mentioned before. The action plans of them aren´t the same of the ones in the FIC projects. The lack of capacity of the executor units ended up with only 9 out of 25 FIC projects completing its objectives (INFYDE, 2015). Nine of them were assigned to Universities and research centers, and sixteen to CORFO, CONICYT, and FIA.

Some measure failed to achieve important goals, as the promotion of R&D offer in the region and at a national level. All the measures with these goals failed. Also, ICT technologies were only tried to be incorporated in the service sector, which also didn’t happen. In addition,

weren't developed new ways of finance new innovative firms. The *innovation policy instruments* of *Private demand for innovation, and Pre-commercial procurement* failed in been implemented (table below). Also, *Technology foresight, and Direct support to firms R&D* haven't been used properly yet, and the measures under these instruments weren't developed at the time of the evaluation.

Continuing, there is an analysis of the configuration of MRS´ Regional Innovation System, according to The Triple Helix Model framework. This model provides a framework to answer the second part of the first research question and explain the quality of the linkages between actors of the RIS.

4.5.6 MRS´ Regional Innovation System configuration:

The Metropolitan Region of Santiago´s Regional Innovation System, even if doesn´t present all the characteristics, seems to be closer to a *statist model* (Etzkowitz & Leydesdorff, 2000). In the MRS, the government seems to be playing the coordinator role, leading most of the projects regarding innovation, also providing resources to develop new projects. The government aims to have the role of collaboration and conflict moderator between the other two spheres, and a collaborative leadership (Ranga & Etzkowitz, 2013). However, the regional government (GORE) relies on specialized public entities (CORFO, CONICYT, CNIC, FIC, etc.) which are linked hierarchically to the central government. These public entities coordinate, and allocate the resources regarding innovation projects in the country and in the region. The GORE wants to coordinate, but at the same time has not enough authority due to the inexistent presence of regional public entities capable to manage innovation processes. In Chile, the State finances 60% of the spending in R&D from Higher Education Institutions (figure nº11) and 64% of Non-Profit Public Institutions. But these funds are directly managed, and allocated by the central, and not the regional government.

As I mentioned at the beginning, is important to remark that the Regional Innovation Strategy shows different points of view from this kind of model. First, Universities are not seeing only as a provider of trained persons anymore, but as providers of new knowledge in form of products and services. Second, the strategy seeks the promotion of the collaboration between Academia and Industry to generate innovation, reducing the "distance" between

them. Companies finance only 6% of Higher Education institutions expenditures. This evidences the distance mentioned before, between the Industry and Academia. Third, the State only finance 12% of the spending in R&D by companies.

The Regional Innovation Strategy can be related to an *endogenous vision* and strategy, which recognizes that a strong knowledge base, skilled workers and proximity to sources of knowledge, are more relevant than cost reductions (Ranga & Etzkowitz, 2013). The strategy aims to improve the infrastructure for local knowledge creation, and the local capacity-building. In less proportion, an *exogenous vision* could also be related to the strategy and its objectives of attracting international firms and knowledge sources from abroad during the second stage of the strategy (program nº7). Both are not mutually exclusive, and as is mentioned by Ranga & Etzkowitz (2013), can support each other.

The fact that the Regional Innovation Strategy wants to promote the collaboration between Institutions-Industry-Academia, tell us that the MRS is trying to move from a statist model to a balanced one, where all the spheres have the same size and overlapped areas, (represented by hybrids organizations) where the innovation processes should work better considering the union of elements from the three spheres of the model (Etzkowitz & Leydesdorff, 2000). In a balanced configuration, the components of each sphere can play two roles. For example, Governments could have trainning programms and state-owned companies, here the state would be playing the role of the industry, and the university (Zhou, 2014).

These hybrids organizations are government and firms research labs, technology transfer offices inside universities, business and financial support institutions, among others (Ranga & Etzkowitz, 2013). The strategy also aims to improve the *innovative space,* by the upgrade of the environment for university technology transfer.

The MRS even if has a statist model, present lack of experience and skills in its regional public institutions regarding innovation. This generates that the linkages with the two other spheres and between them have been inefficient, and that's other of the reasons why the strategy didn't work out in its implementation, besides the problem of design. Furthermore, since there is not much space for the "bottom-up" innovation, this model is considered an unsuccessful development model (Yoon, 2015) in which the innovation it is discouraged.

Next, following the *taxonomy of the innovation policy instruments*, there is an analysis of which instruments were not used during the Regional Innovation Strategy. This aims to answer the second research question of what additional initiatives could be carried out to apply more efficiently the current innovation policy in the region, and improve it even further. Furthermore, includes an explication about the impact of these missing instruments on innovation processes and promotion, and instruments which failed during its implementation.

4.6 Analysis of the Innovation Policy Instruments and Goals of the MRS´s Regional Innovation Strategy:

This section starts with a table that groups the measures of the Regional Innovation Strategy, to continue with a description of each of the instruments missed. Finally, an overall reflexion about these findings and what could be done to improve this strategy, in terms of measures and its implementation, is included.

4.6.1 Innovation Policy Instruments and goals:

The table below shows the summary of all the measures and its progress by colour, using the same standard than in the tables from before. These measures are categorized according to its *goals*, and which *innovation policy instruments* were used to achieve them. *Instruments* in red were not part of the Regional Innovation Strategy.

Taxonomy of innovation policy instruments applied to MRS´s Regional Innovation Strategy:

			GOALS				
Innovation policy instruments	Increase R&D	Skills	Access to expertise	Improve systemic capabilities	Enhance demand for innovation	Improve framework	Improve discourse
Fiscal incentives for R&D							
Direct support to firm R&D	5.2						
Policies for trainning and skills		1.1, 1.2, 2,1, 2.2, 5.1, 6.1					
Entrepreneurship policy							
Technical services and advice			2.2, 3.2, 3.3, 6.2				
Cluster policy							
Policies to support collaboration			4.2, 4.3	1.4, 1.5, 2.3			
Innovation networks							
Private demand for innovation					4.1, 4.3		
Public procurement policies							
Pre-commercial procurement					5.1		
Innovation inducement prizes							
Standards							
Regulation						1.3, 5.3	
Technology foresight							3.1, 3.3

Figure 20: Own Illustration based on "Innovation policy: what, why and how" (2017), Edler.J and Fagerberg.J.

In total, seven instruments were not directly used by any of the measures of the Regional Innovation Strategy. Each of the instruments listed in this table has different impacts on innovation and its generation, and it is important to understand what have been missing by not use them.

- **Fiscal Incentives for R&D:**

  This instrument, has been managed at a national level. The Chilean Government, through CORFO, created five different fiscal incentives to make companies invest more in R&D. First, co-funding of up to 70% of the cost of feasibility studies for projects with a value over US$ 2 million. Second, co-funding on the implementation of technology research projects. Third, a tax benefit consisting of a return of 35% of the expenses incurred in R&D (up to US$ 1 million). Fourth, small subsides to product and process innovations (US$ 90,000 – US$ 300,000). Finally, bonus for projects in remote areas of the country (InvestChile, 2018). These five measures still locate Chile at the end of the list of OECD members, according to the indirect support to companies through R&D tax incentives (OECD, 2018).

  The rationale behind this instrument is that R&D drives more innovations, which will drive better competitiveness of companies, and this competitiveness will drive more jobs, which is the main political concern when we talk about tax incentives (Larédo, Köhler, & Rammer, 2016).

  Tax incentives for R&D are a good way to attract foreign companies to develop new products, technologies or services within the country and the region. Helping to break down the technological barrier mentioned earlier. Attract investment in R&D by foreign companies, (Guimón & Salazar-Elena, 2015) could help the region to develop technological capabilities and diversify the economy. The opportunity which foreign investment presents to access to global innovation networks is crucial to achieving them. Some countries like China or Italy ocus these tax incentives only in some region (Larédo, Köhler, & Rammer, 2016). However, Chilean government applies an extra incentive only for remote places, but nothing special regarding the Metropolitan Region of Santiago.

- **Entrepreneurship Policy:**

  Like the first one, this instrument is also planned at a national level with Start-Up Chile, which is a public business accelerator located in The Metropolitan Region of Santiago, but was not thought just for this region, but for all the Chilean territory. Unlike tax incentives, that require law changes which make them difficult to divided by region, business accelerator can be located strategically by zone. The fact that Start-Up Chile

is in the MRS might have influenced the omission of measures regarding entrepreneurship in the Regional Innovation Strategy. Start-Up Chile, since its creation in 2010, has start-ups valued in US$ 1,400 million, and a 56,4% of the start-ups remain in the country by 2017 (Start-Up Chile, 2017).

- **Cluster Policy:**

  Clusters were defined by Michael Porter (1998) as: ´geographical concentrations of interconnected companies and institutions in a particular field´ (Porter, 1998a, p.78). Different from innovation networks, clusters are necessarily located in the same area. These include related firms, Governments, Universities, etc. Other definitions add a degree of specialization in a certain industry too. Chile is ranked in the position nº85 in the category of "cluster development" according to the Global Talent Competitiveness Index (GTCI, 2018). The literature argues that clusters grow naturally, and policy interventions are often label as "unimportant". However clusters have been associated with knowledge spillovers, and the rise of innovation and productivity (Uyarra & Ramlogan, 2016), if there is no generation of them so far, a strategy should be developed to promote its development in region.

  In Chile, the main cluster developed so far is the mining industry in the north of the country. This was developed with the efforts of the central government, and is an intelligent strategy since almost half of Chile's GDP is mining (figure 2). The lack of institutionalization to coordinate them (MCH, 2014) make it difficult to create new ones.

- **Innovation Networks:**

  The innovation policies regarding innovation networks, more than support the generation of innovation, need to support the cooperation and the creation of competences which at the end will create innovations (Cunningham & Ramlogan, 2016). Different measures that are part the Regional Innovation Strategy aimed to increase collaboration, but most of the time not in a scalable way. These measures focused more on the training and creation of innovation in companies, than in structured cooperation between several actors among various projects. It is largely promoted the collaboration between companies, but not that much with other actors

of the RIS. Incorporate them into innovation networks (Oerlemans, Meeus, & Kenis, 2007), could provide *knowledge spillovers*, exploration of new markets, technological developments and opportunities, among others.

- **Public Procurement Policies:**

  Lack of demand have been pointed as one of the barriers for the generation of innovation (Uyarra, 2016). The procurement is an innovation policy instrument, which can overcome market failures that are against innovation. Public sector can get over these failures by demanding certain products and services in large quantities, doing so it can encourage R&D investment by companies. The Regional Innovation Strategy seems not to include this tool as a way of incentives more expenditures in R&D by firms.

- **Innovation Inducement Prizes:**

  Traditionally, this type of instrument has been seen as an opportunity to generate incentives for the development of a specific technology, however not all the technology areas are adequate for a prize instrument. At the same time, because of the risk to lose the prize, companies might not be interested in spending the money and time developing X technology. However, there are a lot of reason which support the use of this instrument. Prizes could engage non-traditional participants, at the same time would foster technology diffusion, and stimulate stuck technologies (Gök, 2016). In an early stage of the innovation strategy, a prize measure could be a great option to increase the diffusion of news regarding innovation within the region, which is one of the objectives stated in the Regional Innovation Strategy. Since 1991, nearly 80% of innovation prizes in the United States have been planned to provide incentives for particular innovations, and not to recompense excellence in general (Goland, Bays, & Newsum, 2009). This evidence how public sector could benefit from this instrument to boost innovation in the region.

- **Standards:**

  Improving the standards for innovation could enhance the demand for innovation, and improve the framework at the same time. These have not been used as an instrument, but they play a crucial role in the innovation processes (Blind, 2016).

Standards, for example, help companies to demonstrate to customers the innovative features of their products. Furthermore, open standardization processes increase the competition between and within technologies (Blind, 2016). Finally, standards provide infrastructure which could be the basis for future innovations.

To conclude, the *instruments* presented in this section have great potential to boost even further innovation in the region. They need to be considered during the next stages of the regional innovation strategy. Section **4.6.2** presents conclusions about general improvements required in the region and its innovation strategy, to improve its implementation and positive effects in innovation processes.

4.6.2 Discussion on the analysis of the Instruments and Goals of Regional Innovation Strategy:

Overall, the Regional Innovation Strategy needs to clarify the steps necessary to achieve its objectives. Even if they are good in terms of what the region needs, the measures aren't clear enough about how is planned to achieve them. There is a requirement for a better link between measures, objectives, and FIC projects. Is also needed a Regional Board, which needs to share the responsibility of monitoring the strategy with the new "innovation unit". Similar conclusions were found by Planas & Fernández de Lucio (2018) about how the strategy didn't achieve the installation of strategic local governance with an innovative strategic vision in the region and relied more on national public entities managed by the central government. Benavente & Price (2014), concluded in a study about the evolution of public institutions regarding innovation in Chile during the period 1990-2012, that in the country was needed the regionalization of the innovation strategy and execution of it. This was partly achieved with the creation of different regional innovation strategies, however, the goal of the regionalization of the execution and leadership of it wasn't successful in the MRS during the period 2012-2016.

The strategy should also incorporate more measures regarding the collection of systematic statistical data. According to Archibugi, Denni, & Filippetti (2009), the use this data has three main reasons. First, for theoretical analysis, innovation indicators could be used to increase knowledge of technological change, and to test innovation theories, which at the end could be responsible for economic growth in the region. Second, the source of information for

public policies, this one is the most relevant here, without a follow-up and collect data about the results of the different measures, the region loses the opportunity of identifying strengths and weaknesses. The collect of statistics would help to improve the effectiveness of future regional innovation strategies. Third, input for the firm's strategies, local and especially foreign firms could have an accurate understanding of the technological capability of the region, and about the investment and strategic possibilities for them.

The last section will show the final conclusions about this research, and future perspectives to investigate the topics studied.

5 - Final Conclusions and Future Perspectives:

In this section, both research questions are answered, including discussion of limitations during this research, and recommendations for future studies regarding the topics studied here.

This paper addressed the research question:

- ***What is the current regional innovation policy within the Metropolitan Region of Santiago, and how efficient are its implementation activities in the region (level and quality of interaction between Industry, Government and University)?***

Together with a second research question:

- ***What additional initiatives, in view of theory, could be made to apply more efficiently the current innovation policy in the region, and improve it even further ?***

The ***first research question*** aimed to show how the Metropolitan Region of Santiago has been developing innovation within the region. For this purpose, the Regional Innovation Strategy of the region for the period of 2012-2016 was studied in terms of its objectives, design, and implementation. The results of this research reveal a failure during the implementation of the strategy (**4.5.5**). This failure was linked to the design of its measures, and the incapacity of its executor units. The objectives of the strategy approached the three main barriers (*financial, institutional, and technological)* that developing countries present to generate innovation (Pinuly, 2001; Painuly & Fenhann, 2002; Reddy & Painuly, 2004). However, the design of its measures showed incongruences between the vision of the regional government (GORE) and executor units, about measures´ objectives and plans of action. This ended up with 7 out of 23 measures achieved. Action plans about how to achieve each objective of each measure were imprecise, most of them didn't have a clear action plan and were mostly diagnostic and "meetings" without a mission that could be directly relate to the achievement of its objectives. The objective to improve the institutional framework, mentioned extendedly at the beginning of the strategy and remarked in the theory as a key factor to innovation (Doloreux & Parto, 2005; Asheim, Grillitsch, & Trippl, 2015; Nelson, 2008), was approached by axis I, but the measures of this one didn't achieve it.

This research evidenced systemic capability problems like, for example, the lack of capacities to execute innovation processes in public institutions and SMEs part of the region. In addittion, the institutional framework which brings them together wasn't strong enough to coordinate the different components part of the regional innovation strategy. These systemic problems are common in developing countries (Chaminade, Lundvall, Vang, K J., 2009).

Following the Triple Helix Model, the configuration of the RIS of the Metropolitan Region of Santiago seems to be closer to a *statist* one (**4.5.6**). This model is considered an inefficient development model because there is not much room for "bottom-up" innovation (Yoon, 2015). Furthermore, its public institutions´ lack of experience and skills made weak the linkages between the three spheres of the Regional Innovation System. Nevertheless, the regional innovation strategy promotes the collaboration between Institutions-Industry-Academia, which is a good signal about how the Regional Innovation System is moving to a *balanced* configuration, where the innovation processes should work better considering the union of elements from the three spheres of the model (Etzkowitz & Leydesdorff, 2000). The strategy aimed to improve the *innovation space*, building a good environment for the intereaction between the *components* of the regional innovation system.

This research also provides recommendations to improve the regional innovation strategy. The ***second research question*** gave us the following suggestions. First, include the *instruments* missed during the first stage (**4.6.1**). The incorporation of a policy-mix could improve the quality and effectiveness of future strategies. The attraction of MNEs by fiscal incentives for R&D could accelerate the technological catch-up (Guimón & Salazar-Elena, 2015). Also, the developments of *clusters* and a proper institutional set-up to coordinate them (Uyarra & Ramlogan, 2016; MCH, 2014). *Clusters* have been related to the rise of innovation and productivity. Furthermore, the integration of the different components of the RIS into innovation networks could generate *knowledge spillovers*, resulting in new technological developments and the diversification of the economy (Oerlemans, Meeus, & Kenis, 2007). Other *instruments* needed in the future are *public procurement policies, innovation inducement prizes, and the improvement and incorporation of the standards.*

Second, to adequately link the measures, the objectives, the action plans, and the FIC projects. This could improve the effectiveness on the implementation of future innovation strategies, the action plans and designs of future measure should incorporate more components of the RIS.

Third, empowerment of the regional government, assuming the responsibility of monitoring the strategy and its measures through a Regional Board, its innovation unit, and a new executing unit. This "empowerment" isn't related to strength the *statist* configuration of MRS´ RIS, but with the improvement of public institutions´ capabilities to implement, control, evaluate, analyse, and design future innovation strategies in the region.

Fourth, incorporate better systems to collect systematic data (Archibugi, Denni, & Filippetti ,2009) to improve the results of evaluations of the FIC projects, which would help in the future for the development of new innovation strategies and projects.

5.1 Future Perspectives:

This document is an invitation to other researchers to pay attention to how regional innovation systems and innovation policy in emerging economies are developed. Innovation policy is essential for growth, industrial competitiveness and, therefore, recovery (Chaminade, Lundvall, Vang, K J., 2009).

It is necessary to carry out more studies on how innovation is addressed in the Metropolitan Region of Santiago. This study considered the results of the regional innovation strategy (2012-2016) until the end of 2015, the year in which it was possible to obtain data on the execution of the strategy. The lack of data made it impossible to make an even deeper analysis in terms of the strategy´s implementation. However, it was possible to study, in general terms, the topics of regional innovation systems and innovation policies in emerging economies, thus achieving the objective of this investigation.

In no case, was a generalized interpretation of these results sought by the author. The use of a single case-study, rather than the possibility of making a generalization, gave the author a deeper understanding of the phenomena that occur in the specific region of study.

References:

Almeida, A., Santos, C., & Rui Silva, M. (2015). *Science and Technologic Parks in Regional Innovation Systems: A cluster analysis.* University of Porto.

America Economía. (2017). *www.americaeconomia.com*. Retrieved from www.americaeconomia.com: https://especiales.americaeconomia.com/2017/innovacion/santiago

Archibugi, D., Denni, M., & Filippetti, A. (2009). The technological capabilities of nations: The state of the art of synthetic indicators. *Technological Forecasting & Social Change 76* (76), 917-931.

Asheim, B., & Isaksen, A. (2002). *Regional Innovation Systems: The integration of Local ´Sticky´and Global Úbiquitous´Knowledge.*

Asheim, B., Grillitsch, M., & Trippl, M. (2015). *Regional Innovation Systems: Past - Present - Future.* Sweden.

Baharudin, K. (2016, November 15). Case Study Approach to Understanding the Process of Successful R&D Commercialization. *Asian Journal of Scientific Research*, 273-278.

BCN. (2018). *www.bcn.cl*. Retrieved from https://www.bcn.cl/siit/nuestropais/region13

Benavente, J. M., & Price, J. J. (2014). Evolution of the Public Institutions of Science, Technology, and Innovation inf Chile: 1990-2012.

Berg Jensen, M., Johnson, B., Lorenz, E., & Lundvall, B.-Å. (2016). Forms of Knowledge and Modes of Innovation. In B.-Å. Lundvall, *The learning economy and the economics of hope.* ANTHEM PRESS.

Blake, R. (1989). Integrating Quantitative and Qualitative Methods in Family Research. *Families Systems and Health*(7), 411-427.

Blind, K. (2016). The impact of standardisation and standards on innovation. In J. Edler, P. Cunningham, A. Gök, & P. Shapira, *Handbook of Innovation Policy Impact* (pp. 423-449). Edward Elgar Publishing Limited.

Brännaback, M., Carsrud, A., Krueger, N., & Elfving, J. (2008). Challenging the triple helix model of regional innovation systems: A venture-centric model. *Int. J. Technoentrepreneurship, 1*(3).

Chaminade, Cristina & Lundvall, Bengt-Åke & Vang, Jan & Joseph, K J. (2009). Designing innovation policies for development: Towards a systemic experimentation-based

approach. Handbook of Innovation Systems and Developing Countries: Building Domestic Capabilities in a Global Setting.

Cimoli, M., Dosi, G., & Stiglitz, J. (2009). *Industrial policy and Development: The political Economy of Capabilities Accumulation.* New York: Oxford University Press.

CNID. (2018). *http://www.cnid.cl*. Retrieved from Consejo Nacional de Innovación y Desarrollo [National Council for Innovation and Development] : http://www.cnid.cl/home-cnid/cnid-3/el-consejo-y-su-historia/

Cohen, M., & Levinthal, D. (1990). Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly*, 128-152.

CONICYT. (2018). *http://www.conicyt.cl/*. Retrieved from http://www.conicyt.cl/sobre-conicyt/que-es-conicyt/

Cooke, P. (1992). *Regional innovation systems: competitive regulation in the new Europe.* Geoforum.

Cooke, P. (2004). *Integrating global knowledge flows for generative growth in Scotland: Life sciences as a knowledge economy exemplar. In Global Knowledge Flows and Economic Development.*

Cooke, P., & Morgan, K. (1998). *The associational economy. Firms, regions, and innovation.* Oxford: Oxford University Press.

CORFO. (2018). *https://www.corfo.cl/sites/cpp/home*. Retrieved from https://www.corfo.cl/sites/cpp/sobrecorfo

Cunningham, P., & Ramlogan, R. (2016). The impact of innovation networks. In J. Edler, P. Cunningham, A. Gök, & P. Shapira, *Handbook of Innovation Policy Impact* (pp. 279-317). Edward Elgar Publishing Limited.

Cunningham, P., Flanagan, K., Edler, J., & Laredo, P. (2016). The Innovation Policy Mix. In *Handbook of Innovation Policy Impact* (pp. 505-42). Edward Elgar Publishing Limited.

Da Rin, M., Nicodano, G., & Sembenelli, A. (2006). Public policy and the creation of active venture capital markets. *Journal of Public Economies*, 1699-1723.

Doloreux, D., & Parto, S. (2004). Regional Innovation Systems: A Critical Synthesis. *UNU-INTECH*.

Doloreux, D., & Parto, S. (2005). Regional innovation systems: Current discourse and unresolved issues. *Technology In Sociaty*(27), 133-153.

Edler, J., & Fagerberg, J. (2017). *Innovation Policy: What, Why, and How* (Vol. 1). Oxford Review of Economic Policy.

Edquist, C. (2005). Systems of Innovation: Perspectives and Challenges. *The Oxford Handbook of Innovation*.

Eriksson, K., & U, L. (1997). Abduction - a way to deeper understanding of the world of caring. *Scand. J. Caring Sci. , 11*(4), 195-198.

Etzkowitz, H. (1993). *Technology transfer: The second academic revolution.* Technology Acess Report.

Etzkowitz, H., & Leydesdorff, L. (1995). *The Tiple Helix: Univesity - Industry - Government Relations: A laboratoy for knowledge-based economic development.* EASST Review.

Etzkowitz, H., & Leydesdorff, L. (2000). *The dynamics of innovation: from National Systems and "Mode 2" to a Triple Helix of university-industry-government relations.* New York: Science Policy Institute.

Etzkowitz, H., Almeida, M., & Carvalho de Mello, J. (2005). *Towards "meta-innovation" in Brazil: The evolution of the incubator and the emergence of a triple helix.*

Fagerberg, J. (2013). *Innovation - a New Guide.* TIK, university of Oslo; IKE, Aalborg University; CIRCLE, Lund, University.

FORBES. (2017). *https://www.forbes.com*. Retrieved from https://www.forbes.com/best-countries-for-business/list/#tab:overall

Gök, A. (2016). The impact of innovation inducement prizes. In J. Edler, P. Cunningham, A. Gök, & P. Shapira, *Handbook of Innovation Policy Impact.* Edward Elgar Publishing Limited.

GEM. (2016). *Reporte Nacional de Chile [National report from Chile].*

Gobierno Regional Metropolitano de Santiago. (2014). *Estrategia Regional de Innovación Región Metropolitana de Santiago [Regional Innovation Strategy, Metropolitan Region of Santiago].*

Gobierno Regional Metropolitano de Santiago. (2018). *Estrategia Regional de Desarrollo.* Santiago [Regional Development Strategy, Santiago].

Gobierno Santiago. (2018). *Gobierno Santiago [Santiago Government]*. Retrieved from https://www.gobiernosantiago.cl: https://www.gobiernosantiago.cl/proyectos-fondo-de-innovacion-y-competitividad

Goland, T., Bays, J., & Newsum, J. (2009, July). Using Prizes to Spur Innovation. *McKinsey&Company*. Retrieved from https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/using-prizes-to-spur-innovation

GTCI. (2018). *The Global Talent Competitiveness Index: Diversity for Competitiveness.*

Guimón, J., & Salazar-Elena, J. (2015). Collaboration in innovation between foreign subsidiaries and local universities: evidence from Spain. 445-446.

Guimón, J., Chaminade, C., Maggi, C., & Salazar-Elena, J. C. (2018). Policies to Attract R&D related FDI in Small Emerging Countries: Aligning Incentives With Local Linkages and Absorptive Capacities in Chile. *Journal of International Management*.

Hahn, T. (2014). *Cross-Industry Innovation Processes.* Bonn, Germany: Springer Gabler.

Hain, D., Johan, S., & Wang, D. (2015). Determinants of Cross-Border Venture Capital Investments in Emerging and Developed Economies: The Effects of Relational and Institutional Trust.

Howells, J. (1999). Regional systems of innovation? (D. Archibugi, J. Howells, & J. Michie, Eds.) *Innovation Policy in a Global Economy*, 67-92.

ICM. (2018). *http://www.iniciativamilenio.cl*. Retrieved from Iniciativa Cientifica Milenio [Millennium Scientific Initiative] : http://www.iniciativamilenio.cl/#queesmilenio

IdeaConsultora. (2010). *Región Metropolitana: Diagnóstico de las capacidades y oportunidades de desarrollo de la ciencia, la tecnnología y la innovación.* Santiago [Metropolitan Region of Santiago: Diagnosis of the capabilities and opportunities for the development of science, technology and innovation]: CONICYT.

Inc. (2016). *https://www.inc.com*. Retrieved from https://www.inc.com/magazine/201503/greg-lindsay/pushing-the-boundaries-global-cities-photo-essay.html

INE. (2017). *http://www.ine.cl/*. Retrieved from http://www.ine.cl/prensa/detalle-prensa/2017/12/22/primeros-resultados-definitivos-del-censo-2017-un-total-de-17.574.003-personas-fueron-efectivamente-censadas

INFYDE. (2015). *Evaluación de la Estrategía Regional de Innovación de la RMS.* Gobierno de Santiago. [Evaluation of the Regional Innovation Strategy of the MRS. Government of Santiago].

INFYDE. (2018). *INFYDE*. Retrieved from http://www.infyde.eu/inicio: http://www.infyde.eu/inicio

InvestChile. (2018). *www.investchile.gob.cl*. Retrieved from https://investchile.gob.cl/es/programs-and-incentives-for-investment/

Klerkx, L., Álvarez, R., & Campusano, R. (2015). The emergence and functioning of innovation intermediaries in maturing innovation systems: the case of Chile. *Innovation and Development*(5), 73-91.

Kuada, J. (2012). *Research Methodology: A Project Guide for University Students.*

Larédo, P., Köhler, C., & Rammer, C. (2016). The impact of fiscal incentives for R&D. In J. Edler, P. Cunningham, A. Gök, & P. Shapira, *Handbook of Innovation Policy Impact* (p. 608). Edward Elgar Publishing Limited.

Liefner, I., & Schiller, D. (2008, January 3). Academic capabilities in developing countries - A conceptual framework with empirical illustrations from Thailand. *Research Policy*(37), 276-293.

Lundvall, B.-Å. (2007). *Innovation System Research: Where it came from and where it might go.*

MCH. (2014, July 04). *Minería Chilena*. Retrieved from http://www.mch.cl/: http://www.mch.cl/2014/06/02/cluster-2-0-expertos-analizan-los-sectores-con-mayor-potencial-de-competitividad/#

Mikhaylova, A. (2015, June). Spatial Perspective on Regional Innovation System. *Mediterranean Journal of Social Sciences*.

Ministerio de Economía, Fomento y Turismo. (2010). *¿Qué es y como funciona el FIC?* [Ministry of Economy, Development and Tourism. (2010). What is and how does the FIC work?] Retrieved from http://www.economia.gob.cl/: http://www.economia.gob.cl/subsecretarias/economia/innovacion-2/que-es-y-como-funciona-el-fic

Ministerio de Economía, Fomento y Turismo. (2018). *VII Encuesta Nacional sobre Gasto y Personal en I+D.* Santiago. [Ministry of Economy, Development and Tourism. (2018). VII National Survey on Expenditure and Personnel in R & D. Santiago]

Ministerio de Educacion [Ministry of Education]. (2018, July). *http://www.mifuturo.cl.* Retrieved November 2018, from http://www.mifuturo.cl/index.php/servicio-de-informacion-de-educacion-superior/listado-de-instituciones-vigentes-2015

Ministerio de Educación [Ministry of Education], CONICYT. (2018). *CENTROS DE INVESTIGACIÓN CONICYT.* Santiago: Ministerio de Educación. [RESEARCH CENTERS CONICYT. Santiago: Ministry of Education]

Nelson, R. (2008). What enables rapid economic progress: What are the needed institutions? *Research Policy*(37), 1-11.

OEC. (2016). *The Observatory of Economic Complexity*. Retrieved from https://atlas.media.mit.edu/en/: https://atlas.media.mit.edu/en/profile/country/chl/

OECD. (2014). *www.oecd.org*. Retrieved from https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS?contextual=default&end=2015&locations=AR-BR-PE-CO-EC-CL-DK-SE-ES-FI&start=1996&type=points&view=chart

OECD. (2018). *OECD TIME-SERIES ESTIMATES OF GOVERNMENT TAX RELIEF FOR BUSINESS R&D.* OECD.

OECD. (2018). *www.oecd.org*. Retrieved from Data - Chile: https://data.oecd.org/chile.htm

Oerlemans, L., Meeus, M., & Kenis, P. (2007). Regional Innovation Networks. (&. F. Rutten, Ed.) *The Learning Region: Foundations, state of art, future*, 160-183.

Painuly, J. (2001). Barriers to renewable energy penetration; a framework for analysis. *UNEP Collaborating Centre on Energy and Environment, Risø National Laboratory*(24), 73-89.

Painuly, J., & Fenhann, J. (2002). Implementation of Renewable Energy Technologies - Opportunities and Barriers. *UNEP Collaborating centre on Energy and Environment*.

Planas, L., & Fernández de Lucio, I. (2018). Primera estrategias regionales de innovación en Chile [First regional innovation strategies in Chile]. *J. Technol. Manag. Innov, 13*(2).

Políticas CTI. (2015). *Chile: Innovation System.* RICYT.

Polnayi, M. (1958). *Personal Knowledge: Towards a Post-Critical Philosophy.*

Porter, M. (1998a). Cluster and the new economics of Competition. *Harvard Business Review*, 77-90.

ProChile. (2018). *https://www.prochile.gob.cl*. Retrieved from ProChile - Gobierno de Chile [Government of Chile] : https://www.prochile.gob.cl/landing/quienes-somos/

Ranga, M., & Etzkowitz, H. (2013). Triple Helix Systems: An Analytical Framework for Innovation Policy and Practice in the Knowledge Society.

Reddy, S., & Painuly, J. (2004). Diffusion of renewable energy technologies-barriers and stakeholders´perspectives. *Renew. Energy*(29), 1431-1447.

Rossman, G., & Wilson, B. (1985). Numbers and words: Combining qualitative and quantitative methods in a single large scale evaluation. *Evaluation Review*, 627-643.

Saunders, M., Lewis, P., & Thornhill, A. (2015). *Research methods for business students.* Harlow, United Kingdom: Pearson Education.

Schumpeter, J. A. (1934). *The Theory of Economic Developmnet: An Inquiry into Profits, Capital, Credit, Interest and the Business Cycle.* London: Oxford University Press.

Schumpeter, J. A. (1942). *Capitalism, Socialism and Democracy.* London, Unwin.

SII. (2016). *Servicios de Impuestos Internos [Internal Tax Services]*. Retrieved from http://www.sii.cl/: http://www.sii.cl/estadisticas/empresas_region.htm

Smith, A. (1776/1904). *An Inquiry into the Nature and Causes of the Wealth of Nations.* (E. Cannan, Ed.) London: Methuen and Co., Ltd.

Start-Up Chile. (2017). *http://www.startupchile.org*. Retrieved from http://www.startupchile.org/economic-impact/

Suarez-Barraza, M. (2013). Innovación de Procesos de Administraciones Locales: un estudio empírico sobre su esfuerxo de mejora continua [Innovation of Processes of Local Administrations: an empirical study on its effort of continuous improvement]. (P. Gama Boaventura, Ed.) *RBGN, review of business management*.

Uyarra, E. (2016). The impact of public procurement of innovation. In J. Edler, P. Cunningham, A. Gök, & P. Shapira, Handbook of Innovation Policy Impact. Edward Elgar Publishing Limited.

Uyarra, E., & Ramlogan, R. (2016). The impact of cluster policy on innovation. In J. Edler, P. Cunningham, A. Gök, & P. Shapira, *Handbook of Innovation Policy Impact.* Edward Elgar Publishing Limited.

Walker, D. (2001). Integrating Quantitative and Qualitative Methods in Research. *Journal of College Student Development, 42*(3).

World Bank. (2018). Retrieved from The World Bank: https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS?contextual=default&end=2015&locations=AR-BR-EC-CL-DK-SE-FI&start=2006&type=points&view=chart

World Bank Group. (2018). *Doing Business 2018: Reforming to Create Jobs.*

World Economic Forum. (2015). *The 10 most competitive Latin American economies.* WEF.

Yin, R. (2013). *Case study research: Design and methods.* Sage publications.

Yoon, J. (2015). The evolution of South Korea's innovation system: moving towards the triple helix model?. Scientometrics, 104(1), pp.265-293.

Zhou, C. (2014). Four dimensions to observe a Triple Helix: invention of 'cored model' and differentiation of institutional and functional spheres. Triple Helix, 1(1).

Notes:

The sources of information in Spanish were translated into English in [brackets].

Acronyms:

CNIC National Council for Competitiveness

CONICYT National Commission for Scientific and Technological Research

CORFO Production and Development Corporation

DAF Administration and Finance Division

DIPLADE Division of Planning and Development

FIC Innovation Fund for Competitiveness

GDP Gross Domestic Product

GEM Global Entrepreneurship Monitor

GORE Regional Government

GTCI Global Talent Competitiveness Index

HEI Higher Education Institutions

ICT Information and Communications Technology

IVAC Division of Analysis and Control of Management

MRS Metropolitan Region of Santiago

NIS National Innovation System

NPPI Non-Profit Private Institutions

OECD Organisation for Economic Co-operation and Development

R&D Research & Development

RIS Regional Innovation System

SII Internal Tax Service

SMEs Small and Medium Enterprises